MONETARY POLICY, GENERATIONAL INEQUALITY AND WEALTH DISTRIBUTION IN THE UK

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Abstract

This thesis consists of three separate papers:

The first paper is Chapter 1 of this thesis, titled **Monetary Policy and Intergenerational Inequality**. Young people are the most affected by economic crises, and monetary policy tools are one of the key measures used to alleviate the impact of such crises. This study investigates inequality between two generations: the young and the old. This paper examines whether expansionary monetary policy exacerbates income, consumption and wealth inequality between the young generation and the old generation. The periods before monetary policy intervention (1999–2008) and after monetary policy intervention (2009–2020) in the UK are compared to analyse changes in intergenerational inequality.

The second paper is Chapter 2 of this thesis, titled **Monetary Policy and Generational Inequality**. Interest rates have been raised to contain inflation in the UK. This paper investigates the short-term impact of monetary policy on generational inequality and the Granger-Causality relationship between monetary policy and income, consumption and wealth inequality in three generations: the young, the middle-aged and pensioners. The analysis provides detailed insight into the micro-level impact of monetary policy rather than providing a new intuition on its macro-level impact.

The third paper is Chapter 3 of this thesis, titled **Wealth Distribution and Inequality in the UK: A Survey**. Over the years, the UK government and the central bank have implemented fiscal and monetary policy measures that may have consequences for wealth distribution and inequality. This paper analyses wealth distribution and inequality in the UK using data from the Wealth and Assets Survey (WAS). It demonstrates the unevenness of total wealth, property wealth, financial wealth, pension wealth and physical wealth distribution in the UK, among the top and the bottom UK population and across generations.

In memory of my dad, Alhaji Iskil Aremu Raheem.

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Chapter 1

Monetary Policy and Intergenerational Inequality

Abstract

This study examines the differential impact of expansionary monetary policy intervention on two generations, the young and the old, hence allowing this paper to conclude its impact on intergenerational inequality. The difference-in-differences (DID) model is used to examine the differential effects. The periods before monetary policy intervention (pre-2009) and after monetary policy intervention (post-2009) in the UK are compared to examine changes in intergenerational inequality. The data period covers the years 1999–2020. The empirical results show that the young generation benefitted in terms of higher income, consumption and wealth, while the old generation gained in terms of higher wealth during the periods of expansionary monetary policy. This paper concludes that expansionary monetary policy widens income and consumption inequality, but wealth inequality decreases. Further analysis shows that expansionary monetary policy has a significant impact on non-investment income, while the impact on investment income is miniscule.

1.1 Introduction

This paper investigates the differential impact of monetary policy transmission mechanisms on two generations – the young and old generations, thus allowing this paper to draw conclusions about its impact on intergenerational inequality. As monetary policy tools, quantitative easing (QE) and expansionary interest rates are the key policy measures used by central banks to alleviate the impact of an economic crisis, especially during the recession period. There has been renewed interest in the role that interest rates and quantitative easing play in inequality, especially during periods of economic crisis (Vlieghe, 2021; Caldara et al., 2020; Bhar and Malliaris, 2020; Bivens 2015; Blanchard, 2011; Christiano et al., 2004). In the UK, the interest rate was 0.1% in 2020, the lowest in the Bank of England's 326-year history. More recently, quantitative easing employed during the Covid-19 pandemic totalled £450 billion – more than what was previously spent during the financial crisis, Eurozone crisis and Brexit combined. Economic crises exacerbate inequality, especially age-group inequality. Younger generations are especially vulnerable to the effects of economic downturns; they are likelier to suffer during an economic crisis, their financial security deteriorates, and they are often unemployed during a recession period (OECD, 2021; Sironi, 2018; Junankar, 2015; ILO 2010).

This study investigates the key role that monetary policy plays in intergenerational inequality and whether monetary policy intervention increases income, consumption and wealth inequality between the young generation and the old generation in the UK. This study investigates inequality between two generations: the young and the old. This study examines whether the expansionary interest rate policy implemented in the aftermath of the financial crisis (i.e., post-2009) exacerbated inequality between the young and old generations. This paper focuses on the period from 1999 to 2020; the baseline period from 1999 to 2008 is defined as the time when no QE was implemented, and contractionary interest rate policy was

prominent. The baseline period is compared with the period from 2009 to 2020, during which expansionary monetary policy was prominent. The gain or the loss from both periods are compared to examine changes in intergenerational inequality.

Existing studies examine the heterogeneous responses of households and individuals at different levels of percentile and quantile distribution – low-income, middle-income, high-income, consumption and wealth percentile groups – to monetary policy shock (Coibion et al., 2017; Mumtaz and Theophilopoulou, 2017; Cloyne et al., 2016). The distinguishing feature of this study is that it examines whether expansionary monetary policy exacerbated wealth, income and consumption inequality between the young and old generations in the UK. The two periods – pre-monetary policy intervention (pre-QE/pre-2009) and post-monetary policy intervention (post-QE/post-2009) – are compared to understand the difference in inequality between generations. Ultimately, did inequality widen between young and old generations after the expansionary monetary policy intervention in 2009?

A growing number of other empirical studies establish a link between monetary policy transmission mechanisms and inequality (Furceri et al., 2018; Davtyan, 2017; O'Farrell and Rawdanowicz, 2016; Montecino and Epstein, 2015; Saiki and Frost, 2014; Villarreal, 2014). This study differs from other studies by examining the differential impact of monetary policy intervention on two generations. Did post-2009 monetary policy intervention exacerbate income, consumption and wealth inequality between the young generation and the old generation?

Inequality is a longstanding topic of discourse in the economic and political realms, but it gained greater prominence during the 2009 economic crisis. Studies have shown that economic crises exacerbate inequality (Susskind and Vines, 2020; Mínguez, 2017; Atkinson and Morelli, 2011). Central bankers are also paying increasing attention to inequality

(Panetta, 2015; Yellen, 2014).[1] The fact that interest rates and QE impact on wealth and income provides a significant mechanism for the ways in which monetary policy can affect individuals and households. Policymakers and researchers have argued about the distributional effect of monetary policy – who gains and who loses from monetary policy. Bernanke (2015) and Draghi (2016) suggest that expansionary monetary policy has a positive distributional impact, while Acemoglu et al. (2012), Cohen (2014) and Stiglitz (2015) argue that the distributional impact is negative, favouring the rich and exacerbating inequality. Contractionary monetary policy gives rise to low inflation and favours the wealthy (Greider, 1989), whereas high inflation induced by expansionary monetary policy favours young middle-class households, with the rich as the main losers (Doepke and Schneider, 2006).[2]

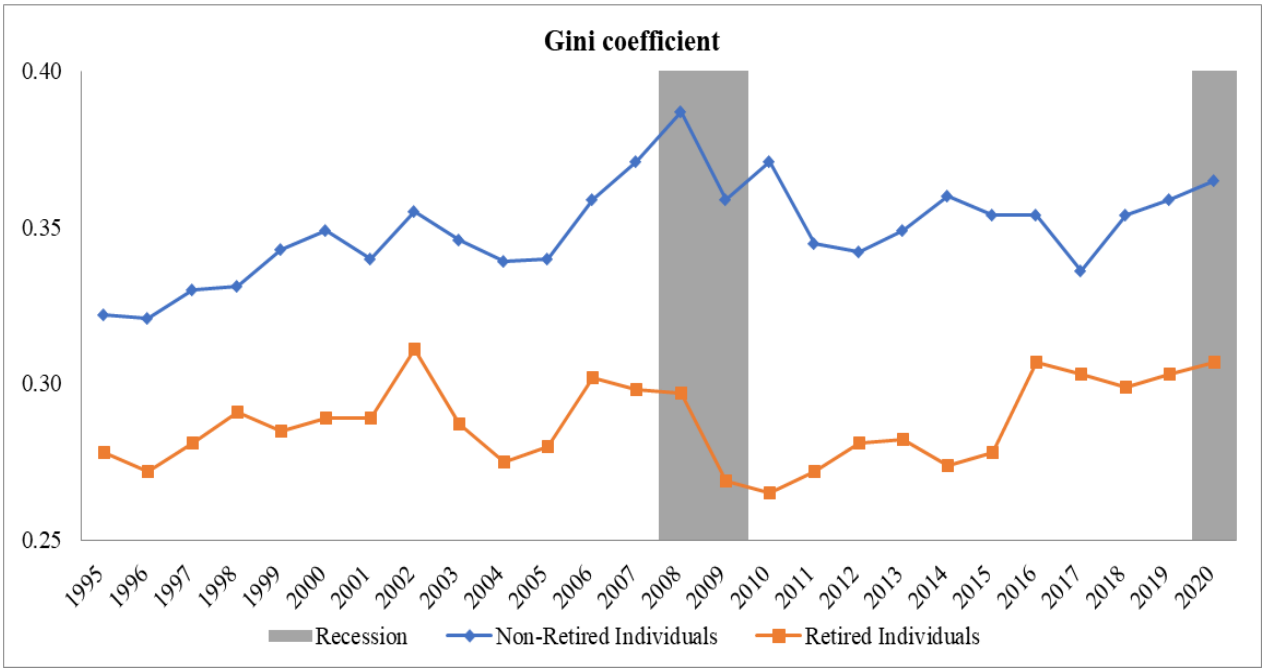
In the UK, inequality is a hot topic among political parties. The government regularly talks about tackling inequality and bridging the gap between the rich and the less wealthy.[3] However, the Gini coefficient shows that inequality is increasing: in 2019/2020, the UK Gini index was 0.36, compared to 0.33 in 2016/17. Overall, inequality has increased in the UK.[4]

Figure 1.1 shows the Gini coefficients for the distribution of income by non-retired and retired individuals. Inequality is higher in the working age group compared to the retired individuals.[5] During the recession period, inequality increased; post-recession, inequality reduced, but the Gini coefficient since 2017/18 shows an increase in both retired and non-

[1] The Bank of England (2012) acknowledged that quantitative easing has increased the prices of a wide range of assets; holdings are densely skewed, with the top 5% holding 40% of the assets.
[2] Several studies have empirically analysed the impact of inflation on inequality (Thalassinos et al., 2012; Albanesi, 2007; Bulíř, 2001; Galli and van der Hoeven, 2001; Romer and Romer, 1998; Al-Marhubi, 1997).
[3] Factors that have contributed to inequality includes de-unionisation (Jaumotte and Osorio Buitron, 2015), decline in top tax rate (Piketty et al., 2014), ageing (Karahan and Ozkan, 2013), increased globalisation (Feenstra and Hanson, 2003) and technology (Acemoglu, 2002).
[4] The Gini coefficient is a popular measure that represents the wealth and income inequality within a nation. It can range from 0 to 1 or 0 to 100. In the 0 to 1 range, 0 means perfect equality and 1 means complete inequality. In the 0 to 100 range, 0 reflects complete equality and 100 reflects complete inequality.
[5] The retired age group are (i) aged at or above the state pension age (SPA), (ii) aged over 50, retired or living in a retired household, sick/injured and not seeking work.

retired individuals, especially within the working age groups; therefore, inequality is increasing.

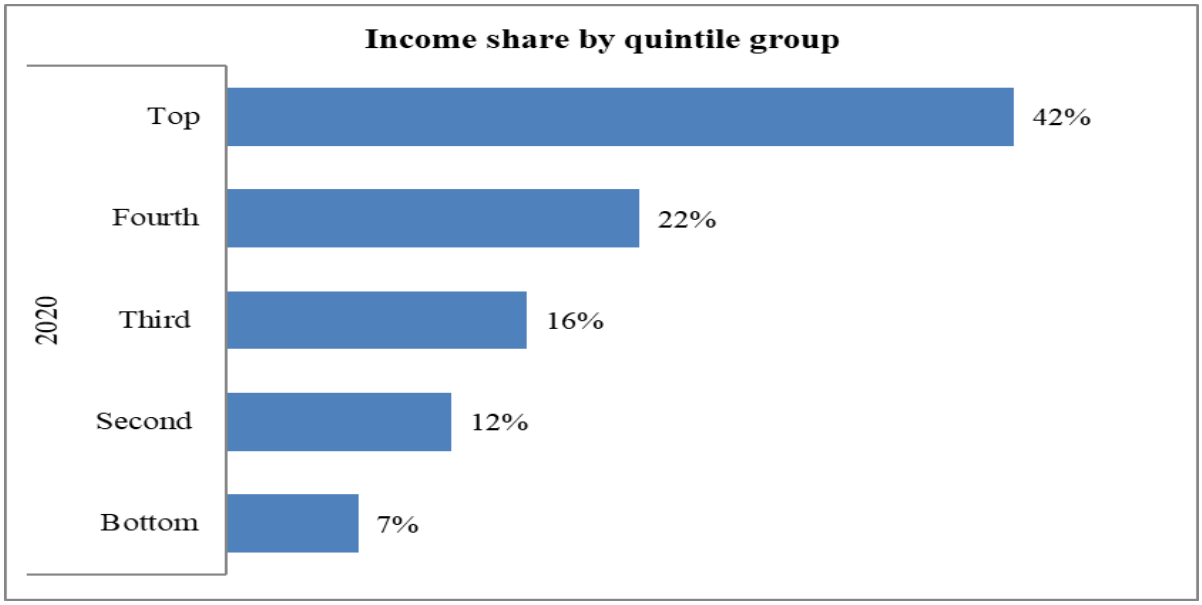
Figure 1.1 Gini coefficients for the distribution of income, retired and non-retired individuals



Source: Author's data analysis and ONS data.

Figure 1.2 presents the distribution of income by quintile group in the UK. Income is highly concentrated in the top quintile group.

Figure 1.2 Shares of household disposable income by quintile group, 2020

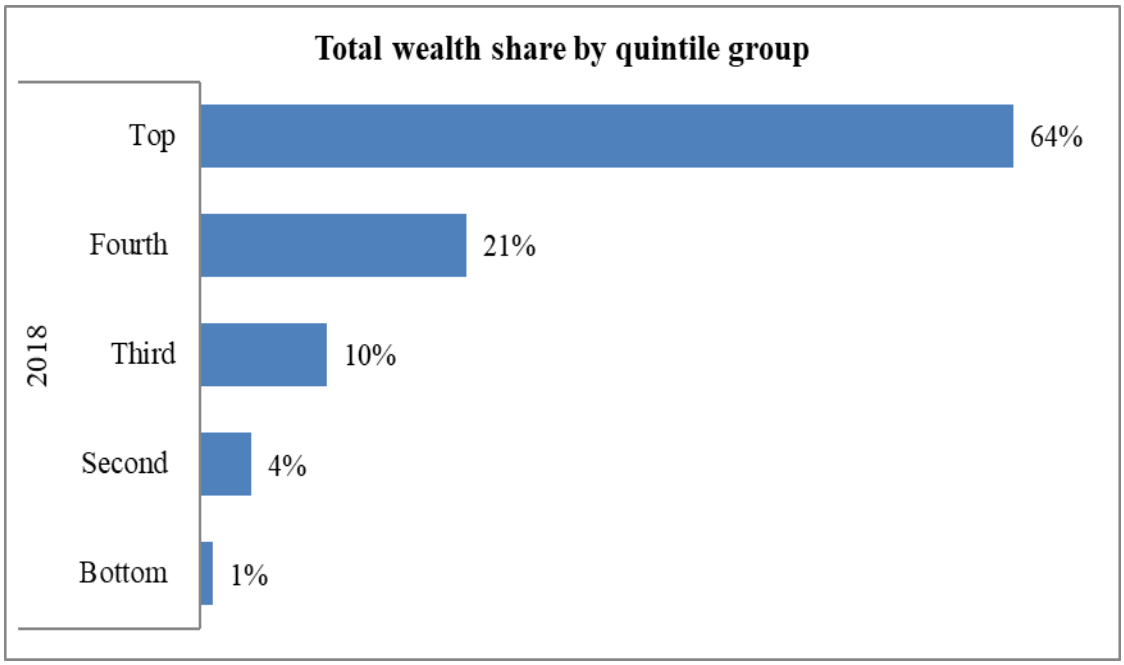


Source: Author's data analysis and ONS Household Finances and Living Costs and Food Survey data.

The disposable income share held in this category in 2020 is 42%. The fourth quintile group holds 22% of the income. This shows that 64% of UK disposable income is held by the top and the fourth quintile groups, while the bottom and second quintile groups accounted for 19% of the disposable income share.

The total wealth distribution by household shows that 64% of total UK wealth is highly concentrated in the top quintile group (Figure 1.3). In contrast, the bottom quintile group only accounted for 1% of total UK wealth. Overall, 85% of the total UK wealth is held by the top and fourth quintile groups, as highlighted in Figure 1.3.

Figure 1.3 Shares of aggregate household total wealth by quintile group, 2018

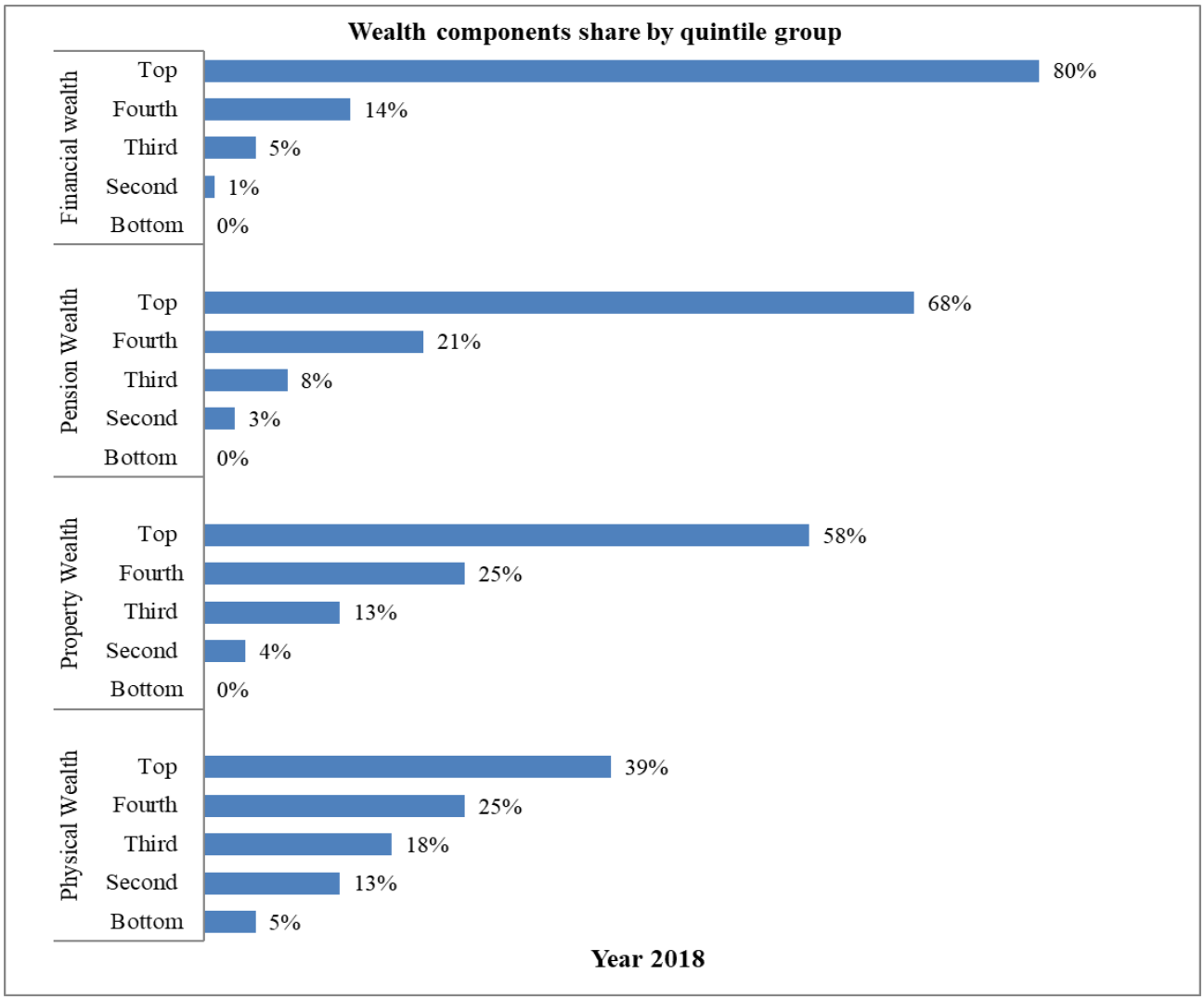


Source: Author's data analysis and ONS Wealth and Assets Survey Wave 6 (2016-18) aggregate data.

The total wealth components include property wealth, physical wealth, financial wealth and private pension wealth. In 2018, the distribution of household wealth by component showed that the aggregate wealth components were unevenly distributed. The bottom quintile group in the UK has no financial wealth, private pension wealth or property wealth, in contrast to the top quintile group, as shown in Figure 1.4. The top quintile group holds 80% of the UK's financial wealth, 68% of the private pension wealth, 58% of the property wealth and 39% of the physical wealth. Overall, more than 80% of the UK aggregate

financial wealth, private pension wealth and property wealth, along with 64% of the physical wealth, are held by the top and fourth quintile groups, as displayed in Figure 1.4.

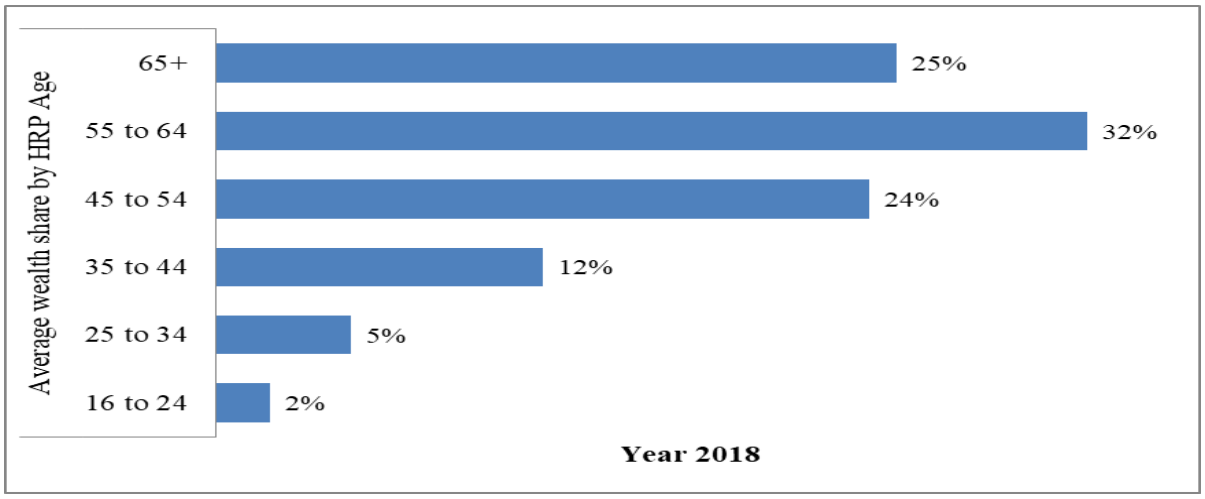
Figure 1.4 Quintile group shares of financial, private pension, property and physical wealth



Source: Author's data analysis and ONS Wealth and Assets Survey Wave 6 (2016-18) aggregate data.

Figure 1.5 shows the average wealth by age. The distribution of wealth by age of household reference person (HRP) shows that wealth is concentrated in the older age group category. On average, more than half of UK aggregate wealth is held by the 55+ age group.

Figure 1.5 Mean wealth share by age of household reference person (HRP)



Source: Author's data analysis and ONS Wealth and Assets Survey Wave 6 (2016-18) aggregate data.

This research seeks to gain an understanding of the implications of monetary policy transmission mechanisms by analysing the differential impact of monetary policy intervention on two generations, thus allowing this study to conclude its impact on intergenerational inequality. The following questions are addressed: What is the differential impact of monetary policy on two generations – the young and the old? Who is better off and who is worse off from the intervention? Did monetary policy intervention increase income, consumption and wealth inequality between young and old generations post-2009?

This paper addresses an information gap in the research on monetary policy transmission mechanisms and contributes to the literature by providing a detailed analysis of the impact of monetary policy intervention on inequality between two generations: the young generation and the old generation. It uses detailed micro-level data from the ONS Living Costs and Food Survey (previously known as the Expenditure and Food Survey) and the Wealth and Assets Survey. Income, consumption and wealth data are used as a measure of inequality. The country of study is the UK. The difference-in-differences (DID) model is used to analyse differences in income, consumption and wealth inequality over time between the young generation (25-44) and the old generation (45+).

The DID model is not widely used in macroeconomic contexts due to threats to identification (Nakamura and Steinsson, 2018). To overcome the challenges of the DID model, several robustness checks are conducted. The robustness checks include using alternative models that are common in macroeconomic contexts, such as Bayesian regression techniques (Bayes) and maximum likelihood estimation (MLE). More importantly, this paper allows a range of proxies for the macroeconomic variables to also have differential impacts on the two generations in order to confirm whether the DID model is actually picking up the differential effects of monetary policy. The challenges of the DID model are discussed in methodology subsection 1.5.3. The robustness checks section 1.8 elaborates further on ways to address the challenges of using the DID model in macroeconomic contexts.

The remainder of this chapter is structured as follows: Section 1.2 presents the literature review; Section 1.3 presents the theoretical framework; Section 1.4 presents the data; Section 1.5 presents the methodology; Section 1.6 presents the parallel trend assumption; Section 1.7 presents the empirical results; Section 1.8 presents the robustness checks and Section 1.9 presents a summary of the research and a conclusion.

1.2 Literature Review

There has been growing interest in the empirical analysis of how monetary policy affects inequality. However, only a few studies have analysed the impact of expansionary monetary on inequality, and the results have been mixed.

Hohberger et al. (2020) compare the impact of policy shock – specifically, the distributional effect of QE and conventional monetary policy – on inequality between two household groups: wealthier and poorer households in the Euro area. The empirical results show that expansionary conventional monetary policy and QE shock mitigate income and wealth inequality between wealthy and less wealthy households. Guerello (2018) uses a VAR

framework to analyse expansionary monetary policy impact on income inequality in the Euro area. The results show that expansionary monetary policy reduces income inequality. Samarina and Nguyen (2018) examine the effect of monetary policy on inequality in 10 countries within the Euro area between 1999 and 2014 using a panel VAR method, again finding that expansionary monetary policy reduces income inequality. Lenza and Slacalek (2018) examine the effect of QE on income and wealth inequality in the Euro area. Their findings show that monetary policy reduces income inequality but has a negligible impact on wealth inequality. O'Farrell et al. (2016) estimate the effect of the monetary policy channel via interest rate and asset price on inequality in selected advanced countries. Their results show that an expansionary interest rate decreases income inequality in Canada, the Netherlands and the US; in contrast, inequality increases in most European countries. Bivens (2015) constructs a counterfactual analysis to estimate the impact of monetary stimulus, low interest rate and QE on inequality in the US, concluding that monetary stimulus reduces income inequality. The distinguishing feature of this research is that the focus of this paper is on intergenerational inequality – inequality between the young generation and the old generation – rather than percentile groups and inequality at the country level. The measure of inequality in this paper includes consumption, in addition to income and wealth.

Mumtaz and Theophilopoulou (2020) analyse the impact of monetary policy shock on wealth inequality in the UK using detailed micro-level household Wealth and Assets Survey data. The study concludes that expansionary monetary policy shocks increase wealth inequality. Taghizadeh-Hesary et al. (2018) assess the impact of expansionary monetary policy in Japan using a vector error correction model (VECM). Their results show that monetary policy, zero interest rate policy and negative interest rate policy increase income inequality. Inui et al. (2017) employ micro-level data to study the distributional effect of monetary policy on inequality in Japan using a local linear projection (LLP) method. The

study finds that expansionary monetary policy shock increases income and earnings inequality. Mumtaz and Theophilopoulou's (2017) study reveal that QE policy increases income inequality. Cloyne et al. (2016) analyse the impact of monetary policy on households with debt in the UK and US. The household survey data sample covers 1975 to 2007 for the UK and 1981 to 2007 for the US. Their findings show that expansionary monetary policy increases income inequality. Domanski et al. (2016) analyse the potential effect of monetary policy via interest rate and asset price on inequality in France, Germany, Italy, Spain, the UK and the US. Their findings conclude that wealth inequality increases under such measures.

Montecino and Epstein (2015) use recentred influence function (RIF) regressions to analyse the impact of QE on income equality in 2008–2010 ("pre-QE") and 2011–2013 ("post-QE") in the US. The study concludes that QE increases income inequality. Saiki and Frost (2014) examine the distributional impact of unconventional monetary policy on inequality in Japan using a VAR model. Their results show that expansionary monetary policy widened income inequality. Juan-Francisco et al. (2019) examine the distributional impact of unconventional monetary policy on income and wealth in the Eurozone and the US using a structural vector autoregressive (SVAR) methodology. Their study finds that expansionary monetary policy increases income and wealth inequality in the US; however, their results were insignificant for the Euro area.

Bunn et al. (2018) estimate the short-term distributional impact of monetary policy in the UK and by age between 2008 and 2014 using panel data from the ONS Wealth and Assets Survey. Their results show that the younger age group benefit from income through higher wages and lower unemployment, while the retirement age group boost their wealth due to rising asset prices. In addition, their findings show that accommodative monetary policy has a negligible impact on income and wealth inequality in the UK. Casiraghi et al. (2018) analyse the distributional implication of monetary expansion for Italian households.

Their findings show that expansionary monetary policy reduces labour income inequality for the less wealthy. Overall, the study concludes that monetary policy has a negligible impact on inequality indexes.

Other studies have analysed the distributional consequences of contractionary monetary policy on inequality, with mixed empirical results reported. Aye et al. (2019) use US quarterly time series data from 1980 to 2008 to investigate the impact of monetary policy shock on inequality, concluding that contractionary monetary policy led to an increase in income inequality. Furceri et al. (2018) conducted panel data analysis of 32 advanced and emerging market countries from 1990 to 2013 to examine the impact of monetary policy shock on inequality. The study concludes that on average, contractionary monetary policy shock increases income inequality. Coibion et al. (2017) analyse monetary policy shock on income inequality in the US since 1980. Their findings show that contractionary monetary policy has a significant and persistent effect on inequality, leading to higher levels of income and labour earning inequality. Mumtaz and Theophilopoulou (2017) use micro-level data from 1969 to 2012 to analyse the impact of monetary policy shock on inequality in the UK. Their results show that a contractionary policy shock leads to an increase in income and earnings inequality and that low-income households are adversely affected compared to top-income households. In contrast, other studies find a decrease in inequality. For example, Davtyan (2017) analyses the distributional effect of monetary policy in the US and finds that contractionary monetary policy reduces income inequality. Similarly, Villarreal (2014) studies the impact of monetary policy on income inequality in Mexico, finding that a sudden increase in nominal interest rate decreases household income inequality.

The country of study for this paper is the UK. This paper is distinct in that it analyses whether income, consumption and wealth inequality was exacerbated between the young and the old generations after expansionary monetary policy intervention post-2009, in the

aftermath of the recession caused by the global financial crisis. The data sample covers the period 1999 to 2020. More specifically, two periods are compared – 1999 to 2008 and 2009 to 2020 – to understand changes in inequality between generations.

Krueger (2012) created the Great Gatsby curve (GGC) that highlighted relationship between inequality and intergenerational mobility. Inequality goes beyond household income. Persistence in inequality is affected by intergenerational mobility and the gap between the wealthy and the least wealthy in society. Krueger (2012) suggests that income inequality has a positive relationship with the lack of upward progression in succeeding generations. Intergenerational mobility factors that affect inequality include family structure, parental socioeconomic status such as educational attainment, social influences and occupation (Durlauf and Seshadri, 2018). Jerrim and MacMillan (2015) find that unequal access to financial resources is an important driver in the intergenerational transmission of advantage. Wealthy parents have greater resources to invest in their children than less wealthy families. Inequality and intergenerational persistence can be reduced if government intervention is significantly skewed towards the less wealthy (Becker et al., 2018). This paper aims to check the impact of monetary policy intervention on the young and the old generation in order to establish whether the intervention alleviates inequality between the two groups.

Several theoretical models exist for monetary policy impact on inequality. In assessing the impact of monetary policy transmission on inequality, Melcangi and Sterk (2020) conclude that monetary tightening increases wealth and consumption inequality. Luetticke (2018) investigates the importance of monetary policy in a New Keynesian business cycle. The results show that contractionary monetary policy increases wealth and income inequality. Gornemann et al. (2016) examine the distributional consequences of monetary policy. Their findings show that contractionary monetary policy shock increases income, earnings, wealth and consumption inequality. Likewise, Areosa and Areosa (2016)

conclude that contractionary monetary policy shock via interest rate increases inequality. Motta and Tirelli (2014) analyse the impact of monetary shock on inequality. In contrast to the other theoretical model, their results show that unexpected monetary contraction policy reduces income inequality. Rather than a theoretical model, this study uses applied micro-econometrics – in the form of a DID model – in analysing the distributional impact of monetary policy on two generations – the young and the old.

1.3 Theoretical Framework

Interest rates and QE are the key monetary policy tools used by central banks to achieve macroeconomic objectives. Interest rate is the conventional monetary policy tool, while QE is the unconventional monetary policy tool. QE was first adopted in the UK during the financial crisis in 2009. It is also known as large-scale asset purchase (LSAP), with the objective of stimulating the economy. The concept involves buying government bonds, corporate bonds and long-term financial securities on the open market with the aim of increasing money supply, which is expected to boost investment and lending. QE has been employed in the UK in four different years, as detailed below.

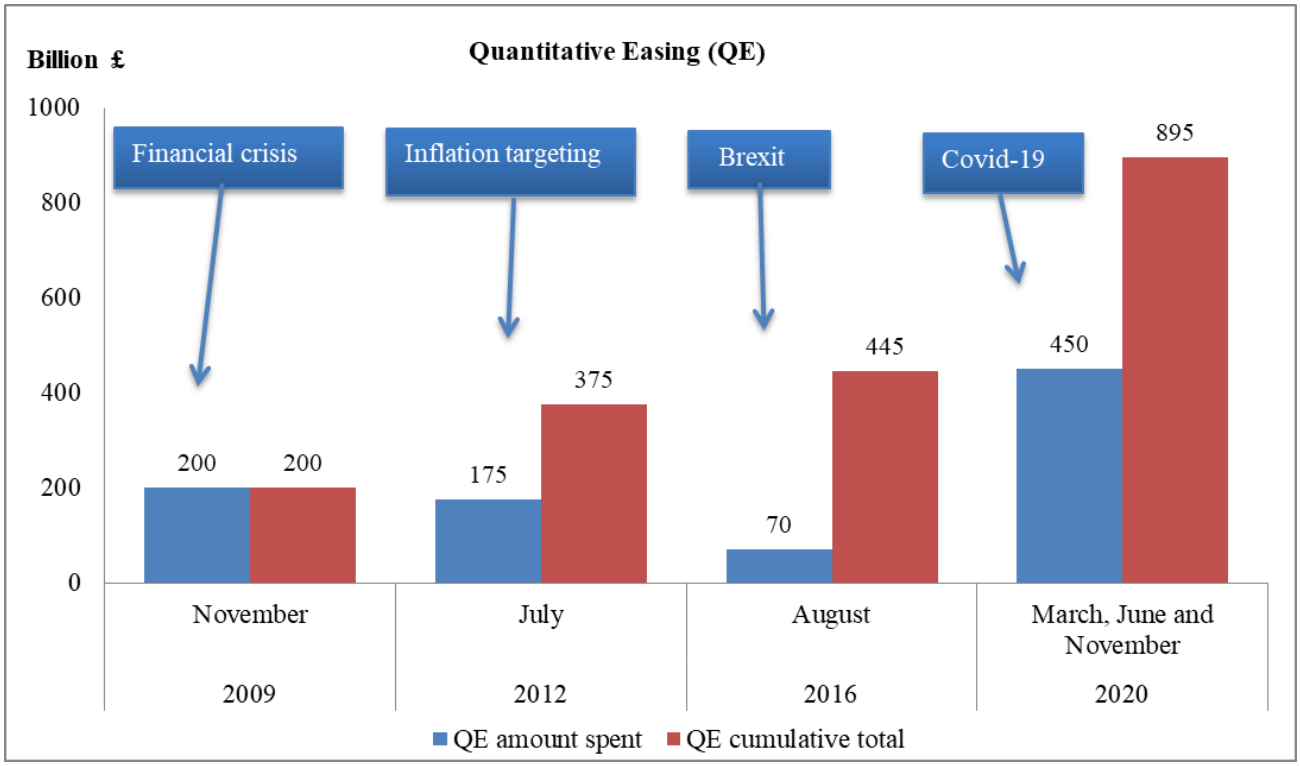
Figure 1.6 shows the QE amount used in each period of the economic crisis along with the cumulative QE to date. The first round of QE was used during the 2009 financial crisis. The second round was employed in 2012 to meet the inflation target in the medium term; a Eurozone crisis occurred during the same period. The third round was utilised in 2016 during the Brexit vote. The fourth round was used in 2020 during the Covid-19 pandemic.[6]

Various theories have been proposed on how QE works, including portfolio balance theory, signalling theory and preferred habitat theory (Williamson, 2017; Yu, 2016). Portfolio balance theory posits that investors will rebalance their portfolios by reducing the quantity of

[6] The Brexit vote is the period in which the UK voted to leave the European Union (EU).

riskier assets and increasing the supply of safer assets; in turn, this lowers the risk premium. Signalling theory posits that interest rates will be low in the future given that LSAP purchases may be viewed as a signal of a weak economy, with the expectation that expansionary monetary policy will be in place for a long time. Habitat theory suggests that an increase in asset purchases will subsequently reduce the net supply of assets, and this will lead to a reduction in interest rate, thereby reducing term premiums.

Figure 1.6 Bank of England (BoE) quantitative easing programme



Source: Author's data analysis and BoE data.

Coibion et al. (2012) proposes the following theoretical channels by which monetary policy may affect income, consumption and wealth inequality: the earnings heterogeneity channel, the income composition channel, the portfolio channel, the financial segmentation channel and savings redistribution channel.

In the earnings heterogeneity channel, the major source of household income is labour income. Low-skilled and high-skilled workers are disproportionately affected by the economic crisis, with the former likely to be severely impacted during the economic

downturn. Low-income households are likelier to benefit from economic stimuli than high-income households, and expansionary monetary shock could ameliorate income inequality.

In the income composition channel, the primary sources of income for households are wages, business income, financial income and pension income. Expansionary monetary policy shock may have a positive impact on business and financial income. Wages are sticky and less likely to change. High-income households whose primary sources of income are business income and financial income are likelier to benefit more from expansionary monetary stimuli than low-income households with labour earning because business income may increase as profit increases. Expansionary monetary policy may potentially widen income and consumption inequality.

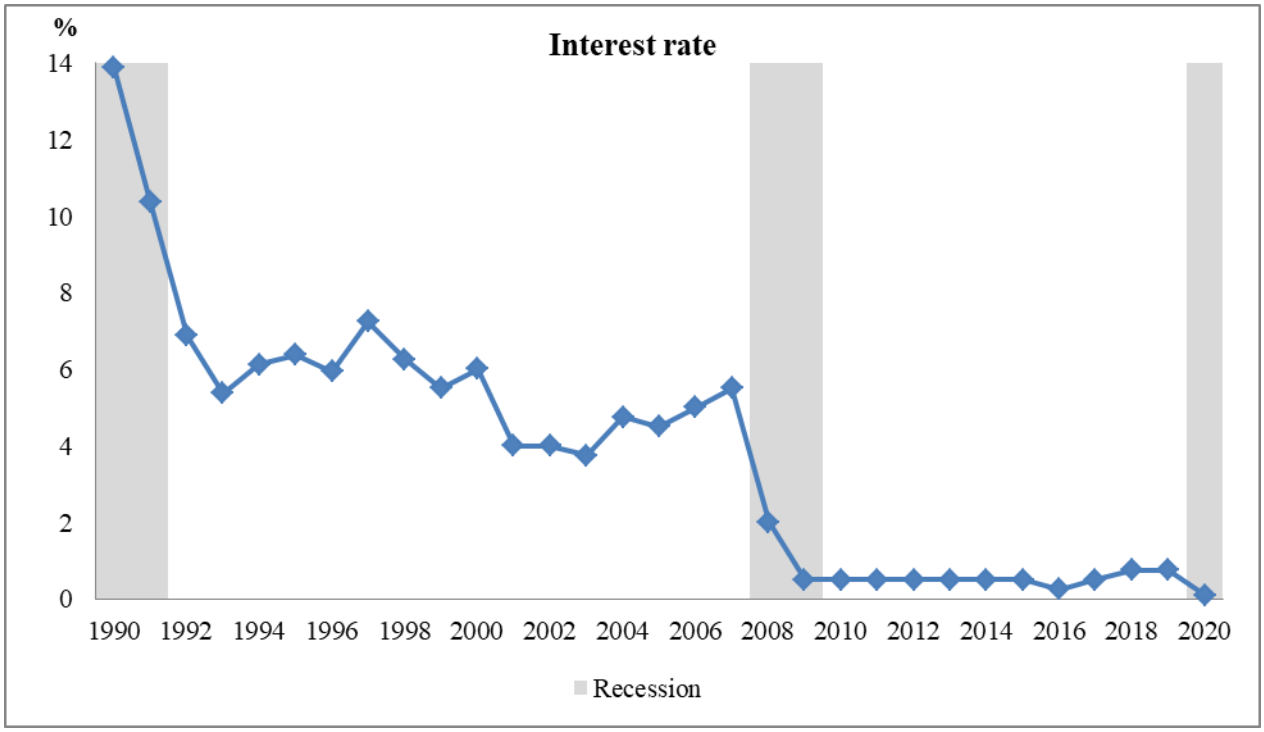
In the portfolio channel, high-income households invest in assets, while low-income households tend to hold cash. Wealthier households benefit from expansionary monetary policy through increasing asset prices, to the detriment of low-income households that experience inflationary action and decreasing interest rates. This leads to an increase in wealth inequality.

In the financial segmentation channel, wealthy households are likelier to trade in financial markets than low-income households. As such, the increase in money supply tends to benefit those households linked to the financial markets compared to the unconnected households, and income, consumption and wealth inequality may increase as a result of the expansionary monetary policy.

In the savings redistribution channel, high-income households tend to be savers, while low-income households are likelier to be borrowers. A sudden increase in interest rate benefits savers, while borrowers' expenses increase. As a result, savers become wealthier than borrowers, and this increases consumption inequality.

Figure 1.7 shows the UK interest rates from 1990 to 2020. Since the financial crisis, the UK has enjoyed much lower interest rates compared to before the financial crisis (in addition to the QE intervention). With QE, demand for assets increases, so QE and expansionary interest rates can have a positive impact on asset prices (Bordo and Landon-Lane 2013; Bernanke and Gertler, 2000). Increasing demand for bonds tends to increase the price of the bonds but lowers the interest rate, and a low interest rate makes loans cheaper and savings unattractive. Households and individuals with cash may prefer to invest their money in assets for a higher return. As the demand for assets increases, the price of assets rises. When demand outstrips supply (one example is the property market), asset prices are pushed up.

Figure 1.7 Bank of England interest rates, 1990–2020



Source: Author's data analysis and BoE data.

Simultaneously, the cost of servicing assets is inexpensive due to the low interest rate. The increasing asset price may compensate for the loss of investment income. QE and expansionary interest rates may have little impact on investment income. Since QE facilitates the reduction of risky assets while increasing the supply of safer assets, risky assets usually

attract a high return, while safer assets attract a low return. As a result, expansionary monetary policy may have a negligible impact on investment income.

Additionally, with QE, the expectation is that the interest rate will be low. This may have an impact on consumption expenditure. Mortgages are one of the consumption expenses that households incur, and QE has a mitigating impact on mortgage payments (Fuster and Willen, 2010: Krishnamurthy and Vissing-Jorgensen, 2011). Since the interest rate determines the price of a mortgage, the expectation of low interest rates caused by QE can make mortgages cheaper and more affordable, thereby reducing consumption expenditure. Other studies have examined the effect of monetary policy on the wider economy. Some have shown that QE has a positive impact on firm behaviour, leading to further capital investment and boosting employment income. Consequently, firms become less credit-constrained (Ferrando et al., 2019; Foley-Fisher et al., 2016; Montecino and Epstein, 2015).

This paper hypothesises the channels by which monetary policy can affect intergenerational inequality: the intergenerational income channel, the intergenerational consumption channel and the intergenerational wealth channel.

In the intergenerational income channel, the younger generation is likely to be more affected during the recession period due to a decline in financial security caused by job losses, while the older generation's income may be relatively stable since part of this income comes from pensions, which seem to be unaffected during the recession.[7] Since QE boosts investment in firms through credit availability, firms expand and create more employment opportunities, thereby boosting income. The younger generation gains from firm expansion and investment, and its income position improves. However, this generation is likeliest to be vulnerable to the effects of economic shock. Since the older generation is likelier to be highly

[7] The UK government introduced a triple lock policy on the state pension in 2010. It was a pledge that the state pension would not dwindle its value in real terms. It guarantees a yearly increase in the state pension by the highest of the three measures: average earnings, inflation, and 2.5%.

skilled than the younger generation, it is less vulnerable to economic crises and has better job security than the younger generation. The older generation may also gain from firm expansion by moving from low-paying jobs to high-paying jobs due to their work experience and skills. Consequently, QE can potentially reduce income inequality between the younger and older generations. The latter are likely to be savers and to gain additional income from saving. With expansionary interest rates, they may lose out on savings income, thus potentially increasing income inequality between the young generation and the old generation. Increasing investment through QE makes the younger generation's position stronger and their income relatively stable, whereas the older generation's position may become weaker due to the loss in savings income. Given that expansionary interest rates make saving unattractive, this paper empirically analyses the following hypothesis: Did expansionary monetary policy intervention increase income inequality between the young generation and the old generation?

In the intergenerational consumption channel, mortgage payments form part of consumption expenditure. If mortgage payments are reduced by QE, the implication is that this can stimulate consumption. Another implication is that if household expenditure falls due to low mortgage payments, this can free up more cash for households. Expansionary interest rates make credit facility cheaper, easier and affordable; more cash and affordable credit facilities can cumulate to higher consumption. For example, a household with high mortgage expenses can potentially benefit more than a household with lower mortgage payments, and the older generation is likelier to have fewer mortgage repayments than the younger generation. If QE reduces consumption overall, the spill-over effect and expansionary interest rate leads to more cash and affordable credit facilities, which can lead to higher consumption in younger households than older ones (i.e., greater consumption inequality). This study will

empirically test this hypothesis as follows: Did expansionary monetary policy intervention increase consumption inequality between the young generation and the old generation?

In the intergenerational wealth channel, the older generation is likelier to be the wealthier household, while the younger generation is the less wealthy household. Individuals and households tend to accumulate wealth with age, especially during active working age. The average value of household assets increases as the age of the head of the household increases. If QE leads to higher asset demand, the price of assets increases. The older generation also has a higher level of wealth portfolio, and its average asset values increase relative to the younger generation, which has little or no assets. Thus, QE can potentially widen asset inequality between the generations. As QE reduces interest rates, an expansionary interest rate reduces risk premiums, leading to a boost in the financial condition of the borrower. In other words, expansionary interest rates enhance the financial position of the borrower. The younger generation are borrowers and the generation of big spenders, while the older generation are likelier to be savers. Due to the reduction in interest rate and risk premium, this incentive can drive the younger generation to purchase assets to take advantage of the lower interest rate and risk premium. As a consequence, an expansionary interest rate can potentially reduce wealth inequality between the generations. This study empirically evaluates the following hypothesis: Did expansionary monetary policy intervention reduce wealth inequality between the young generation and the old generation?

Theoretically, monetary policy impacts on intergenerational income, consumption and wealth inequality. This paper empirically evaluates the above hypotheses by estimating the differential impact of monetary policy intervention on income, consumption and wealth inequality between the young generation and the old generation. This reflects the information gap in the literature that this study intends to resolve.

1.4 Data

Microdata are utilised in this study to investigate the differential impact of monetary policy intervention on intergenerational inequality. Equivalised income, consumption per capita and wealth at household level are constructed from the microdata and used as measures of inequality for the young generation and the old generation.

1.4.1 Living Costs and Food Survey (LCF)

Consumption and income data are used as measures of inequality in the analysis of the impact of monetary policy on intergenerational inequality. The microdata are taken from the Living Costs and Food Survey (LCF), run and controlled by the UK's Office for National Statistics (ONS).[8] The raw data are accessible from the UK data service in Stata, SPSS and other formats. The LCF survey sampled more than 5,000 households in a year, on average. The data for this paper are derived at the household level.

The disposable household income components are made up of gross wages, income from self-employment, income from investment, pension, annuities and social security benefit less national insurance contribution, income tax and excluding any refunds. Household disposable income is equivalised using the modified Organisation for Economic Co-operation and Development (OECD) scale household size.[9] Equivalised income makes standard of living comparable among households; the equivalisation method adjusts household income, considering household composition and size together with differential financial resources requirements for different types of households (ONS, 2015). The household age range covered in the sample for the equivalised income is 25 and over. The

[8] The survey was initially named the Family Expenditure Survey (FES) when it started in the 1960s (until 2001). The survey name was changed to the Expenditure and Food Survey (EFS) from 2001 to 2007, then again in 2008 to the Living Costs and Food Survey (LCF). EFS, FES and LCF typically reflect the same survey.

[9] The equivalised income is derived by dividing household income by the OECD modified scale. The modified OECD scale assigns a value of 1 to the household head, 0.5 to each additional adult member and 0.3 to each child. The modified OECD scale reference point used in our data construction is all adults living in the household excluding children.

sample data cover between 1999 and 2020; this allows for trend analysis in inequality at least 10 years before the intervention in 2009 and compares it with the trend in inequality after 2009. The total household sample size for the whole sample period used for the equivalised income is approximately 123,400 observations.

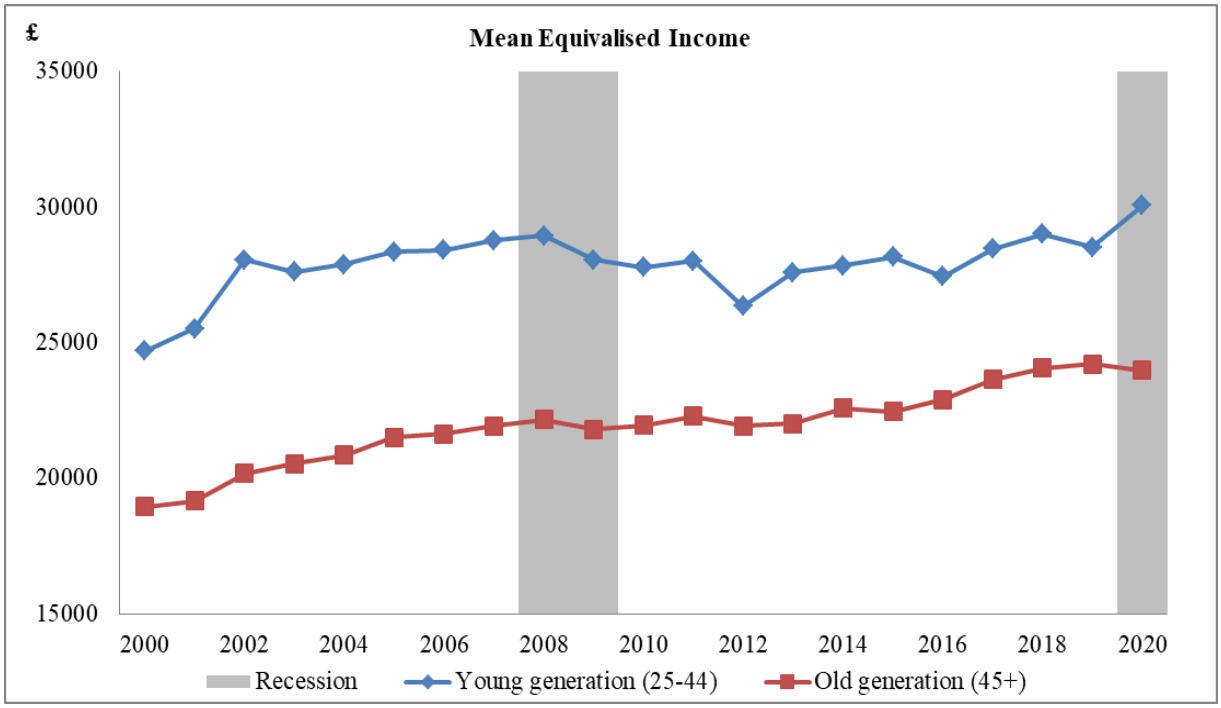
The difference-in-differences (DID) model is used to analyse whether expansionary monetary policy intervention after 2009 widens income inequality between the younger and the older generations. DID examines the trend pre-intervention and post-intervention. The trend in "pre-2009" income is examined before the monetary policy intervention, while "post-2009" examines the differences in income between the younger and the older generations after the intervention. The age-group income distribution range for the young generation is 25–44, while the old generation age range is 45+. The equivalised household disposable income is deflated to 2019/20 prices using the Consumer Prices Index including owner occupiers' housing costs (CPIH). The household income raw data obtained from the LCF are analysed to provide a preliminary examination of the trend in the mean and median equivalised income for the young generation and the old generation.

Figure 1.8 shows the average (mean) equivalised income for adults aged 25–44 and over 45. The average income for the young generation is about £25,000 in 2000; in 2020, the mean income is £30,000. A slight decrease in income is observed during the financial crisis; post-crisis, income increased for both the young generation and the old generation.

Figure 1.9 shows the median equivalised income for the two generations. The median shows the income earned by the middle person in the young and old generational populations. In 2000, the median equivalised income for the young generation was approximately £21,500. In 2020, the median equivalised income was £28,000. The median income for the old generation is £15,000 in 2000, rising to about £21,000 in 2020. Although the young

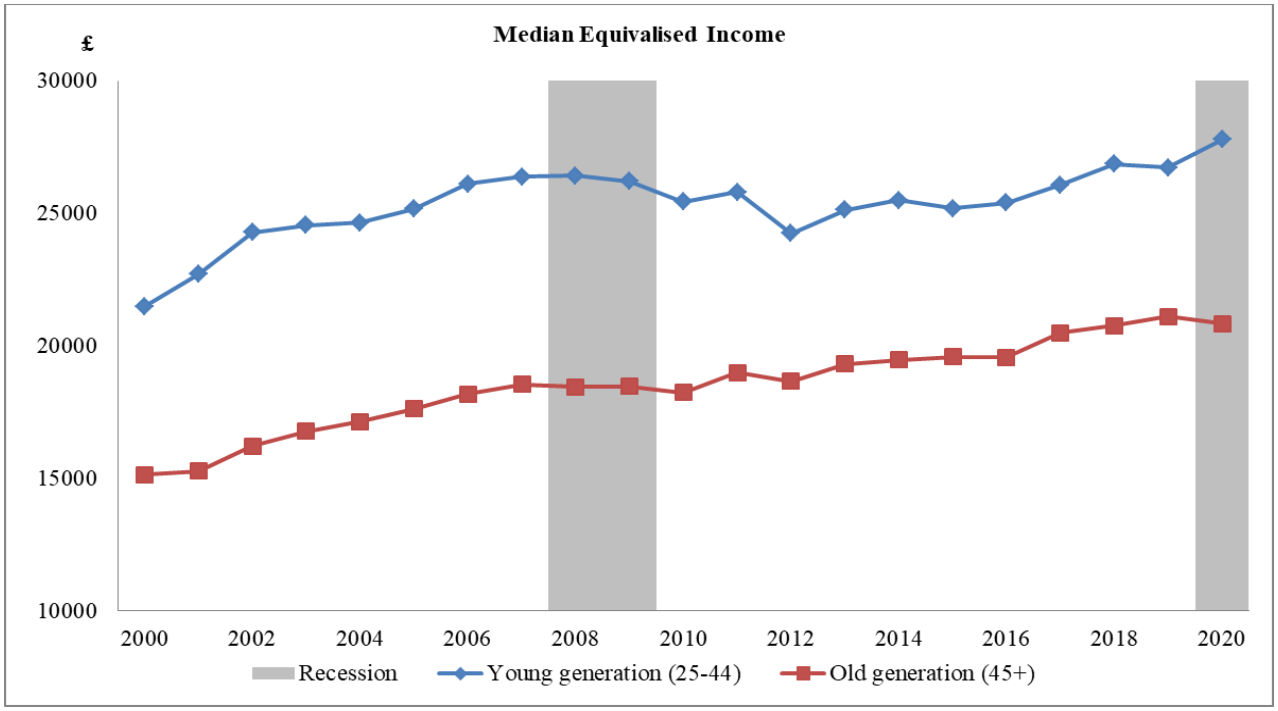
generation median equivalised income decreased during the financial crisis, it increased after 2012.

Figure 1.8 Mean (average) equivalised income



Source: Author's data analysis and LCF.
Notes: Data are weighted and presented in real values.

Figure 1.9 Median equivalised income



Source: Author's data analysis and LCF.
Notes: Data are weighted and presented in real values.

The total consumption data components include durable, semi-durable and non-durable consumption.[10] The consumption data at the household level obtained from the LCF are measured as consumption per capita, which shows the expenditure per adult in the UK. Measuring the consumption data as consumption per capita makes the household data comparable by taking into consideration household financial resources. The household age range covered in the sample for consumption per capita is 25 and over.

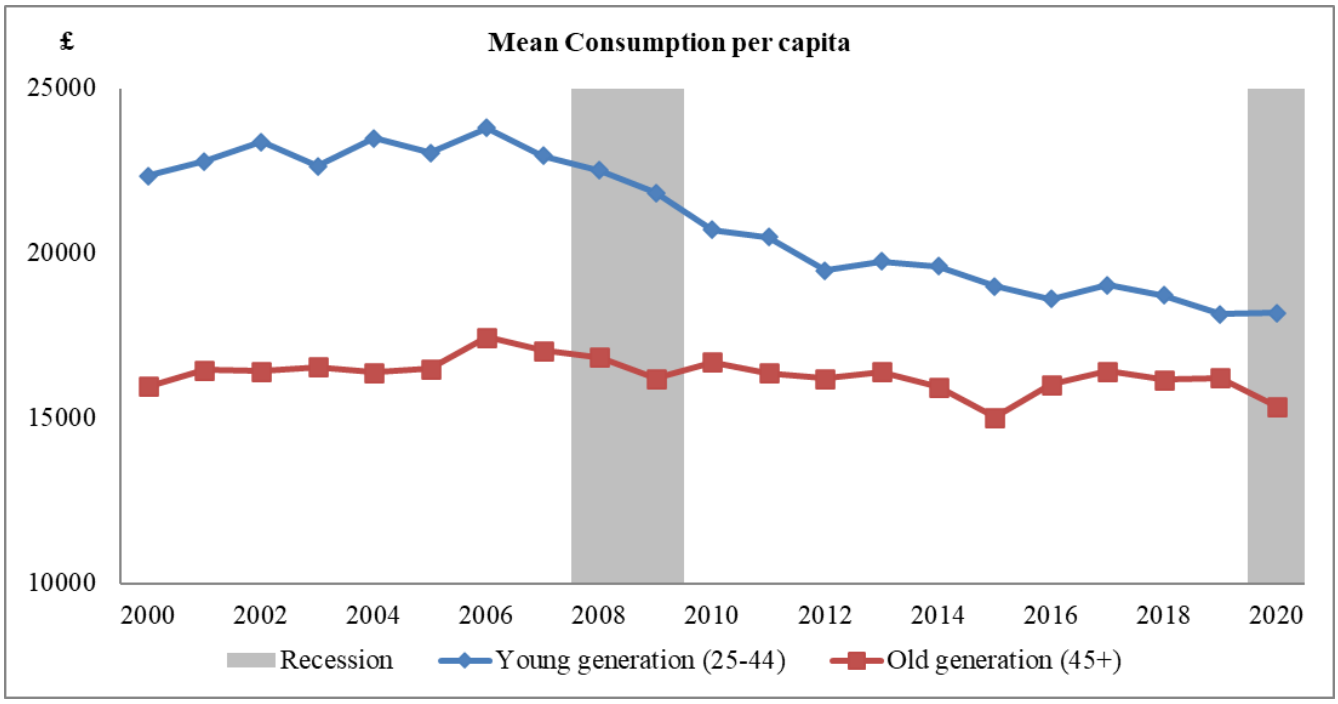
The total household sample size for the whole sample period used for the consumption per capita is approximately 123,700 observations. The data cover the period from 1999 to 2020. The period 1999–2008 ("pre-2009") examines the trend in consumption before the monetary policy intervention, while the period 2009–2020 ("post-2009") examines the trend in consumption after the monetary policy intervention. The two periods are compared to establish whether consumption inequality is reduced after monetary policy intervention. The DID model is used to examine whether expansionary monetary policy decreased consumption inequality between the young generation and the old generation. The consumption per capita figure is deflated using the Retail Price Index (RPI).[11] All values used in this paper are presented in real values.

Figure 1.10 shows the average (mean) consumption per capita for both generations. The trend in consumption per capita shows a decrease for the young generation, while the old generation shows little difference in consumption per capita over the period of analysis.

[10] The total consumption expenditure is for all adults in the household; children's expenditure is excluded from the total expenditure. Expenses include food and non-alcoholic beverages, alcohol, clothing and footwear, equipment, household goods, housing education, health, transport and communication. A detailed breakdown of total consumption expenditure can be found on the Living Costs and Food Survey Volume G Derived Variable Flowcharts page.

[11] Consumption per capita is derived by dividing total consumption by total number of adults in the household. All expenditures relate to adults living in the household.

Figure 1.10 Mean consumption per capita

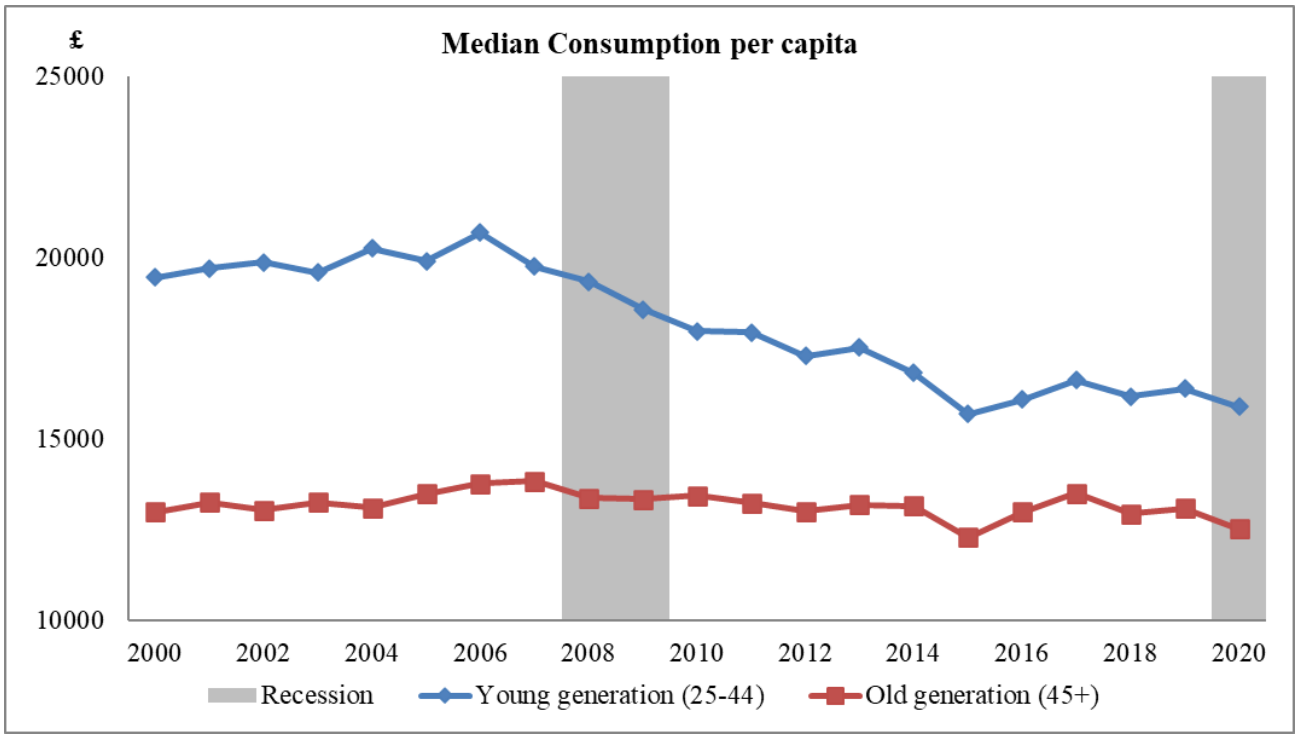


Source: Author's data analysis and LCF.
Notes: Data are weighted and presented in real values.

Consumption per capita is higher for the young generation than the old generation, amounting to £22,300 and £15,900, respectively, in the year 2000. During the recession in 2009, consumption per capita reduced to £21,800 for the young generation, while the old generation consumption per capita remains fairly consistent. In 2020, consumption per capita further reduced to £18,200 for the young generation, while the old generation saw a slight reduction to £15,400.

Figure 1.11 presents the median consumption per capita for the young and the old generations. The median consumption per capita for the young generation shows a decrease both during and after the recession period. In the pre-recession period, the consumption per capita for the young generation was approximately £20,600 in 2006 and £15,800 in 2020. In contrast, the old generation shows minor differences in consumption per capita over the period of analysis: falling slightly from £13,700 in 2006 to £12,500 in 2020.

Figure 1.11 Median consumption per capita



Source: Author's data analysis and LCF.
Notes: Data are weighted and presented in real values.

1.4.2 Wealth and Assets Survey (WAS)

The final measure for inequality is wealth data, which measures the wellbeing of households in term of their assets, savings, pensions and debt. Here, the wealth data are taken from the Wealth and Assets Survey (WAS), established by the ONS in 2006. The dataset for this study covers the period from 2006 to 2020; the data are collected biennially. The first wave of survey data is 2006–2008, and the last wave for this empirical analysis covers wave seven (2018–2020). Wave one covers approximately 30,500 households; 20,100 households in wave two; 21,400 households in wave three; 20,200 households in wave four; 18,800 households in wave five; 18,000 households in wave six; and 17,500 households in wave seven. The raw data are accessible from the UK data service in Stata, SPSS and other formats.

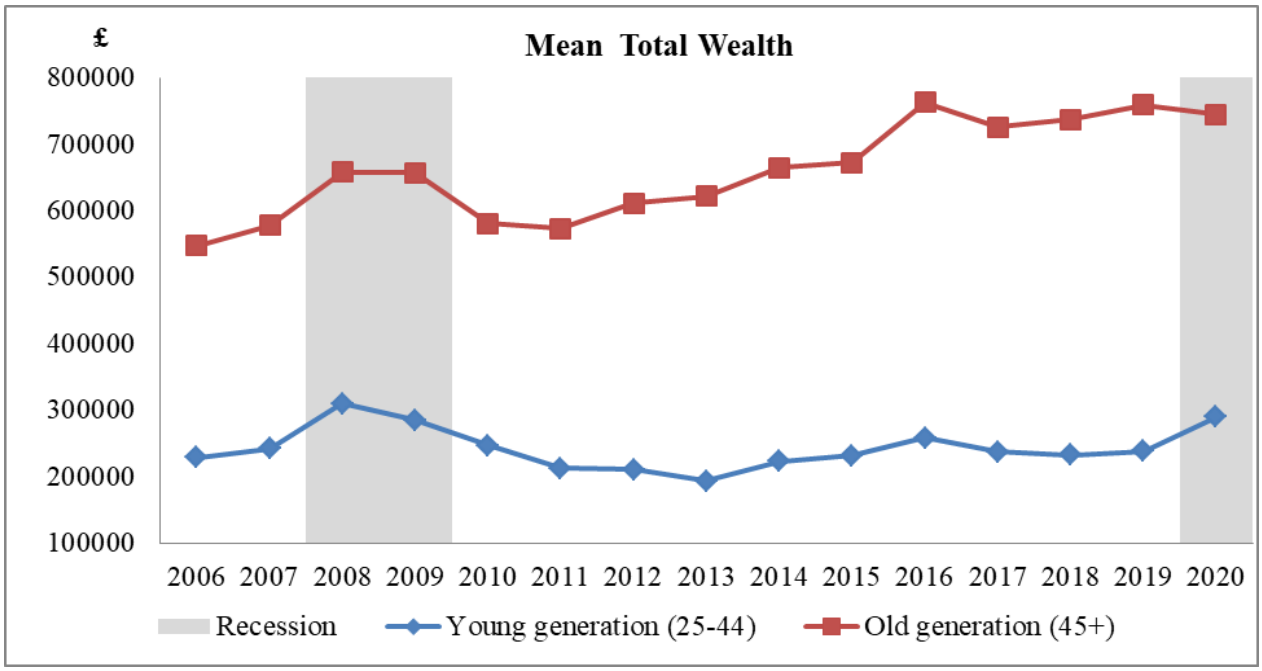
The wealth data components include physical wealth, property wealth, pension wealth and financial wealth less any liabilities. The household age range covered in the sample for

the wealth data is 25 and over. The total household sample size for the whole sample period used for the household wealth data is approximately 139,800 observations. The age-group wealth distribution range for the young generation is 25–44, while the old generation age range is 45+. The household total wealth data are deflated to 2019/20 prices using the CPIH.

The WAS started in 2006, so the period 2006–2009 is used to examine the trend in wealth before the monetary policy intervention; post-2009 examines the trend in wealth after the expansionary monetary policy intervention. The two periods are compared to investigate whether monetary policy intervention exacerbates wealth inequality between the young generation and the old generation.

A preliminary review of the raw data from the WAS shows the trend in total wealth holdings for the two generations. Figure 1.12 shows the mean (average) wealth for the young and old generations. The old generation's average total wealth is higher than that of the young generation. In 2006, the average total wealth for the young generation was about £230,000, compared to approximately £550,000 for the old generation.

Figure 1.12 Mean total wealth

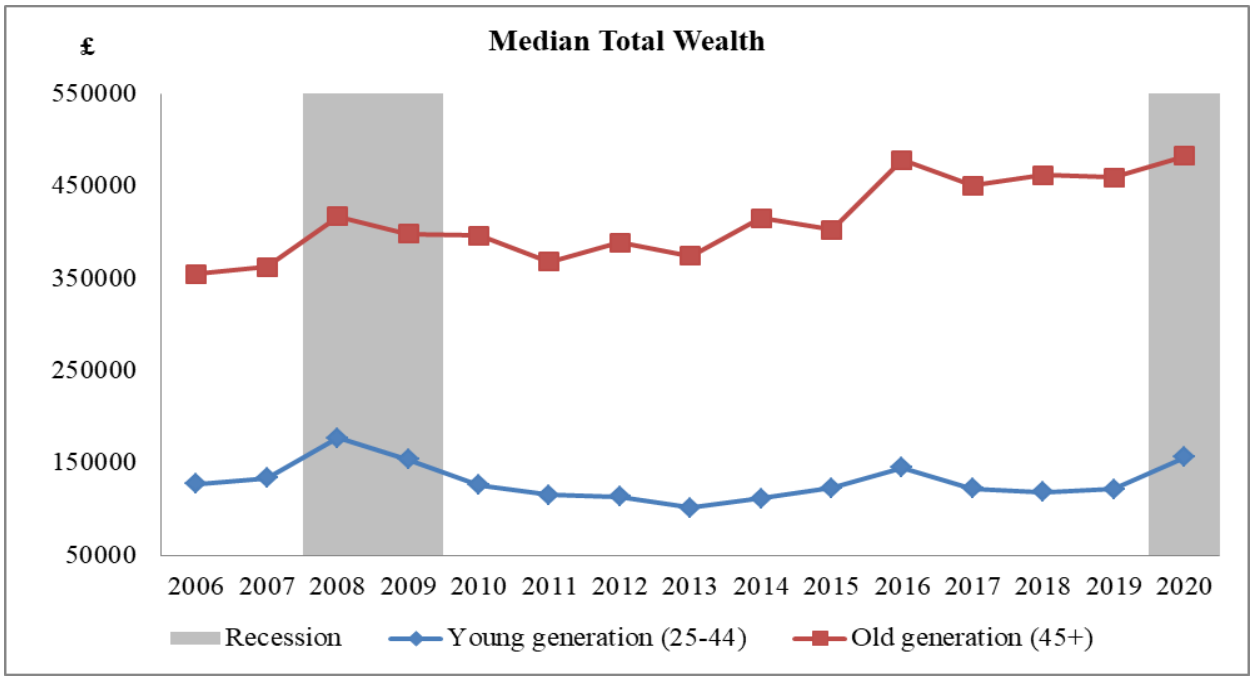


Source: Author's data analysis and WAS.
Notes: Data are weighted and presented in real values.

During the recession period in 2008–2009, total wealth decreased for both the young and the old generations. Post-financial crisis, average total wealth increased for both groups. In 2020, the average total wealth for the young generation was £290,000, while the average total wealth for the old generation was £740,000. Evidently, then, the old generation increased its average wealth significantly more than the young generation (Figure 1.12).

Figure 1.13 presents the median total wealth for the two generations. Pre-financial crisis, median wealth increased for both; however, during the financial crisis, both suffered a reduction in median total wealth. Nonetheless, a few years after the recession in 2008–2009, total wealth increased for both generations. In 2006, the median total wealth was approximately £128,000 for the young generation and £355,000 for the old generation. In 2020, the median total wealth was £156,000 and £480,000 for the young and the old generations, respectively.

Figure 1.13 Median total wealth



Source: Author's data analysis and WAS.
Notes: Data are weighted and presented in real values.

1.5 Methodology

This study investigates the differential impact of monetary policy intervention on the young generation and the old generation. A difference-in-differences (DID) model is used to analyse the differential effects, thus allowing this paper to conclude whether income, consumption and wealth inequality increased between the young generation and the old generation after expansionary interest rate intervention in the UK in 2009. The DID model compares the pre-intervention (1999–2008) and post-intervention (2009–2020) periods to examine differences in inequality.

The DID method – also known as "controlled before-and-after study" – was developed by John Snow in 1855 (Angrist and Pischke, 2009).[12] It is a widely used approach in policy evaluation to gauge the causal effect of an intervention by comparing differences in outcomes over time. The DID model provides a quasi-experimental approach to analyse the causal impact of interventions between the treatment group and the control group. It can be used even when randomisation is not plausible. The DID model focuses on changes in the groups rather than the absolute level. Another advantage of the DID model is that it can account for change due to factors other than the policy intervention being studied.

1.5.1 Difference-in-Differences (DID) Method

The DID model is used in this paper to estimate the differential impact of expansionary monetary policy intervention on two generations, therefore allowing this paper to conclude its effect on intergenerational inequality. During the 2009 financial crisis, the Bank of England introduced QE for the first time as a tool to stimulate the UK economy. Since the aftermath of the financial crisis up to 2020, interest rates have been low. This paper investigates whether

[12] DID model have been famously used in research (Card 1990; Card and Krueger, 1994; Eissa and Leibman, 1996; Finkelstein, 2002). For extensive literature on Difference-in-differences (DID) methods (see Bertrand et al. 2004; Abadie, 2005; Donald and Lang, 2007; Angrist and Pischke, 2009; Conley and Taber, 2011; Wooldridge, 2012).

expansionary monetary policy widened income, consumption and wealth inequality between the young (25-44) and the old (45+) generations. Two periods of analysis are used: pre-2009 and post-2009. Outcomes are observed for the two generations in the two different time periods. The total sample period for this paper is from 1999 to 2020.

The conventional approach to estimating the DID model is that one of the groups has never been exposed to treatment (control group) in any time period, while the other group is exposed to treatment (treatment group) in at least one time period. This paper adopts a different approach to the DID model in estimating the impact of monetary policy on intergenerational inequality. Given that monetary policy is an intervention at the macro level, both the young and the old generations are, in principle, exposed to the policy. The justification for using the DID approach is that this paper argues that the policy affects the two generations differently based on their economic circumstances – for instance, the quantity and type of assets they hold and the type of income earned (see Section 1.3 for a discussion on why monetary policy affects different generations differently). Therefore, the extent to which the two generations are effectively treated by monetary policy differs, and the DID model allows an estimation of these differential effects. Researchers who have estimated monetary policy intervention using a DID model include Thornton and di Tommaso (2018), Kose et al. (2018), Christensen and Hansen (2007) and Ball and Sheridan (2004).[13]

The old generation (45 years and over) is defined as the treatment group, and the young generation (25–44 years) is defined as the control group. The DID model will estimate the loss or gain due to the monetary policy intervention for the old generation relative to the

[13] Kose et al. (2018), Christensen and Hansen (2007) and Ball and Sheridan (2004) estimate the impact of monetary policy intervention via inflation, inflation targeting and exchange rate on output growth using a DID model. Thornton and di Tommaso (2018) use a DID model to analyse the impact of unconventional monetary policy on exchange rate volatility.

loss or gain for the young generation, thus allowing this paper to analyse changes in intergenerational inequality (Table 1.1).

Table 1.1 Difference-in-Differences Design Approach

	Time: 1 (Pre-2009)	Time: 2 (Post-2009)	Difference
Treated group (old)	$\bar{Y}_{old\,|\,pre}$	$\bar{Y}_{old\,|\,post}$	$\bar{Y}_{old\,|\,post} - \bar{Y}_{old\,|\,pre}$
Control group (young)	$\bar{Y}_{young\,|\,pre}$	$\bar{Y}_{young\,|\,post}$	$\bar{Y}_{young\,|\,post} - \bar{Y}_{young\,|\,pre}$
Treatment effect (Diff-in-Diff)	$\hat{\beta}_{DID} = (\bar{Y}_{old\,|\,post} - \bar{Y}_{old\,|\,pre}) - (\bar{Y}_{young\,|\,post} - \bar{Y}_{young\,|\,pre})$		

Notes: $\bar{Y}$ is the observed outcome of income, consumption and wealth for the young generation and the old generation.

1.5.2 DID Model Assumptions

The parallel trend assumption is one of the key assumptions of the DID model. The parallel trend hypothesis assumes that if the expansionary monetary policy intervention had not been implemented, the income, consumption and wealth outcomes for the young and the old generations would not be systematically different. The expectation is that the difference between the control and the treatment group will be constant over time in the absence of the intervention. The purpose of the parallel trend assumption model is to check whether the control group and treated group are comparable. The groups did not exhibit unusual trends before the monetary policy intervention (pre-2009).

The parallel trend assumption model is as follows:

$$\boldsymbol{E}\,(\hat{Y}_{young\,|\,post}) - \boldsymbol{E}\,(\hat{Y}_{young\,|\,pre}) = \boldsymbol{E}\,(\hat{Y}_{old\,|\,post}) - \boldsymbol{E}\,(\hat{Y}_{old\,|\,pre}),$$

where $\hat{Y}$ is the potential outcome in the absence of the monetary policy intervention. The other assumptions of DID models are that the composition of the control and treatment groups remains unchanged over time and that the intervention is unrelated to the outcome at the baseline.

1.5.3 Challenges of Difference-in-Differences Model

Ideally, a DID model is a non-experimental technique that is used to analyse the causal impact of an intervention. The DID model relies on certain assumptions and this includes linearity of the model and parallel trend assumptions (see section 1.5.2).

In the monetary policy context, there are threats to identification because monetary policy responds to certain economic crises such as the 2009 financial crisis and the subsequent housing market collapse; other crises include unemployment, inflation and a weak economy. Various policies, conventional and unconventional policies are used in different periods. Other confounding factors may exist. A DID model may not be able to filter out the confounding factors of these economic events that happen at the same time, be it a financial crisis, housing market collapse, pandemic and other economic shocks.

The idea of causal inference of a DID model may not hold due to a series of economic crises and turmoil. This paper recognises the identification problems that exist using a DID model. To address such problems, several robustness checks are carried out to ensure that the differential effect of monetary policy estimated in the empirical section is not confounded by house price changes, unemployment, GDP and inflation, which are all likely to be correlated with monetary policy and that these events are not partially picked up by the effect of monetary policy estimated in the empirical section. Most importantly, this study checks whether the differential effect of monetary policy remains when simultaneously allowing a range of additional macroeconomic variables to also have differential impacts on the two generations.

The conclusion reported in the robustness checks does not change the main results. This suggests that the estimated DID regression models indeed pick up differential effects of monetary policy, net of other macroeconomic changes or events that happened during the economic crisis under study (see robustness checks section 1.8 for more details).

1.5.4 DID Regression Model Specification

This paper investigates three different types of outcomes: income, consumption and wealth. Here, the disposable income at the household level is recalculated as equivalised income, and the consumption data at the household level are measured as consumption per capita. The wealth data are utilised at the household level. Equivalised income (EI), consumption per capita (CPC) and wealth at household (WH) level are the outcome variables for this paper and are transformed into natural logarithms for the empirical analysis.

Outcomes are observed for two generations (GENS): the young generation and the old generation. The age range for the young generation is 25 to 44, while the age range for the old generation is 45 and over. The young generation is the control group, and the old generation is the treatment group. The two groups are recalculated as a dummy variable: the control (young) group dummy value is 0, whereas the treatment (old) group dummy value is 1.

This paper investigates the differential impact of expansionary monetary policy on income, consumption and wealth. The type of intervention at the subject of the DID analysis is the expansionary interest rates. The interest rate is a continuous variable; as such, interest rate intervention is used as a continuous variable in the empirical analysis. The interest rate is used in its original format, and the interest rate variable is interacted with the groups to estimate the differential impact of monetary policy intervention on the young and the old generations. The macroeconomic variables included in the DID model closely resemble the specification by Romer and Romer (2004) and Coibion et al. (2017).

The DID model is estimated using the fixed effects (FE) model accounting for region fixed effects. This model is advantageous in that it can potentially correct for omitted variable bias within the model (Kropko and Kubinec 2018). Using robust standard errors in the FE model also corrects for any potential autocorrelation and heteroskedasticity in the model.

Specifying robust standard error in the FE model and clustering the panel variables produces a consistent variance-covariance estimator (VCE) when the disturbances are not identically distributed over the panels or serial correlation is present (Wooldridge, 2020; Stock and Watson, 2008; Arellano, 2003). In addition to using the fixed effects model, this paper employs commonly used techniques in macroeconomic contexts; Bayesian analyses (Bayes) and maximum likelihood estimation (MLE) as alternative estimation methods for the DID regression model (see robustness checks section 1.8 for details).

DID Model Specification Based on Interest Rate Intervention

$$\text{LN}\ (EI_{it}) = REG_{\_FE} + \beta_1 INT_t + \beta_2\ GENS_i + \beta_{DID}\ GENS_i{*}INT_t + \beta_4\ INF_t + \beta_5 GDP\_GR_t + \beta_6\ UER_t + \beta_7\ NEER_t + \beta_8\ HPI_t + \varepsilon_{it}$$

$$\text{LN}\ (CPC_{it}) = REG_{\_FE} + \beta_1 INT_t + \beta_2\ GENS_i + \beta_{DID}\ GENS_i{*}INT_t + \beta_4\ INF_t + \beta_5 GDP\_GR_t + \beta_6\ UER_t + \beta_7\ NEER_t + \beta_8\ HPI_t + \varepsilon_{it}$$

$$\text{LN}\ (WH_{it}) = REG_{\_FE} + \beta_1 INT_t + \beta_2\ GENS_i + \beta_{DID}\ GENS_i{*}INT_t + \beta_4\ INF_t + \beta_5 GDP\_GR_t + \beta_6\ UER_t + \beta_7\ NEER_t + \beta_8\ HPI_t + \beta_9\ HS_{it} + \beta_{10}\ Educ_{it} + \varepsilon_{it}$$

As part of the robustness tests, the interest rate (*INT*) is replaced by the shadow rate in the DID estimation model. Since the global financial crisis, unconventional monetary policy has been employed as well as zero lower bound (ZLB) interest rates. As a result, interest rates are partly informative because there are various mediums by which unconventional monetary policies are transmitted to longer-term interest rates. The shadow rate is the implied policy rate in a new policy environment. Additional details on the shadow rates can be found in the robustness checks section 1.8.[14]

[14] The high frequency shock (HFI) narrative measure of monetary policy shock by Cesa-Bianchi et al. (2020) is used as an alternative indicator in the DID model. The HFI replaces the interest rates in the DID model (see appendix 1C for the DID results).

1.5.5 Predictive Margins and Marginal Effects for DID Effect

The standard approach to regression-based DID analysis is simply to report β_{DID} from the regression results. This paper uses a slightly different approach by generating predictions from the β_{DID} coefficient and transforming them into tables and graphs using margins to estimate the marginal effects and margins plot, respectively. The β_{DID} regression is reported in addition to the predictive margins (see Section 1.7).

The predictive margins allow for estimating the average outcome for the young generation and the old generation before and after the monetary policy intervention, while the contrasts of the predictive margins generate the marginal effects. The marginal effects estimate the loss or gain for the young and the old generations due to the monetary policy intervention. The relative loss or gain is compared to analyse changes in intergenerational inequality. For a more detailed description of how this is implemented in Stata, see Appendix 1B.

LN is the natural logarithm.

$\boldsymbol{EI_{it}}$ is the equivalised income, subscript *i* indexes individual groups, subscript *t* indexes time.

$\boldsymbol{CPC_{it}}$ is the consumption per capita, subscript *i* indexes individual groups, subscript *t* indexes time.

$\boldsymbol{WH_{it}}$ is the net wealth for the household, subscript *i* indexes individual groups, subscript *t* indexes time.

$\boldsymbol{REG_{\_FE}}$ is the region-specific fixed effects. It considers all effects specific to the regions, including geographical features that do not vary over time.[15]

$\boldsymbol{GENS_i}$ is the group dummy variable for the young and the old generations.

[15] Region fixed effects are included in the model to account for differences in the regions in the UK. The WAS and LCF surveys are carried out in 12 regions in the UK.

$\boldsymbol{INT_t}$ is the interest rate. This is a continuous variable for t = 1999,…,2020. The interest rates include the respective periods of contractionary interest rate policy (1999–2008) and expansionary interest rate policy (2009–2020).[16]

$\boldsymbol{GENS_i{*}INT_t}$ is the interaction between the group dummy and interest rates.

$\boldsymbol{\beta_{DID}}$ is the coefficient of the treatment effect on the outcome. This measures the average differential effects of the monetary policy intervention on each group (the young generation and the old generation) over time.

Covariates (Control Variables)

The reason for including covariates in the DID model is that monetary policy strategy is mostly conditional on changes in macroeconomic variables. The addition of GDP growth rate, unemployment rate, inflation, housing price index (HPI) and nominal effective exchange rate (NEER) as covariates thus enriches the DID model by improving the precision of the DID estimate (Wooldridge, 2012).

INF is the inflation rate. Inflation is included in the model because price stabilisation is an important macroeconomic policy objective. The interest rate decision depends on inflation. QE was used in 2012 to achieve inflation targeting, so inflation is included in the model as a covariate. The inclusion of inflation in the model as an instrumental variable may address the issue of endogeneity and increase the precision of the DID estimate.

GDP_GR is the gross domestic product growth rate.[17] The inclusion of GDP growth rate and other macroeconomic variables in the model serves as an instrumental variable to potentially correct for endogeneity bias in the model and to improve its precision.

UER is the unemployment rate.

[16] Wealth analysis INT_t is for t = 2006,…,2020. The wealth data cover the period 2006–2020.

[17] A separate regression is estimated to establish whether covariates affect the estimation result (see robustness checks); GDP, inflation and other covariates are invariant to the regression outcome and the conclusion drawn.

NEER is the nominal effective exchange rate. The nominal effective exchange rate is transformed into natural logarithm in the DID model.

HPI is the housing price index. The housing price index is transformed into natural logarithm in the DID model.

HS is the household size.

Educ is the educational achievement of the head of the household.

Household size and educational attainment of households are added to the wealth equation to control for compositional changes in the households, thereby making the households more comparable. The wealth data are at the household level. They are not measured to any specific standard, unlike the income and consumption household data that are measured in specific units as equivalised income and consumption per capita, respectively.

The summary statistics for the data analysis for income, consumption and wealth that shows the number of observations, the mean, median, minimum and maximum values for each variable are presented in the Appendix 1A.

1.6 Parallel Trend Assumption Analysis

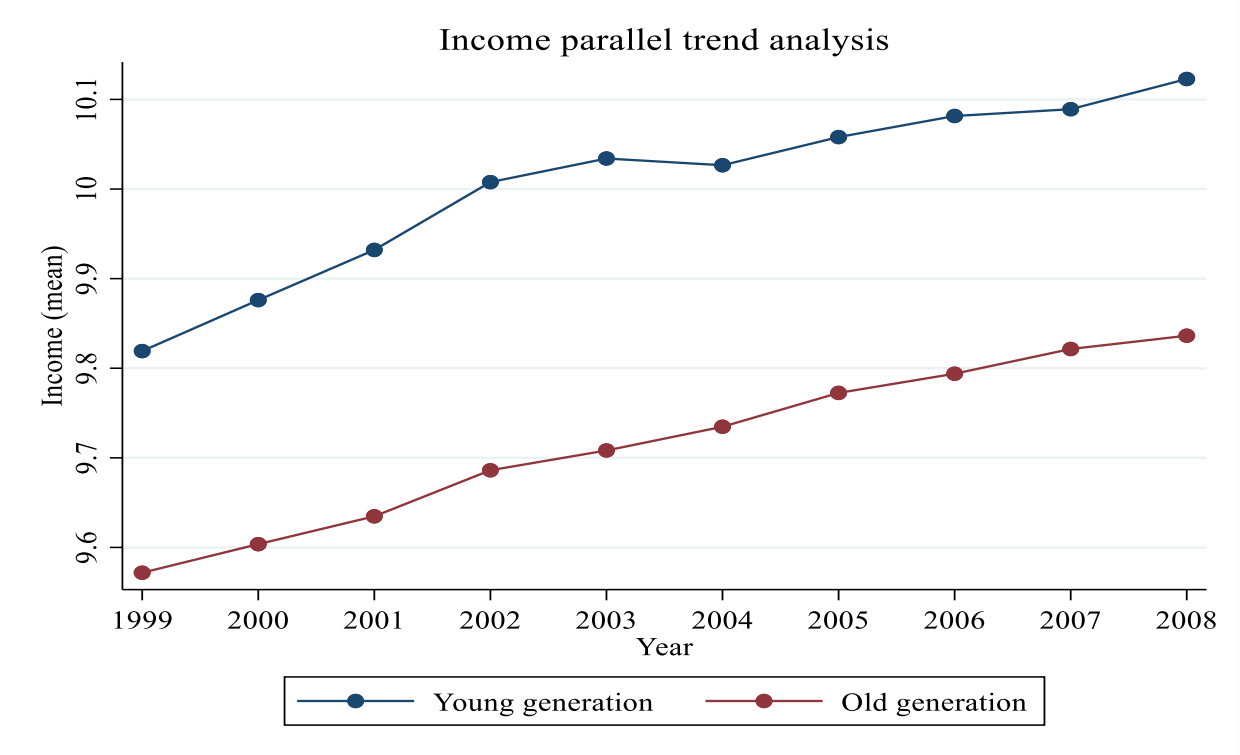
The most important assumption of the DID model is the parallel trend assumption. This assumption must hold for the DID model to be valid. The parallel trend assumes that the differences between the control group (young generation) and the treatment group (old generation) are constant over time. In the absence of monetary policy intervention, the trends would be parallel not only in the pre-period, but also in the post-period. Testing the validity of the parallel trend is crucial. If the parallel assumption is violated, the average differential effect estimation result of the DID model is biased. Two methods exist for checking the validity of the parallel trend assumption. The first is by visual inspection, constructing a

graph of the control group and the treatment group and examining any variation before the intervention period. The second is by estimating the regression model and restricting the estimation to the pre-intervention period and including a linear time trend interacted with a generation indicator. The regression model estimates the counterfactual outcomes in the absence of intervention. This paper utilised both of these methods to test the validity of the parallel trend assumption.

1.6.1 Validation of Income Parallel Trend Assumption

Figure 1.14 shows the graph of the parallel trend analysis for equivalised income. No differences are observed between the young generation and the old generation prior to the monetary policy intervention (i.e., pre-2009). Both graphs show an upward trend in income prior to the monetary policy intervention.

Figure 1.14 Income Parallel Trend Diagnostic



Regression estimation is carried out to confirm the result of the visual inspection in Figure 1.14. The regression model estimates the average outcome in the absence of

intervention. The regression is estimated only for the time period before the monetary policy intervention (i.e., for t = 1999,…..,2008).

The regression model is as follows:

LN (EI_{it}) $=REG_{\_FE} + \beta_1 Year_t + \beta_2 GENS_i + \beta_3 GENS_i{*}Year_t + \beta_4 INF_t + \beta_5 GDP\_GR_t + \beta_6 UER_t + \beta_7 NEER_t + \beta_8 HPI_t + \varepsilon_{it}$

The coefficient of interest is the β_3.

Null hypothesis H_0: β_3 = 0 (i.e., no differences in the income of the control group and the treatment group over time).

Alternative hypothesis H_A: $\beta_3 \neq 0$ (i.e., differences identified in the income of the control group and the treatment group over time).

An alternative form of the regression model is also estimated to include at most four of the control variables and exclude all the control variables totally as a means of establishing whether the control variables influence the outcome of the parallel trend regression result.

Table 1.2 presents the income parallel trend regression results. Model (1) includes all the control variables. Model (2) excludes all control variables.

Table 1.2 Income Parallel Trend Regression Estimation Diagnostic

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
B3: ($\boldsymbol{GENS_i{*}Year_t}$)	-0.0009 (0.0021)	-0.0013 (0.0021)	-0.0010 (0.0021)	-0.0009 (0.0021)	-0.0010 (0.0020)
B3 (P value)	0.663	0.555	0.643	0.652	0.651
GDP growth rate (GDP_GR)	Yes	No	Yes	Yes	Yes
Inflation (INF)	Yes	No	Yes	Yes	Yes
Unemployment rate (UER)	Yes	No	No	Yes	Yes
Exchange rate (NEER)	Yes	No	No	No	Yes
Housing Price Index (HPI)	Yes	No	No	No	No
R-squared	0.0599	0.0594	0.0597	0.0597	0.0598
Number of observations	64,806	64,806	64,806	64,806	64,806
Region FE	Yes	Yes	Yes	Yes	Yes

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

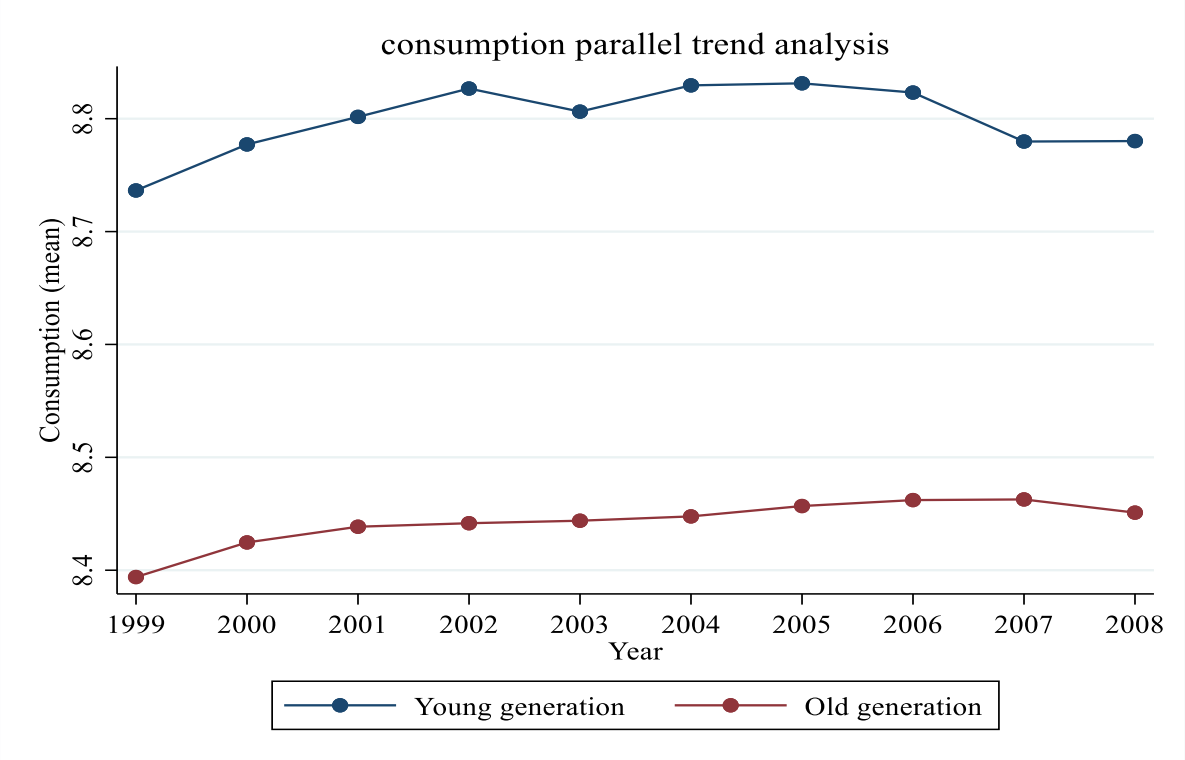
Notes: Standard errors are reported in parentheses. $GENS_i$ is the dummy for the young generation (control) and the old generation (treated). Income is equivalised and presented in real values. Income (EI), exchange rate and housing price index are converted to logarithm (LN).

Models (3), Model (4) and Model (5) excludes at most three control variables. Based on the *p*-value results, the null hypothesis cannot be rejected: the difference between the control group and the treatment group is constant over time, and no differences in the control group and the treatment group are identified before the monetary policy intervention (pre-2009). The control variables are invariant to the outcome of the parallel trend result analysis. Therefore, both the graphical analysis (Figure 1.14) and the regression result (Table 1.2) validate the parallel trend assumption.

1.6.2 Validation of Consumption Parallel Trend Assumption

Figure 1.15 presents the parallel trend visual analysis for consumption per capita before the monetary policy intervention in 2009. The graph shows relatively similar trends, with no apparent differences between the two generations pre-intervention. Although, the trend slightly differs in 2003 and 2008, this does not look significant. Overall, consumption seems similar over time between the control group and the treatment group.

Figure 1.15 Consumption Parallel Trend Diagnostic



The parallel trend visual inspection is validated by regression estimation.

The regression model is as follows:

LN $(CPC_{it}) = REG\_FE + \beta_1 Year_t + \beta_2 GENS_i + \beta_3 GENS_i{*}Year_t + \beta_4 INF_t + \beta_5 GDP\_GR_t + \beta_6 UER_t + \beta_7 NEER_t + \beta_8 HPI_t + \varepsilon_{it}$

The coefficient of interest is the β_3.

Null hypothesis H_0: $\beta_3 = 0$ (i.e., no differences in the consumption of the control group and the treatment group over time).

Alternative hypothesis H_A: $\beta_3 \neq 0$ (i.e., differences in the consumption of the control group and the treatment group over time).

An alternative form of regression model is also estimated to include at most one of the control variables and exclude the control variables.

Table 1.3 presents the consumption parallel trend regression results. Model (1) includes all control variables. Model (2), Model (3), Model (4) and Model (5) excludes all or at least one of the control variables. The null hypothesis cannot be rejected.

Table 1.3 Consumption Parallel Trend Regression Estimation Diagnostic

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
B3: ($\boldsymbol{GENS_i{*}Year_t}$)	0.0020 (0.0019)	0.0016 (0.0019)	0.0019 (0.0019)	0.0020 (0.0019)	0.0019 (0.0019)
B3 (P value)	0.319	0.419	0.331	0.321	0.321
GDP growth rate (GDP_GR)	Yes	No	Yes	Yes	Yes
Inflation (INF)	Yes	No	Yes	Yes	Yes
Unemployment rate (UER)	Yes	No	No	Yes	Yes
Exchange rate (NEER)	Yes	No	No	No	Yes
Housing Price Index (HPI)	Yes	No	No	No	No
R-squared	0.0754	0.0749	0.0753	0.0753	0.0753
Number of observations	64,952	64,952	64,952	64,952	64,952
Region FE	Yes	Yes	Yes	Yes	Yes

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

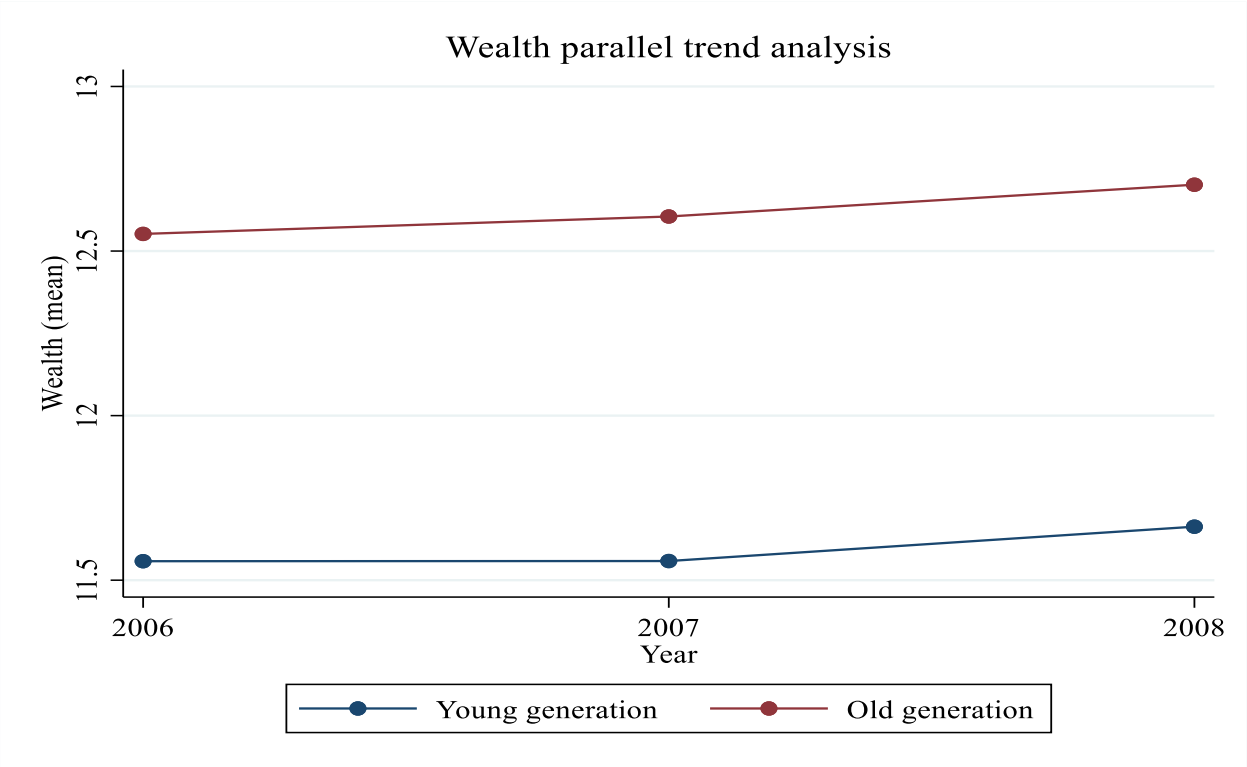
Notes: Standard errors are reported in parentheses. $GENS_i$ is the dummy for the young generation (control) and the old generation (treated). Consumption is measured in consumption per capita and presented in real values. Consumption (CPC), exchange rate and housing price index are converted to logarithm (LN).

The regression results in Table 1.3 support the graphical diagnostic for the consumption parallel trend: no differences are observed in the consumption of the young generation and the old generation prior to the monetary policy intervention. The difference in consumption per capita for the control and treatment groups is constant over time, and the control variables are invariant to the conclusion drawn from the parallel trend results.

1.6.3 Validation of Wealth Parallel Trend Assumption

Figure 1.16 displays the parallel trend visual analysis for wealth. The graph for both generations shows the same trend before the policy intervention.

Figure 1.16 Wealth Parallel Trend Diagnostic



The parallel trend visual inspection is validated by regression estimation. The regression is estimated only for the time period before the monetary policy intervention (i.e., for t = 2006,..,2008).[18]

The regression model is as follows:

[18] Wealth data are only available from 2006, in contrast to consumption and income data, as the WAS was launched in 2006.

LN $(WH_{it}) = REG\_FE + \beta_1 Year_t + \beta_2\ GENS_i + \beta_3\ GENS_i{*}Year_t + \beta_4\ INF_t + \beta_5 GDP\_GR_t + \beta_6\ UER_t + \beta_7\ NEER_t + \beta_8\ HPI_t + \varepsilon_{it}$

The coefficient of interest is β_3.

Null hypothesis H_0: $\beta_3 = 0$ (no differences in the wealth of the control group and the treatment group over time).

Alternative hypothesis H_A: $\beta_3 \neq 0$ (i.e., differences in the wealth of the control group and the treatment group over time).

Table 1.4 presents the wealth parallel trend regression results. Model (1) includes all control variables. Model (2) excludes all control variables. Models (3), Model (4) and Model (5) include at least two of the control variables. The null hypothesis cannot be rejected (*p*-values: 0.510, 0.497).

Table 1.4 Wealth Parallel Trend Regression Estimation Diagnostic

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
B3: ($\boldsymbol{GENS_i{*}Year_t}$)	0.0205 (0.0300)	0.0213 (0.0302)	0.0205 (0.0300)	0.0205 (0.0300)	0.0205 (0.0300)
B3 (P value)	0.510	0.497	0.510	0.510	0.510
GDP growth rate (GDP_GR)	Yes	No	Yes	Yes	Yes
Inflation (INF)	Yes	No	Yes	Yes	Yes
Unemployment rate (UER)	Yes	No	No	Yes	Yes
Exchange rate (NEER)	Yes	No	No	No	Yes
Housing Price Index (HPI)	Yes	No	No	No	No
R-squared	0.0713	0.0712	0.0713	0.0713	0.0713
Number of observations	33,439	33,439	33,439	33,439	33,439
Region FE	Yes	Yes	Yes	Yes	Yes

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Notes: Standard errors are reported in parentheses. $GENS_i$ is the dummy for the young generation (control) and the old generation (treated). Wealth is at the household level and presented in real values. Wealth (WH), exchange rate and housing price index are converted to logarithm (LN).

The wealth of the young generation and the old generation follows a parallel path prior to the monetary policy intervention. The parallel trend assumption holds; the difference in wealth for the control and treatment groups is constant over time.

1.7 Empirical Results

The empirical results show whether monetary policy intervention in the form of expansionary interest rates widens income, consumption and wealth inequality between the young generation and the old generation. QE was introduced in the UK in 2009 after the financial crisis, while expansionary interest rate policy was in place from 2009 to 2020. Interest rates in the period remained very low compared to the pre-crisis period. The difference-in-differences (DID) model is used to estimate the differential impacts of expansionary monetary policy intervention by comparing differences in outcomes over time.

1.7.1 Expansionary Interest Rate Policy and Intergenerational Inequality

The DID regression estimation results are further decomposed into the period of contractionary interest rates (pre-2009) and the expansionary phase of interest rates (post-2009) to examine the differential effect of income, consumption and wealth between the two generations under study, thus allowing for changes in intergenerational inequality. The DID regression estimation results show the impact of expansionary interest rates on income consumption and wealth inequality between the young generation and the old generation.

1.7.1.1 Income: Expansionary Interest Rate and Intergenerational Inequality

Table 1.5 shows the DID estimation results for the differential impacts of expansionary interest rate policy on income inequality between the young and old generations. The young generation earns more income than the old generation. After 2009, the expansionary interest rate policy had a positive effect on the income of the young generation, which increased significantly by 0.68%. The old generation is worse off; after 2009, its average income decreased by 0.60%. This indicates that expansionary interest rates increase income inequality between the young generation and the old generation. The overall difference that can be attributed to expansionary interest intervention after 2009 is a decline in average income of 1.2%.

Table 1.5 Income: DID Estimation Results for Impact of Expansionary Interest Rate on Intergenerational Inequality

Variable	Young generation (Control)	Old generation (Treated)	**DID**
Income before expansionary interest rate intervention (pre-2009)	10.0254 (0.0133)***	9.8034 (0.0125)***	
Income after expansionary interest rate intervention (post-2009)	10.0322 (0.0097)***	9.7974 (0.0081)***	
Change in mean income	0.0068 (0.0041)*	-0.0060 (0.0046)	**-0.0128 (0.0015)*** **

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.
Notes: Income is converted to logarithm and real terms using the CPIH. Standard errors are reported in parentheses. The sample size is 123,450.

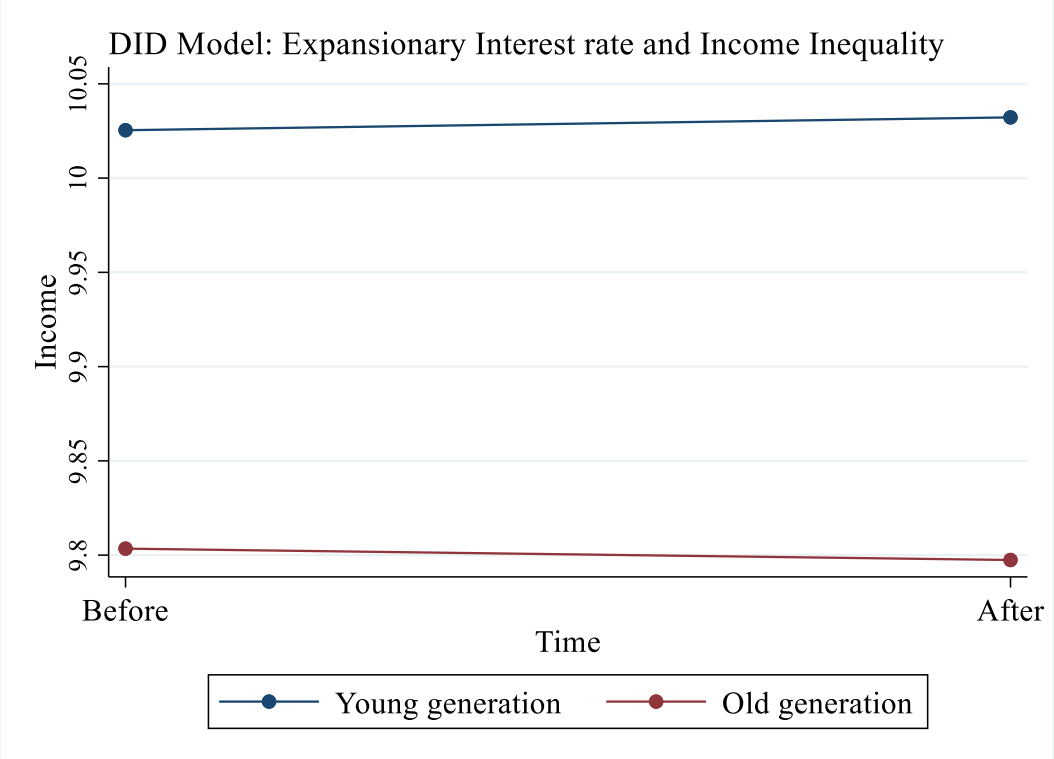
The notion of reduction in income inequality stems from the fact that the low-income group gains relatively more than the high-income group in such circumstances. The young generation is the high-income group, and the old generation is the low-income group. However, a recession typically results in greater job loss and a decline in financial security, with the young generation the most affected. Empirical literature posits that unconventional monetary policy has a positive impact on firm behaviour, capital investment and employment income (Ferrando et al., 2019; Foley-Fisher et al., 2016; Montecino and Epstein, 2015). Unconventional monetary policy leads to a lower interest rate – signalling theory of QE.

Expansionary interest rates make loans cheaper and boost borrowing, thereby making firms less credit constrained. Firms expand, invest and create job opportunities. The results here show that the young generation gains additional income after expansionary monetary policy intervention. The expansionary interest concept revolves around low interest rates. On average, the old generation's income is lower than the young generation's income, but members of the old generation are likelier to be savers and gain additional income through saving income. Low interest rates make saving unattractive, and this erodes savings income. This concept may explain why expansionary interest rates increase income inequality between the young and old generations. The DID results show a loss in income for the old

generation. Expansionary interest rate policy thus leaves the old generation in a weaker position due to the loss of additional earnings from savings. Expansionary interest rates therefore exacerbate income inequality between the young generation and the old generation.

Figure 1.17 displays the DID results for the impact of expansionary interest rates on income inequality between the generations (presented in Table 1.5 as a graph). Before 2009, the income gap was narrower between the young generation and the old generation. However, after 2009, the income trend has widened between the generations. This shows that expansionary interest rates have a negative impact on income inequality between the two generations.

Figure 1.17 Differential Effects of Expansionary Interest Rate on Income Inequality Between Young and Old Generations



Note: This figure depicts difference-in-differences estimates derived from the regressions in Table 1.5.

1.7.1.2 Consumption: Expansionary Interest Rate and Intergenerational Inequality

The DID results for the impact of expansionary interest rates on consumption inequality is shown in Table 1.6. Average consumption for the young generation is higher overall than the

old generation. The old generation's consumption decreased by 1.1% after the expansionary rate intervention in 2009, while the young generation gained; average consumption increased by 1.7%. The old generation's average consumption decreased; their position is weak in comparison to the young generation. Economic crises, especially recessions, can drive down consumption due to the loss of earnings by households. Empirical studies have found that QE facilitates a reduction in mortgage payments (Fuster and Willen, 2010; Krishnamurthy and Vissing-Jorgensen, 2011), one of the most prominent consumption expenses. The consensus of portfolio theory, signalling theory and habitat theory posits that QE reduces interest rates. Since mortgages are affected by interest rates, if mortgage payments are reduced, the implication is that QE stimulates consumption. In addition, the income result in Table 1.5 shows that the income of the young generation increased after the expansionary monetary policy intervention. An increase in income may lead to an increase in consumption.

Table 1.6 Consumption: DID Estimation Results for Impact of Expansionary Interest Rate on Intergenerational Inequality

Variable	Young generation (Control)	Old generation (Treated)	**DID**
Consumption before expansionary interest rate intervention (pre-2009)	8.6821 (0.0196)***	8.4676 (0.0181)***	
Consumption after expansionary interest rate intervention (post-2009)	8.7000 (0.0134)***	8.4566 (0.0119)***	
Change in mean consumption	0.0179 (0.0066)***	-0.0110 (0.0063)*	**-0.0289 (0.0025)*** **

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

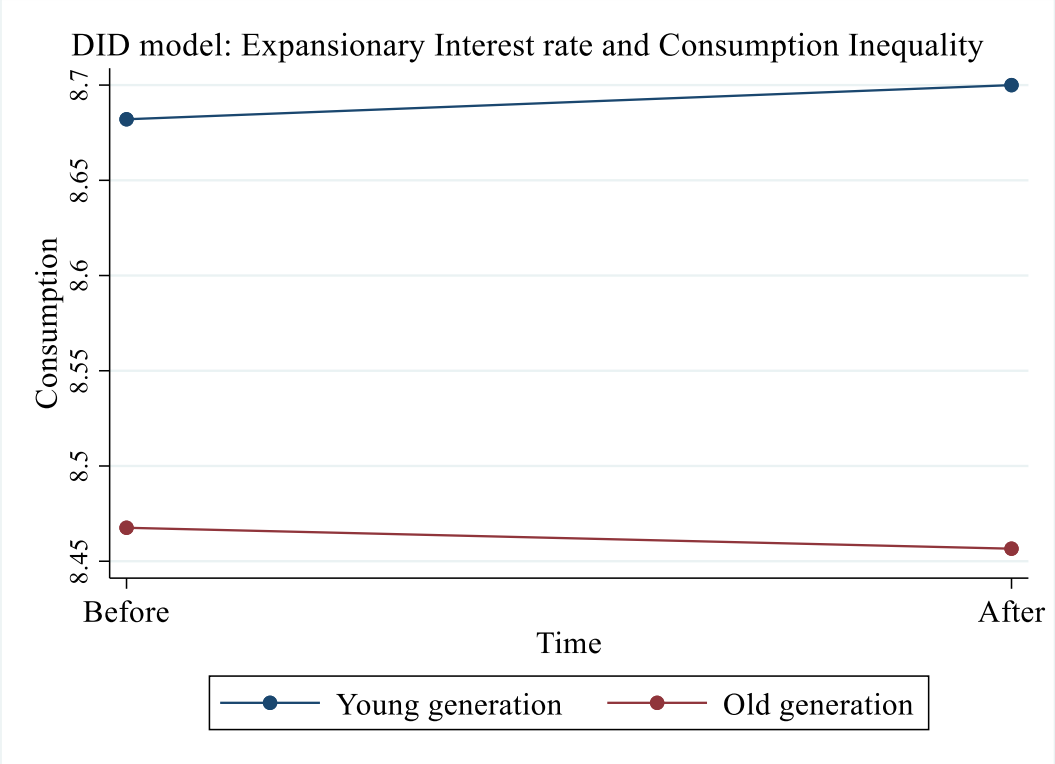
Notes: Consumption is converted to logarithm and real terms using the RPI. Standard errors are reported in parentheses. The sample size is 123,715.

Furthermore, expansionary interest rates reduce the cost of debt, making credit facilities more affordable and potentially freeing up more cash for households. The young generations are likely to be borrowers. As such, the young generation (with a higher consumption level) benefits more than the old generation. This strengthens the consumption

position of the young generation relative to the old generation. Bridging the gap in consumption inequality is about ensuring that households with a lower consumption group benefit significantly more than households with a higher average consumption; the policy intervention favours the low-consumption group relatively more than the high-consumption group. Here, the young generation's average consumption is higher than that of the old generation. The young generation clearly fared better than the old generation after the monetary policy intervention. In summary, expansionary interest rates increase consumption inequality. Due to the expansionary interest rate imposed post-2009, overall average total consumption decreased by 2.8%.

Figure 1.18 displays the graphical representation of the DID results for the differential effects of expansionary interest rates on consumption inequality presented in Table 1.6.

Figure 1.18 Differential Effects of Expansionary Interest Rate on Consumption Inequality Between Young and Old Generations



Note: This figure depicts difference-in-differences estimates derived from the regressions in Table 1.6.

Before 2009, the consumption gap was closer; after 2009, the consumption gap was wider. This shows that consumption inequality widened between the young and old generations. The results show that the young generation benefits more than the old generation, but the former (with a higher consumption value) gains significantly more than the latter. This explains why expansionary interest rate policy increases consumption inequality.

1.7.1.3 Wealth: Expansionary Interest Rate and Intergenerational Inequality

Table 1.7 shows the differential impact of expansionary interest rate policy on wealth between the young generation and the old generation. The old generation's average wealth increased by 3.5% due to the expansionary interest rate policy, while the young generation's wealth also increased by 7.1%. The young generation's wealth fared better than the old generation due to the expansionary interest rate policy interventions. The differences in the impact may be attributed to the composition and quantity of wealth. Financial wealth, property wealth and pension wealth are highly skewed towards the old generation and overall, as shown in Figure 1.12 and Figure 1.13, the older generation has a greater quantity of wealth than the younger generation.

Table 1.7 Wealth: DID Estimation Results for Impact of Expansionary Interest Rate on Intergenerational Inequality

Variable	Young generation (Control)	Old generation (Treated)	**DID**
Wealth before expansionary interest rate intervention (pre-2009)	11.2272 (0.0272)***	12.8586 (0.0209)***	
Wealth after expansionary interest rate intervention (post-2009)	11.2989 (0.0141)***	12.8940 (0.0087)***	
Change in mean wealth	0.0717 (0.0153)***	0.0354 (0.0125)***	**-0.0363 (0.0064)*** **

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

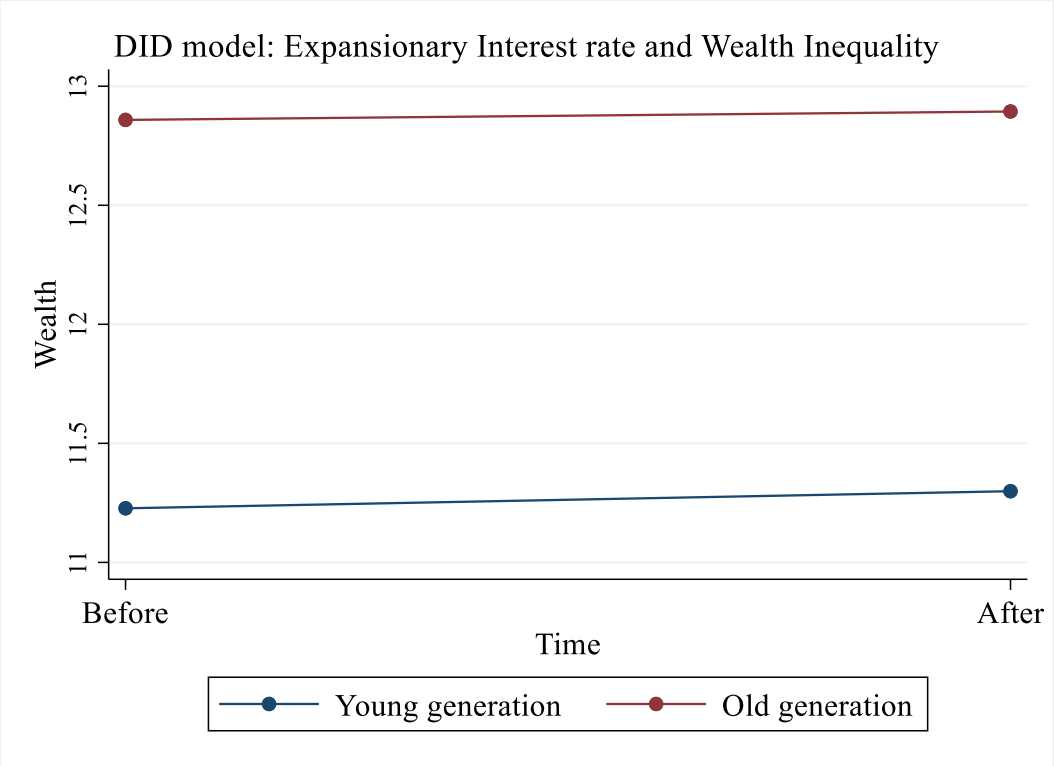
Notes: Wealth is converted to logarithm and real terms using the CPIH. Standard errors are reported in parentheses. The sample size is 139,840.

The benefit of expansionary monetary policy to the young generation is strong because, with additional income, the young generation may aspire to buy more assets. One of the most popular assets is property wealth. In the UK, property is mostly financed through mortgages. The lower the interest rates, the cheaper the mortgage. During the expansionary interest rate periods, the young generation's demand for assets may increase due to low interest rates.

On the other hand, the old generation who have already invested in assets gets a low return on their investment due to low interest rates. According to QE theory, investors reshuffle their portfolios from riskier assets to safer assets. Risky assets attract high returns and safer assets attract low returns. QE has a positive impact on asset values. The increase in asset prices most likely compensates for the low returns on investment. This may explain the differences in the gains experienced by the two generations. In total, average wealth decreased by 3.6% due to the expansionary interest rate policy between the young and the old generations. Expansionary interest rates therefore ameliorate wealth inequality between the young generation and the old generation.

Figure 1.19 presents Table 1.7 DID estimation in graphical form, the differential effects of expansionary interest rate policy on wealth inequality between the two generations. Expansionary interest rates reduce wealth inequality between the young generation and the old generation. The trend in Figure 1.19 shows that the wealth gap narrowed after 2009. Expansionary interest rates enhance the financial position of the borrower. The young generation are borrowers and the generation of spenders, while the old generation are likelier to be savers. Due to the reduction in interest rates and risk premiums, this incentive can drive the young generation to purchase assets to take advantage of the lower interest rate and risk premium. As a consequence, expansionary interest rate intervention can potentially reduce wealth inequality between the young generation and the old generation.

Figure 1.19 Differential Effects of Expansionary Interest Rate on Wealth Inequality Between Young and Old Generations



Note: This figure depicts difference-in-differences estimates derived from the regressions in Table 1.7.

1.7.2 Income Components: Channel of Monetary Policy and Intergenerational Inequality

Exploring the components of income provides a better understanding of the channel of monetary policy and which of the income components monetary policy impacted the most. Income is made up of gross wages, income from self-employment, income from investment, pension, annuities and social security benefits. For this analysis, social security benefits are excluded from non-investment income (Model [3]) and then included in non-investment income (Model [4]). Income is divided into two categories: investment income and non-investment income. Non-investment income includes all other income except investment income.

Table 1.8 shows the DID results for the components of income. The Model (1) analysis is presented in sub-section 1.7.1. The conclusion is that expansionary interest rates

widen income inequality between the young generation and the old generation. Decomposing the income into investment and non-investment income, the main result (Model [1]) is strongly driven by non-investment income. The impact of investment income is negligible on the overall result. Decomposition by income shows that non-investment income drives the DID effects of expansionary interest rates. Adding or excluding social security benefits is invariant to the conclusion.

Table 1.8 Expansionary Interest Rate, Intergenerational Inequality and Income Components

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
	All Income	Investment income	Non-investment income	Non-investment income plus social security benefit
$\boldsymbol{\beta_{DID}}$	-0.0128 (0.0015)***	0.0053 (0.0092)	-0.0329 (0.0038)***	-0.0202 (0.0024)***

Inference: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Empirical studies also show that expansionary monetary policy has a positive impact on employment income and firm behaviour. Expansionary interest rates make loans cheaper. Firms expand by borrowing and this creates employment opportunities, thereby impacting non-investment income. The negligible impact of investment income may be attributed to the portfolio balance theory of QE, whereby investors substitute risky assets with safer assets. Risky investments and assets attract high returns, while safer assets attract low returns, and the latter may explain why expansionary interest rates have only a negligible impact on investment income, as presented in Tables 1.8.[19]

1.8 Robustness Checks

In the following sub-sections, a range of robustness checks are carried out to probe the validity of the results. First, the interest rate is replaced by the shadow interest rate (section 1.8.1). Second, the stability of the effects against several variations of the regression

[19] The same conclusion is reached using shadow rate on the component of income in the DID model estimation.

model is explored (section 1.8.2). Third, other confounding macroeconomic variables are introduced into the model and allowed to have a differential impact across generations (section 1.8.3). Finally, alternative estimation techniques that are more common in macroeconomic context are employed (section 1.8.4).

1.8.1 Shadow Rate and Intergenerational Inequality

In periods of new policy surprises, policy adoption and economic crises, unconventional monetary policy, new forms of money and policies are used to stimulate the economy. Interest rates are partially informative during these periods, for instance the inflation targeting and ZLB periods. There are different mediums by which unconventional policies are transmitted to the interest rates. An estimation that measures the overall stance of these channels on interest rates is crucial. Shadow rate considers the wide range of unconventional policies during the ZLB and non-ZLB periods. Shadow rate is the approximation of the overall stance of monetary policy during the unconventional monetary policy (De Rezende and Ristiniemi, 2023; Wu and Xia, 2016). Prior to the financial crisis, the Bank of England adopted an inflation targeting policy in 1992. The shadow rates data for the UK covers other policy periods such as the inflation targeting framework, in addition to the unconventional policy environment. The shadow rates data for this study covers from 1992 to 2020.[20]

Consequently, the shadow rate is deemed to be an accurate measure of monetary policy as it is more informative than the standard interest rates since it takes into account other ranges of measures adopted by the central banks. This paper employs shadow rates in the DID model to estimate the differential impacts on the two generations. The shadow rates replace the interest rates in the DID model. The results for both shadow rates and interest rates are then compared to establish whether the conclusions align. Another narrative

[20] The shadow rates data for the UK was provided by De Rezende, R.B (rafaelbderezende.com/shadow-rates).

measure of monetary policy surprises, Cesa-Bianchi et al. (2020) high frequency identification (HFI) shock is used to estimate the regression model in addition to the shadow rates. The Cesa-Bianchi et al. (2020) – HFI estimation result is reported in Appendix 1C.

Table 1.9 shows the DID regression results for the differential impact of shadow rate on intergenerational inequality. There is a variation in the DID coefficients for shadow rates compared to the baseline model, but the significance level remains the same.

Table 1.9 DID Estimation Results for Shadow Rate and Intergenerational Inequality

β_{DID}	**Income**	**Consumption**	**Wealth**
Shadow rates	-0.0085 (0.0008)***	-0.0191 (0.0015)***	-0.0255 (0.0047)***
Baseline model (Interest rates)	-0.0128 (0.0015)***	-0.0289 (0.0025)***	-0.0363 (0.0070)***

*, **, *** denote significance at the level of 10%, 5% and 1%, respectively.

The DID regression results for the shadow rates are qualitatively similar to the baseline results – the empirical results for income, consumption and wealth reported in the empirical section 1.7.

1.8.2 Model Variations Robustness Checks

Covariates are added to the DID regression model to control for endogeneity and increase the precision of the DID estimation results. The model variation test is carried out to check whether the results are sensitive to controlling for other macroeconomic changes that happen during any economic crisis. The model variation test aims to check whether the conclusions will remain the same if all or at least one of the covariates is excluded from the DID regression. The next sub-section goes further than this and allows macroeconomic confounders to have differential impacts across the generations.

Table 1.10 confirms that adding control variables and excluding control variables has no impact on the conclusion of the DID estimation results. Although the coefficient sizes

vary, the significant levels are the same for income, consumption and wealth. The conclusions are similar to the baseline models (Model 1) – empirical section results.

Table 1.10 Expansionary Monetary Policy and Intergenerational Inequality With and Without Control Variable

β_{DID}	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Income – Panel A					
Interest rate	-0.0128	-0.0131	-0.0120	-0.0122	-0.0128
	(0.0015)***	(0.0015)***	(0.0016)***	(0.0016)***	(0.0014)***
Shadow rate	-0.0085	-0.0086	-0.0081	-0.0080	-0.0085
	(0.0008)***	(0.0008)***	(0.0009)***	(0.0009)***	(0.0008)***
Consumption – Panel B					
Interest rate	-0.0289	-0.0292	-0.0287	-0.0286	-0.0288
	(0.0025)***	(0.0025)***	(0.0024)***	(0.0024)***	(0.0025)***
Shadow rate	-0.0191	-0.0192	-0.0190	-0.0189	-0.0191
	(0.0015)***	(0.0015)***	(0.0015)***	(0.0015)***	(0.0015)***
Wealth – Panel C					
Interest Rate	-0.0363	-0.0367	-0.0363	-0.0357	-0.0359
	(0.0070)***	(0.0069)***	(0.0069)***	(0.0069)***	(0.0070)***
Shadow rate	-0.0255	-0.0257	-0.0255	-0.0251	-0.0252
	(0.0047)***	(0.0046)***	(0.0046)***	(0.0047)***	(0.0047)***
Controls (Covariates)					
GDP growth rate (GDP_GR)	Yes	No	Yes	Yes	Yes
Inflation (INF)	Yes	No	Yes	Yes	Yes
Unemployment rate (UER)	Yes	No	No	Yes	Yes
Exchange rate (NEER)	Yes	No	No	No	Yes
Housing Price Index (HPI)	Yes	No	No	No	No
Time effects	No	Yes	No	No	No
Region effects	Yes	Yes	Yes	Yes	Yes

*, **, *** denote significance at the level of 10%, 5% and 1%, respectively.

1.8.3 Macroeconomic Effects and Confounding Factors Robustness Checks

It is very important to note that the DID model is unable to filter out confounding factors and macroeconomic effects after monetary policy intervention. Robustness checks are essential to rule out any other confounding factors, ensure that the identification strategy is valid and the model is unbiased and consistent.

Monetary policy responds to various macroeconomic factors such as the housing market collapse of 2008–2009, unemployment, inflation, Brexit in 2016, a weak economy and recession. Monetary policy may be correlated with house price changes, unemployment, GDP and inflation, and more generally with other things that may have happened at the same time. The DID model only filters out confounding factors that affect the young generation and the old generation similarly. Likewise, the test for parallel pre-trends (Section 1.6) only detects confounding factors that happen before the monetary policy change, not those that happen at the same time. Crucially, these macroeconomic factors may affect the young and the old differently and as a result, monetary policy intervention may be partially picking up these effects.

To rule out these macroeconomic effects, a robustness test is carried out. The robustness test involves the interaction of the macroeconomic variables with the young and the old generations and includes all the interactive terms in the DID model to establish how the monetary policy intervention reacts. For instance, inflation interacts with GENS (INF#GENS); this shows the impact of an inflationary situation on generations. The GDP growth rate and nominal effective exchange rate interact with GENS (GDP_GR#GENS and NEER#GENS); this highlights the impact of a recessionary period and a weak economy on the two generations. The unemployment rate interacts with GENS (UER#GENS); this shows the reaction of generations to unemployment. The housing price index interacts with the generations (HPI#GENS); this shows the impact of the financial crisis and housing market collapse on the young and old generations. During periods of economic turmoil and instability, monetary policy responds to these events in the form of expansionary monetary policy intervention to stimulate the UK economy. The impact of monetary policy intervention on the young and old generations is captured by the β_{DID} (INT#GENS). The interactions of the covariates with the generation dummy (GENS) are added as variables in the regression

model to gauge whether the main effect of interest remains qualitatively similar; several macroeconomic changes that happened during any economic crisis did not influence the outcome of the DID results.

The DID macroeconomic effects equation model:

$$\text{LN}(Y_{it}) = REG_{\_FE} + Time_{\_FE} + \beta_{DID} GENS_i * INT_t + \beta_2 GENS_i * INF_t + \beta_3 GENS_i * GDP\_GR_t + \beta_4 GENS_i * UER_t + \beta_5 GENS_i * HPI_t + \beta_6 GENS_i * NEER_t + \varepsilon_{it}$$

LN (Y_{it}) represents income, consumption and wealth.[21] The DID macroeconomic model is re-estimated with the shadow rate.

Table 1.11 shows that the results for the macroeconomic effect robustness checks for income, consumption and wealth. In comparison to the baseline model, the significance level and the effect sizes vary. The income (covariates and GENS) results display a lower level of significance for the shadow rates at 10%, and the interest rates show a minuscule impact when compared to the baseline model. The change in coefficient sizes and significance levels did not alter the conclusions reported in the empirical section.

Table 1.11 Interest Rates and Shadow Rates With Additional Interactive Terms (Covariates and GENS)

$\boldsymbol{\beta_{DID}}$	**Income**	**Consumption**	**Wealth**
Interest rates (Covariates and GENS)	-0.0034 (0.0059)	-0.0192 (0.0068)**	-0.0719 (0.0210)***
Shadow rates (Covariates and GENS)	-0.0066 (0.0031)*	-0.0188 (0.0034)***	-0.0708 (0.0123)***
Baseline model	-0.0128 (0.0015)***	-0.0289 (0.0025)***	-0.0363 (0.0070)***

*, **, *** denote significance at the level of 10%, 5% and 1%, respectively.

1.8.4 Maximum Likelihood Estimation (MLE) and Bayesian Analysis (Bayes)

This paper utilises alternative estimation methods that are commonly used in macroeconomic contexts; Bayesian Analysis (Bayes) and maximum likelihood estimation (MLE) to estimate

[21] Wealth analysis includes household size and education status (see methodology section for more details).

the regression model. The Bayesian framework generates a posterior distribution that allows it to capture uncertainty in regression estimation parameters as opposed to a single point estimate in standard linear regression. The estimated parameters in Bayes are treated as random variables and use all available information within the model to generate the credible regions with a probability level given a priori (Grzenda, 2015).

MLE chooses the parameter that maximizes the likelihood function of observing the datasets. MLE produces an estimator that is most efficient and consistent using the optimization problem principle (Cameron and Trivedi 2005).

Table 1.12 shows that the conclusions from Bayes and MLE are invariant to the results outlined in the empirical section (Baseline model).[22]

Table 1.12 Maximum likelihood Estimation and Bayesian Analysis Regression results

$\boldsymbol{\beta_{DID}}$	**Income**	**Consumption**	**Wealth**
Interest rates (MLE)	-0.0128	-0.0289	-0.0363
	(0.0014)***	(0.0024)***	(0.0069)***
Shadow rates (MLE)	-0.0084	-0.0191	-0.0254
	(0.0008)***	(0.0015)***	(0.0047)***
Interest rates (Bayes)	-0.0123	-0.0284	-0.0373
	(0.0017)***	(0.0016)***	(0.0043)***
Shadow rates (Bayes)	-0.0081	-0.0187	-0.0261
	(0.0010)***	(0.0010)***	(0.0028)***
Baseline model	-0.0128	-0.0289	-0.0363
	(0.0015)***	(0.0025)***	(0.0070)***

*, **, *** denote significance at the level of 10%, 5% and 1%, respectively.
Notes: For Bayes, interpretation is valid if the Markov Chain Monte Carlo (MCMC) converged. *** indicates that MCMC converged.

In conclusion, the results are robust against additionally allowing for differential effects of a range of additional macroeconomic variables at the same time (inflation, unemployment, GDP growth rate, housing price index, exchange rate) – suggesting that interest rates indeed have their own differential impact over and above these other variables.

[22] Nakamura and Steinsson (2018) discuss identification in macroeconomics, the DID model and its challenges.

1.9 Summary and Conclusion

This paper examines the differential impacts of monetary policy intervention on two generations, thus allowing this paper to make inferences about its impact on intergenerational inequality in the UK. Two generations are compared: the young generation and the old generation. The young generation is aged 25-44, and the old generation is aged 45 and above. The study investigates whether expansionary monetary policy that has been in place since 2009 exacerbates inequality between the young generation and the old generation. Income, consumption and wealth are used as measures of inequality. Two periods – pre-monetary policy intervention (1999–2008) and post-monetary policy intervention (2009–2020) – are compared to examine changes in income, consumption and wealth between the young generation and the old generation. Income and consumption data covers the period from 1999 to 2020, while wealth data covers the period from 2006 to 2020.

A difference-in-differences (DID) model is employed to examine the differential effects in income, consumption and wealth between the young generation and the old generation in the two periods to establish changes in intergenerational inequality over time. The empirical results show the young generation benefits from expansionary monetary policy in terms of higher income, consumption and wealth, while the old generation gains in the form of higher wealth. This paper concludes that expansionary monetary policy increases income and consumption inequality between the young generation and the old generation, whereas wealth inequality decreases. This study confirms that expansionary interest rates indeed have their own differential effects. The results are robust against simultaneously including a range of additional macroeconomic variables into the model and allowing them to also have differential effects on the two generations. This suggests that expansionary interest rates indeed have their own differential effects, over and above the differential effects of other macroeconomic variables that they are typically correlated with.

A further analysis explores the components of income, showing that expansionary interest rate policy has a significant impact on non-investment income, while the impact on investment income is negligible. This study illustrates the importance of exploring other monetary policy transmission mechanisms that can benefit different categories of people, as well as the need for an innovative, flexible and micro-level approach to monetary policy rather than an aggregate, macro-level approach or one-size-fits-all policy.

Appendix 1

1.A Data Summary Statistics

Table 1.13, Table 1.14 and Table 1.15 and Table 1.16 present the summary statistics and data sources for the data used in the income, consumption and wealth DID model estimation. The tables show the number of observations and the mean, median, minimum and maximum values for each variable and data source.

Table 1.13 Summary Statistics for Equivalised Income Model Empirical Analysis

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Year	123,450	2008.632	6.37561	1999	2020
Age	123,450	53.2045	16.02458	25	99
Equivalised Income (log)	123,450	9.876487	0.652509	0.039221	14.46025
GDP growth rate	123,450	1.349286	3.09124	-11	4.1
Interest rate	123,450	2.746586	2.198203	0.2289	5.9663
Shadow rate	123,450	1.469938	3.505715	-3.03681	6.117952
Inflation rate	123,450	1.980869	0.744285	0.368047	3.856112
Unemployment rate	123,450	4.306274	0.998149	2.9	6.1
Effective Nominal Exchange rate (log)	123,450	3.578701	0.10946	3.426571	3.720099
Housing Price Index (log)	123,450	4.427043	0.29753	3.76746	4.867996
Regions	123,450	6.549137	3.256467	1	12
GENS	123,450	0.65535	0.475256	0	1

Table 1.14 Summary Statistics for Consumption per Capita Model Empirical Analysis

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Year	123,715	2008.631	6.375695	1999	2020
Age	123,715	53.18907	16.02028	25	102
Consumption per Capita (log)	123,715	8.540889	0.624344	4.15141	12.02387
GDP growth rate	123,715	1.348773	3.092719	-11	4.1
Interest rate	123,715	2.746754	2.198249	0.2289	5.9663
Shadow rate	123,715	1.470236	3.505812	-3.03681	6.117952

Table 1.14 (Continued)					
Inflation rate	123,715	1.980631	0.744267	0.368047	3.856112
Unemployment rate	123,715	4.306134	0.998019	2.9	6.1
Effective Nominal Exchange rate (log)	123,715	3.578717	0.109465	3.426571	3.720099
Housing Price Index (log)	123,715	4.427027	0.297535	3.76746	4.867996
Regions	123,715	6.548632	3.255555	1	12
GENS	123,715	0.655119	0.475332	0	1

Table 1.15 Summary Statistics for Household Wealth Model Empirical Analysis

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Year	139,840	2012.309	4.047715	2006	2020
Age[23]	139,840	5.788215	1.591162	3	9
Wealth (log)	139,840	12.53202	1.655296	0.254642	19.06856
GDP growth rate	139,840	1.261925	2.316173	-11	3.2
Interest rate	139,840	1.590127	1.938379	0.2289	5.5128
Shadow rate	139,840	-0.41072	3.016628	-3.03681	5.585071
Inflation	139,840	2.243868	0.880149	0.368047	3.856112
Unemployment rate	139,840	4.570149	1.151613	2.9	6.1
Effective Nominal Exchange rate (log)	139,840	3.52571	0.094011	3.426571	3.720099
Housing Price Index (log)	139,840	4.595556	0.127141	4.435804	4.867996
Household size	139,840	2.280957	1.232515	1	9
Education[24] level	139,840	2.09832	1.076947	-9	4
Regions	139,840	6.903475	3.233729	1	12
GENS	139,840	0.755034	0.430068	0	1

[23] The head of household representative person in the WAS data is banded. The code ranges from 1 to 9. The minimum age band for this paper is 25 years. The description for the banded age is as follows: 3 = 25–34; 4 = 35–44; 5 = 45–54; 6 = 55–64; 7 = 65–74; 8 = 75–84; 9 = 85+.

[24] The educational attainment in the WAS data is coded for people with different levels of education (above and below degree level).

Table 1.16 Data Sources

Variables	**Source**
Income data	Living Costs and Food Survey, Office for National Statistics and UKDS
Consumption data	Living Costs and Food Survey, Office for National Statistics and UKDS
Wealth data	Wealth and Assets Survey, Office for National Statistics and UKDS
Consumer Price Index	Office for National Statistics
Retail Price Index	Office for National Statistics
GDP growth rate	Office for National Statistics
Unemployment rate	Office for National Statistics and https://www.nomisweb.co.uk/
Interest rate	Bank of England
Nominal Effective Exchange rate	Bank of England
Inflation rate	World Bank and www.rateinflation.com/inflation-rate/
Housing Price Index	https://landregistry.data.gov.uk/
Shadow rate	https://www.rafaelbderezende.com/shadow-rates

Note: The income, consumption and wealth raw data are accessible from the UK Data Service (UKDS)

1.B Margins and Marginal Effect for DID

Margins are used to predict the average outcomes for the young and old generations before and after the expansionary monetary policy intervention from the β_{DID} coefficient. Marginal effects are generated by contrasting these margins to estimate the gain and loss from the monetary policy intervention. Margins and marginal effects are presented in tables and graphs in the empirical section. The predictive margins, marginal effects and margins plots are generated using Stata software (Jann, 2013; Royston, 2013).

Expansionary Interest Rate Margins Prediction and Marginal Effects (Continuous Variable)

The margins commands can be used to generate predictive margins, marginal effects and margins plots for the continuous variable. The average outcome for the young generation and the old generation before and after expansionary interest rate policy intervention is generated using the predictive margins Stata command is **margins GENS, at(INT=(0(1)1))**.

The command generates four outcomes: $\bar{Y}_{young|pre}$,$\bar{Y}_{old|pre}$, $\bar{Y}_{young|post}$, $\bar{Y}_{old|post}$

Marginal effects (ME) commands to generate the loss or gain for the young and old generation is **margins, dydx(INT) over(GENS)**

$\bar{Y}_{young|ME} = \bar{Y}_{young|post} - \bar{Y}_{young|pre}$

$\bar{Y}_{old|ME} = \bar{Y}_{old|post} - \bar{Y}_{old|pre}$

Contrasting the marginal effects summed up to the β_{DID} estimated from the regression results.

$\beta_{DID} = \bar{Y}_{old|ME} - \bar{Y}_{young|ME}$

Margins plot command is **margins GENS, at(INT=(0(1)1)) plot**.

1.C High Frequency Shock of Cesa-Bianchi et al. (2020) and Intergenerational Inequality

This paper estimates the DID model using Cesa-Bianchi et al. (2020) high frequency identification (HFI) shock. The HFI replaces the interest rate in the baseline model. Interest rate changes in reaction to new policy and monetary policy shocks. The HFI is a narrative measure that accounts for monetary policy surprises.

Table 1.17 shows the DID estimation results using the HFI. The HFI coefficient effect sizes show a small variation in comparison to the baseline model. The variation in effect sizes may be attributed to the fact that the Cesa-Bianchi et al. (2020) HFI is estimated using macroeconomic variables such as the consumer price index, unemployment rate, nominal effective exchange rates, GDP, the mortgage, and corporate bond spread. HFI is computed by combining all these macroeconomic variables, and thus there is a risk that it might be picking up the effects of some of these variables, leading to some variation in the effect size.

Based on these reasons, this paper argues that using interest rates in the DID baseline model is preferable. Overall, although coefficient sizes still vary a bit, the conclusion remains qualitatively the same as the results reported in the empirical section.[25]

[25] The HFI DID data analysis covers 1999–2015.

Table 1.17 DID Estimation Results using Cesa-Bianchi et al. (2020) – High Frequency Identification shocks

β_{DID}	**Income**	**Consumption**	**Wealth**
Cesa-Bianchi et al. (2020) – HFI	-0.0047 (0.0022)*	-0.0018 (0.0008)**	-0.0183 (0.0034)***
Baseline model (Interest rates)	-0.0128 (0.0015)***	-0.0289 (0.0025)***	-0.0363 (0.0070)***

*, **, *** denote significance at the level of 10%, 5% and 1%, respectively.

Chapter 2

Monetary Policy and Generational Inequality

Abstract

This paper investigates the impact of monetary policy shocks on income, consumption and wealth inequality within three generations – the young, the middle-aged and pensioners using a vector autoregressive (VAR) model. The empirical results show that one standard deviation contractionary monetary policy shock increases income inequality within the young, middle-aged and the UK, but income inequality decreases among the pensioners. The consumption results show that consumption inequality decreases among the young and the UK, but consumption inequality increases within the middle-aged and pensioners. The wealth results show that wealth inequality increases within the young generation, while other generations and the UK experience a reduction in wealth inequality. Among the generations, monetary policy shocks exacerbate inequality the most for the young. This study finds that monetary policy does not Granger-cause income, consumption, wealth inequality within the generations and the UK.

2.1 Introduction

This paper investigates the impact of monetary policy shocks on generational inequality and whether monetary policy causes generational inequality – using income, consumption and wealth as measures of inequality. Inflation is rising rapidly in the UK: as of December 2022, it stands at 10.5%, the highest since the 1980s. Inflation is worsening the cost-of-living crisis. To contain inflation, the Bank of England (BoE) has increased interest rates nine times between November 2021 and December 2022, from 0.1% to 3.5%. Interest rates are expected to increase in line with rising inflation. Figure 2.1 shows inflation and interest rates from 1980 to 2022.

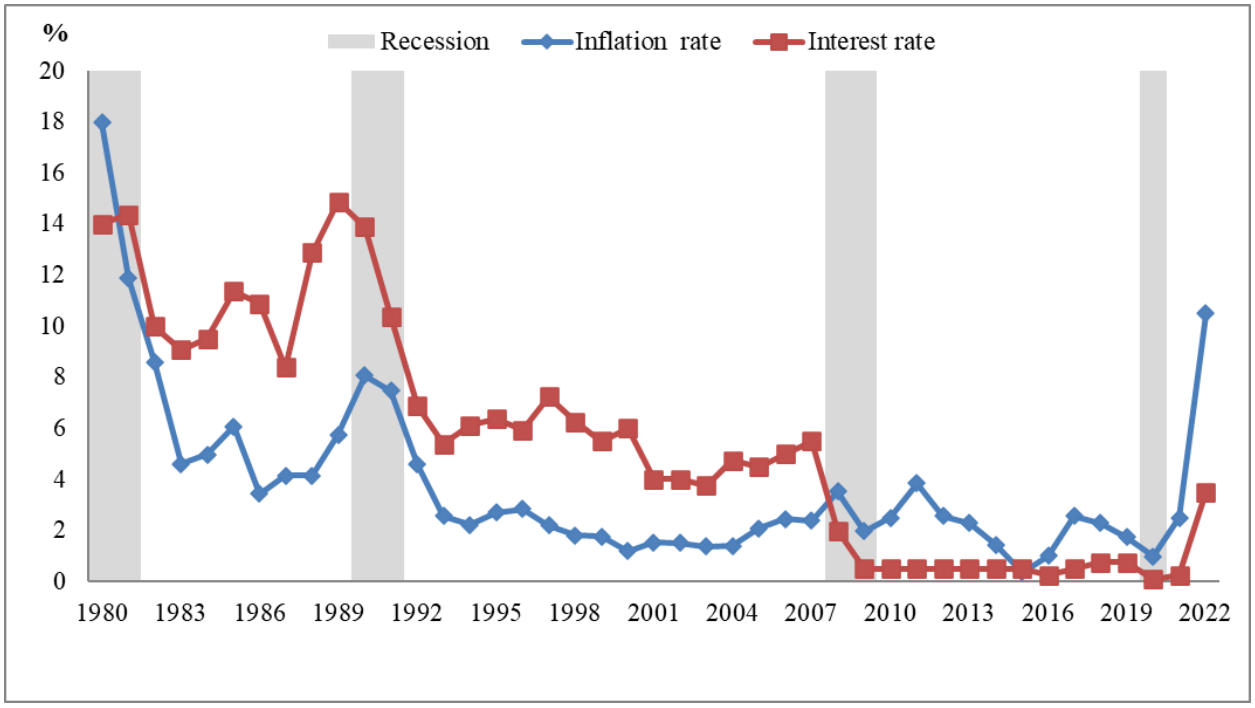
This paper investigates whether monetary policy shock plays a key role in income, consumption and wealth inequality within three age groups: the young (25–44), the middle-aged (45–64) and pensioners (65+). The following questions are addressed: What are the implications of short-term changes in monetary policy on the income, consumption and wealth of the young, the middle-aged and pensioners? Which age group category is most affected by inequality?

This study complements and extends the existing literature. Bunn et al. (2018) examine the short-term, marginal impact of expansionary monetary policy on income and wealth by age between 2008 and 2014. The distinguishing feature of this study is that it focuses on the impact of monetary policy shocks and the Granger-causal relationship between monetary policy and inequality within generations. Does monetary policy shock widen income, consumption and wealth inequality within the young, the middle-aged and pensioners? Is there a causal link between monetary policy and generational inequality?

A growing number of studies have considered the impact of monetary policy on inequality. Some examine the heterogeneous responses of different household groups, such as

low-income, middle-income and high-income percentile households, to monetary policy shock (Coibion et al., 2017; Mumtaz and Theophilopoulou, 2017; Cloyne et al., 2016).

Figure 2.1 Interest Rates and Inflation Rates, 1980–2022



Source: Author's data analysis, BoE data and World Bank data.
Note: The interest rate and inflation rate for 2022 are as of December 2022.

The distinguishing feature of this paper is that it examines the impact of monetary policy shocks on inequality by age group. Other studies analyse the impact of monetary policy on inequality in advanced and emerging economies, including the UK, the US, Europe and Mexico (Galbraith et al., 2007; Villarreal, 2014; Mumtaz and Theophilopoulou, 2017; Furceri et al., 2018; Aye et al., 2019). Distinctively, this paper analyses monetary policy impact at the micro-level: that is, the generational effect of monetary policy.

Few studies have documented the role of inflation on inequality (Siami-Namini and Hudson, 2019; Adam and Zhu, 2016; Doepke and Schneider, 2006; Galli and von der Hoeven, 2001; Greider, 1989). Contractionary monetary policy gives rise to low inflation, which favours the wealthy (Greider, 1989). High inflation induced by expansionary monetary policy favours the young and middle-class households; the main losers are the rich (Doepke

and Schneider, 2006).[26] Restrictive monetary policy in high-inflation countries is often favourable to inequality, while shrinking inflation in low-inflation economies can have a negative impact on inequality (Galli and von der Hoeven, 2001). The focus of this paper is the implications of the short-term changes in monetary policy on income, consumption and wealth inequality by generation.

Inequality is a widely debated topic, one which has gained greater prominence due to the ongoing cost-of-living crisis in the UK. Indeed, inflation is rising not only in the UK, but in other countries across the globe.[27] Studies have shown that the factors contributing to inequality include de-unionisation (Jaumotte and Osorio Buitron, 2015), decline in top tax rate (Piketty et al., 2014), ageing (Karahan and Ozkan, 2013), increased globalisation (Feenstra and Hanson, 2003) and technology (Acemoglu, 2002).

This paper joins a growing body of literature on monetary policy and inequality. It presents two levels of analysis. The first investigates the relationship between monetary policy shocks and inequality: What are the implications of monetary policy shocks on generational income, consumption and wealth inequality? The second level of analysis considers the causal link between monetary policy and income, consumption and wealth inequality in the young, the middle-aged and pensioners. Is there any direction of causal link between monetary policy and generational income, consumption and wealth inequality? This paper extends the analysis at the aggregate level by estimating the short-term changes and causal relationship between monetary policy and income, consumption and wealth inequality in the UK.

[26] Several studies have empirically analysed the impact of inflation on inequality (Thalassinos et al., 2012; Albanesi, 2007; Bulíř, 2001; Galli and van der Hoeven, 2001; Romer and Romer, 1998; Al-Marhubi, 1997). Siami-Namini and Hudson (2019) investigate causality between inflation and income inequality.

[27] The rate of inflation is 6.5% in the US, 8.6% in Germany, 6.3% in Canada, 12.3% in Italy and 5.9% in France (December 2022 figures; Source: www.rateinflation.com/inflation-rate/).

This research seeks an understanding of the implications of the monetary policy transmission mechanism. In doing so, it contributes to the research literature by providing detailed insights into the micro-level impact of monetary policy rather than providing a new intuition on the aggregate (macro)-level impact of monetary policy.

This paper uses detailed micro-level data from the Living Costs and Food Survey (LCF; previously known as the Expenditure and Food Survey) and the Wealth and Assets Survey (WAS). Income, consumption and wealth data are used as a measure of inequality. The micro data for income and consumption are obtained from the LCF, while the wealth data are taken from the WAS. The country of study is the UK.

The remainder of this chapter is structured as follows: Section 2.2 presents the justification of the study; Section 2.3 presents the literature review; Section 2.4 presents the data; Section 2.5 presents the methodology; Section 2.6 presents the empirical results; Section 2.7 presents the robustness checks; and Section 2.8 presents a summary and conclusions.

2.2 Justification of Study

This paper examines the relationship between monetary policy shocks and inequality within three generations: the young (25–44), the middle-aged (45–64) and pensioners (65+).

Rising interest rates can affect different generations differently depending on the composition of their income and wealth. For example, pensioners are likelier to have a larger wealth portfolio than the young and the middle-aged. Property wealth is the most popular component of wealth. In the UK, property is mostly bought through mortgages, which are dependent on interest rates. The higher the interest rates, the more expensive the mortgage value of the property, and this increases the debt value.

Research has shown that expansionary monetary policy – specifically a combination of low interest rates and quantitative easing (QE) – has a significant impact on mortgages, thereby reducing consumption (Fuster and Willen, 2010: Krishnamurthy and Vissing-Jorgensen, 2011). Expansionary interest rates make loans cheaper, with consequences for asset value. Low interest rates result in significant demand for assets and investment; as demand outstrips supply, the value of those assets increases. This means that high interest rates can reduce demand for assets, causing the price of assets to fall.

In the UK, interest rates are increasing in an attempt to curb inflation, and they are forecasted to continue increasing in the near future.[28] Crucially, the benefits to each generation are different. Contractionary interest rates may lead to a decrease in asset value due to a fall in demand for assets. As assets become cheaper, they become more accessible and affordable to the young and middle-aged generations with no history of an asset portfolio. This can bridge the gap in wealth for the young generation and the middle-aged, while the pensioners suffer from a loss in wealth. This leads to generations benefitting differently: the young generation and the middle-aged can benefit from contractionary monetary policy through low asset value making assets more accessible and affordable to the group. Conversely, asset value for pensioners is eroded, potentially widening inequality within this group.

In this paper, generational inequality examines inequality within each of the following generations: the young, the middle-aged, and pensioners. More specifically, inequality examines the gap in income, consumption and wealth between the top and bottom percentiles of the young generation, the middle-aged generation and pensioners. Contractionary monetary policy can affect the consumption of the different generations differently,

[28] The top central bank heads at the Bank of England (BoE), the European Central Bank (ECB) and the Federal Reserve have advised that the era of modest inflation and low interest rates has come to an end; extracted from Financial Times; https://www.ft.com/content/0c686df6-823b-49c2-bf0e-80e119d9e80a

depending on the widening of the consumption gap between the top and the bottom percentiles of the generation. For example, contractionary monetary policy makes credit and loans more expensive, meaning the low percentile group is likelier to be vulnerable to debt due to low income. As interest rates increase, the cost of debt increases, leading to a widening and worsening of the consumption gap. The young generation is likelier to be prone to debt than any other generation. In the UK, members of the young generation have funded their studies through student debt and loans, which are subject to interest rates. The interest rate on student loan debt and repayments are therefore dependent on the rate of inflation. If the inflation rate is 9%, student debt and loan interest rates should increase by the same rate, plunging the young generation into more debt. As a result, the young generation is likeliest to be impacted by contractionary monetary policy. Contractionary monetary policy affects inequality within the generation differently, and the impact can be more significant within the generation depending on the debt, the loan portfolio and the percentile ratio between the top and bottom groups.

Contractionary monetary policy makes savings more attractive. High-income earners benefit most from increasing interest rates due to additional income derived from saving income. Conversely, investment becomes less attractive, since inflation erodes the purchasing power of money. The low-income group within each generation is likelier to be severely affected, while the high-income group benefits from additional income as a result of contractionary monetary policy. This can widen the inequality gap between the low-income group and the high-income group within each generation. The severity of the impact depends on the percentile ratio between the low-income and high-income groups within the young generation, the middle-aged and pensioners. Coibion et al. (2012) identify the following four channels through which monetary policy can affect income consumption and wealth inequality:

The income consumption channel – Households derive their income from different sources, namely wages, business income, financial income and transfers. Expansionary monetary policy may increase business income and profit. Due to the heterogeneity of income, expansionary monetary policy shocks can increase income and consumption inequality since wages are less likely to increase relative to business income. As a result, households that own a business and derive their income from business and financial income tend to benefit more than households with other sources of income.

The savings redistribution channel – A sudden rise in interest rates or a decline in inflation will mostly benefit savers, while borrowers lose out. Low-income households are likelier to be borrowers compared to high-income households. Low-income households are likelier to be negatively affected by the sudden increase in interest rates, which leads to an increase in consumption inequality.

The portfolio channel – High-income households hold more assets than low-income households. Expansionary monetary policy drives asset prices up, thereby benefiting wealthy households that hold more assets than low-income households that hold cash. Low-income households experience a loss in interest earnings, leading to a widening of wealth inequality.

The financial segmentation channel – High-income and high-consumption households are wealthy and are likeliest to be connected to the financial markets. An increase in the money supply will benefit those wealthy households that trade in the financial markets by redistributing wealth in their direction. Ultimately, an increase in money supply and expansionary monetary policy can increase wealth, consumption and income inequality.

Theoretically, monetary policy impacts inequality and generations in different ways. As such, an empirical study that seeks to examine the impact of monetary policy shocks on generational inequality becomes imperative. In response, this paper empirically analyses the implications of the short-term changes in monetary policy on inequality within three

generations: the young, the middle-aged and pensioners. Which of the generations benefited from monetary policy shock? Which generation has seen inequality exacerbated the most due to monetary policy shock? Is there any causal link between monetary policy and generational inequality? This is the information gap in the monetary policy literature that this report sets out to resolve.

2.3 Literature Review

The aim of this study is to analyse the relationship between monetary policy and generational inequality. A reasonable amount of research exists regarding the impact of conventional monetary policy on inequality in advanced and emerging economies.

In the US, Aye et al. (2019) investigated the impact of conventional monetary policy on income and consumption inequality using quarterly time-series data between 1980 and 2008. The empirical results showed that contractionary monetary policy led to an increase in income and consumption inequality. Similarly, Coibion et al. (2017) analysed the impact of monetary policy shock on income inequality in the US since 1980. Their findings show that restrictive monetary policy has a significant and persistent effect on inequality, leading to a higher level of income and labour earning inequality. Galbraith et al. (2007) find evidence of a significant causal impact between monetary policy and pay inequality in the US. In contrast, in analysing the distributional effect of monetary policy in the US using vector autoregressive (VAR) and vector error correction models (VECM), Davtyan (2017) found that contractionary monetary policy reduces income inequality. This study follows previous studies by using VAR in its methodology. The VAR framework provides the foundation for the Granger causality test in analysing the causal link between monetary policy and inequality. The VAR model also provides a framework for developing impulse response, a model for analysing the relationship between monetary policy shocks and inequality.

In the UK, Mumtaz and Theophilopoulou (2017) used micro-level data from 1969 to 2012 to analyse the impact of monetary policy shock on income and consumption inequality. Their analysis is based on a structural VAR model. The results show that contractionary policy shocks lead to an increase in income and consumption inequality: households with low income and consumption are adversely affected compared to top-income households. Mumtaz and Theophilopoulou (2020) analyse the impact of monetary policy shock on wealth inequality in the UK using detailed micro-level (household) WAS data. Their study concludes that expansionary monetary policy shocks increase wealth inequality. Conversely, Bunn et al. (2018) find that accommodative monetary policy has a negligible impact on income and wealth inequality in the UK. In addition, they observe that the younger age group boosted their income, while the retirement age group benefits in wealth due to higher asset prices. This paper adds to a growing number of studies by estimating the impact of monetary policy shock on generational inequality in the UK. The distinguishing feature is that this paper analyses the causality relationship and monetary policy shock impact on inequality within different generations – the young, the middle-aged and pensioners – using income, consumption and wealth as a measure of inequality.

In Europe, Guerello (2018) uses a VAR framework to analyse the impact of expansionary monetary policy on income inequality in the Eurozone. The results show that expansionary monetary policy reduces income inequality in the Euro area. Samarina and Nguyen (2018) examine the effect of monetary policy on inequality in 10 countries within the Eurozone from 1999 to 2014 using a panel VAR method, with similar results. Lenza and Slacalek (2018) use a Bayesian VAR and microsimulation model to examine the effect of QE on income and wealth inequality in the Euro area. Their findings show that monetary policy reduces income inequality but has a negligible impact on wealth inequality. Casiraghi et al. (2018) analyse the distributional implications of monetary expansion for Italian households.

They show that expansionary monetary policy reduces labour income inequality for the less wealthy. Overall, their study concludes that monetary policy has a negligible impact on inequality indexes. However, O'Farrell et al. (2016) observe an increase in income inequality in most European countries after estimating the effect of monetary policy channels (via interest rates and asset prices) on inequality.

In selected advanced and emerging economies, Cloyne et al. (2016) analyse the impact of monetary policy when households have debt in the UK and the US. The household survey data sample covers 1975 to 2007 for the UK and 1981 to 2007 for the US. Their findings show that expansionary monetary policy increases income inequality. Taghizadeh-Hesary et al. (2018) assess the impact of expansionary monetary policy in Japan using a VECM. Their results show that monetary policy, zero interest rate policy and negative interest rate policy increase income inequality. Inui et al. (2017) employ micro-level data to study the distributional effect of monetary policy on inequality in Japan. Their study finds that expansionary monetary policy shock increases income and earnings inequality. Domanski et al. (2016) analyse the potential effect of monetary policy via interest rates and asset prices on inequality in France, Germany, Italy, Spain, the UK and the US. Their findings conclude that wealth inequality increases as a result. Furceri et al. (2018) conduct a panel data analysis of 32 advanced and emerging market countries from 1990 to 2013 to analyse the impact of monetary policy shock on inequality; their results show that, on average, contractionary monetary policy shocks increase income inequality. However, other studies show a reduction in inequality. O'Farrell et al. (2016) estimate the effect of the monetary policy channel (via interest rate and asset price) on inequality in selected advanced countries. Their results show that expansionary monetary policy decreases income inequality in Canada, the Netherlands and the US. Similarly, Villarreal (2014) examine the impact of

monetary policy on income inequality in Mexico, finding that a sudden increase in nominal interest rate decreases household income inequality.

A few empirical studies have analysed the impact of unconventional monetary policy on income and wealth inequality.

In the US, Bivens (2015) estimates the impact of monetary stimulus, low interest rate and QE on inequality in the US, concluding that monetary stimulus reduces income inequality. In contrast, Montecino and Epstein (2015) conclude in their research that QE increased income inequality in the US between 2008 and 2010.

In Europe and the UK, Hohberger et al. (2020) compare the distributional effect of QE and conventional monetary policy on inequality between two population groups in the Euro area. Their findings show that expansionary conventional monetary policy and QE shock mitigate income and wealth inequality between wealthy and less wealthy households. In contrast, Mumtaz and Theophilopoulou (2017) observe that QE policy increases income inequality.

In selected advanced and emerging economies, Juan-Francisco et al. (2019) examine the distributional impact of unconventional monetary policy on income and wealth in the Eurozone and the US using a structural vector autoregressive (SVAR) methodology. The study finds that expansionary monetary policy increases income and wealth inequality in the US. However, the result was insignificant for the Eurozone. Saiki and Frost (2014) consider the distributional impact of unconventional monetary policy on inequality in Japan using a VAR model. Their results show that expansionary monetary policy widens income inequality. The focus of this paper is on the impact of conventional monetary policy via restrictive interest rates on inequality.

Other studies have examined the impact of monetary policy via the inflation channel on inequality. Bulíř (2001) examines the impact of inflation on income inequality in 75

countries. The study finds that a low inflation rate reduces income inequality, while hyperinflation has a negative impact on inequality. Romer and Romer (1998) investigate the impact of inflation on poverty and the wellbeing of the poor in the US and other countries. The regression estimation results imply that monetary policy that targets low inflation and stable aggregate demand reduces inequality in the long run. Galli and von der Hoeven (2001) analyse the impact of inflation on inequality in the US and 15 OECD countries. Their results show that restrictive monetary policy aimed at reducing high inflation reduces inequality, while any further reduction in inflation in economies with initial low inflation leads to an increase in inequality. Al-Marhubi (1997) observes that high inflation countries have high-income inequality. Thalassinos et al. (2012) examine the impact of inflation on income inequality in 13 EU countries. They conclude that a positive relationship exists between inflation and inequality. Albanesi (2007) supports the same conclusion that inflation and income inequality are positively correlated. Siami-Namini and Hudson (2019) investigate causality between inflation and income inequality in developed countries and less developed countries. The study finds evidence of a causal relationship between inflation and income inequality.

This paper is distinctive from the other research because its focus is on examining inequality within generations. There are two levels of analysis for this study. The first analysis investigates the impact of monetary policy shock on the income, consumption and wealth inequality of the young, the middle-aged and pensioners. Which age group benefits from monetary policy shock? The second analysis examines whether a causal link exists between monetary policy and generational income, consumption and wealth inequality. Can monetary policy cause inequality within different generations, namely the young, the middle-aged and pensioners? This paper also investigates the relationship between monetary policy and income, consumption and wealth inequality in the UK (aggregate level). A VAR model,

impulse response function is used to investigate the monetary policy shock and inequality relationship, while a Granger causality test is used to examine the causal relationship.

2.4 Data

The three measures of inequality are income, consumption and wealth. In this empirical analysis, microdata are used to investigate the impact of monetary policy on generational inequality. The income and consumption data are obtained from the Living Costs and Food Survey (LCF), and the wealth data are taken from the Wealth and Assets Survey (WAS). The data are utilised at the household level. Income is measured as equivalised disposable income, consumption is measured as consumption per capita, and wealth is measured at the household level as constructed from the microdata. The Gini coefficient is then constructed from the equivalised income, consumption per capita and wealth and used as a measure of inequality for the three age groups under study.

2.4.1 Income

The household disposable income components include gross wages, income from self-employment, income from investment, income from pension and annuities, social security benefit less national insurance contribution, and income tax while excluding any refunds. Household disposable income is equivalised using the modified OECD scale household size.[29] The household age range covered in the sample for the equivalised disposable income is 25 and over. In total, 14,457 observations were excluded from the sample, including households outside the age range and negative and zero values. Subsequently, the total

[29] The modified OECD scale assigns a weighted value of 1 to the household head, 0.5 to each additional adult member and 0.3 to each child. The modified OECD scale reference point used in our data construction is all adults living the household (i.e., excluding children).

household sample size for the whole sample period used for the equivalised disposable income is approximately 330,800 observations.

The age groups are divided into three categories: the young (25–44), the middle-aged (45–64) and pensioners (65+). This paper uses one of the most popular measures of inequality, the Gini coefficient, constructed at a level between 0 (perfect equality) and 1 (perfect inequality) from the raw sample data using the equivalised disposable income observations. The data are in annual frequency and cover the period between 1968 and 2020.[30] The equivalised household disposable income has been deflated to 2019/2020 prices using the Consumer Price Index including owner occupiers' housing costs (CPIH). The data are weighted; this rebalances the data to ensure that they more accurately reflect the population being studied.

Figure 2.2 shows the Gini coefficient for the three age groups. In the 1960s, pensioners had the highest level of income inequality, while income inequality was lowest for the young. Since then, the pensioners' Gini coefficient and income inequality have reduced; however, in 2015, income inequality increased. Since the 1980s, the middle-aged group's Gini coefficient has been the highest of the three. Although income inequality increased significantly within the middle-aged group between 1980 and 2000, it decreased thereafter; nonetheless, income inequality is still the highest compared to the other age groups. Income inequality in the young generation increased significantly from the 1960s to the 2000s, but it has fallen since 2008; by 2015, income inequality was the lowest for the young. In 2020, their Gini coefficient was 0.26, compared to 0.31 for the middle-aged and 0.28 for the pensioners.

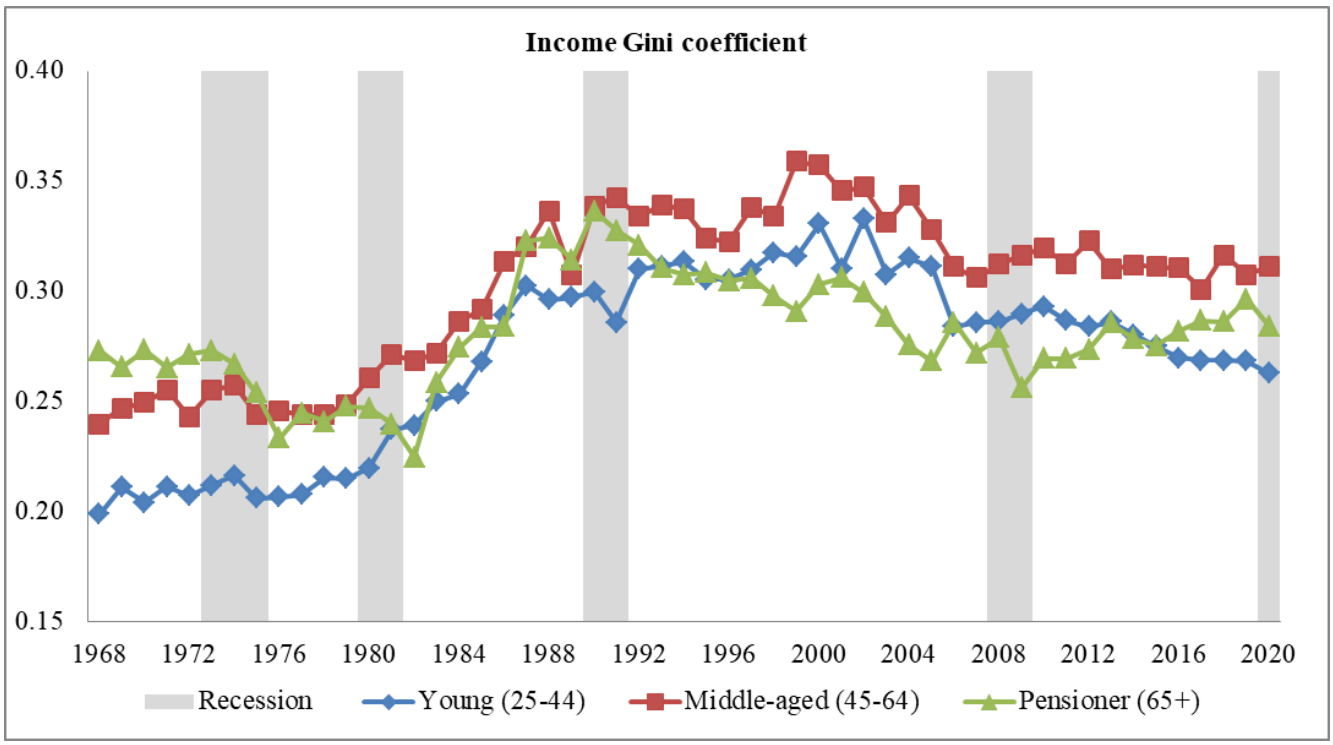
Visual inspection suggests that pre-financial crisis, an era of high interest rates led to increasing inequality, while the post-crisis period shows a decrease in income inequality.

[30] The financial year-end of the survey data was changed from April to March during the 1990s. This study envisages that this change will not have any impact on the estimation results.

Since interest rates are rising in the UK due to inflation, and this is expected to increase for the foreseeable future, this paper examines the implications of monetary policy shocks on income inequality.

This paper also constructs a P90/P10 percentile ratio from the equivalised disposable income to better understand the trend in inequality between two people at different positions of income distribution. P90/P10 compares how many times larger the equivalised income at the 90th percentile is to that of the 10th percentile.

Figure 2.2 Income Gini Coefficient for Young, Middle-aged and Pensioner Age Groups

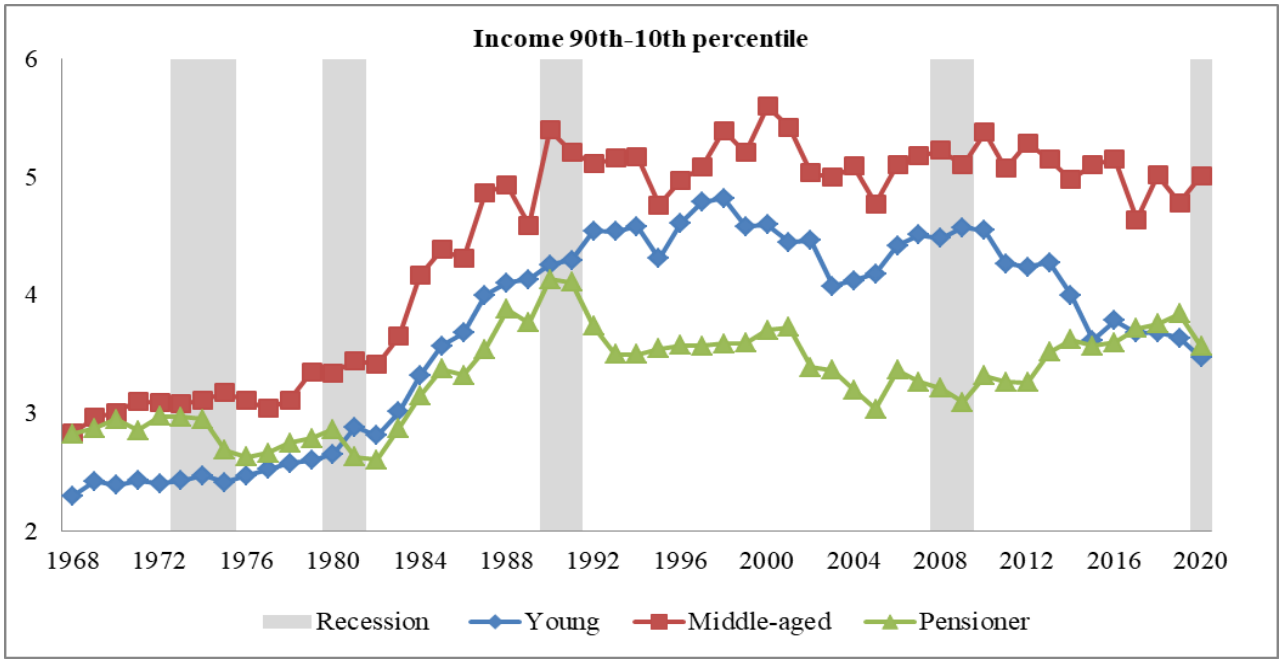


Source: Author's data analysis and LCF survey.

Figure 2.3 shows the income percentile ratio for the young, middle-aged and pensioner groups. The percentile ratio is another important form of measuring inequality. This shows the percentile ratio of the upper bound value of the 90th percentile to that of the 10th percentile of the equivalised disposable income, thus comparing the income of the top 10% to the bottom 10% of the population. In the 1960s and 1970s, the percentile ratio was very low, indicating that inequality was low. From the 1980s, however, the ratio increased, highlighting a widening of inequality within all age groups. Income inequality within the

middle-aged group is very high, while the pensioner ratio of the richest to the least wealthy is the lowest, although the P90/P10 ratio increased in 2016. In 2020, the P90/P10 ratio was 3.5 for the young, 5 for the middle-aged and 3.6 for the pensioners (Figure 2.3).

Figure 2.3 Income 90th-10th Percentile for Young, Middle-aged and Pensioner Groups



Source: Author's data analysis and LCF data.

2.4.2 Consumption

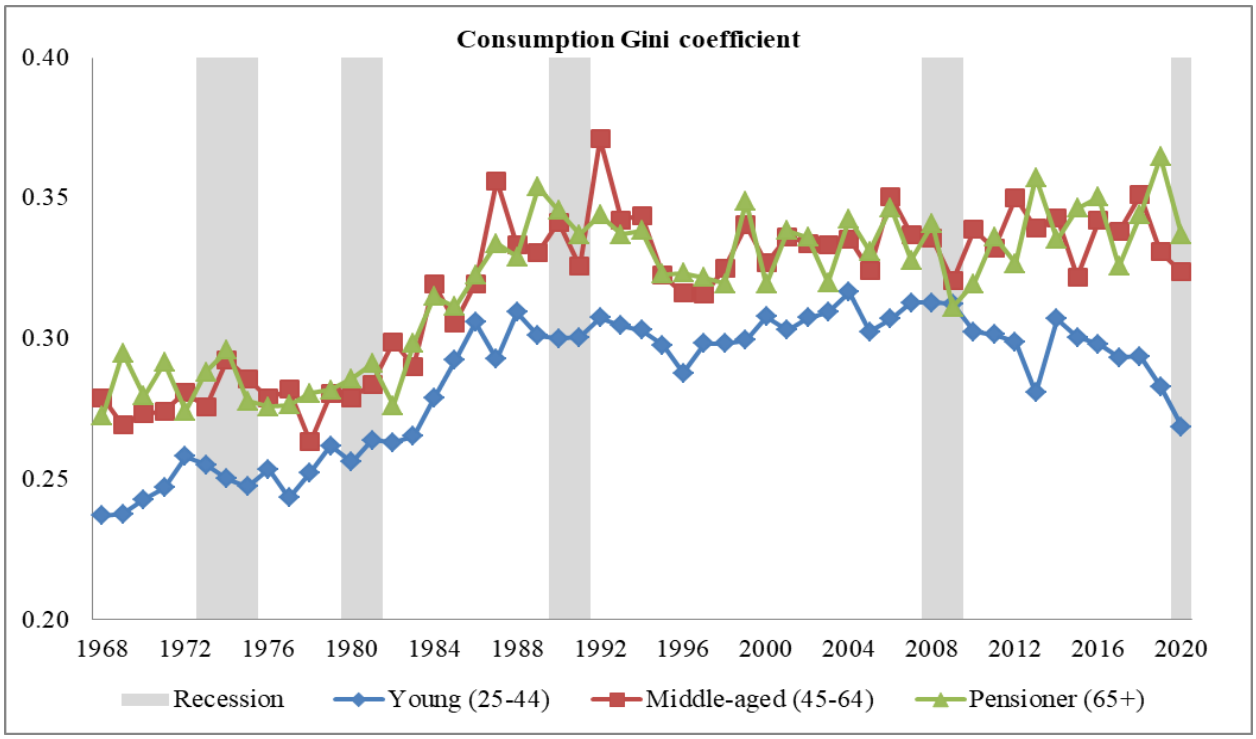
Consumption data comprise total consumption expenditures, which consist of durable, semi-durable and non-durable consumption.[31] The household age range covered in the sample for consumption per capita is 25 and over; 14,109 observations were excluded from the sample due to being outside the age range or negative or zero values. Overall, the total household sample size for the whole sample period used for the consumption per capita measurement is approximately 331,200 observations. The age group range for consumption per capita is the same as the income distribution category. The frequency is annual data covering the period between 1968 and 2020. The consumption per capita data are weighted and deflated using the

[31] Total consumption expenditure is for adults in the household. Expenses include food and non-alcoholic beverages, alcohol, clothing and footwear, equipment, household goods, housing education, health, transport and communications expenditure. The detailed breakdown of total consumption expenditure can be found on the Living Costs and Food Survey Volume G Derived Variable Flowcharts page.

Retail Price Index (RPI).[32] The Gini coefficient – at a level between 0 (perfect equality) and 1 (perfect inequality) – is constructed from the raw sample data using the consumption per capita observations.

Figure 2.4 shows the consumption per capita Gini coefficient. The age group categories are the same as for the income group. The Gini coefficient for consumption per capita shows that consumption inequality is lower within the young generation than in the other generations. Between the 1960s and the 1970s, consumption inequality was very low; however, after 1978, consumption inequality increased across all age groups. In 2020, the Gini coefficient was 0.27 for the young, 0.32 for the middle-aged and 0.34 for pensioners (Figure 2.4).

Figure 2.4 Consumption Gini Coefficient for Young, Middle-aged and Pensioner Groups



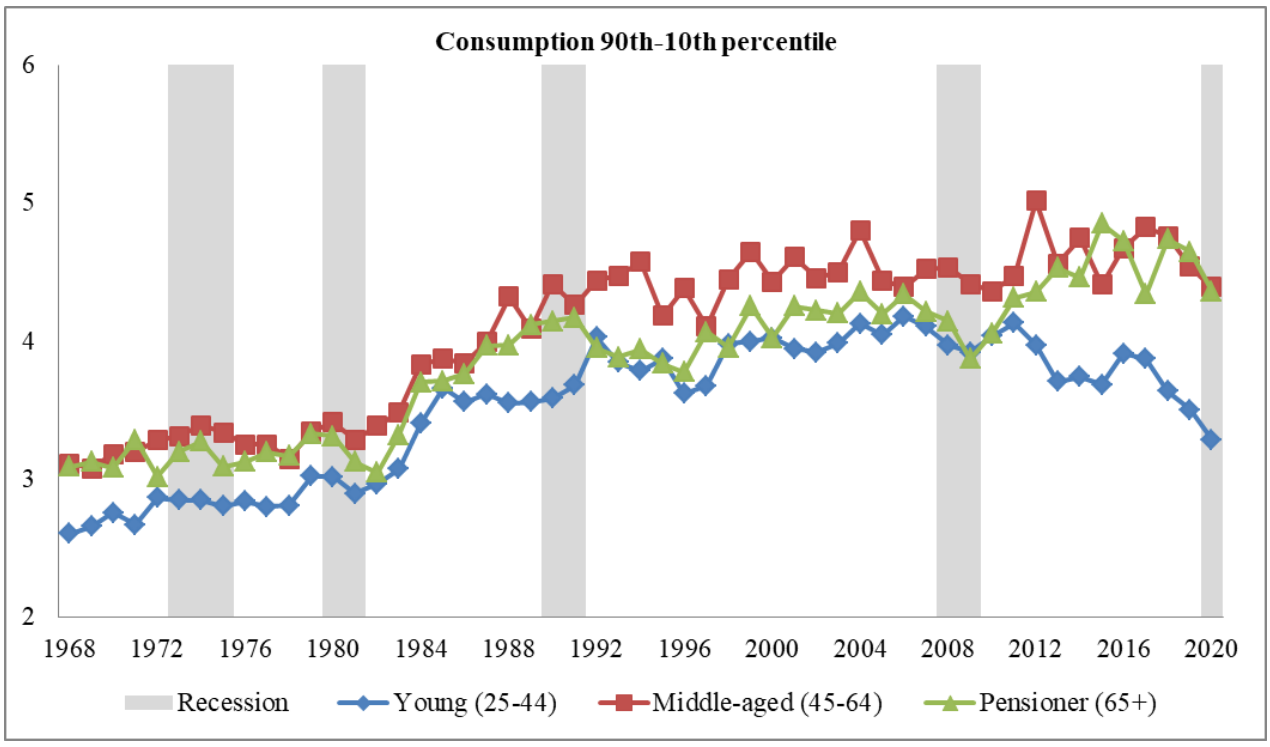
Source: Author's data analysis and LCF data.

Figure 2.5 shows the consumption per capita P90/P10 percentile ratio between the top 10% and the bottom 10% by generation. The 90th–10th percentile ratio of consumption per

[32] Consumption per capita is derived by dividing total consumption by total number of adults in the household.

capita shows an almost identical trend to the consumption Gini coefficient. Over the years, consumption inequality has risen between the top 10% and the bottom 10%. The young generation has a lower consumption percentile ratio overall; this means that consumption inequality is low within this age group. The pensioner P90/P10 ratio increased further from 2008, while the young P90/P10 decreased in the same period. In 2020, the P90/P10 ratio for the young was approximately 3.3, while the middle-aged and pensioner ratios were both 4.4.

Figure 2.5 Consumption 90th-10th Percentile for Young, Middle-aged and Pensioner Groups



Source: Author's data analysis and LCF data.

The consumption Gini coefficient and P90/P10 graph indicate that before 2008, the period of high interest rates shows an increase in inequality, while the post-2008 era of low interest rates shows a constant or decrease in consumption inequality.

2.4.3 Wealth

The final measure of inequality is wealth data, which quantify the wellbeing of a household in terms of its assets, savings, pensions and debt. The wealth data are drawn from the WAS, which was established in 2006; the dataset for this study covers the period from 2006 to

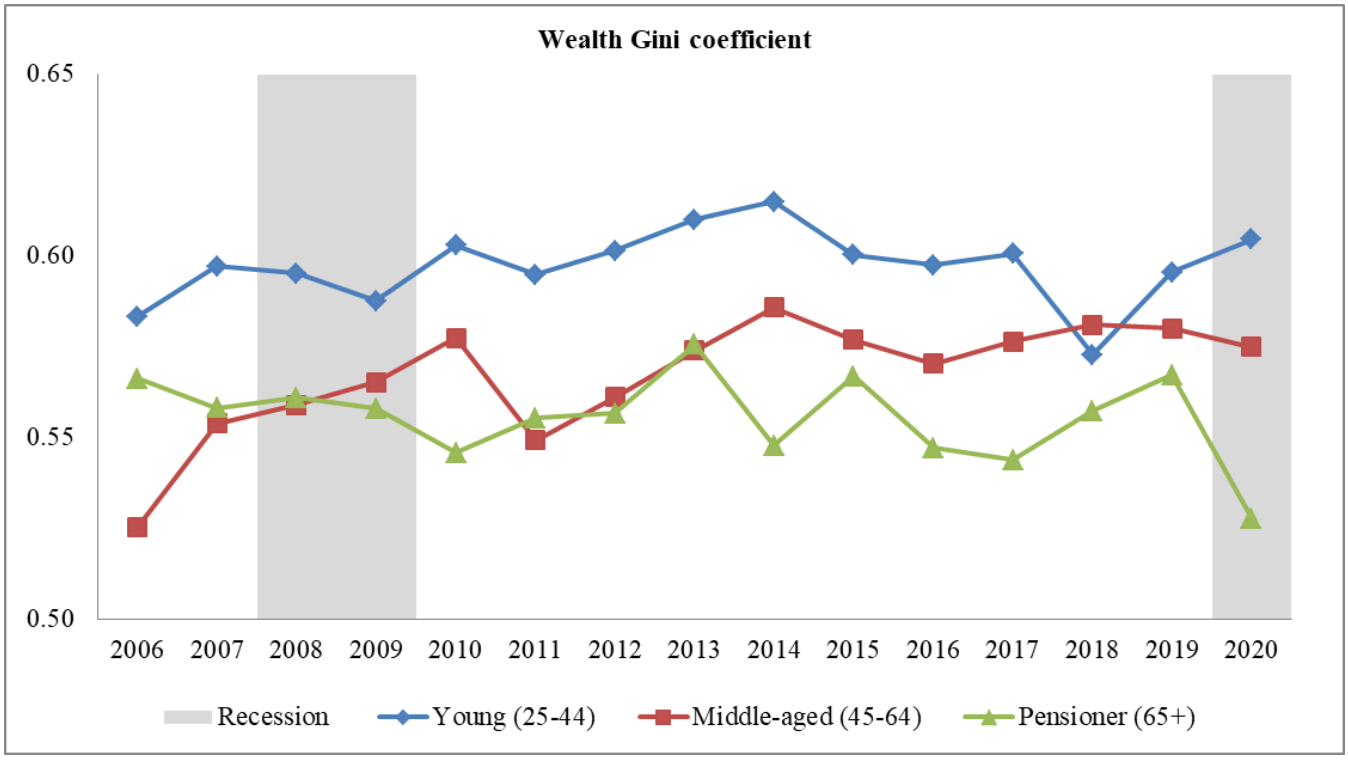
2020. The data are collected biennially: the first wave of survey data comes from 2006–2008, and the last wave used for this study covers wave seven (2018–2020). The survey is run and controlled by the UK Office for National Statistics (ONS). The WAS sampling structure involves an initial drawing of the annual sample and grouping the sample into primary sampling units (PSUs). The sampled PSUs were allocated to months at random using a repeating random permutation to ensure that the samples are evenly spread and balanced. The WAS data are available in monthly and annual frequencies. The raw data are accessible from the UK data service in Stata, SPSS and other formats.

The wealth data components include physical wealth, property wealth, pension wealth and financial wealth less any liabilities. The household age range covered in the sample for the wealth data is 25 and over. The total household sample size for the whole sample period used for the household wealth data is approximately 141,900 observations after excluding households outside the age range and negative and zero values. The age group wealth distribution range is 25–44 for the young, 45–64 for the middle-aged and 65+ for pensioners. The household wealth data are weighted and deflated to 2019/2020 prices using the CPIH. The wealth data are used on a monthly frequency to increase the sample size, given that the wealth survey data started in 2006. The Gini coefficient is constructed at a level between 0 (perfect equality) and 1 (perfect inequality) from the raw sample data using household wealth observations.

Figure 2.6 shows the household wealth Gini coefficient estimate for the young, middle-aged and pensioner groups in the UK. Wealth inequality is higher in the young generation compared to the other two. Wealth inequality is low within the pensioner group. Post-recession, wealth inequality increased within the young generation. In 2020, the wealth Gini coefficient was 0.60 for the young, 0.57 for the middle-aged and 0.53 for the pensioners.

A preliminary look at the wealth Gini coefficient graph for the three age groups suggests that the post-crisis expansionary monetary policy resulted in an increase in wealth inequality for the young and the middle-aged, whereas the pensioners derived gains from it.

Figure 2.6 Wealth Gini Coefficient for Young, Middle-aged and Pensioner Groups

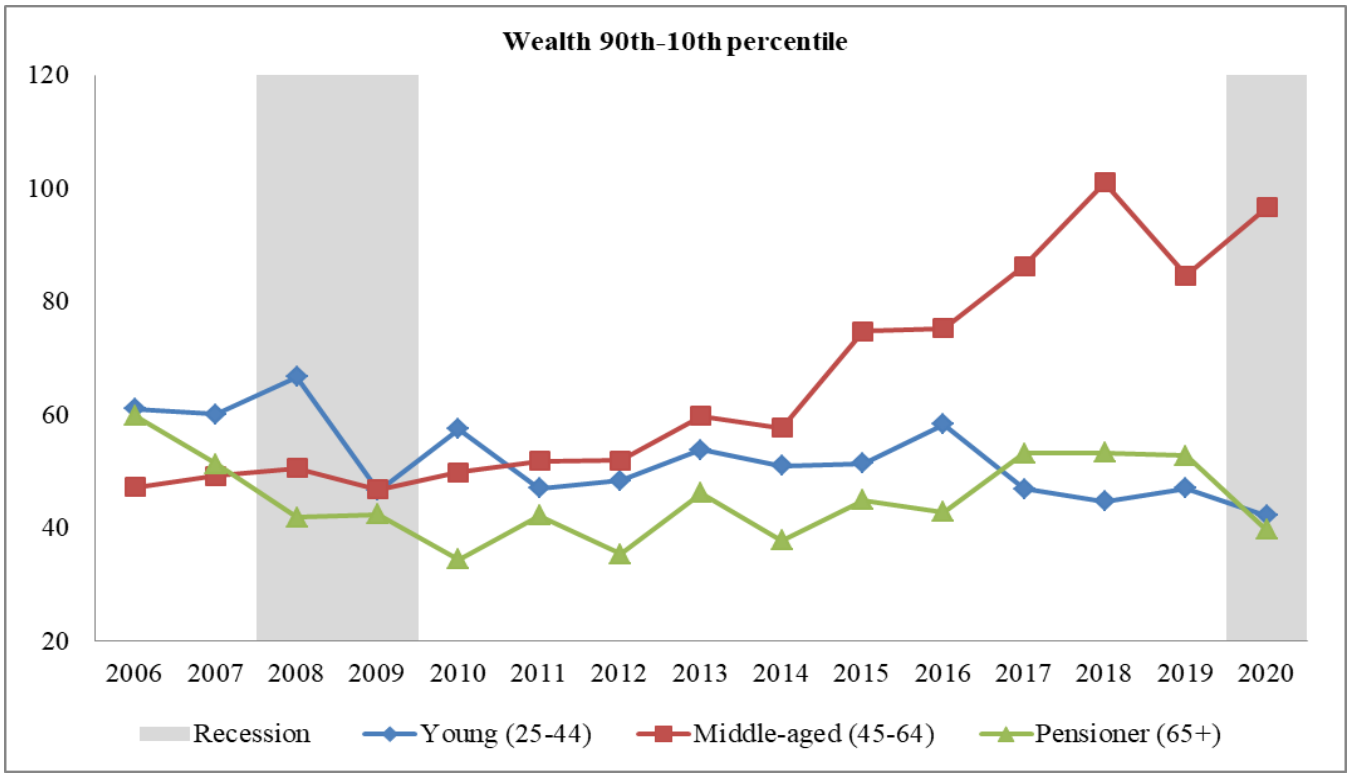


Source: Author's data analysis and WAS data.

Figure 2.7 shows the wealth percentile ratio between the top 10% and the bottom 10% – the upper bound value of the 90th percentile to that of the 10th percentile. Wealth disparity between the middle-aged top 10% and bottom 10% increased significantly after 2014. In 2006, the percentile ratio for the middle-aged group was 47; in 2020, it was 96. In other words, the percentile ratio more than doubled for this group between 2006 and 2020. The pensioner group has the lowest P90/P10 percentile ratio, although the percentile ratio increased in 2016 before decreasing in 2019. The wealth percentile ratio for the young generation decreased from 2016, which indicates that the gap between the top 10% and the bottom 10% narrowed in this period. In 2020, the P90/P10 percentile ratio was 42 for the young age group, 96 for the middle-aged group and 40 for the pensioner group.

A preliminary review of the P90/P10 wealth ratio in different eras of interest rates shows mixed results. The young and the pensioner age groups show little or no difference in wealth inequality over time, but wealth inequality increases significantly for the middle-aged group after the financial crisis (post-2008) in the era of low interest rates.

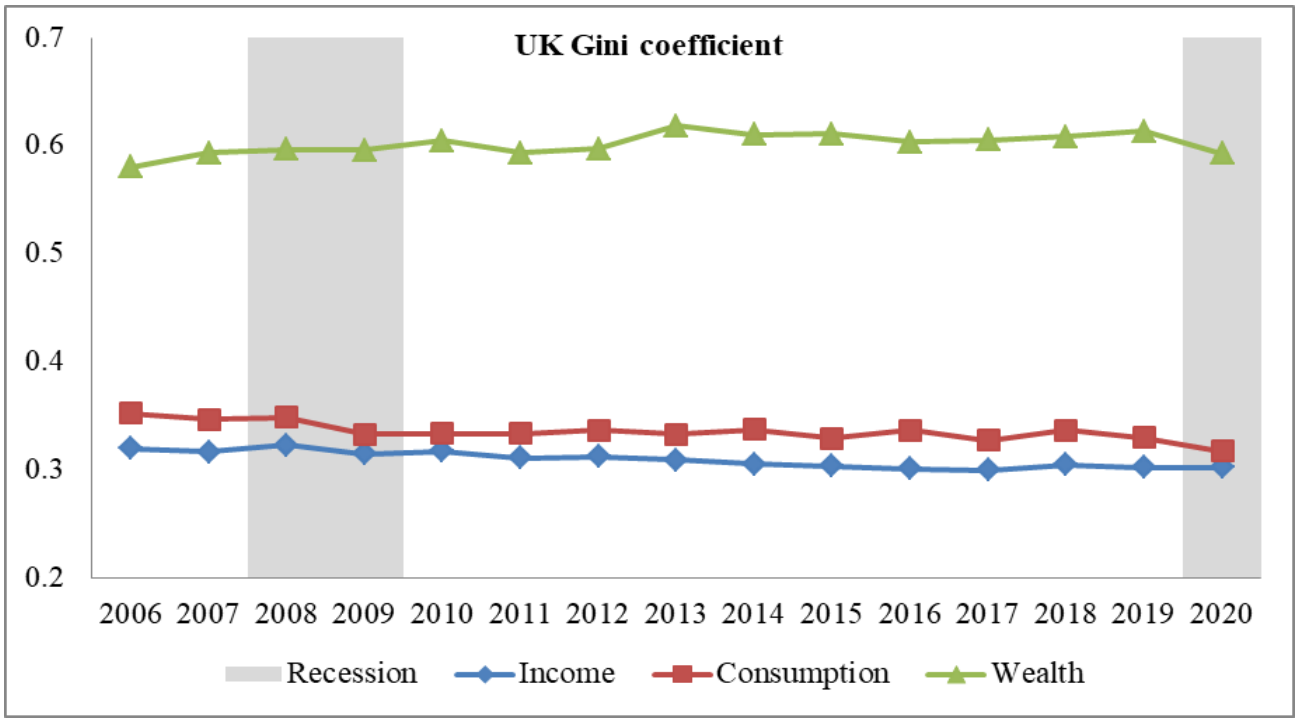
Figure 2.7 Wealth 90th-10th Percentile for Young, Middle-aged and Pensioner Groups



Source: Author's data analysis and WAS data.

Figure 2.8 shows the income consumption and wealth Gini coefficient in the UK. Inequality in wealth is high, while income inequality is low in comparison to wealth and consumption. In 2020, the UK Gini coefficient is 0.59 for wealth, 0.3 for income and 0.32 for consumption. The post-2008 era of low interest rates shows a decrease in income and wealth inequality in the UK, while the wealth Gini coefficient shows a slight increase.

Figure 2.8 UK Income, Consumption and Wealth Gini Coefficient

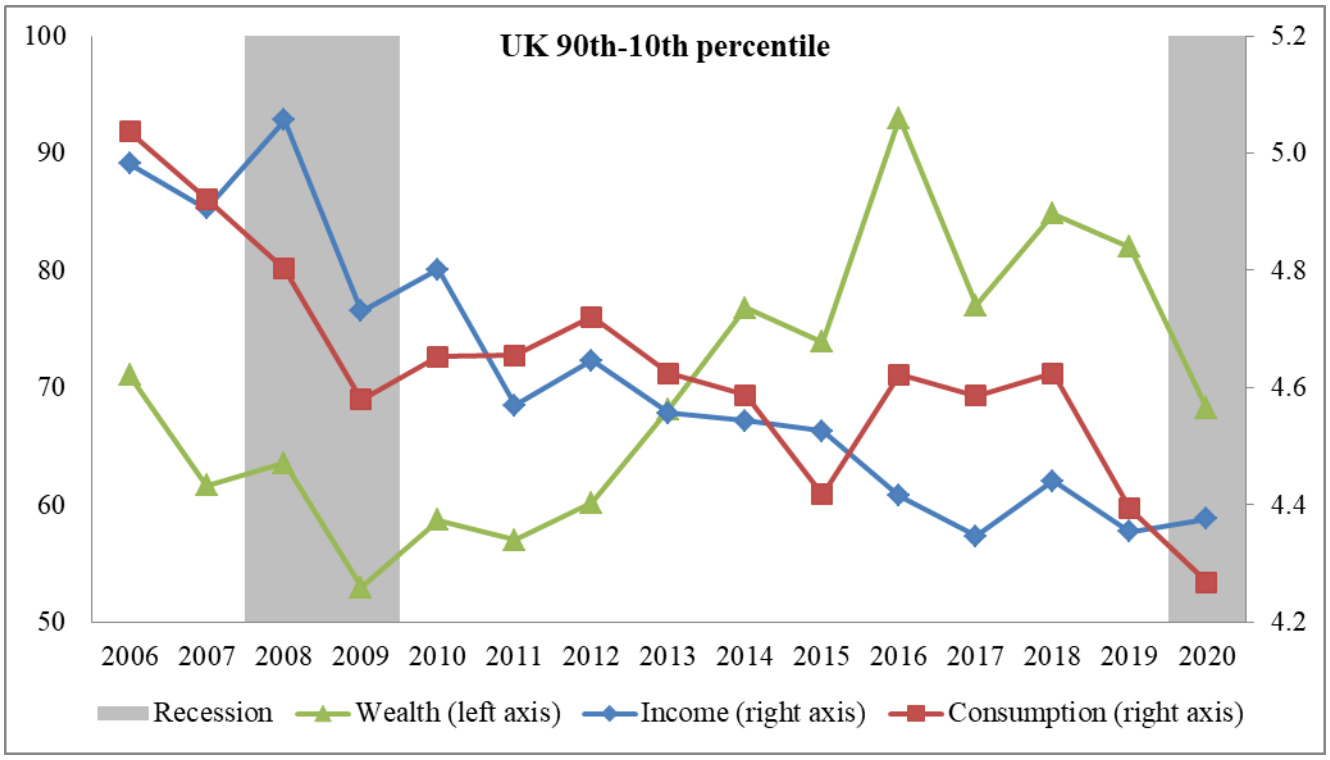


Source: Author's data analysis, LCF and WAS data.

Figure 2.9 compares the UK P90/P10 percentile ratio for income, consumption and wealth. This compares the income, consumption and wealth of the top 10% of the UK population to the bottom 10%. The P90/P10 percentile ratios for income and consumption show a similar trend. The percentile ratio for wealth is high, which indicates that wealth is unevenly distributed in the UK. In 2020, the P90/P10 ratios for income and consumption were approximately 4; the P90/P10 ratio for wealth was 68.

The UK P90/P10 ratio for income and consumption shows that expansionary monetary policy seems to have a positive impact on inequality, while the UK P90/P10 ratio for wealth seems to illustrate a contrast. This paper extends the analysis to the UK by examining the impact of monetary policy shocks on income, consumption and wealth inequality in the UK.

Figure 2.9 UK 90th-10th Percentile for Young, Middle-aged and Pensioner Groups



Source: Author's data analysis, LCF and WAS data.
Note: Income and consumption P90/P10 (right-hand side of the y-axis); wealth P90/P10 (left-hand side).

2.5 Methodology

This study investigates the impact of monetary policy on generational income, consumption and wealth inequality. A vector autoregressive model (VAR) is used to establish the implications of short-term changes in monetary policy on inequality within the young, the middle-aged and pensioners and the causal relationship between monetary policy and generational inequality. The VAR model provides a framework for the development of the impulse response function (IRF) and the Granger causality test. The impulse response function is used to estimate the impact of monetary policy shocks on generational inequality, while the Granger causality test is employed to examine whether a direction of causal relation exists between monetary policy and generational inequality.

2.5.1 Vector Autoregressive (VAR) – Impuse Response Function (IRF) and Granger Causality Test

To investigate the response of generational inequality to a monetary policy shock and the causality relationship between monetary policy and generational inequality, a VAR model is used. The VAR model was developed by Sims (1980). Sims (1980) criticises the differentiation of variables into exogenous and endogenous. Some variables can be explanatory variables to other variables within the model, in addition to the dependent variable. Therefore, there should be no distinction between variables as exogenous and endogenous. The VAR model treats variables symmetrically – variables as endogenous, a theory-free technique of estimating macroeconomic relationships (Asteriou and Hall, 2007).

VAR is a system of variables that depends on its own lagged value and that of other variables in the model. The optimal lag length is chosen using information criteria, including the Akaike information criterion (AIC), Hannan information criterion (HIC), Schwarz Bayesian information criterion (SBIC), finite prediction error (FPE) and likelihood ratio (LR). An important condition of the VAR model is that the variables must be stationary. An augmented Dickey-Fuller test (ADF) is used to test for the unit root problem.

The impulse response function (IRF) is developed from the VAR model estimation results. IRF describes the reaction of a model variable to a shock in one or many variables. IRF estimates how monetary shock affects generational inequality. IRF describes the dynamic behaviour by tracking the response of generational inequality to impulses of a monetary policy shock.

Granger causality test utilises the VAR model estimation results. The direction of causal relationship between variables is analysed using Granger causality tests. The model identifies the cause-and-effect relationship among variables of interest. This paper investigates whether monetary policy Granger-causes income, consumption and wealth inequality. The model examines whether monetary policy predicts (and thereby causes)

income, consumption and wealth inequality using the lagged values of conventional monetary policy through the F-test (joint lagged test).

The VAR model includes the income, consumption and wealth Gini coefficient as the target variable. The monetary policy tool under study is the interest rate. The macroeconomic variables specification follows Romer and Romer (2004) and Coibion et al. (2017). Macroeconomic variables included in the VAR model are the UK gross domestic product (GDP) growth rate, unemployment rate, housing price index (HPI), nominal effective exchange rate, inflation rates, the United States (US) GDP growth rate and US BAA Moody's Corporate Bond 10-Year Yield.[33] The US is one of the UK's major trading partners and top import and export destinations for goods and services. The UK has the largest trade surplus in goods and services with the US. In addition, the US financial market is very crucial to the global financial industry. The global financial crisis of 2008–2009 started in the US and spread around the world.[34] The US dollar plays a pivotal role in international credit facilities and, as such, may be regarded as a global indicator of credit market conditions (Cesa-Bianchi et al. 2020). Controlling for macroeconomic variables enriches the VAR model by increasing the robustness of the regression result and serving as instrument variables to potentially correct for omitted variable bias.

The VAR model specification is as follows:

$$\Delta Gini = \beta_0 + \beta_1 \Delta Gini_{t-1} + \ldots + \beta_p \Delta Gini_{t-p} + \delta_1 \Delta Y_{t-1} + \ldots + \delta_p \Delta Y_{t-p} + \varepsilon_t$$

The model specification represents information for the young, middle-aged and pensioner groups and at the UK (aggregate) level.

[33] The inclusion of the US GDP growth rate and US corporate bond yield did not alter the conclusion of the VAR results, meaning that adding or excluding the US data has no effect on the conclusion.

[34] Information on the UK's major trading partners can be found on the UK government website. https://www.gov.uk/government/statistics/trade-and-investment-core-statistics-book

Gini represents the young, middle-aged and pensioner groups and the UK income, consumption and wealth Gini coefficient. The wealth Gini coefficient is in monthly frequency, while the income and consumption Gini coefficients are in annual frequency.

Y_t is the vector of the macroeconomic variables: interest rates, inflation rates, the UK GDP growth rate, unemployment rates, nominal effective exchange rates and housing price index (HPI), and the US GDP growth rate and US corporate bond yield. The nominal effective exchange rates and HPI are transformed into natural logarithms, while the remaining variables are utilised in their original format. For the income and consumption VAR model analysis, all variables are in annual frequency, while wealth VAR model analysis variables are in monthly frequency.

Δ is an indication that the data are stationary. The unit root problem does not exist; the data are stationary at level; data are stationary at first difference. The unit root problem is eliminated by differencing the variable to make it stationary.

$\beta_0, \beta_1, \beta_p, \delta_1, \delta_p$, are the coefficients of the VAR.

t-1, t-p is the lag length chosen by the information criteria.

Robustness checks, including stability condition testing, heteroskedasticity testing and autocorrelation testing and omitted variable bias, are carried out on regression results. This ensures that the model estimation results are best, unbiased and consistent. Corrections are made where applicable if the model fails the test.

In addition to the robustness checks, a shadow rate is used as an alternative indicator to the interest rate in estimating the VAR model. Since the financial crisis of 2008–2009 up to 2020, the BoE has cut interest rates near the zero lower bound (ZLB) to stimulate the economy. During this period, unconventional monetary policies are also utilised. The policy rate is partially informative since unconventional monetary policies can be transmitted through various channels to the interest rates. An approximation that tracks the stance of

policy cuts near the ZLB and the macroeconomic effect of unconventional monetary policies is the shadow rate (Wu and Xia, 2016; De Rezende and Ristiniemi, 2023). Shadow rates, the implied rate of interest rate policy during the periods of ZLB replace the interest rates in the baseline model to check whether the VAR estimation results are robust. The shadow rate sample covers the period of inflation targeting framework and ZLB periods in the UK.[35]

2.5.1.1 Stationarity Test

An ADF test is used to test for the stationarity of the variables. Testing for stationarity and correcting for unit root are important to avoiding spurious regression. The unit root problem is eliminated by differencing the variable. The results show that the variables are stationary at first difference except for the Gini coefficient for wealth, the UK monthly GDP growth rate, the US annual and monthly GDP growth rate and corporate bond yield. The Gini coefficient for wealth, the UK monthly GDP growth rate, the US annual and monthly GDP growth rate and the US annual and monthly corporate bond yield did not suffer from a unit root problem; the variables are stationary at the level. Stationarity is crucial in a VAR model. The results of the stationarity test for income, consumption and wealth Gini coefficient for the young, middle-aged and pensioner groups and the UK interest rates and macroeconomic variables are reported in Appendix 2B.

2.5.1.2 Optimal Lag Length Selection

The most common lag length selection information criteria (IC) are the Akaike information criterion (AIC), Hannan information criterion (HIC), Schwarz Bayesian information criterion (SBIC), finite prediction error (FPE) and likelihood ratio (LR). These information criteria could produce conflicting results, and no single best information criterion exists. None of the information criteria is better than another. The IC lag length chosen for the income and

[35] The shadow rate series used in this paper was provided by Rafael B. De Rezende (https://www.rafaelbderezende.com/shadow-rates)

consumption models range from 0 to 2, while the wealth IC lag length ranges from 1 to 6 (see Appendix 2B). For this paper, the choice of lag length starts with the lowest lag length. The problem with the VAR model is that using too many lag lengths leads to a loss of degree of freedom. To circumvent this problem, using the IC with the lowest lag length seems appropriate. The next highest lag length is considered if the model estimated fails the robustness test, omitted variable bias test, autocorrelation test, heteroskedasticity test and stability test. Thus, the chosen lag length for this study depends on the validation of the robustness of the regression model. Based on the robustness validation result, the lag length of 2 is used in the income and consumption models. The wealth lag length varies. The lag length for the young wealth model is 4, the middle-aged lag length is 5, the pensioners lag length is 2 and the lag length of 6 is utilised in the UK wealth model.

The data summary statistics for the income, consumption and wealth Gini coefficient and the macroeconomic variables show the mean, median, standard deviation, minimum and maximum of the data used in the empirical analysis are reported in Appendix 2B.

2.6 Empirical Results

2.6.1 Monetary Policy Shocks and Generational Inequality

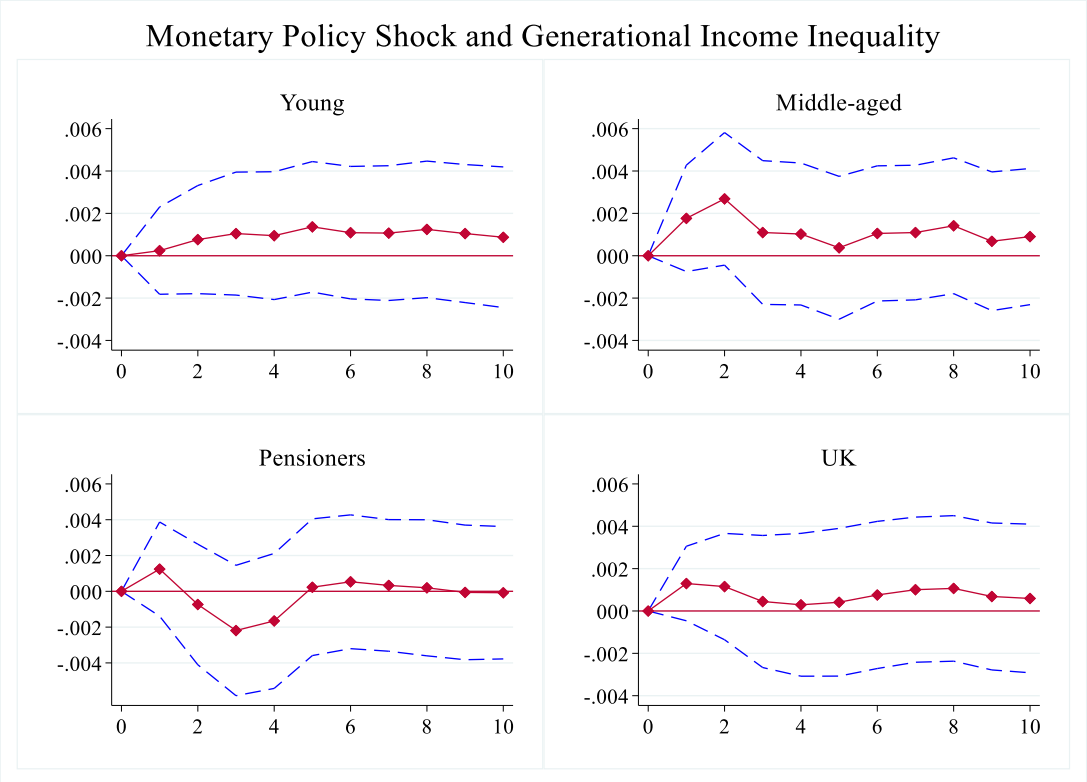
This paper investigates the impact of monetary policy shock on generational inequality using the vector autoregressive model (VAR). The impulse response function (IRF) generated from the VAR estimation model examines whether monetary policy shock increases income, consumption and wealth inequality within the young, the middle-aged and pensioners.[36]

[36] The results from structural VAR – IRF model are indifference to the VAR -IRF model results reported in the empirical section.

2.6.1.1 Income

Figure 2.10 shows the cumulative IRF response of the income Gini coefficient of the young, the middle-aged, the pensioners and the UK to one standard deviation (S.D.) contractionary monetary policy shock. The results show that a one S.D. policy contraction increases income inequality in the young, the middle-aged and the UK, but income inequality decreases among pensioners after the first year. A year after the S.D. shock, the Gini coefficient of the young, the middle-aged and the UK increased approximately by 0.001, 0.002 and 0.001 units respectively, while the pensioners' Gini coefficient decreased by 0.002 units. Thus, contractionary monetary policy shocks lead to an increase in income inequality within the young, the middle-aged and the UK, but income inequality decreases among pensioners. The pensioners are likely to be savers and benefit from contractionary monetary policy through additional income from savings.

Figure 2.10 Monetary Policy shock and Generational Income Inequality



Note: – – – 95% confidence interval (CI). Young (25–44), Middle-aged (45–64) and Pensioners (65+).

The young and the middle-aged are more likely to be borrowers and borrowing costs increase as interest rates rise. The young and middle-aged lose out on income due to the additional costs of loans. Income inequality due to restrictive monetary policy is more exacerbated for the young generation than any other age group. The young generation experiences a persistent increase in the income Gini coefficient. The middle-aged show a decrease in income inequality after the second year. Altogether, income inequality increases in the UK. This analysis supports the conclusion reached by Mumtaz and Theophilopoulou (2017) and Furceri et al. (2018): that contractionary monetary policy shocks increase income inequality in the UK. Overall, it indicates that contractionary monetary policy shocks increase income inequality in the UK and within two generations, namely the young and the middle-aged.

2.6.1.2 Consumption

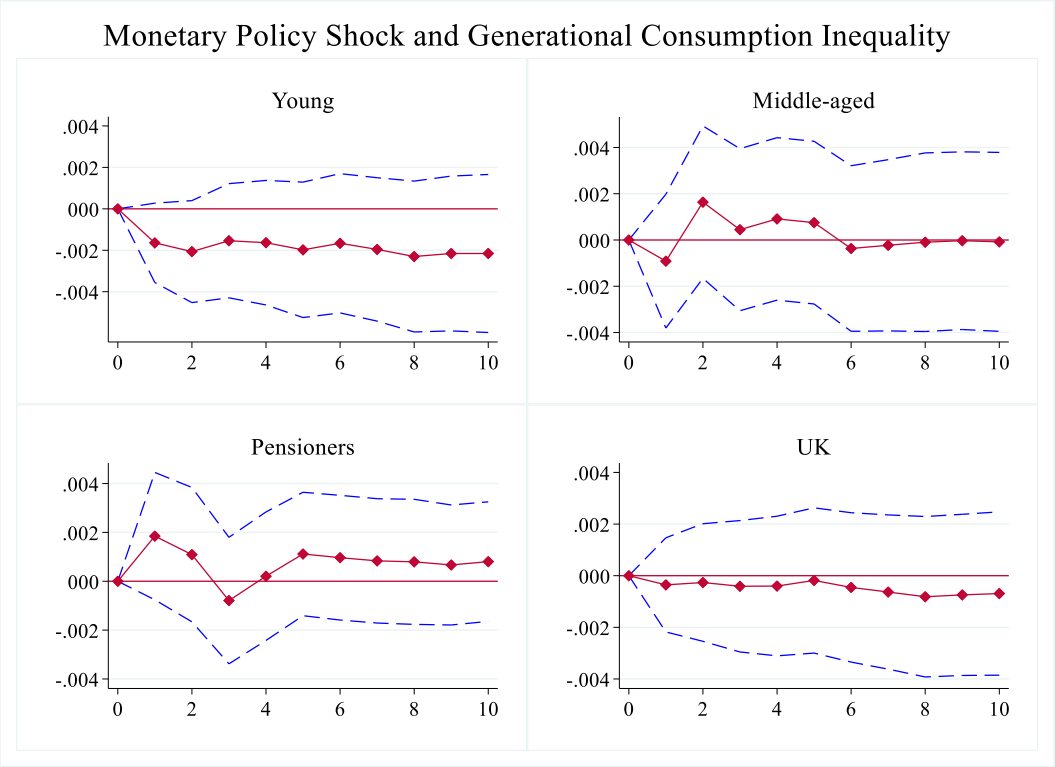
Figure 2.11 displays the cumulative IRF response of the consumption Gini coefficient for the young, the middle-aged, pensioners and the UK to a one S.D. contractionary monetary policy shock. The graph shows mixed results. A one S.D. contraction shock to monetary policy is likely to reduce consumption inequality in the young and the UK, while pensioners are likely to experience an increase in consumption inequality. The middle-aged show a mixed result.

Due to the additional income from savings, the pensioners' consumption is likely to increase, with the higher earners gaining more in saving income than the lower earners. This can lead to uneven consumption, thereby leading to an increase in consumption inequality. As a consequence of the rising costs of debt, the young and the middle-aged may significantly cut down on consumption and defer their consumption to the future, with the expectation that interest rates may fall in the future. The higher earners among the young and the middle-aged are likely to save during the period of the contractionary interest rate policy and may significantly cut down on consumption than the lower earners. As a result,

consumption may be reduced, leading to a reduction in consumption inequality. The impact is more significant in the young than in any other age group.

A one S.D. shock to monetary policy reduces the Gini coefficient of the young by approximately 0.002 units, while the Gini coefficient of the pensioners increases by the same units. The Gini coefficient of the middle-aged shows mixed results for different years, but on average, consumption inequality increases. In general, a one S.D. contractionary monetary policy shock reduces consumption inequality in the UK.

Figure 2.11 Monetary Policy shock and Generational Consumption Inequality



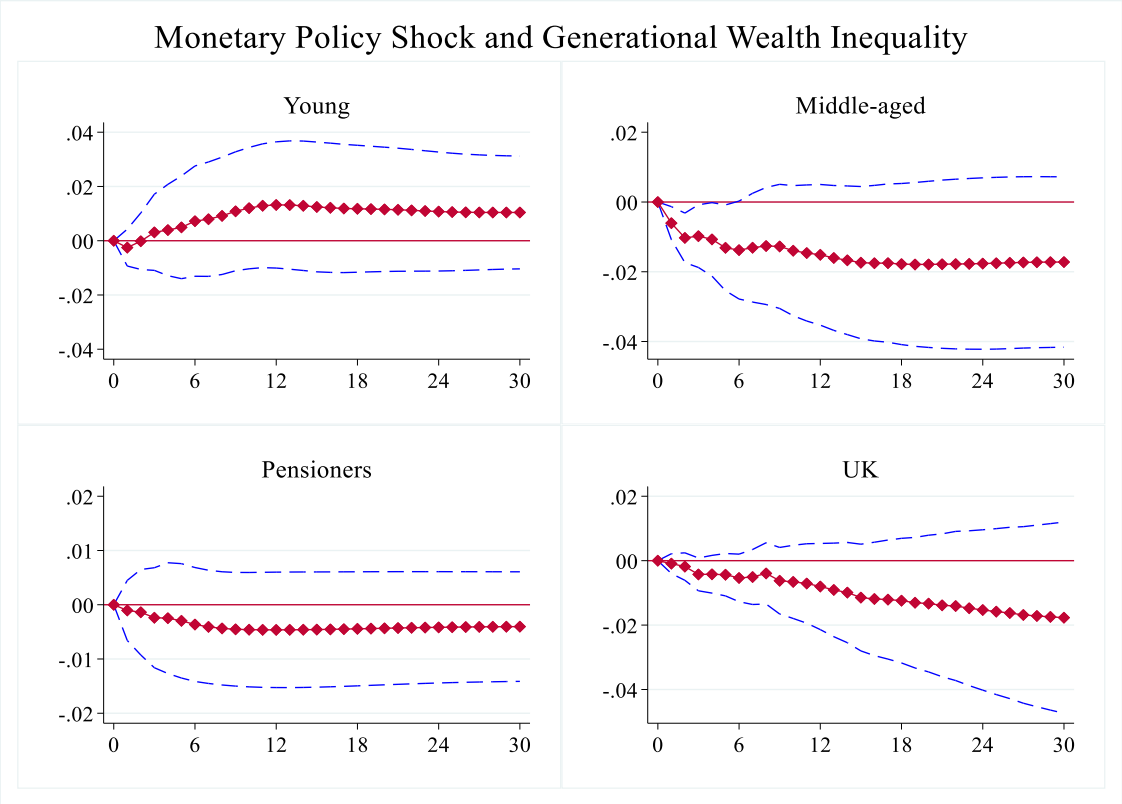
Note: – – – 95% CI. Young (25–44), Middle-aged (45–64) and Pensioners (65+)

2.6.1.3 Wealth

Figure 2.12 shows the response of wealth to one S.D. contractionary monetary policy shock. The effect of monetary policy shocks on wealth shows mixed results within the three generations. However, on aggregate, a one S.D. contractionary monetary policy shock reduces wealth inequality in the UK. The generational effect of monetary policy shocks on

wealth shows that one S.D. shock to monetary policy reduces wealth inequality within the middle-aged and pensioners, but wealth inequality increases within the young generation.

Figure 2.12 Monetary Policy shock and Generational Wealth Inequality



Note: – – – 95% CI. Young (25–44), Middle-aged (45–64) and Pensioners (65+)

After 12 months, one S.D. shock increases wealth inequality in the young generation by 0.01 units, while wealth inequality decreases by 0.02, 0.005 and 0.01 units for the middle-aged, pensioners and the UK respectively.

The middle-aged and pensioners are likely to hold more assets than the young generation. Interest rates have an impact on asset prices. As interest rates increase, asset prices fall. For instance, property is one of the most popular assets. In the UK, interest rates determine the mortgage payments and if interest rates are high, mortgage payments may become very expensive, and this can drive down the demand for assets. Due to falling asset prices, wealth inequality decreases among middle-aged and pensioners. The young generation is more likely to hold cash rather than assets. Since interest rates are linked to the cost of

repayment on loans and assets, assets may become unaffordable due to the high cost associated with interest rates, leading to an increase in wealth inequality within the young generation.

A few studies (Domanski et al., 2016; Mumtaz et al., 2020) have examined the impact of expansionary monetary policy on wealth inequality in the UK. Their findings show that expansionary monetary policy increases UK wealth inequality and imply that contractionary monetary policy is likelier to reduce wealth inequality. This paper reports similar findings: contractionary monetary policy shocks reduce wealth inequality in the UK.

Overall, using the three measures of inequality (income, consumption and wealth), the results indicate that restrictive monetary policy shocks are likely to have a more negative impact on the young than the other generations. Of the three measures of inequality, the young generation ranked as the worst affected in terms of income and wealth due to contractionary monetary policy.

2.6.2 Causality: Monetary Policy and Generational Inequality

This paper investigates the causal relationship between monetary policy and inequality using a Granger causality test. Specifically, it examines whether monetary policy causes inequality, triggering income, consumption and wealth inequality within the young, the middle-aged, pensioners and the UK.[37]

2.6.2.1 Income

The Granger causality results between monetary policy and income inequality are presented in Table 2.1. The results show the probability value of the F-statistics, the joint lag significance test.

Null hypothesis (H_0): Monetary policy does not Granger-cause income inequality.

[37] This paper finds no evidence of a Granger-causal relationship between shadow rate and generational income, consumption and wealth inequality.

The results in Table 2.1 for the generations and the UK are not significant. The results indicate no evidence of a causal relationship between monetary policy and income inequality within the three age groups and the UK. This runs counter to studies such as Galbraith et al. (2007) that have found evidence of said causal relationship between monetary policy and pay inequality in the US. This paper analysis includes all income; income from employment and other sources such as investment income and income from pension and annuities.

Table 2.1 Causality Between Contractionary Monetary Policy and Income Inequality

	Young	Middle-aged	Pensioner	UK
Monetary policy does not Granger-cause income inequality	0.471	0.197	0.116	0.142

*, **, *** denote rejection of null at 10%, 5% and 1%, respectively.
Note: The age categories are the same as the VAR-IRF results.

Similarly, Siami-Namini and Hudson (2019) find evidence of a causal relationship between inflation and income inequality. However, the focus of this study is on conventional monetary policy (via interest rates) and income inequality. This study finds that monetary policy does not Granger-cause income inequality in the UK.

2.6.2.2 Consumption

Table 2.2 reveals the causality relationship between monetary policy and consumption inequality. The probability of the F-statistics, joint significance test of the lagged variable is reported.

Null hypothesis (H_0): Monetary policy does not Granger-cause consumption inequality.

The null hypothesis is accepted: no causal relationship exists between monetary policy and consumption inequality within the young, the middle-aged, pensioners or the UK.

Table 2.2 Causality Between Contractionary Monetary Policy and Consumption Inequality

	Young	Middle-aged	Pensioner	UK
Monetary policy does not Granger-cause consumption inequality	0.119	0.745	0.620	0.649

*, **, *** denote rejection of null at 10%, 5% and 1%, respectively.
Note: The age categories are the same as the VAR-IRF results.

2.6.2.3 Wealth

Table 2.3 presents the Granger causality results between monetary policy and wealth inequality.

Null hypothesis (H_0): Monetary policy does not Granger-cause wealth inequality.

No causal relationship is observed between monetary policy and wealth inequality within the young generation, the middle-aged, pensioners or the UK. The null hypothesis is therefore accepted.

Table 2.3 Causality Between Contractionary Monetary Policy and Wealth Inequality

	Young	Middle-aged	Pensioner	UK
Monetary policy does not Granger-cause wealth inequality	0.307	0.368	0.758	0.244

*, **, *** denote rejection of null at 10%, 5% and 1%, respectively.
Note: The age categories are the same as the VAR-IRF results.

Overall, the Granger-Causality results presented in Tables 2.1, 2.2, and 2.3 are not significant. Therefore, the Granger causality result shows no evidence of a causal relationship between monetary policy and income, consumption and wealth inequality within the generations and the UK.[38]

2.7 Robustness Checks

Robustness checks are carried out to ensure the regression model is consistent and unbiased. It comprises an omitted variable bias test, a heteroskedasticity test, an autocorrelation test and a stability test. An autocorrelation test is conducted to establish whether the observations are independent of each other. The heteroskedasticity test is carried out to ensure that the error terms are normally distributed. The omitted bias check ensures that the model is specified correctly and that all relevant variables are included in the model. For the stability test, the model result must pass this test for it to have a meaningful interpretation. This paper

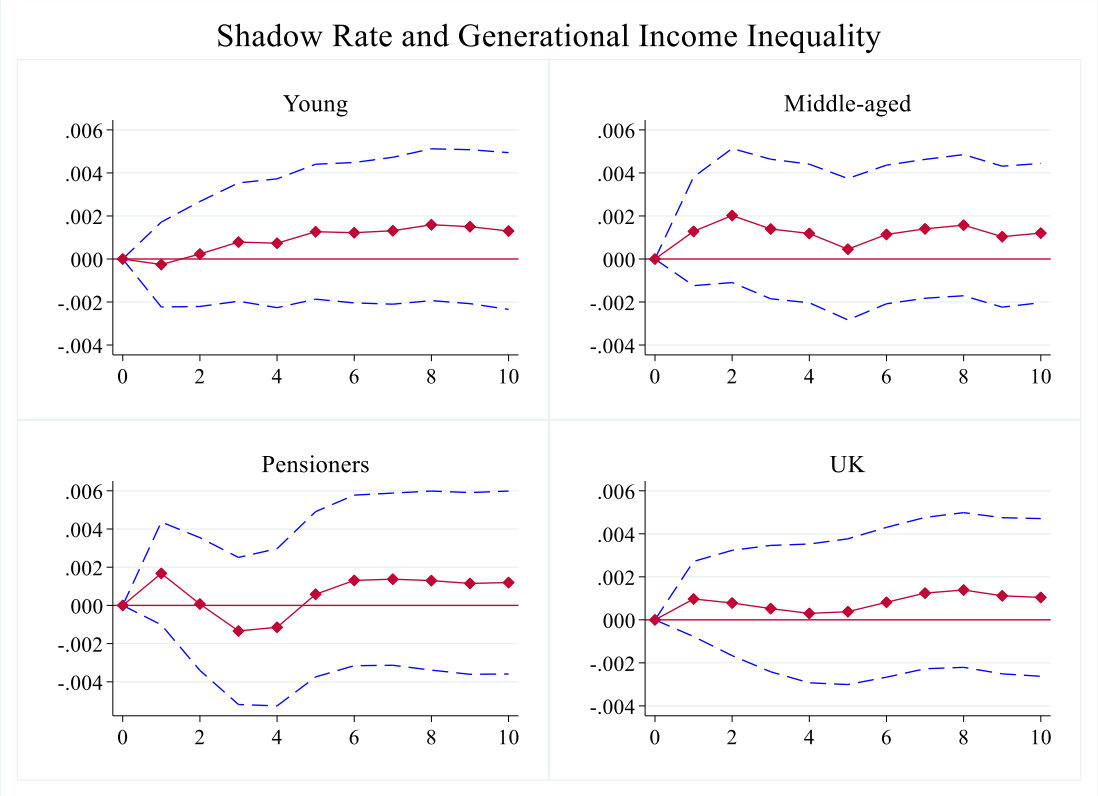
[38] The chosen lag length is 2 for income and consumption and the wealth model lag length is 6. The US GDP growth rate and corporate bond yield are excluded from the Granger causality test.

estimates shadow rate policy shock on generational inequality as a robustness check. The shadow rate is the implied policy rate during the inflation targeting periods and ZLB interest rate period.

2.7.1 Shadow Rate and Generational Inequality

This paper estimates the impact of shadow rate shock on generational income, consumption and wealth inequality. The shadow rates replace the interest rates in the VAR estimation model. The results show a similar conclusion to the results reported in the empirical section.[39]

Figure 2.13 Shadow rate shock and Generational Income Inequality



[39] The lag length chosen for the VAR-IRF interest rate model are the same for the shadow rate model except for the shadow rate UK wealth model, where the chosen lag length is 5.

Figure 2.14 Shadow rate shock and Generational Consumption Inequality

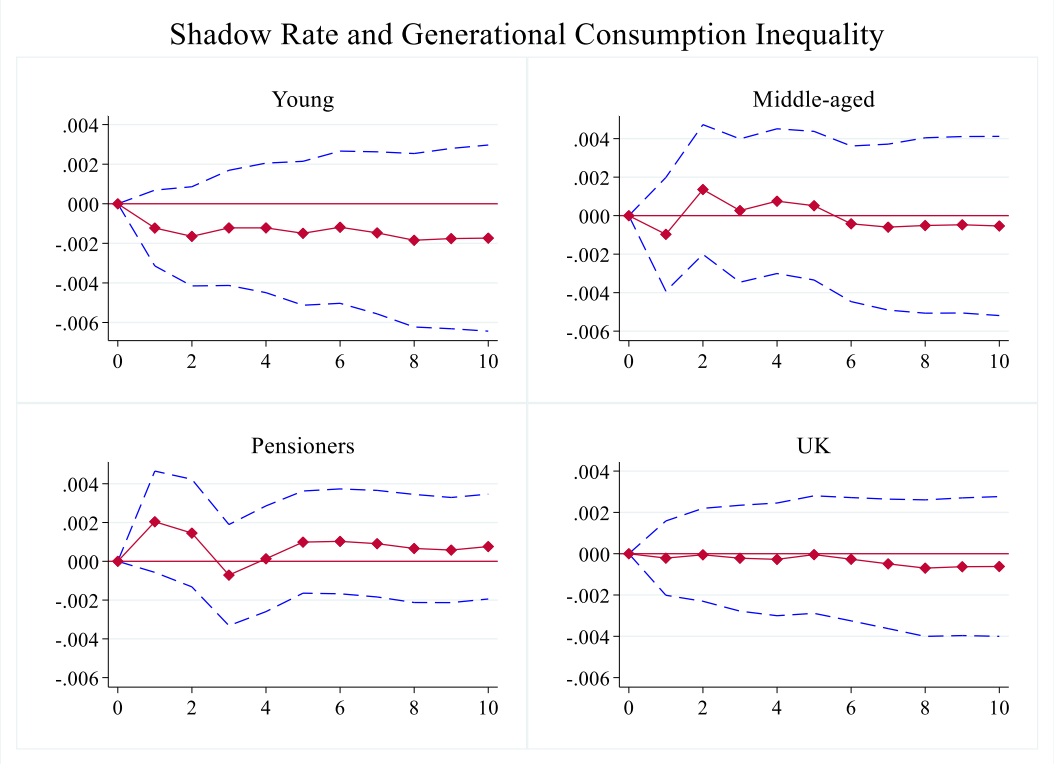
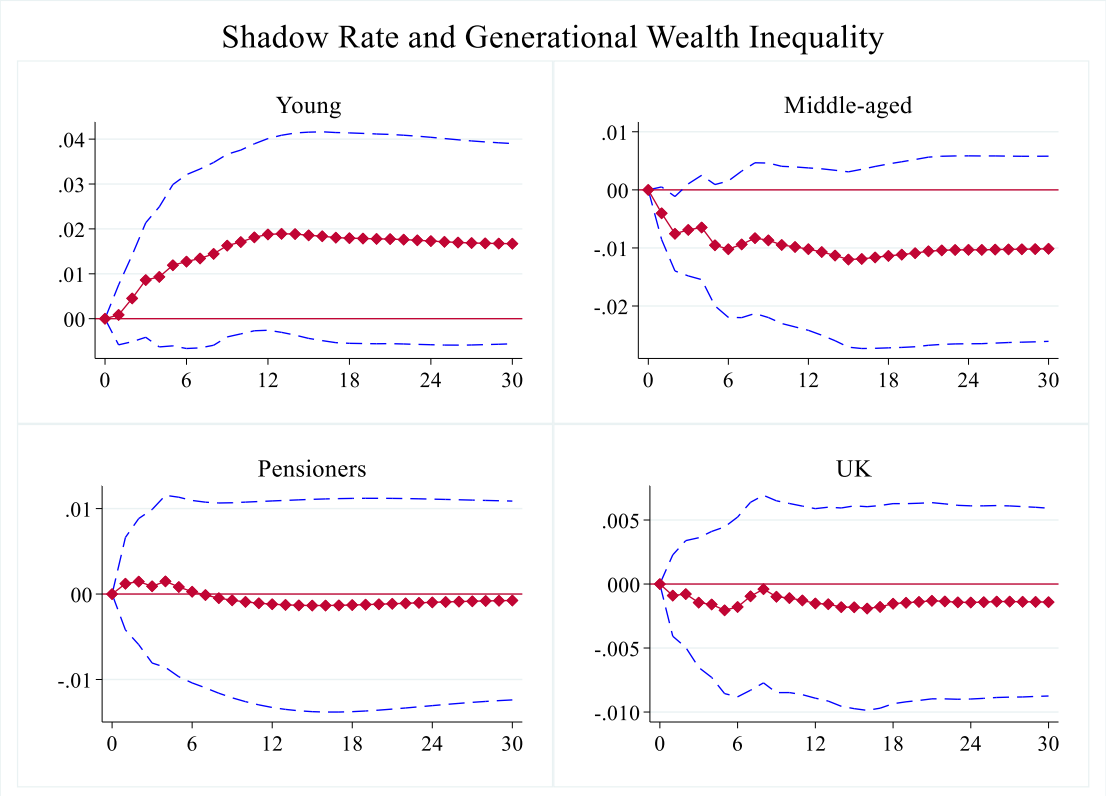


Figure 2.15 Shadow rate shock and Generational Wealth Inequality



2.7.2 Omitted Variable, Heteroskedasticity and Skewness Test Results

The omitted variable bias test, heteroskedasticity test and the nonnormal skewness test are estimated using the Cameron & Trivedi's decomposition of IM-test (Cameron and Trivedi, 1990). Table 2.4 presents the omitted variable test, heteroskedasticity and skewness results for the income, consumption and wealth empirical model.[40] The test is re-estimated by replacing interest rates in the baseline model with shadow rates.

Null hypothesis (H_0): No omitted variables, heteroskedasticity and nonnormal skewness are observed in the income, consumption and wealth models.

Alternative hypothesis (H_A): Omitted variables, heteroskedasticity and nonnormal skewness are present in the income, consumption and wealth models.

The results find no evidence of omitted variables, heteroskedasticity and nonnormal skewness in the interest rates and shadow rates baseline regression models. Therefore, the null hypothesis cannot be rejected.

Table 2.4 Omitted Variable, Heteroskedasticity and Skewness Test Results

Interest Rate				
Model	Young	Middle-aged	Pensioner	UK
Income	0.7432	0.7992	0.6229	0.6802
Consumption	0.5166	0.6007	0.5474	0.6523
Wealth	0.2793	0.7179	0.3381	0.6704
Shadow Rate				
Model	Young	Middle-aged	Pensioner	UK
Income	0.7196	0.8263	0.6376	0.6765
Consumption	0.5349	0.6332	0.5970	0.6431
Wealth	0.3806	0.7543	0.3301	0.5971

*, **, *** denote rejection of null at 10%, 5% and 1%, respectively.

[40] The advantage of a short-run dynamic model (VAR) is that it can be estimated using linear regression. The IM-test was generated by estimating the VAR model using linear regression.

2.7.3 Autocorrelation

The autocorrelation results for income, consumption and wealth are presented in Table 2.5.

Null hypothesis (H_0): No serial autocorrelation is present in the income, consumption and wealth models.

Alternative hypothesis (H_A): Serial autocorrelation is present in the income, consumption and wealth models.

The results indicate that no serial autocorrelation is present in the income, consumption and wealth Gini coefficient models. The null hypothesis is therefore accepted.

Table 2.5 Autocorrelation Test Results

Interest Rate				
Model	Young	Middle-aged	Pensioner	UK
Income	0.61656	0.89886	0.62384	0.91637
Consumption	0.83294	0.41255	0.97315	0.83447
Wealth	0.12495	0.35408	0.11991	0.59593
Shadow Rate				
Model	Young	Middle-aged	Pensioner	UK
Income	0.44118	0.85449	0.21718	0.79136
Consumption	0.51269	0.10017	0.72046	0.59597
Wealth	0.32276	0.37109	0.13257	0.17366

*, **, *** denote rejection of null at 10%, 5% and 1%, respectively.

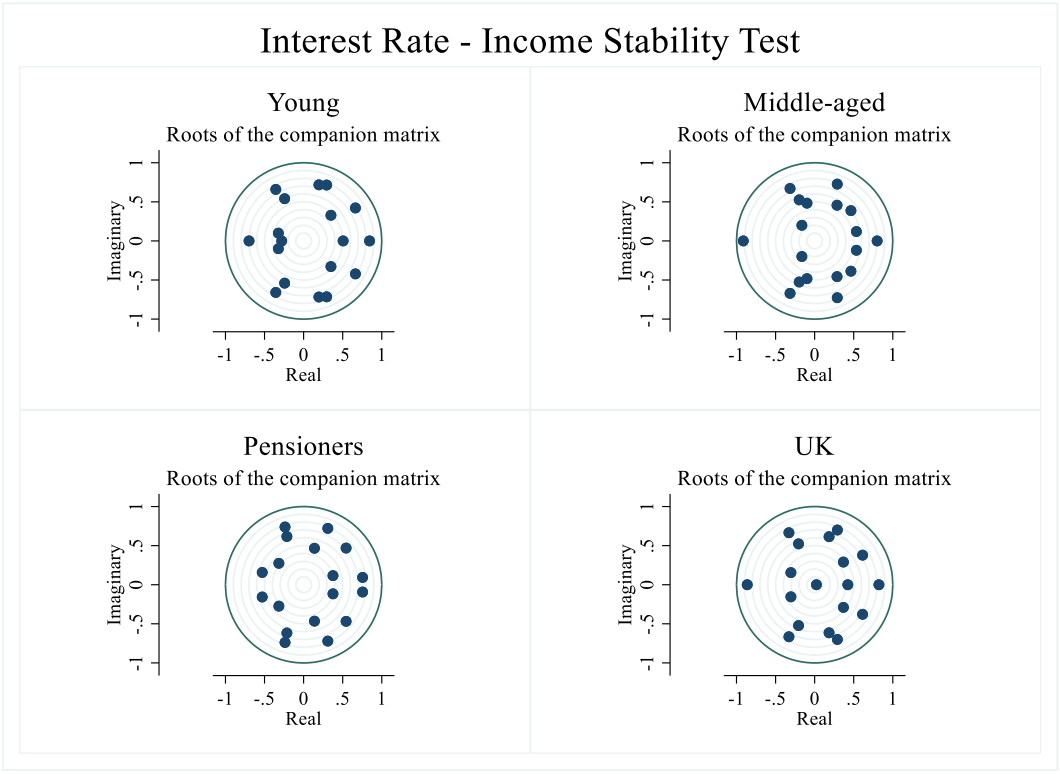
2.7.4 Stability Test

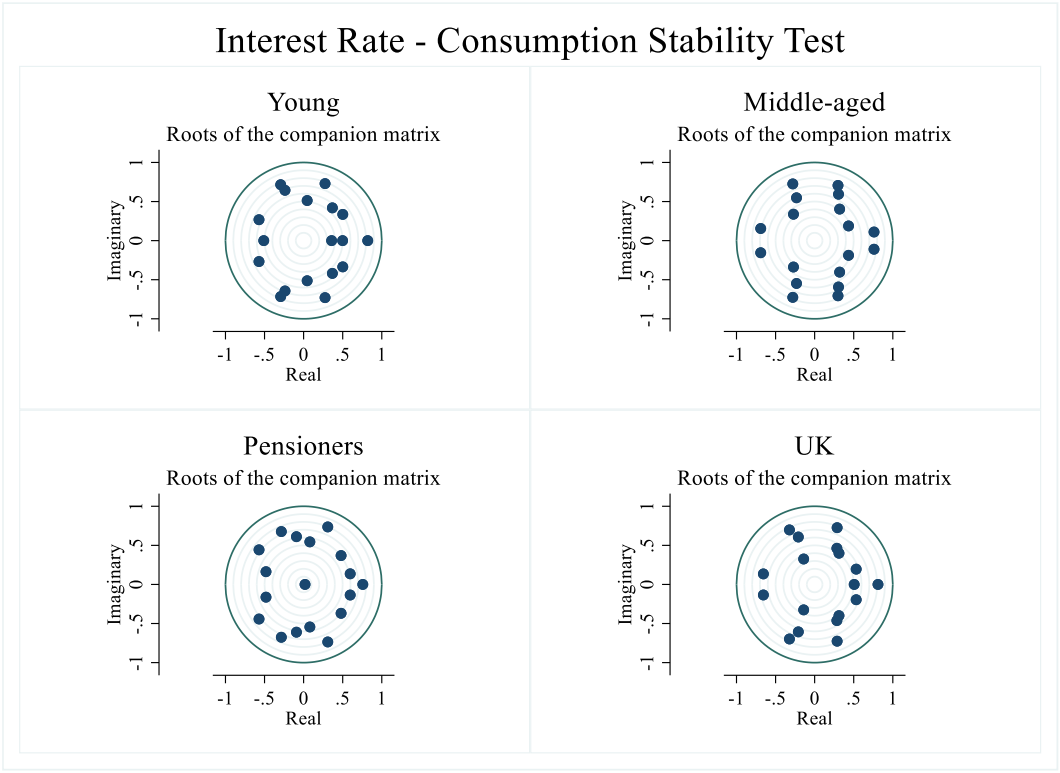
Figures 2.16, and 2.17 show the stability test for income, consumption and wealth. The respective models must pass the stability test for a meaningful interpretation to exist. For the stability test to be valid, the eigenvalues must lie within the unit circle.

The stability test results indicate that the eigenvalues for the income, consumption and wealth models all fall within the unit circle. This means that the income, consumption and wealth models all pass the stability test; the models have a meaningful interpretation.[41]

[41] The cumulative sum test for parameter stability (CUSUM) is used to test for structural breaks. This paper finds no evidence of structural breaks in the models.

Figure 2.16 Interest Rate - Income, Consumption and Wealth Inequality Model Stability Test Results





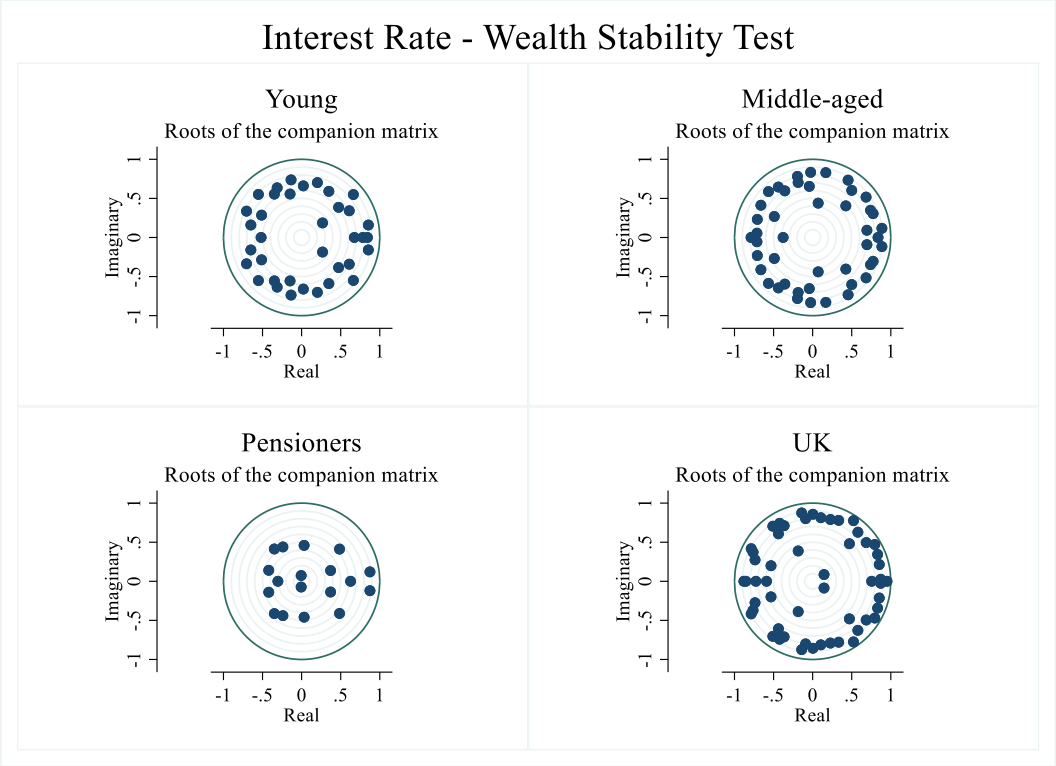
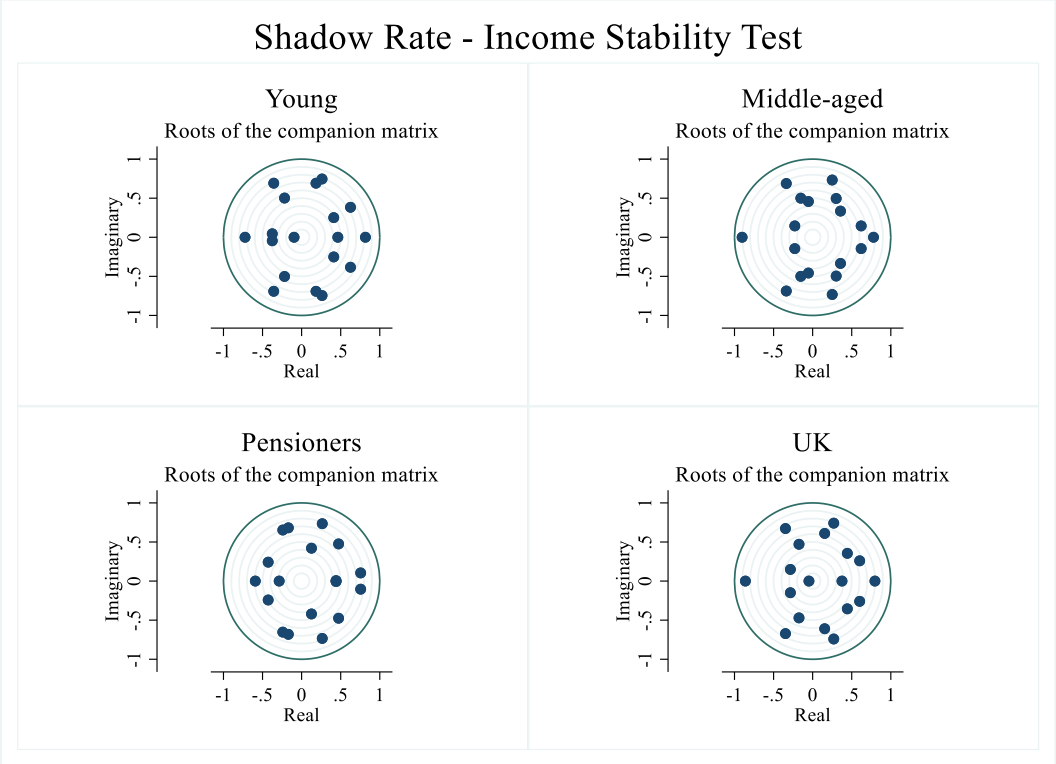
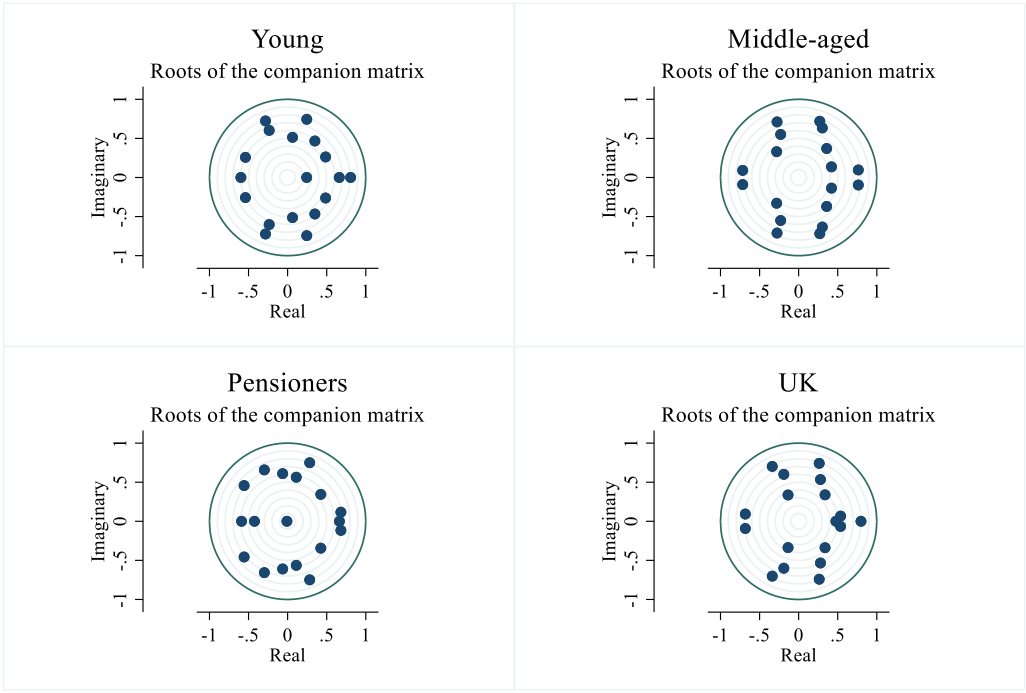


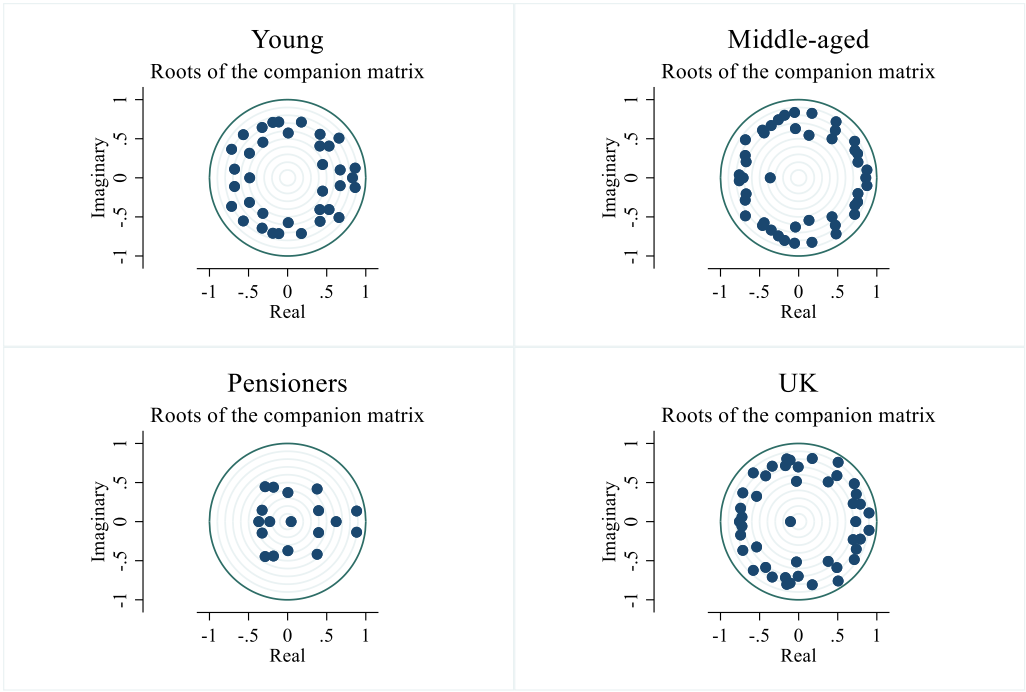
Figure 2.17 Shadow Rate - Income, Consumption and Wealth Inequality Model Stability Test Results



Shadow Rate - Consumption Stability Test



Shadow Rate - Wealth Stability Test



2.8 Summary and Conclusion

This paper investigates the impact of monetary policy on generational inequality in the UK. The two levels of analysis are as follows: The first objective investigates the impact of monetary policy shocks on income, consumption and wealth inequality within the young, the middle-aged, pensioners and the UK on aggregate. The second objective considers whether a causal link exists between monetary policy and income, consumption and wealth inequality within these generations and the UK. The age category for this study is 25 and over. The young generation is aged 25–44, the middle-aged generation is aged 45–64, and the pensioner generation is aged 65+. A vector autoregressive model (VAR) – impulse response function (IRF) is used to investigate the relationship between monetary policy shocks and inequality, while a VAR – Granger causality model is used to analyse the causal relationship between monetary policy and inequality.

The results show that one S.D. contractionary monetary policy shock increases income inequality within the young, the middle-aged, but income inequality decreases among the pensioners. The consumption results show a slightly different outcome. A S.D. shock to monetary policy reduces consumption inequality within the young, while consumption inequality increases among the middle-aged and pensioners. Wealth results show that wealth inequality reduces among middle-aged and pensioners, but the young generation shows a contrast. On aggregate, in the UK, income inequality increases, but consumption and wealth inequality decrease. The results also show that – based on the three measures of inequality (income, consumption and wealth) – the young are more negatively impacted by contractionary monetary policy shocks than the other generations. More specifically, the young generation is the worst affected by contractionary monetary policy in terms of income and wealth inequality. This study finds no evidence of a causal relationship between

monetary policy and income, consumption and wealth inequality within the generations and the UK.

The implication of these findings is that monetary policy decisions have a significant impact on income, consumption and wealth inequality within the young, the middle-aged and pensioners in the UK. Monetary policy is currently embedded in aggregate-level decision-making. This study provides an understanding of the impact of monetary policy decisions at the micro level rather than at the aggregate level. In turn, central banks need to pay more attention to inequality.[42] The lesson from this study is to understand the need for an innovative, flexible, micro-level approach to monetary policy, resulting in macroeconomic policy objectives that encompass inequality. Contractionary monetary policy may achieve the macroeconomic targeted inflation objective in the long term, but the scar it leaves on the generations is strong due to worsening inequality. Macroeconomic policy can be accompanied by a kind of redistribution programme. The young are likelier to be indebted than other generations, and contractionary monetary policy worsens their position due to interest rates that are linked to debt and loans. Pensioners, meanwhile, are probably debt-free but earn a lower income than the working-age generations (the young and the middle-aged). More targeted monetary policy aimed at the different generations should therefore be considered.

[42] Bailey (2022), as BoE Governor, has admitted that raising interest rates is important to tame inflation as it could bring inflation down to the 2% target. However, he has also acknowledged that such action will make life difficult for households (extracted from the FT; https://www.ft.com/content/4ebc27ad-baae-426a-874e-0175a2e7f3f4).

Appendix 2

2.A Monetary Policy Shocks, Shadow Rate and Macroeconomic Variables

Figure 2.18 Monetary Policy and Macroeconomic variables

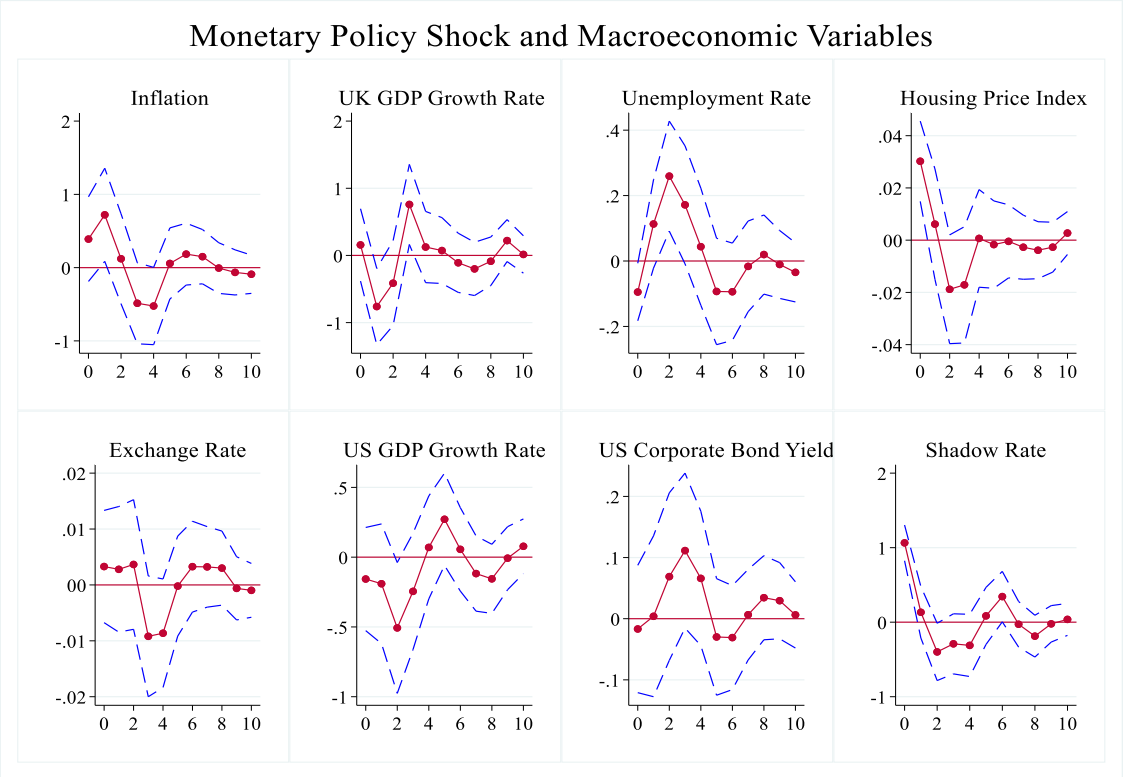


Figure 2.19 Shadow rates and Macroeconomic variables

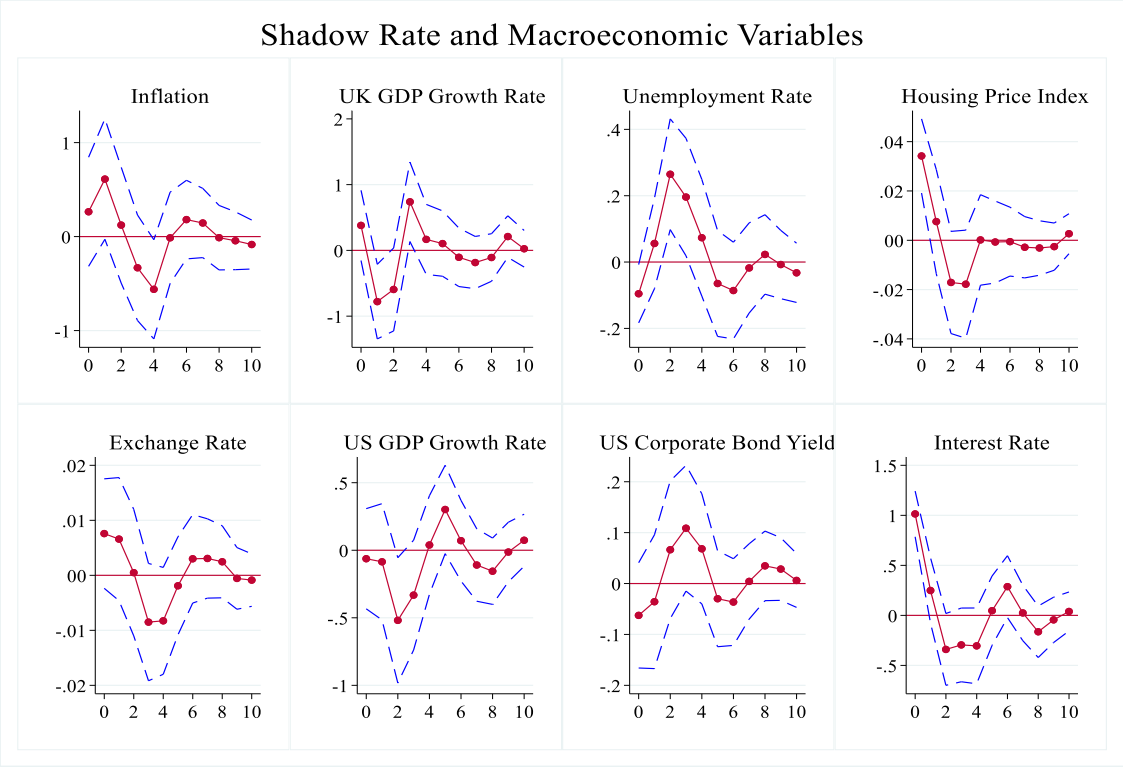


Figure 2.18 and Figure 2.19 display the response of other macroeconmic variables to interest rates and shadow rates. The response of macroeconomic variables to one standard deviation shock to monetary policy and shadow rate policy shows the same conlusion.

2.B Data Summary and Statistics, Stationarity Test and Optimal Lag Length Results

Table 2.6 shows the stationary test results for income, consumption, wealth and macroeconomic variables. The results show that the wealth Gini coefficient for the young, middle-aged, pensioners and the UK, the UK monthly GDP growth rate, the US annual and monthly GDP growth rate and the US annual and monthly corporate bond yield are stationary at level, but the remaining variables are stationary at first difference.

Table 2.6 Stationarity Test results

Variables	At level	First difference	Critical value (1%)	Critical value (5%)	Critical value (10%)
Income Gini					
Young	-1.608	-4.145 ***	-3.580	-2.930	-2.600
Middle-aged	-1.633	-5.168***	-3.580	-2.930	-2.600
Pensioner	-1.620	-4.893***	-3.580	-2.930	-2.600
UK	-1.522	-3.690 ***	-3.580	-2.930	-2.600
Consumption Gini					
Young	-2.036	-4.888***	-3.580	-2.930	-2.600
Middle-aged	-1.835	-5.907***	-3.580	-2.930	-2.600
Pensioner	-1.302	-7.835***	-3.580	-2.930	-2.600
UK	-1.892	-4.702***	-3.580	-2.930	-2.600
Wealth Gini					
Young	-6.785***	-14.523 ***	-3.489	-2.886	-2.576
Middle-aged	-8.383***	-15.763***	-3.489	-2.886	-2.576
Pensioner	-8.880***	-15.927***	-3.489	-2.886	-2.576
UK	-9.651***	-17.104***	-3.489	-2.886	-2.576
Interest rate					
Annual	-1.445	-6.976 ***	-3.579	-2.929	-2.599
Monthly	-2.219	-5.087***	-3.489	-2.886	-2.576
Inflation rate					
Annual	-1.973	-5.736 ***	-3.579	-2.929	-2.599
Monthly	-1.959	-7.045***	-3.489	-2.886	-2.576
Shadow rate					
Annual	-1.162	-7.040***	-3.580	-2.930	-2.600
Monthly	-2.184	-5.330***	-3.489	-2.886	-2.576

Table 2.6 (continued)					
UK GDP growth rate					
Annual	-3.534	-5.772***	-3.580	-2.930	-2.600
Monthly	-5.215***	-11.928***	-3.489	-2.886	-2.576
Unemployment rate					
Annual	-2.876	-4.101***	-3.580	-2.930	-2.600
Monthly	-0.174	-4.865***	-3.489	-2.886	-2.576
Housing price index					
Annual	-2.579	-4.047***	-3.580	-2.930	-2.600
Monthly	-0.176	-4.393***	-3.489	-2.886	-2.576
Nominal effective Exchange rate					
Annual	-2.498	-4.819***	-3.580	-2.930	-2.600
Monthly	-2.141	-7.917***	-3.489	-2.886	-2.576
United States GDP growth rate					
Annual	-4.997***	-7.197***	-3.580	-2.930	-2.600
Monthly	-7.700 ***	-15.896 ***	-3.489	-2.886	-2.576
United States 10-Year Government Corporate Bond Yield					
Annual	-4.560***	-7.708***	-3.579	-2.929	-2.600
Monthly	-3.008**	-6.454***	-3.489	-2.886	-2.576

***, **, * indicate rejection of null hypothesis for the presence of a unit root at 1%, 5% and 10%, respectively.

The summary statistics show the mean, median, standard deviation, minimum and maximum of the data used in the empirical analysis. Table 2.7 and Table 2.8 show the summary details of the income, consumption and wealth Gini coefficient models. The income and consumption data are in annual frequency and wealth data are in monthly frequency.

Table 2.7 Summary Statistics for Income and Consumption Gini Coefficient Model

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Year	53	1994	15.44345	1968	2020
Income Gini Coefficient					
Young	53	0.2704	0.0402	0.1988	0.3329
Middle-aged	53	0.3020	0.0360	0.2398	0.3591
Pensioner	53	0.2814	0.0252	0.2248	0.3366
UK	53	0.3128	0.0315	0.2569	0.3619
Consumption Gini Coefficient					
Young	53	0.2855	0.0242	0.2371	0.3166
Middle-aged	53	0.3177	0.0273	0.2633	0.3711
Pensioner	53	0.3189	0.0261	0.2723	0.3647
UK	53	0.3418	0.0211	0.3034	0.3821

Table 2.7 (continued)					
Macroeconomic Variables					
Interest rate	53	6.7734	4.5430	0.2289	16.3031
Inflation rate	53	5.3846	5.1333	0.3680	24.2072
Shadow rate	53	6.0924	5.4283	-3.0368	16.3031
GDP growth rate	53	1.9132	2.7397	-11	6.5
Unemployment rate	53	6.6641	2.4243	3.5	11.8
Housing Price Index (log)	53	3.2612	1.2713	0.6575	4.8679
Nominal Effective Exchange rate (log)	53	3.6798	0.19111	3.4265	4.1363
United States GDP growth rate	53	2.6832	2.0868	-2.7678	7.2366
United States Corporate Bond Yield	53	2.1907	0.6342	1.08	4.04

Table 2.8 Summary Statistics for Wealth Gini Coefficient Model Empirical Analysis

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Month	165	May 2013	47.7755	July 2006	March 2020
Young	165	0.6000	0.0432	0.5241	0.8015
Middle-aged	165	0.5602	0.0333	0.4891	0.6806
Pensioner	165	0.5492	0.0355	0.4822	0.7232
UK	165	0.6055	0.0222	0.5631	0.6953
Interest rate	165	1.3391	1.7786	0.25	5.75
Inflation rate	165	2.3296	1.1860	-0.2	5.1
Shadow rate	165	-0.8164	2.7773	-3.099	5.89
UK GDP growth rate	165	0.0666	0.7544	-7.1	1.7
Unemployment rate	165	6.0169	1.5336	3.8	8.5
Housing Price Index (log)	165	4.5983	0.1248	4.3945	4.8080
Exchange Rate (log)	165	4.4356	0.0916	4.3133	4.6594
US GDP growth rate	165	0.1216	0.6422	-5.1164	1.6790
US Corporate bond yield	165	2.6913	0.8116	1.56	6.01

Table 2.9 Optimal Lag Length Selection for Income, Consumption and Wealth Model

Information criteria (IC) lag length				
Income Model	Young	Middle-aged	Pensioner	UK
Likelihood ratio (LR)	2	2	2	2
Finite prediction error (FPE)	2	2	2	2
Akaike information criterion (AIC)	2	2	2	2
Hannan information criterion (HIC)	1	1	1	1
Schwarz Bayesian information criterion (SBIC)	0	0	0	0
Consumption model				
Likelihood ratio (LR)	2	2	2	2
Finite prediction error (FPE)	1	2	2	1
Akaike information criterion (AIC)	2	2	2	2
Hannan information criterion (HIC)	1	1	1	1
Schwarz Bayesian information criterion (SBIC)	0	0	0	0
Wealth model				
Likelihood ratio (LR)	4	5	4	6
Finite prediction error (FPE)	2	2	2	2
Akaike information criterion (AIC)	2	2	2	2
Hannan information criterion (HIC)	1	1	1	1
Schwarz Bayesian information criterion (SBIC)	1	1	1	1

Table 2.10 Data Sources

Variables	**Source**
Income data	Living Costs and Food Survey, Office for National Statistics and UKDS
Consumption data	Living Costs and Food Survey, Office for National Statistics and UKDS
Wealth data	Wealth and Assets Survey, Office for National Statistics and UKDS
Consumer Price Index	Office for National Statistics
Retail Price Index	Office for National Statistics
GDP growth rate	Office for National Statistics
Unemployment rate	Office for National Statistics and https://www.nomisweb.co.uk/
Interest rate	Bank of England
Nominal Effective Exchange rate	Bank of England
Inflation rate	World Bank and www.rateinflation.com/inflation-rate/
Housing Price Index	https://landregistry.data.gov.uk/
Shadow rate	https://www.rafaelbderezende.com/shadow-rates
United States Annual GDP Growth rate	World Bank https://data.worldbank.org/indicator/
United States Monthly GDP	S&P Global Market Intelligence https://www.spglobal.com/marketintelligence/en/mi/products/us-monthly-gdp-index.html
United States Corporate Bond Yield	Federal Reserve Bank of St. Louis https://fred.stlouisfed.org/series/BAA10YM

Note: The income, consumption and wealth raw data are accessible from the UK Data Service (UKDS)

Chapter 3

Wealth Distribution and Inequality in the UK: A Survey

Abstract

This paper analyses the impact of monetary policy and fiscal policy on wealth distribution and inequality in the UK using data from the Wealth and Assets Survey (WAS). The survey results show that UK wealth is concentrated in a few hands. The top 20% hold more than 60% of the UK's total wealth, while the bottom 10% have no property wealth, financial wealth or pension wealth. The study finds that property wealth and financial wealth inequality are increasing post-financial crisis, whereas pension wealth inequality decreases over time. Wealth distribution and inequality are analysed by generation: the young (25–44), the middle-aged (45–64) and pensioners (65+). The wealth analysis shows that wealth inequality is highest within the young generation. This study also finds that wealth accumulation increases up to the active working age, but wealth decumulation occurs at the retirement age.

3.1 Introduction

The concentration of wealth in fewer households has increased in recent years, and this has created a powerful force for increasing inequality (Piketty, 2014). Wealth is crucial as it can support and maintain the welfare and wellbeing of households in the case of economic shock, be it a recession, a pandemic or an unexpected fall in income. Concerns have been raised over whether households are accumulating wealth towards retirement due to ageing populations, pressure on public pension systems and changes to workplace pensions (Crossley et al., 2016). The young generation has a slower rate of wealth accumulation (Hood and Joyce, 2013), which could culminate in a larger problem in the decades to come. As a result, research interest has increased in wealth distribution and inequality (Hills et al., 2013; Piketty 2014; Atkinson, 2015; Saez, 2017). Wealth can be bequeathed from one generation to the next – an important implication for the descendants of those whose generation holds wealth and for those whose generation has no wealth (Crawford et al., 2016).

In the UK, the government and central bank have pursued various types of fiscal policy and monetary policy that may have significantly impacted wealth inequality and distribution. This paper investigates wealth distribution, wealth inequality, changes in wealth and wealth components (financial wealth, physical wealth, property wealth and pension wealth) over time using Wealth and Assets Survey (WAS) data. By examining the survey data collected from households in the UK about their wealth and wealth components, the following questions are addressed: How has policy impacted wealth inequality and distribution between the wealthiest and least wealthy households in the UK? How has policy impacted wealth inequality and distribution among different generations? The main methodology for this paper is descriptive statistics. Gini coefficient, percentile, percentile ratio, mean and median total wealth and wealth components are constructed to analyse the evolution of wealth distribution and inequality.

Property wealth is one of the most popular assets in the UK. Before the global financial crisis, rules on obtaining mortgages and buying assets were somewhat relaxed; in contrast, after the financial crisis in 2008–2009, which led to the housing market collapse, monetary policy rules on asset acquisition became more stringent. The Bank of England (BoE) introduced affordability test in 2014, which led to a tightening of the mortgage market. Since the financial crisis, the BoE has embarked on an expansionary monetary policy, especially through quantitative easing (QE), which has significantly impacted asset prices (BoE, 2012; Huston and Spencer, 2018). Stringent affordability rules coupled with QE fuelled asset prices may have implications for the wealth of different generations, specifically wealthy and less wealthy households. Research has shown that between 2006 and 2019, the average age of first-time home buyers has risen from 27 years to 34 years or older (ONS, 2019). Currently, more than three times as many 25–44 year-olds are living in rented private-sector property than 20 years ago (ONS, 2018), and this age group has seen a significant decline in home ownership compared to older age groups (ONS, 2015). Another important form of asset is financial assets. Studies have shown that QE introduced as part of post-crisis monetary policy measures has had a significant impact on financial asset growth (Balatti et al., 2018; Fratzscher et al., 2013; Bridges and Thomas, 2012).[43]

The fiscal policy measures introduced may have impacted wealth inequality and distribution. These measures include the Help to Buy scheme, introduced in 2013, where the UK government contributes a certain percentage towards the acquisition of property assets. Another such policy is the abolition of stamp duty (tax) on property assets worth up to a certain threshold for homebuyers and first-time property asset owners. The stamp duty tax relief was initiated in 2017. The UK government also introduced restrictions on tax relief for residential landlords (buy-to-let) in 2017 as part of its fiscal policy measures. These

[43] Monetary policy measures (https://www.bankofengland.co.uk/).

restrictions carry the potential to make the rental market unprofitable, prompting landlords to exit the property market and freeing up their property assets. A mandatory housing building target was also introduced in 2017, committed to building 300,000 homes per year, but the government has fallen short of the target.

Pension wealth is another form of wealth, and pension reforms have been introduced as part of UK fiscal policy measures. Due to declining fertility rates and improvements in life expectancy, the UK population is ageing, and this is projected to increase (ONS, 2020). In 2012, the UK government introduced compulsory pension automatic enrolment to help people save towards retirement with their employers' help. In addition, tax relief is provided on pensions for people under the age of 75 to encourage more contributions towards retirement. The default retirement age was also removed in 2011, meaning that employers can no longer require employees to retire at a certain age.

Other fiscal policy measures include the Health and Social Care Levy and inheritance tax law, both of which may have implications for wealth distribution in the UK. Gifting assets and selling personal possessions during an individual's lifetime is usually tax-free (albeit with some exceptions to the rule). Conversely, on death, wealth is subjected to inheritance tax if the value of the estate (property, possessions and money) is over a certain threshold. Beneficiaries are expected to pay this tax, which may ultimately result in them liquidating the assets to generate the necessary cash. UK inheritance tax law mostly results in tax planning, which may ultimately have implications for wealth distribution and the decisions that individuals make at a later stage in life.[44]

Using descriptive statistics, this paper examines the UK wealth data to understand how the fiscal and monetary policy pursued by the UK government and the central bank has impacted wealth inequality and distribution in the country. Scholarly papers like Crawford et

[44] Fiscal policy measures (https://www.gov.uk/).

al. (2016) have touched on subsets of the wealth sample, specifically wave 1 (2006–2008) and wave 3 (2010–2012) of the WAS data. This paper is distinct in its analysis of wealth inequality and distribution by utilising all rounds of the WAS – from wave 1 to wave 7 of the sample data (2006–2020) – in examining the evolution, trend and changes in wealth distribution and inequality in the UK over time.[45]

A detailed analysis of the WAS data provides a comprehensive insight into the trend in wealth on a year-by-year basis, as well as which groups have benefited or lost out from wealth distribution in the UK. This study provides an elaborate evaluation of wealth inequality and distribution during the pre-financial and post-financial crisis periods in the UK. This has important implications for monetary and fiscal policymaking in terms of wealth redistribution and narrowing wealth inequality. This paper explores two levels of wealth analysis. The first focuses on wealth inequality and wealth distribution in the UK, while the second offers a detailed description of wealth inequality and distribution among three different generations: the young (25–44), the middle-aged (45–64) and pensioners (65+).

Historically, wealth research has been constrained due to a lack of comprehensive wealth and assets data. In the UK, the sources of wealth data used by earlier research include wealth and estate tax records, household surveys of assets and debts and investment income data. Davies and Shorrocks (2000) have highlighted the problems associated with these sources of data and the issues that need to be addressed to improve reliability. Other challenges associated with measuring wealth data include the underestimation of wealth and the under-capturing of the top-tail distribution due to non-response and failure to disclose sensitive information (Vermeulen, 2014; Advani et al., 2021). In 2006, the Wealth and Assets

[45] The WAS data covers Great Britain, excluding addresses north of the Caledonian Canal, the Scottish Islands and the Isles of Scilly (ONS, 2022).

Survey (WAS) was launched by the Office for National Statistics (ONS) and was dedicated to collecting household wealth and personal wealth in the UK.

The WAS is a detailed dataset that records the wealth and components of wealth assets and liabilities of private households in the UK. The data are collected in waves and biennially. Currently, seven waves of data are available, spanning 2006 to 2020 and including the financial crisis period. This paper examines changes in household wealth distribution and inequality over time in the UK using this WAS data. The seven waves that cover the period from 2006 to 2020 are utilised to establish the trend in wealth distribution for households in the UK.

The methodology for this paper is mainly descriptive statistics. This includes the Gini coefficient, a measure of dispersion (percentile) and a measure of central tendency (mean and median). The wealth and assets data are presented in real values. The data are weighted to ensure that they reflect the population being studied more accurately.

The remainder of this chapter is structured as follows: Section 3.2 presents details on the Wealth and Assets Survey; Section 3.3 analyses UK household wealth distribution and inequality; Section 3.4 presents wealth distribution and inequality by generation; Section 3.5 presents age decomposition; and Section 3.6 presents the summary and conclusion.

3.2 Wealth and Assets Survey (WAS)

The Wealth and Assets Survey (WAS) is a biennial longitudinal household survey that collects information on a wide range of assets and liabilities, level of savings and debt, and savings for retirement among households and individuals in the UK. The WAS measures the distribution of wealth across households, the economic wellbeing of households, the wellbeing of individuals and the factors that influence financial planning, as well as monitoring changes in wealth over time. The WAS comprises two main interview stages. The

first stage is the "mainstage" interview, also known as the primary interview stage, in which the WAS questionnaires are completed by the respondent. The second stage is the "keeping in touch exercise" (KITE). The KITE aims to keep the respondent engaged with the survey process and to capture the respondent's contact details.[46]

Throughout, the key challenges have been low response rates and the reduction in sample size with each wave. ONS has addressed the challenges by adding new respondents to reduce the effect of attrition. The new cohort accounts for changes in the population characteristics. Another challenge with other wealth data in the UK is the under-capturing of the top-tail distribution. The ONS has addressed this issue in the WAS data by sampling at a higher rate, addresses that are most likely to contain wealthier households. In addition, the WAS questions are harmonised with other UK government surveys to ensure consistency, comparability and coherence of the data. Great effort is made to ensure that the WAS data are robust, reliable and accurate. This includes a data cleaning process to identify outliers, checking outliers for credibility, comparison with previous waves, inspection of wealth and revisiting respondents to affirm previous wave data, as well as potentially revising previously published data if higher-quality data are available at a later date (ONS, 2022). The WAS captures the total wealth including the top percentiles.

Currently, seven waves of WAS survey data are available. The first wave of WAS survey was completed in 2006 and covers a period of two years. In wave one, 30,500 households were interviewed, and the response rate attained was 55%. In wave two, about 20,100 households were sampled, with a response rate of 68%. From wave three onwards, new respondents were included to reduce the effect of attrition. Wave three included approximately 21,400 respondents (including the new sample); the response rate attained was

[46] The WAS survey excludes people living in communal establishments such as retirement homes, hotels, prisons, barracks and halls of residence.

65%. In wave four, around 20,200 households were sampled, with a response rate of 66%. In wave five, 18,800 households were sampled, with a response rate of 65%. Wave six sampled about 18,000 households in total, with a response rate of 63%. Finally, in wave seven, about 17,500 households were sampled, with a response rate of 58%.

The WAS data are made up of four components: net property wealth, net financial wealth, net physical wealth and private pension wealth. Net property wealth is the value of all property less any liabilities (such as mortgages and any outstanding debt). Net financial wealth is the total value of all financial assets, including bonds, gilts, equities, investments, children's investments and assets, and endowments less any liabilities. Net physical wealth is the total value of valuables, vehicles, household contents and collectibles less any liabilities. Private pension wealth is the total sum of personal pensions, occupational pensions, pensions in payment and pensions expected from a former partner or spouse.[47] This paper utilises the total wealth and wealth components – property wealth, financial wealth, physical wealth, and private pension wealth – to analyse wealth distribution and inequality in the UK over time. WAS collects information on wealth at individual and household levels.

The level of analysis in this paper is at the household level. Household levels are a better comparison of wealth standards because households operate as a single financial unit. The wealth of households affects living standards (Crawford et al., 2016). In addition, components of wealth, such as property wealth, are more likely to be jointly owned than individually owned. Wealth and assets are sometimes held in trust for the benefit of the family. Wealth is bequeathed from generation to generation. For the following reasons, this paper analyses wealth at the household level.

[47] WAS Household wealth does not include business assets.

3.3 UK Household Total Wealth Distribution and Inequality

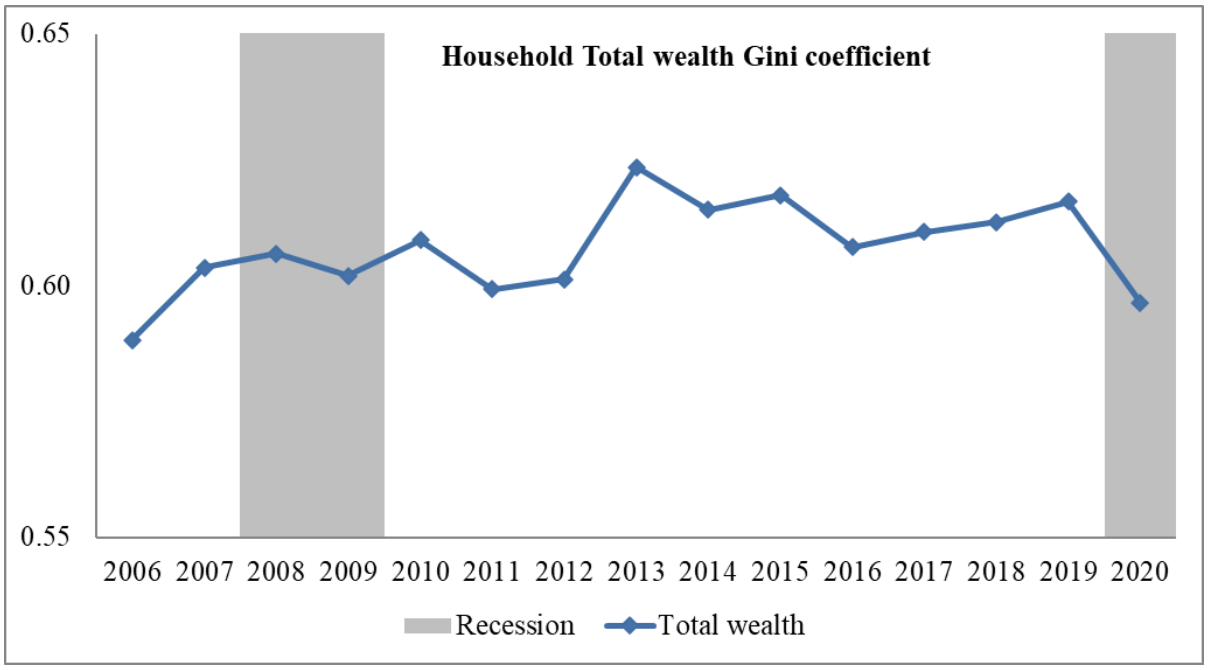
This paper examines the distribution and inequality of UK household total net wealth and wealth components. The Gini coefficient, percentile, mean wealth and median wealth are constructed to analyse the wealth distribution and changes in wealth in the UK over time. The total wealth and wealth components are deflated to 2019/2020 prices using the Consumer Prices Index including owner occupiers' housing costs (CPIH). The data are weighted, and the wealth and assets value presented are in real values.

Figure 3.1 and Figure 3.2 compare the Gini coefficient for household total net wealth and wealth components in the UK. The total wealth comprises property wealth, financial wealth, physical wealth and private pension wealth. The total wealth Gini coefficient fluctuates between 0.60 and 0.62 over the period of study.[48] Breaking down total wealth into its separate components, the highest inequality is in financial wealth, and the lowest inequality is in physical wealth. Before the 2008 financial crisis, inequality in property wealth was the lowest of the components of wealth; post-financial crisis, property wealth inequality has increased. This increase in property wealth inequality might be attributed to quantitative easing (QE). Research suggests that QE increases wealth inequality. Stringent affordability tests and a lack of affordable housing may be additional factors contributing to this increase in property wealth inequality.

Post-financial crisis, pension wealth inequality has decreased more than the other components of wealth. This decrease might be attributed to greater awareness about saving for retirement due to pressure on public services and the health and social care crisis, as well as the compulsory workplace pension automatic enrolment introduced in 2012.

[48] The focus of this paper is wealth analysis at the household level. Household wealth measures the wealth of all individuals in the household. A household is treated as a single financial unit. Household wealth is different from net personal wealth. Net personal wealth examines the wealth of an individual. The Gini index for UK net personal wealth in 2020 is 0.73 (WAS and World Inequality Database (WID)).

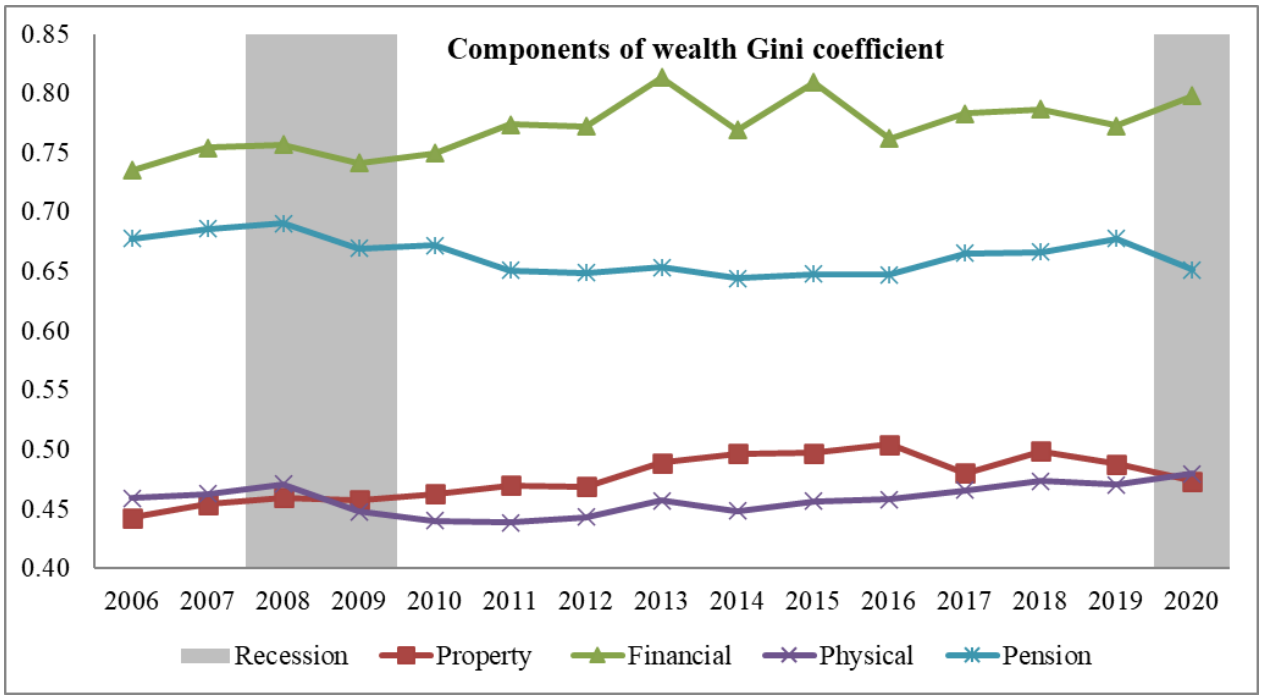
Figure 3.1 Gini Coefficient for Total Wealth



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Additional possible reasons include the removal of the default retirement age and pension tax relief. The workplace pension auto-enrolment provides income support in addition to the state pension during retirement.

Figure 3.2 Gini Coefficient for Wealth Components

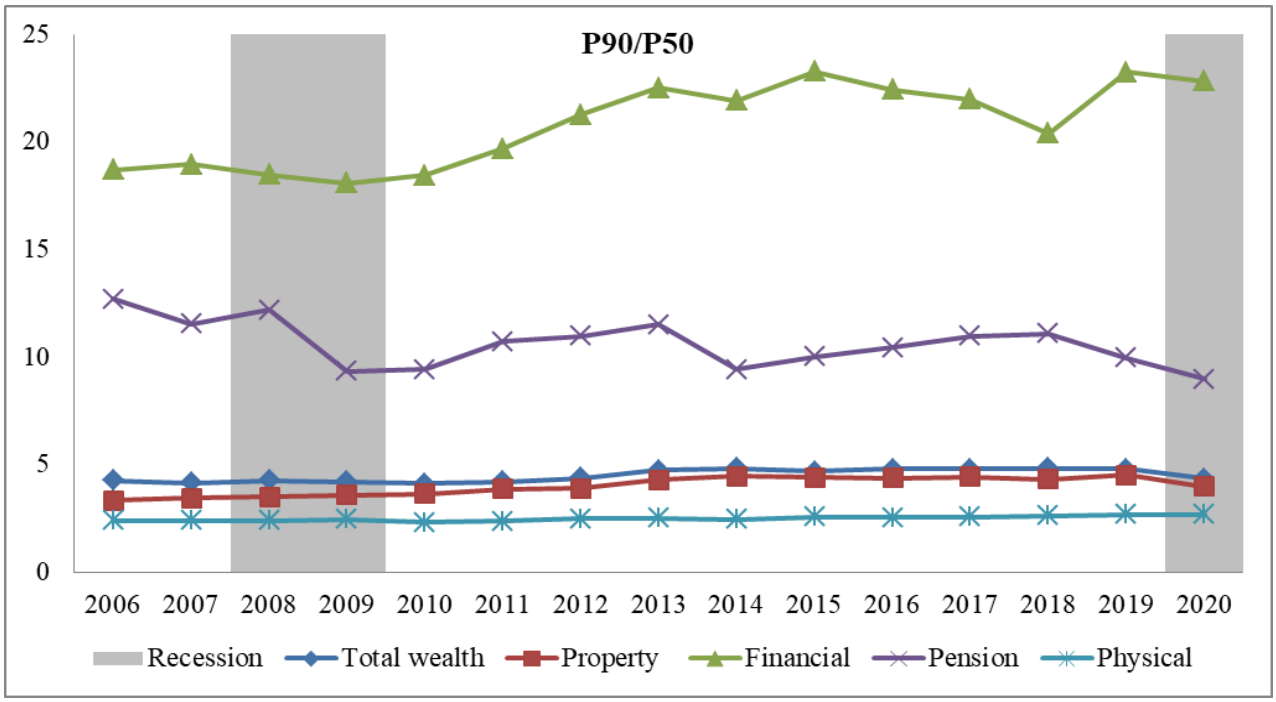


Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

In 2020, the total wealth Gini coefficient is 0.60 (Figure 3.1); the property wealth and physical wealth Gini coefficient is 0.47; the pension wealth Gini coefficient is 0.65; and the financial wealth Gini coefficient is 0.80 (Figure 3.2).[49]

Figure 3.3 compares the wealth and wealth components of the top 10% to 50% of the UK population (P90/P50). A higher ratio means high inequality and vice versa. The inequality distribution within the population is the lowest for physical wealth.[50] Property wealth inequality increases between the top 10% and the 50%, whereas the pension wealth P90/P50 shows a decline post-financial crisis and, more significantly, after 2013. Pension wealth inequality decreased within the UK population. This might be attributed to workplace pension auto-enrolment or greater awareness of the importance of saving for retirement.

Figure 3.3 P90/P50 Percentile Ratio for Total Wealth and Wealth Components



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

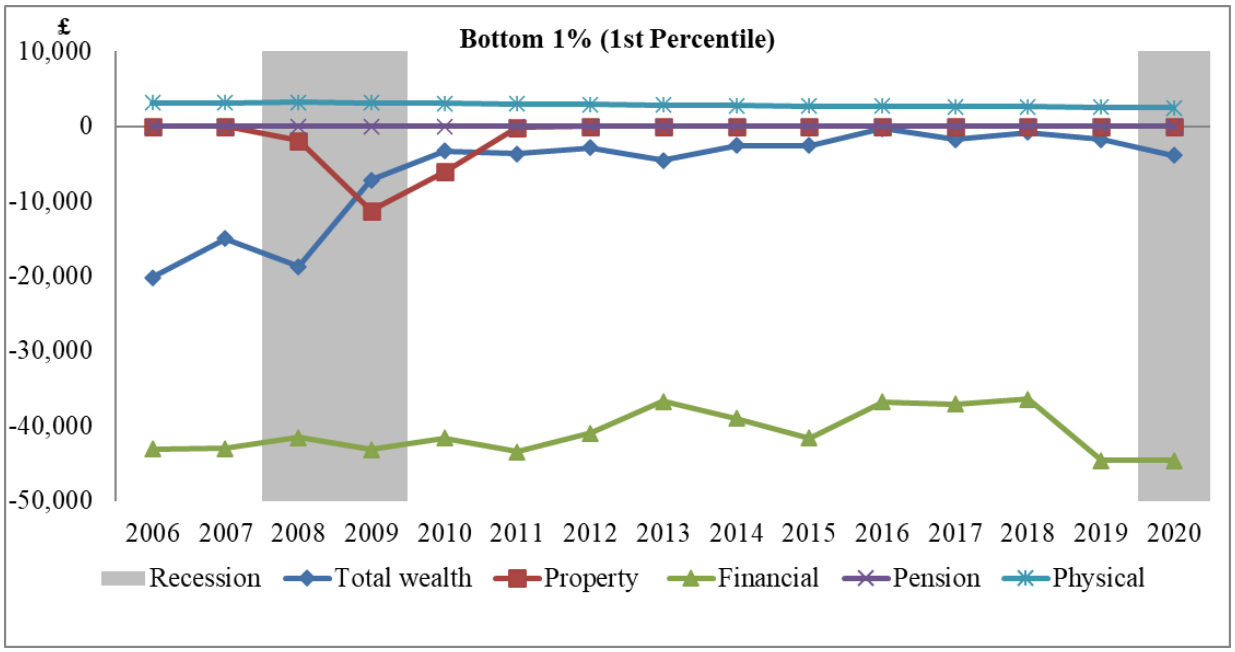
[49] Negative values are excluded from the Gini coefficient. The Gini coefficient range is between 0 and 1.

[50] The physical wealth estimate reported in wave 1 of the WAS raw data was based on a half-sample (see ONS WAS 2006/08 Section 1.4). The WAS wave 1 physical asset result presented in this paper has been adjusted based on an assumption of a full-response sample.

A large disparity in financial wealth is evident between the top 10% and the 50%. Post-financial crisis, financial wealth inequality increased between the top 10% and 50% of the UK population. This may be attributed to QE, which has a significant impact on the growth of financial assets (Balatti et al., 2018; Fratzscher et al., 2013; Bridges and Thomas, 2012). The total wealth P90/P50 shows a similar trend to the property wealth P90/P50. In 2020, the P90/P50 ratio is 4.3 for total wealth, 2.7 for physical wealth, 4 for property wealth, 9 for pension wealth and 22.8 for financial wealth.

Figure 3.4 shows the distribution of wealth for the bottom 1% (first percentile) of the UK population. The bottom 1% has negative and zero wealth, with the exception of physical wealth. Physical wealth is the only component of wealth that shows a positive value for the bottom 1%. The average physical value between 2006 and 2020 for the bottom 1% is approximately £2,900; financial wealth is negative £41,000; pension wealth is nil; and property wealth is negative £1,300.

Figure 3.4 Bottom 1% (P1) of Total Net Wealth and Wealth Components



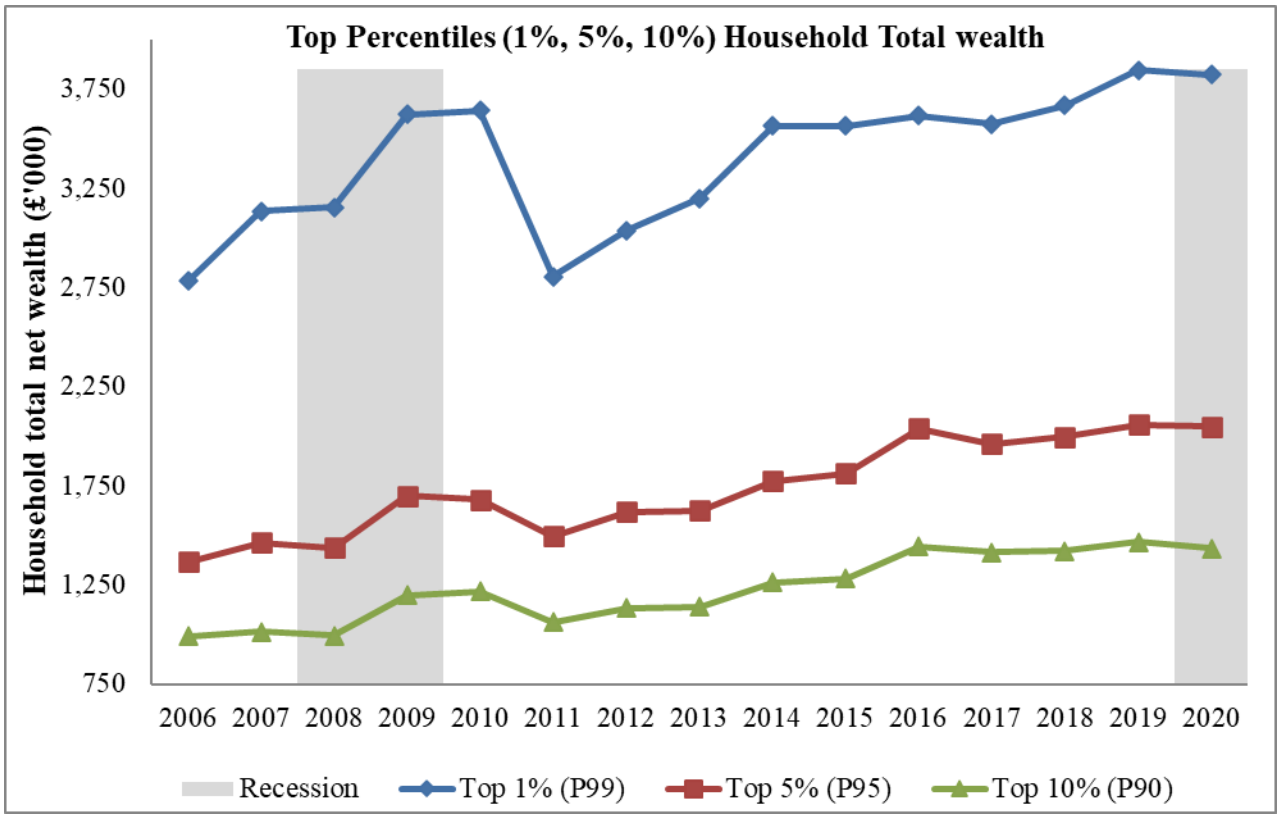
Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Overall, total net wealth is negative £5,900 for the bottom 1%. Property wealth for the bottom 1% was nil pre-financial crisis, but during the financial crisis, property wealth shows a negative value. Post-financial crisis, property wealth is nil. Evidently, property wealth, financial wealth and pension wealth are out of reach for the bottom 1% of the UK population. In addition, the bottom 5% (fifth percentile) and 10% (10th percentile) of the UK population do not have private pension wealth, financial wealth and property wealth (see Appendix 3A).

Figure 3.5 displays the household total wealth of the top 1%, 5% and 10%. Wealth is concentrated in the top percentiles. This is in contrast to the bottom percentiles. The total wealth of the top 1%, 5% and 10% increased post-financial crisis. In 2006, the total wealth for the top 1% was £2.78 million, £1.37 million for the top 5% and £0.99 million for the top 10%. In 2020, the total wealth for the top 1% is about £3.82 million, £2.05 million for the top 5% and £1.44 million for the top 10%.

Figure 3.5 Top 1% (P99), 5% (P95), 10% (P90) of Total Net Wealth

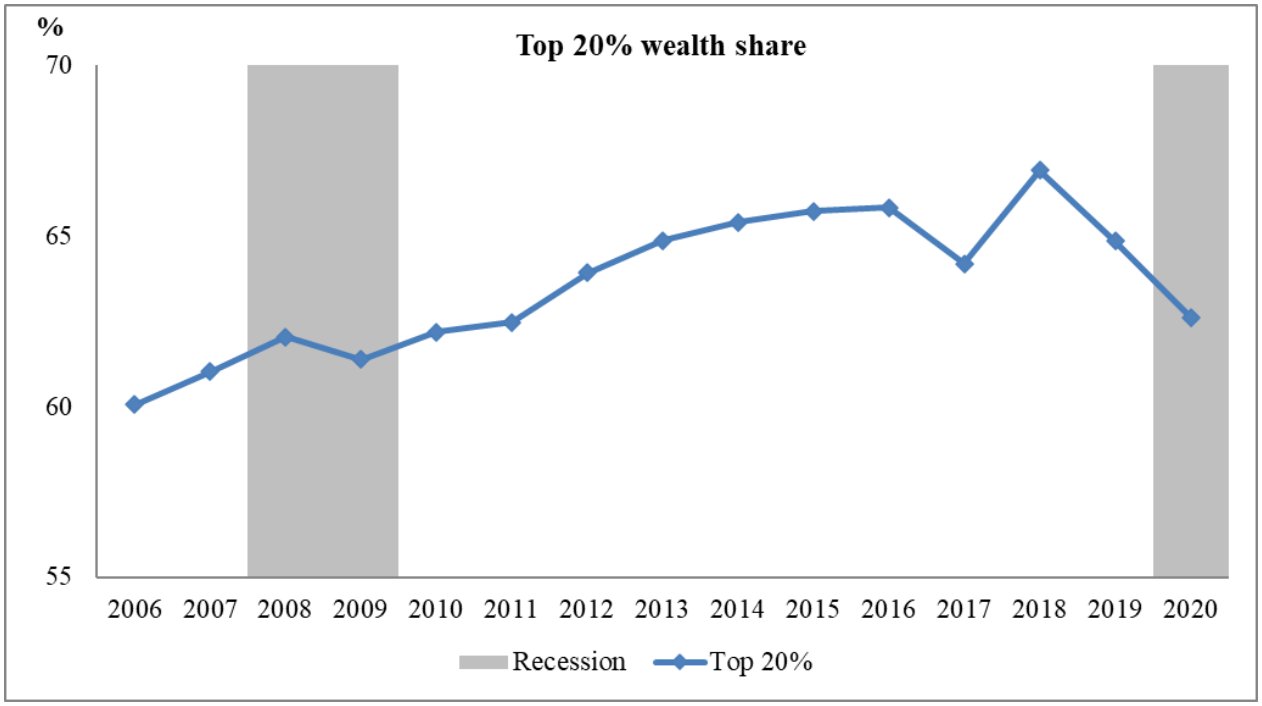


Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.6 shows the top 20% share of UK total wealth compared to the rest of the UK population (i.e., the bottom 80%). The top 20% holds more than 60% of the UK's total wealth. This shows that UK total net wealth is highly concentrated in only a few hands. The total wealth share for the top 20% increased post-financial crisis, while the bottom and the bottom 80% total wealth share decreased for the same period. In 2020, the wealth share for the top 20% is approximately 63%, while the bottom 80% wealth share for the same period is 37%. Of the four components of wealth, property wealth, financial wealth and pension wealth follow a similar trend as the total wealth share for the top 20% and the bottom 80%, but physical wealth for the top 20% shows mixed results for different years (see Appendix 3B).

Figure 3.6 UK Household Top 20% Share of Total Wealth



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.1 displays the average wealth of UK households. The mean shows the average value of the wealth holdings of a typical household in the UK. Average wealth and wealth components increase between 2006 and 2020. On average, in 2020, the mean total wealth for a typical household in the UK is £594,664; the mean property wealth is £200,711; the mean financial wealth is £80,135; the mean pension wealth is £260,440; and the mean

physical wealth is £53,379. On average, then, pension wealth is higher than any other component of wealth.

The median is an important measure of wealth living standards because, unlike the mean, it is not influenced by extreme values. The median shows the wealth of 50% of typical households in the UK population.

Table 3.1 Household Mean Wealth and Wealth Components

Year	Total wealth (£)	Property (£)	Financial (£)	Pension (£)	Physical (£)
2006	412,901	181,994	53,989	149,841	51,756
2007	438,039	192,280	57,148	155,780	51,776
2008	432,709	192,428	55,650	158,138	51,726
2009	515,099	166,793	55,143	242,299	50,863
2010	529,242	173,669	55,881	248,229	51,463
2011	446,666	170,630	59,041	164,278	52,716
2012	473,618	169,884	57,641	188,964	52,351
2013	477,382	166,052	69,704	192,031	49,596
2014	511,129	184,688	66,886	208,596	50,959
2015	530,841	184,094	71,142	224,361	51,244
2016	570,859	217,469	68,929	251,055	54,827
2017	565,558	201,807	70,521	239,850	53,380
2018	584,861	205,567	78,928	243,332	53,908
2019	593,592	208,071	70,834	261,702	52,985
2020	594,664	200,711	80,135	260,440	53,379

Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.2 displays the median wealth and wealth components of middle households in the UK. The median property wealth value is the highest among the components of wealth, unlike the mean wealth where pension wealth ranks the highest. Median pension wealth increased between 2006 and 2020, but property, financial and physical wealth declined over the same period. Overall, median total wealth increased between 2006 and 2020. In 2020, the median total wealth is approximately £329,000; the median property wealth is £120,000; the median financial wealth is £7,350; the median pension wealth is £83,500; and the median physical wealth is £39,500.

Table 3.2 Household Median Wealth and Wealth Components

Year	Total wealth (£)	Property (£)	Financial (£)	Pension (£)	Physical (£)
2006	232,207	121,500	7,474	32,338	41,260
2007	245,518	125,400	7,561	34,319	41,270
2008	233,229	125,775	7,430	33,775	41,280
2009	285,211	106,250	8,125	67,215	40,000
2010	295,804	111,019	7,808	67,754	42,700
2011	253,531	104,720	7,009	43,280	41,769
2012	259,489	103,500	6,521	50,297	40,825
2013	240,254	91,864	6,272	48,098	39,200
2014	261,760	99,000	7,495	62,571	39,600
2015	273,648	98,280	6,361	65,960	38,880
2016	301,433	118,800	7,473	71,280	41,148
2017	295,422	111,300	7,369	64,580	39,644
2018	295,468	104,000	9,360	62,400	40,040
2019	306,102	113,220	7,737	73,216	38,505
2020	329,861	120,000	7,350	83,500	39,500

Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.4 Generations: Household Wealth and Wealth Components

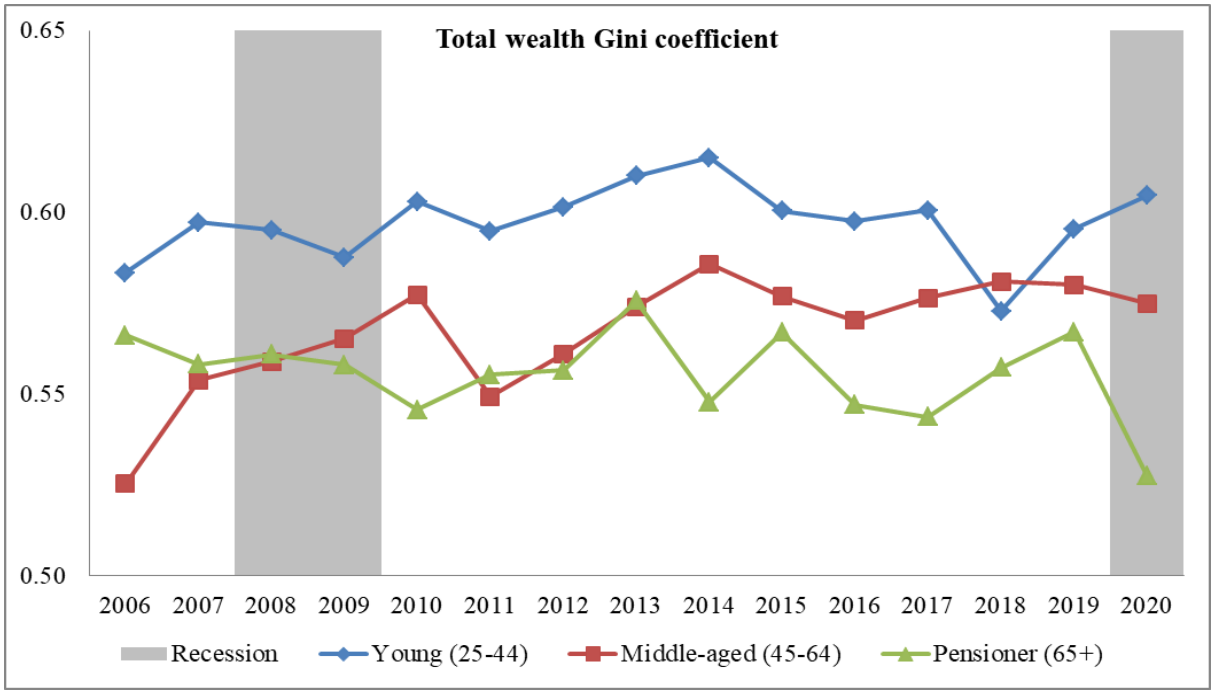
This paper examines the distribution and inequality of total net wealth and wealth components by generation. The Gini coefficient, percentile, mean and median wealth for the young, the middle-aged and the pensioner groups are constructed to analyse the wealth distribution and changes in wealth over time. The age category for this study is 25 and over. The young generation corresponds to adults in the household aged 25–44; the middle-aged group is 45–64, and the pensioner group is 65+.

3.4.1 Total Net Wealth Distribution and Inequality by Generation

This study examines total wealth distribution and inequality by generation using the Gini coefficient, percentile ratio, mean and median wealth. Figure 3.7 shows the Gini coefficient of total wealth for the young, middle-aged and pensioner groups in the UK. The results show that wealth inequality is high within the young generation compared to the other two age groups. Post-financial crisis, total wealth inequality increased in all generations compared to the pre-financial crisis period. Wealth inequality decreased more in the pensioner group after

2013 than in the other two generations. In 2020, the total wealth Gini coefficient is 0.60 for the young, 0.57 for the middle-aged and 0.53 for pensioners.

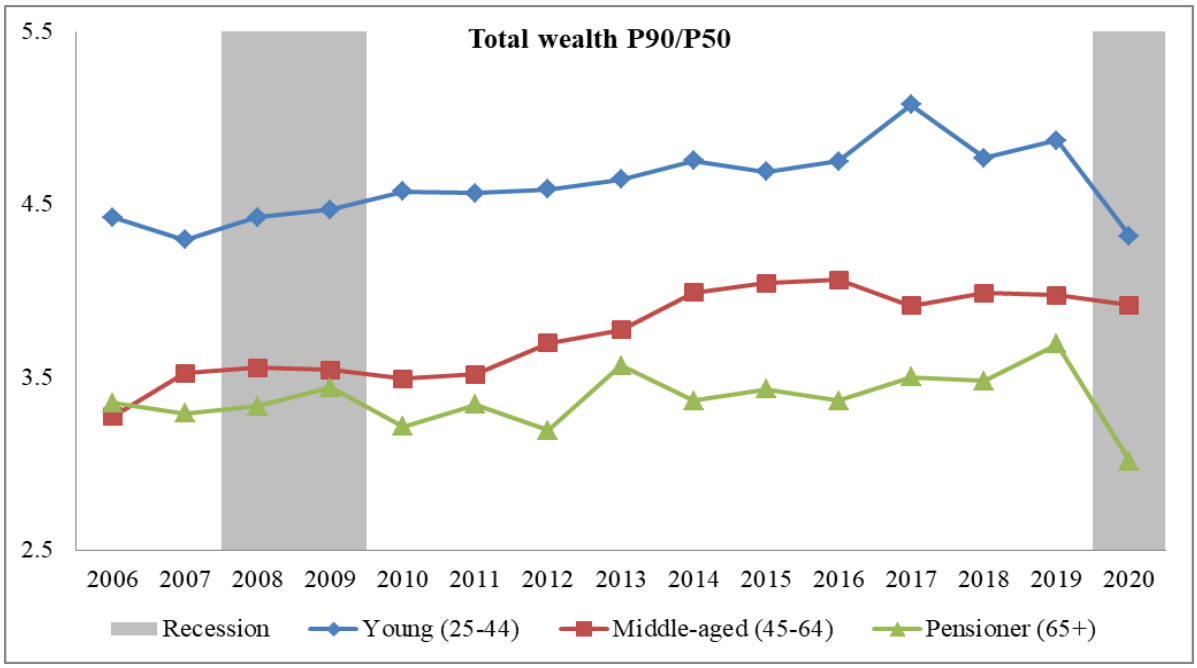
Figure 3.7 Total Wealth Gini Coefficient by Generation



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.8 examines total wealth inequality within generations by comparing the top 10% with the middle of the distribution within each generation. The wealth gap between the wealthy households and the median household within the young generation is wider than in the other generations; wealth is more unevenly distributed between the top wealthy households and the median population of the young generation than in the other generations. The P90/P50 is the lowest within the pensioner population, meaning that pensioners experience the lowest total wealth inequality between the top wealthy household and the median household among the three generations studied here. Total wealth inequality increases within the young and the middle-aged groups post-financial crisis. Between 2019 and 2020, the total wealth P90/P50 declines, indicating that wealth inequality fell between the wealthy and the median households within the generations. In 2020, the total net wealth P90/P50 ratio is 4.3 for the young, 3.9 for the middle-aged and 3 for the pensioner group.

Figure 3.8 Total Wealth P90/P50 Percentile Ratio by Generation



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.3 shows the mean and median total wealth for the young, the middle-aged and the pensioner groups.

Table 3.3 Mean and Median Total Wealth by Generation

Total wealth (£)						
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	Mean	Median	Mean	Median	Mean	Median
2006	229,008	127,847	606,180	412,831	469,845	294,975
2007	242,473	133,808	643,310	402,365	488,941	319,193
2008	310, 579	177,452	746,063	477,951	535,918	334,863
2009	285,783	153,918	753,096	461,950	524,724	332,124
2010	270,610	145,108	763,698	458,110	527,634	357,292
2011	213,128	115,672	612,175	393,226	518,778	334,786
2012	211,221	113,408	653,257	404,969	552,949	372,091
2013	194,109	101,667	644,852	391,612	592,229	358,216
2014	222,915	120,411	661,458	403,440	630,394	399,490
2015	231,748	123,138	704,448	417,420	655,370	400.514
2016	258,580	138,649	765,469	463,025	700,318	437,083
2017	237,897	122,241	733,937	439,380	713,873	463,115
2018	232,523	143,557	721,431	452,993	761,205	485,349
2019	238,775	121,707	756,120	454,836	762,994	463,067
2020	290,072	156,329	724,342	451,390	770,985	546,935

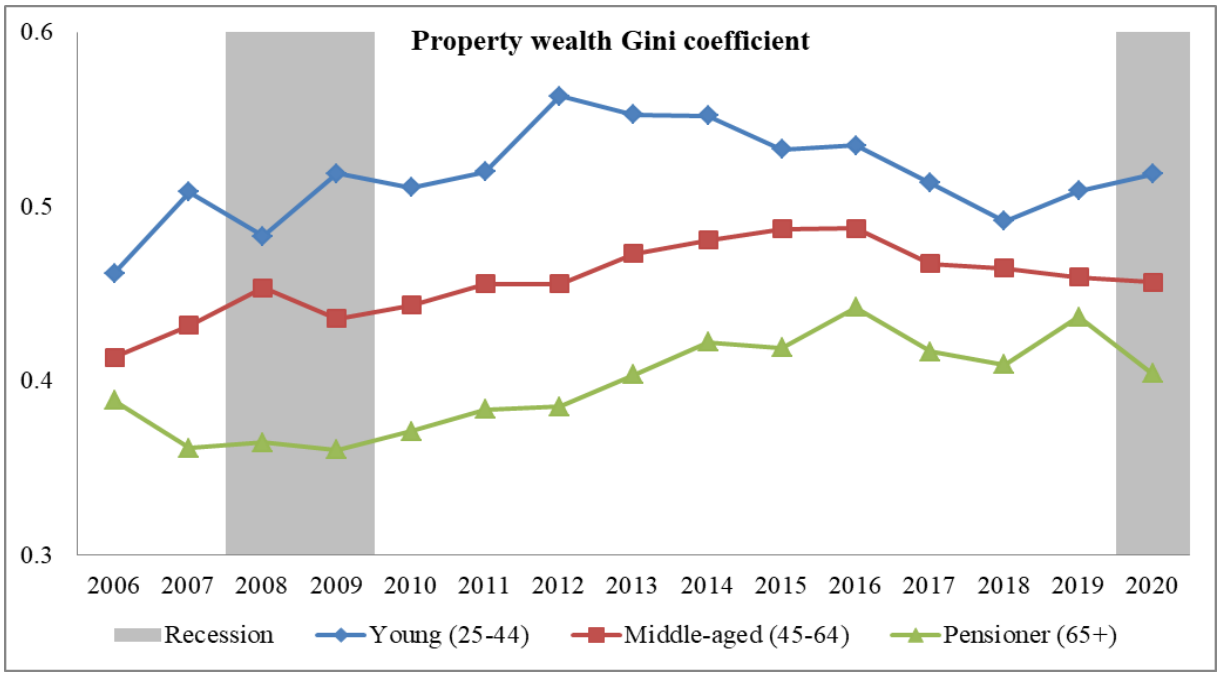
Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

The average wealth and the median wealth increased between 2006 and 2020. A positive correlation is apparent between total wealth and age: based on the 2018–2020 data, total wealth increases as the age of the head of the household increases.

3.4.2 Property Wealth Distribution and Inequality by Generation

Property wealth distribution and inequality are analysed using the Gini coefficient, percentile, mean and median. Figure 3.9 illustrates the property wealth Gini coefficient for the young, the middle-aged and the pensioner groups. The property wealth Gini coefficient for the pensioner group is the lowest of the three generations. Post-financial crisis, property wealth inequality increased in all generations.

Figure 3.9 Property Wealth Gini Coefficient by Generation



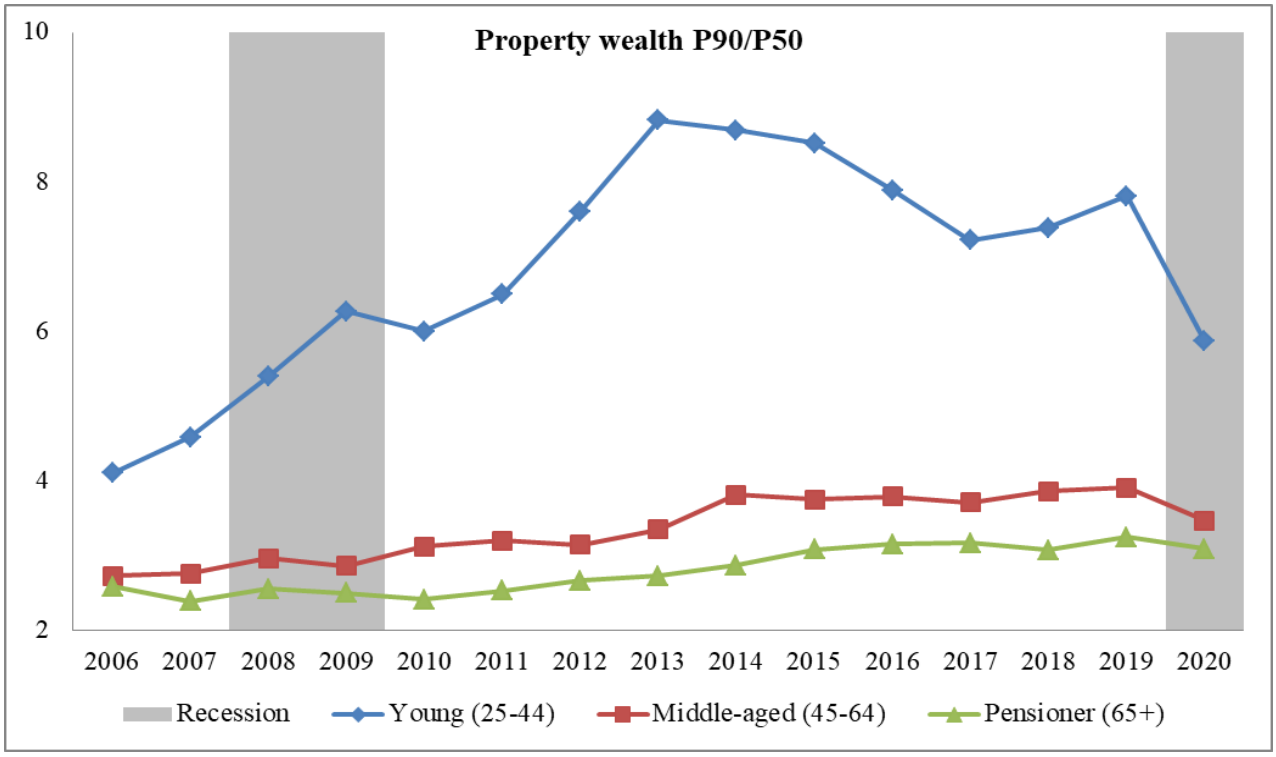
Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

From 2013, property inequality decreases in the young generation. This could be attributed to targeted government policies such as the Help to Buy scheme and stamp duty tax relief. The young generation is likelier to fall into the category of first-time buyers than other generations, and property wealth inequality has been increasing within this generation since 2018. This may be due to a lack of affordable housing by first-time buyers. For the middle-

aged and the pensioner groups, a slight reduction in property wealth inequality is apparent after 2016. In 2020, the property wealth Gini coefficient is 0.52 for the young, 0.46 for the middle-aged and 0.40 for pensioners.

Figure 3.10 compares property wealth for the top 10% with the median household by generation. Property wealth inequality is high within the young generation. The disparity between the top and the 50th percentiles increases significantly within the young generation after the financial crisis; however, the P90/P50 reduces after 2014. The pensioner property wealth P90/P50 is the lowest of the three generations. In 2020, the property wealth P90/P50 is 5.9 for the young, 3.5 for the middle-aged and 3.1 for pensioners.

Figure 3.10 Property Wealth P90/P50 Percentile Ratio by Generation



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.4 shows the mean and median property wealth for the young, middle-aged and pensioner groups. Property wealth accumulates with age, signalling a positive correlation between property wealth and age. Using details from 2010 to date, property wealth increases as the age of the head of the household increases. The mean and median property wealth for

the young are the lowest among the generations, while the pensioner mean and median property wealth are the highest. Between 2006 and 2020, the mean and median property wealth decrease for the young and the middle-aged groups, while the mean and median property wealth increase for the pensioner group.

Table 3.4 Mean and Median Property Wealth by Generation

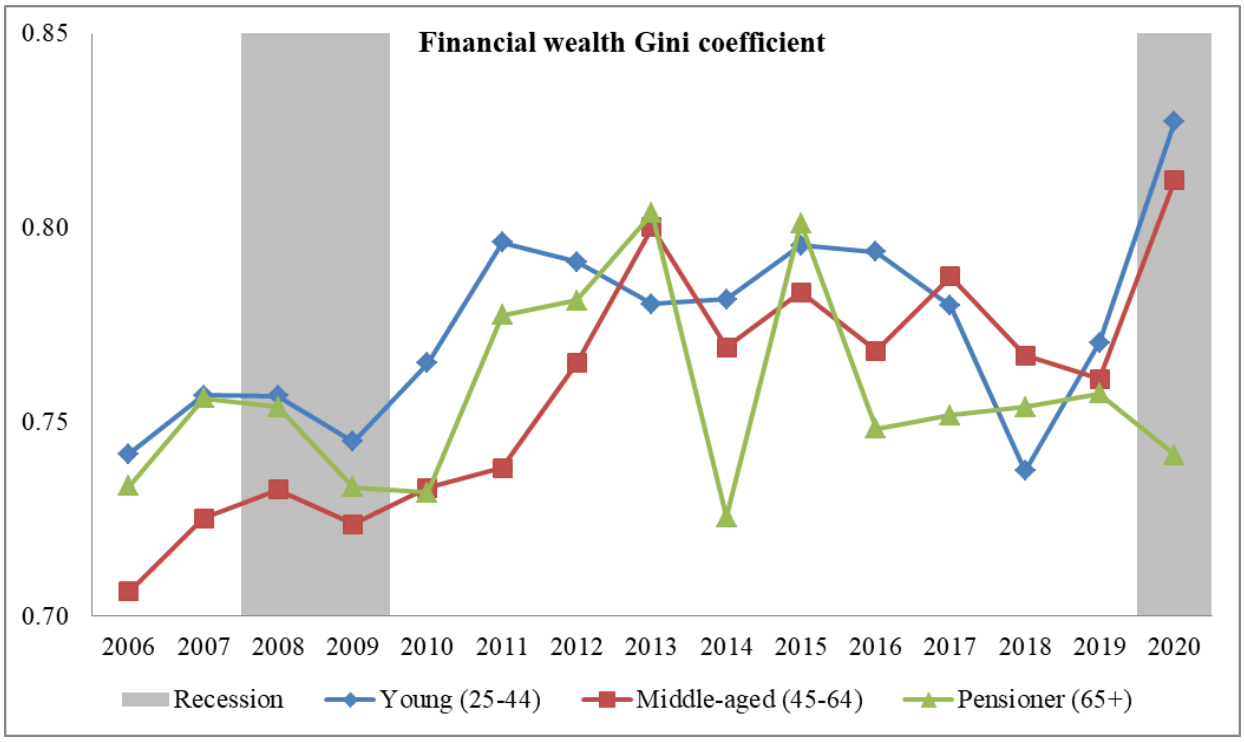
Property wealth (£)						
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	Mean	Median	Mean	Median	Mean	Median
2006	110,902	65,745	241,155	184,950	227,031	182,250
2007	122,579	63,360	259,004	191,400	224,037	192,982
2008	105,117	52,890	262,967	180,600	236,467	193,500
2009	94,865	37,500	217,118	156,936	204,468	175,000
2010	84,346	30,499	225,048	156,160	227,658	183,000
2011	87,444	35,700	213,913	148,750	218,807	178,500
2012	78,908	26,450	213,599	146,050	223,599	172,500
2013	77,204	22,400	205,050	134,400	221,524	168,000
2014	89,264	25,300	220,823	133,650	255,517	176,000
2015	85,603	27,000	219,276	129,600	244,720	174,960
2016	85,032	35,598	240,918	144,720	282,312	205,200
2017	98,978	38,160	231,156	144,160	279,179	200,340
2018	90,828	34,320	213,865	156,000	284,317	202,800
2019	90,777	32,640	234,945	144,840	298,890	204,000
2020	104,098	46,000	222,626	144,000	282,388	210,000

Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.4.3 Financial Wealth Distribution and Inequality by Generation

The financial wealth Gini coefficients for the young, the middle-aged and the pensioner groups are presented in Figure 3.11. Pre-financial crisis, the financial wealth inequality of the middle-aged is the lowest among the generations. Post-financial crisis, financial wealth inequality increases in all generations. A series of increases and decreases is apparent in all generations over time, overtaking each other at different years. In 2020, the financial wealth Gini coefficient is 0.83 for the young, 0.81 for the middle-aged and 0.74 for pensioners.

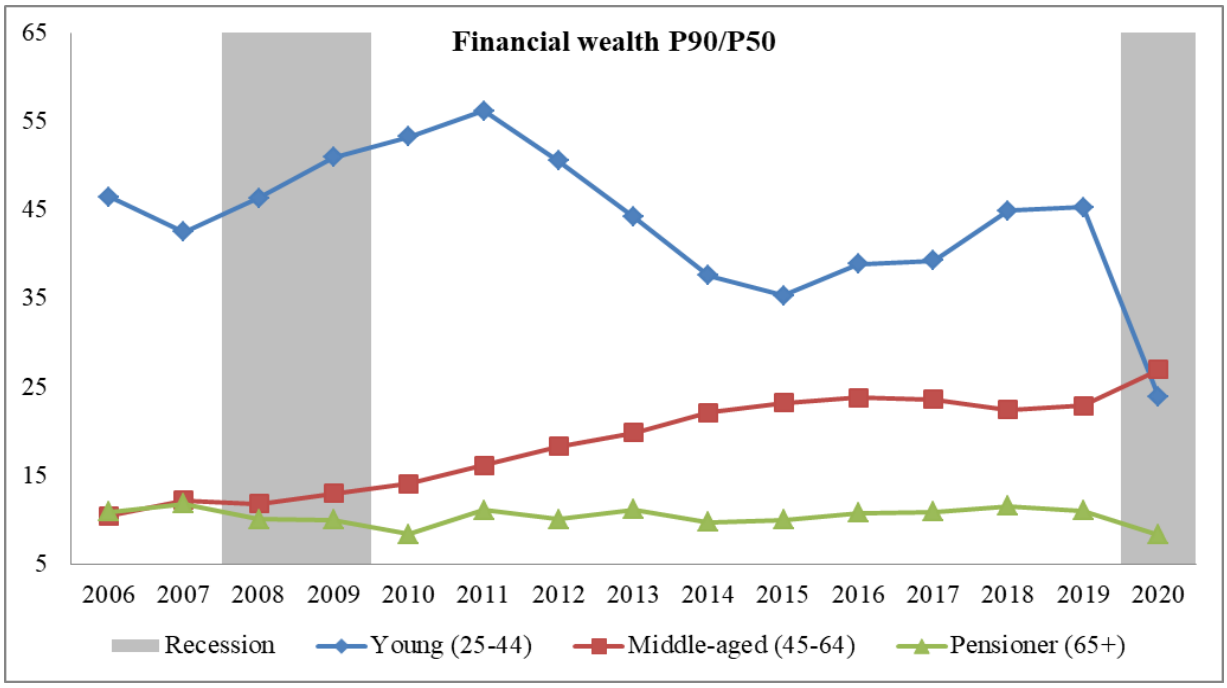
Figure 3.11 Financial Wealth Gini Coefficient by Generation



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.12 shows the financial wealth P90/P50 for the young, the middle-aged and the pensioner groups. The financial wealth P90/P50 compares the financial wealth between the wealthy and the median populations by generation. The difference in financial wealth between the top and the median household for the young generation is larger compared to the other generations until 2020. Financial wealth inequality within the young generation is higher than the other generations. Post-financial crisis, financial wealth inequality decreases within the young. After 2012, financial wealth inequality decreases between the top and the median distribution. The middle-aged financial wealth P90/P50 increases post-financial crisis. The pensioner group has the lowest P90/P50 financial wealth ratio among the generations. In 2020, the financial wealth P90/P50 is 23.8 for the young, 26.9 for the middle-aged and 8.3 for pensioners.

Figure 3.12 Financial Wealth P90/P50 Percentile Ratio by Generation



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.5 shows the mean and median financial wealth for the young, the middle-aged and the pensioner groups.

Table 3.5 Mean and Median Financial Wealth by Generation

Financial wealth (£)						
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	Mean	Median	Mean	Median	Mean	Median
2006	26,784	1,715	74,971	18,158	71,478	16,758
2007	29,506	1,848	81,252	16,479	70,792	14,586
2008	26,613	1,935	76,858	15,480	72,046	16,934
2009	24,688	1,433	76,600	14,758	69,879	17,500
2010	21,305	1,179	76,141	13,420	75,118	20,618
2011	25,940	1,133	71,356	10,889	84,715	16,660
2012	23,911	1,150	69,037	7,935	84,116	19,435
2013	18,668	1,120	80,821	8,232	113,290	19,600
2014	24,208	1,550	83,010	7,684	98,117	25,905
2015	22,596	1,513	69,796	6,821	120,427	22,140
2016	20,575	1,458	87,219	9,004	109,627	27,540
2017	25,037	1,806	76,712	6,837	112,406	25,224
2018	23,254	1,716	65,826	8,268	115,392	27,040
2019	24,202	1,459	75,463	8,412	114,489	24,480
2020	31,636	2,176	90,382	6,683	121,630	33,050

Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

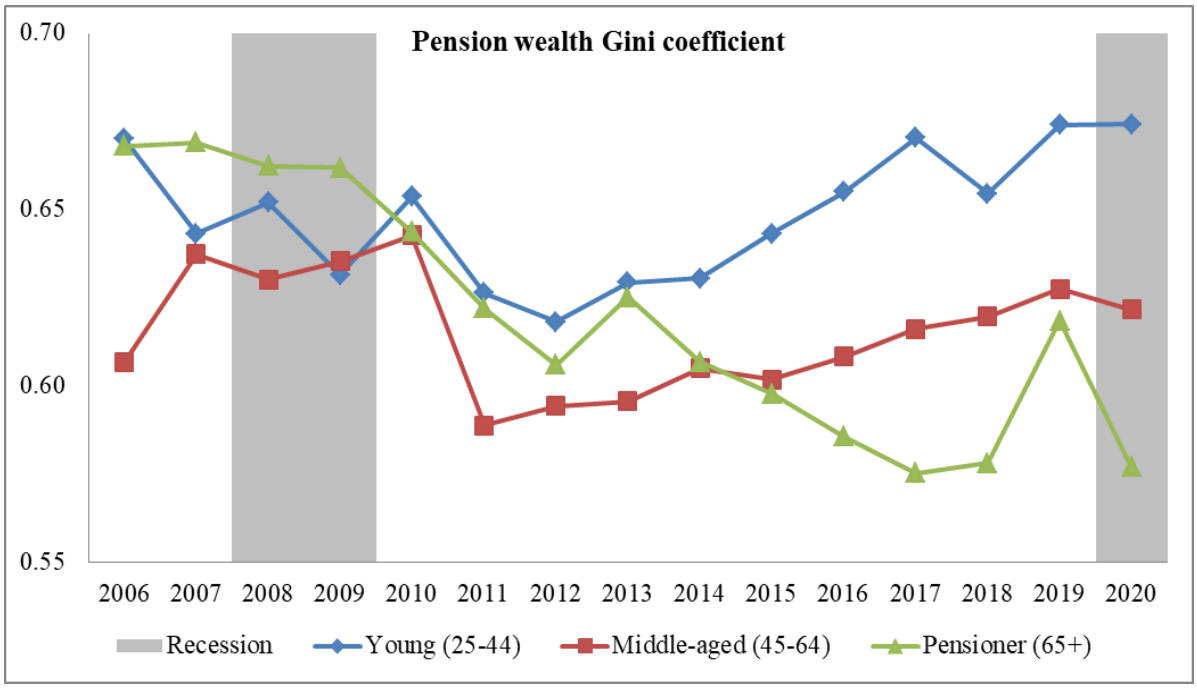
The average financial wealth increases between 2006 and 2020. Median financial wealth shows mixed results. The middle-aged median financial wealth decreases between 2006 and 2020, but the median financial wealth increases for the young and the pensioner groups. Financial wealth shows a positive correlation with age. In 2020, the median financial wealth is £2,176 for the young, £6,683 for the middle-aged and £33,050 for pensioners, while the average financial wealth for the same year is £31,636 for the young, £90,382 for the middle-aged, and £121,630 for pensioners.

3.4.4 Pension Wealth Distribution and Inequality by Generation

The private pension wealth Gini coefficient is illustrated in Figure 3.13. Between 2006 and 2009, the private pension wealth Gini coefficient for pensioners is the highest among the generations. Since 2010, pension wealth inequality decreases within the pensioner group.

Since 2015, the pensioner Gini coefficient ranks the lowest among the generations. Pension wealth inequality increases in the young generation post-financial crisis; the young generation has the highest pension wealth inequality among the generations.

Figure 3.13 Pension Wealth Gini Coefficient by Generation

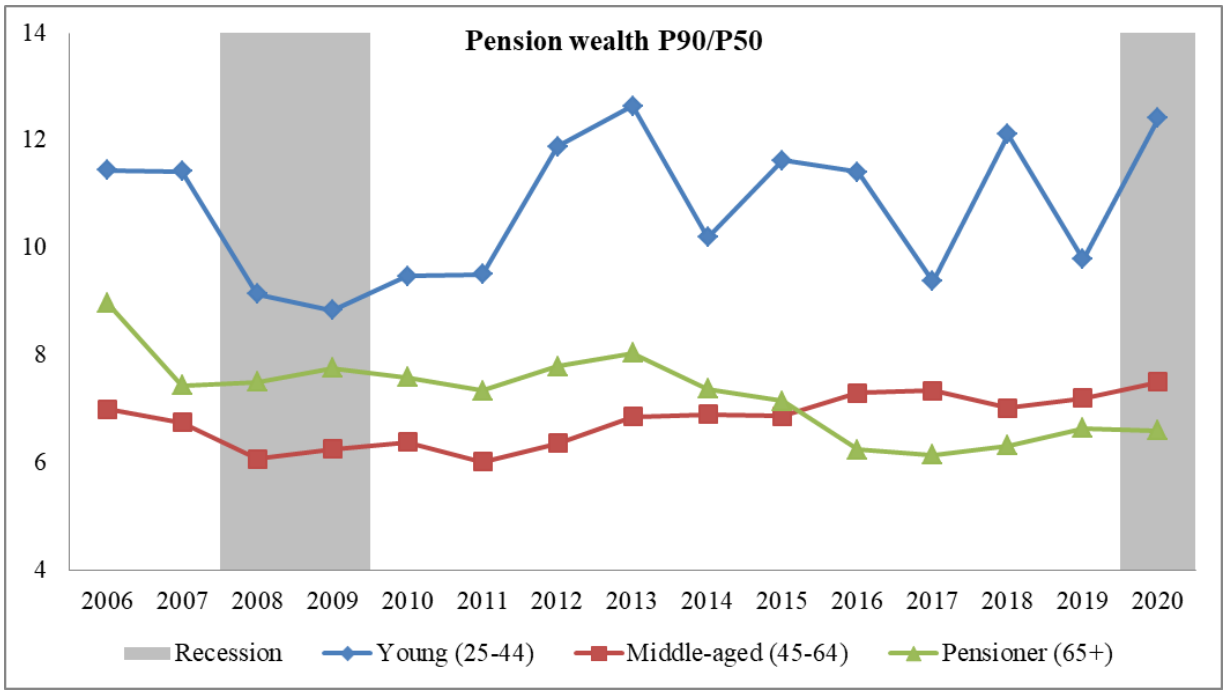


Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Between 2006 and 2014, the middle-aged group shows the lowest inequality in private pension wealth; after 2014, private pension wealth inequality increases, with the Gini coefficient increasing more than the pensioner group equivalent. In 2020, the private pension wealth Gini coefficient is 0.67 for the young, 0.62 for the middle-aged and 0.58 for pensioners.

Figure 3.14 shows the pension wealth P90/P50 ratio for the young, the middle-aged and the pensioner groups. Between 2006 and 2015, the difference in private pension wealth between the wealthy and the median populations was the lowest in the middle-aged group, indicating that pension wealth inequality is low within this group. However, after 2015, this P90/P50 increases more than the pensioner P90/P50. Pension inequality increases within the middle-aged group post-2015 and vice versa for pensioners. Private pension wealth inequality is very high within the young generation. In 2020, the private pension wealth P90/P50 ratio is 12.4 for the young, 7.5 for the middle-aged and 6.6 for pensioners.

Figure 3.14 Pension Wealth P90/P50 Percentile Ratio by Generation



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.6 presents the mean and median private pension wealth for the young, middle-aged and pensioner groups. The middle-aged mean and median private pension wealth are higher than the other generations. In 2020, the average pension wealth is £111,853 for the young, £350,833 for the middle-aged and £309,919 for pensioners. For the same year, the median pension wealth is £28,392 for the young, £138,500 for the middle-aged and £130,601 for pensioners.

Table 3.6 Mean and Median Pension Wealth by Generation

Pension wealth (£)						
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	Mean	Median	Mean	Median	Mean	Median
2006	66,858	14,949	256,985	101,250	146,255	37,901
2007	61,234	14,792	262,769	94,396	163,571	51,061
2008	132,182	38,376	245,680	153,287	185,644	54,180
2009	122,236	36,935	398,633	150,000	201,562	62,219
2010	120,919	24,400	269,508	147,951	211,860	79,327
2011	55,031	15,827	265,497	117,382	162,847	58,438
2012	65,459	19,969	310,107	131,252	191,507	65,569
2013	58,864	13,857	301,172	118,712	205,220	68,888
2014	68,000	21,779	328,264	132,087	223,494	82,835
2015	85,028	20,466	347,089	139,676	221,731	86,964
2016	87,228	24,014	376,566	155,250	280,516	129,975
2017	71,728	20,444	365,686	140,298	264,372	113,402
2018	79,585	26,097	374,459	168,480	260,582	112,384
2019	83,430	23,438	386,157	149,388	291,043	112,330
2020	111,853	28,392	350,833	138,500	309,919	130,601

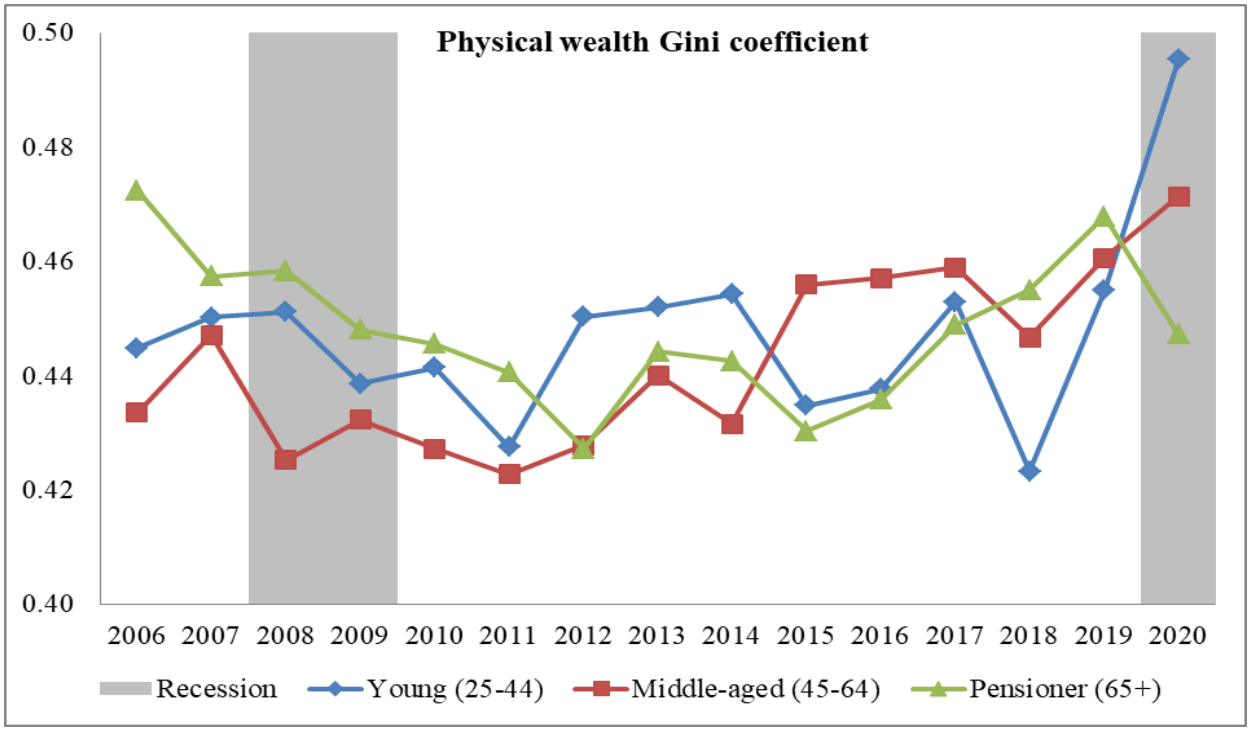
Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.4.5 Physical Wealth Distribution and Inequality by Generation

Figure 3.15 shows the physical wealth Gini coefficient for the young, middle-aged and pensioner groups. A series of increases and decreases in physical wealth Gini coefficient is evident over the years. Between 2006 and 2011, based on the Gini coefficient, the highest inequality in physical wealth occurs within the pensioner generation. However, in 2020, the physical wealth Gini coefficient for the pensioner group is the lowest among the generations.

In 2020, the physical wealth Gini coefficient is 0.49 for the young, 0.47 for the middle-aged and 0.44 for pensioners.

Figure 3.15 Physical Wealth Gini Coefficient by Generation



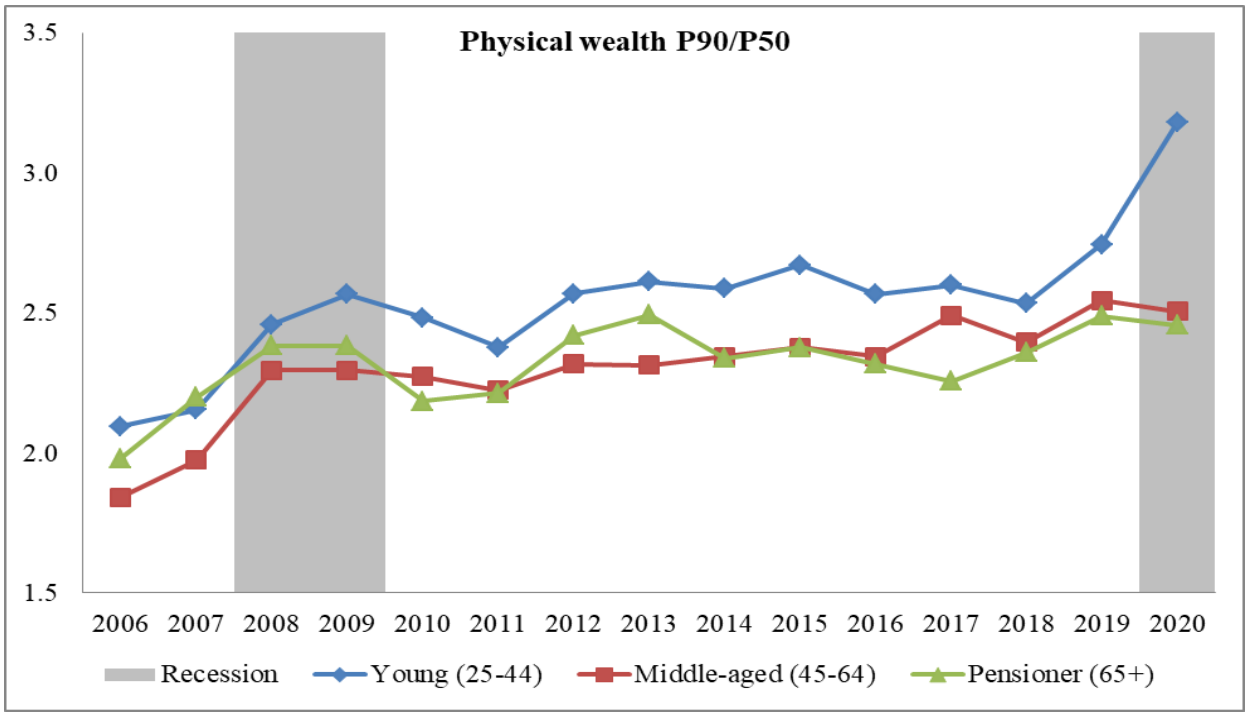
Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

The physical wealth P90/P50 is displayed in Figure 3.16. The P90/P50 compares how much greater the physical wealth of the top 10% is to 50% of the population. The young generation shows a high P90/P50 ratio, indicating that physical wealth is more unevenly distributed within this generation than the other generations. Between the middle-aged and the pensioner groups, a series of P90/P50 increases and decreases is observed, alternating over a few periods; however, from 2016, physical wealth inequality is the lowest within the pensioner group. In 2020, the physical wealth P90/P50 is 3.1 for the young, 2.5 for the middle-aged and 2.4 for pensioners.[51]

[51] This study analyses wealth components distribution by Gini coefficient within three generations (see Appendix 3C).

Figure 3.16 Physical Wealth P90/P50 Percentile Ratio by Generation



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.7 presents the mean and median physical wealth by generation. The mean and

Table 3.7 Mean and Median Physical Wealth by Generation

Physical wealth (£)						
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	Mean	Median	Mean	Median	Mean	Median
2006	43,464	34,185	33,069	48,775	25,080	37,375
2007	43,154	34,860	40,284	48,384	30,541	37,140
2008	43,878	34,225	32,707	48,773	25,021	37,000
2009	43,994	34,813	60,745	48,750	48,816	37,500
2010	44,040	34,160	59,580	49,105	51,804	42,700
2011	44,713	36,295	61,408	50,099	52,410	41,650
2012	42,943	32,200	60,514	47,185	53,727	41,573
2013	39,373	30,240	57,808	46,480	52,196	39,760
2014	41,443	31,680	59,094	46,222	53,267	42,350
2015	38,520	29,732	60,521	47,012	54,392	42,336
2016	40,444	32,076	62,174	48,600	61,797	45,360
2017	42,154	31,800	60,382	45,845	57,915	45,580
2018	38,855	29,640	63,204	46,800	60,127	47,424
2019	40,366	29,733	59,555	45,900	58,573	44,370
2020	42,485	28,505	60,501	46,300	57,049	45,000

Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

median physical wealth for the young generation show the lowest values among the generations for most of the years. No great difference in mean and median physical wealth is found between the generations. Physical wealth is more evenly distributed than the other components of wealth.

3.5 Age Decomposition

Age decomposition gives a more detailed picture of the wealth lifecycle; that is, the accumulation and decumulation of wealth at different ages in life. Table 3.8 illustrates the distribution of mean total wealth by age group. The results show that as age increases, wealth increases, but at the age of 75+, average total wealth decreases. This indicates that although wealth tends to be accumulated during the working-age period, at this later stage in life, decumulation of wealth takes place. This could be as a result of inheritance tax policy, the sale of possessions to meet health and social care costs, or the sale of assets to compensate for lost or reduced income.

Table 3.8 Mean Total Wealth by Age Group

	Mean total net wealth (£)					
	Young (25-44)		**Middle-aged (45-64)**		**Pensioner (65+)**	
Year	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**75+**
2006	122,332	304,454	527,437	694,374	547,825	390,404
2007	141,920	313,253	531,216	767,614	580,267	395,534
2008	113,589	290,311	550,706	694,021	641,520	401,078
2009	176,218	363,674	624,339	890,289	636,884	415,095
2010	148,057	354,510	657,233	887,964	703,911	422,910
2011	114,333	280,017	490,190	748,825	621,193	417,717
2012	121,692	272,898	554,327	775,597	672,681	429,281
2013	106,240	262,682	532,585	776,631	752,076	431,187
2014	123,944	294,439	565,312	845,469	768,679	470,897
2015	121,145	311,232	548,263	890,890	825,955	473,474
2016	143,869	294,803	602,781	953,175	890,350	534,302
2017	127,951	325,734	589,295	905,024	841,629	571,005
2018	128,890	314,478	612,167	841,038	864,038	581,418
2019	137,307	320,421	612,929	916,002	918,541	594,999
2020	153,364	395,225	568,360	888,592	926,434	599,294

Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Table 3.9 shows the median total net wealth by age group. This shows that wealth increases with age before decumulating at a later stage in life. This follows the same conclusion as the mean total wealth by age decomposition.[52]

Table 3.9 Median (P50) Total Wealth by Age Group

	Median total net wealth (£)					
	Young (25-44)		Middle-aged (45-64)		Pensioner (65+)	
Year	25-34	35-44	45-54	55-64	65-74	75+
2006	62,122	195,678	351,647	490,585	359,667	257,850
2007	62,410	202,778	344,676	486,546	381,532	271,359
2008	63,356	184,588	324,592	445,889	391,469	276,295
2009	90,064	233,540	393,751	535,635	421,491	279,891
2010	89,618	223,769	402,873	532,693	454,375	319,847
2011	69,069	170,466	332,343	509,819	409,326	284,616
2012	72,220	158,728	340,776	503,099	452,605	297,276
2013	64,288	155,532	327,126	508,363	476,392	290,874
2014	68,909	160,050	338,161	543,950	530,517	345,018
2015	77,178	193,516	324,279	600,221	489,571	324,600
2016	81,072	208,808	365,285	639,831	616,933	382,782
2017	68,733	194,669	353,143	616,854	541,057	392,253
2018	69,940	208,247	397,501	475,647	604,785	371,264
2019	88,774	190,230	379,682	601,928	563,507	391,872
2020	76,807	250,762	376,991	546,784	645,456	443,779

Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.6 Summary and Conclusion

This paper investigates wealth inequality, distribution and changes in wealth in the UK over time using Wealth and Assets Survey (WAS) data. Over the years, fiscal policy and monetary policy measures have been implemented by the UK government and central bank that may have affected wealth distribution and inequality. The wealth analysis covers the period from 2006 to 2020. The main methodology for this paper is descriptive statistics. The Gini coefficient, percentile, percentile ratio, mean and median are constructed from the wealth data to analyse the evolution of wealth distribution and inequality.

[52] This paper analyses wealth distribution and inequality by year of birth cohort (see Appendix 3D).

The survey results show that property wealth, financial wealth and private pension wealth are out of the reach of the bottom 10%, 5% and 1% of the UK population. While the bottom 10%, 5% and 1% have no property wealth, private pension wealth or financial wealth, the top 20% holds the majority of total UK wealth, with a wealth share of more than 60%.

This study finds that inequality in financial wealth is the highest among the four components of wealth. The private pension wealth Gini coefficient ranked second, although private pension inequality has decreased over time, potentially due to greater awareness of the importance of saving for retirement given pressures on the state pension, as well as the automatic workplace pension contributions introduced in 2012. Property wealth inequality has increased post-financial crisis. Prior to the financial crisis, property wealth ranked as the lowest level of inequality among the components of wealth. Increases in property wealth can be attributed to unconventional monetary policy, specifically quantitative easing, stringent affordability rules and a lack of affordable housing. The physical wealth Gini coefficient currently ranks the lowest among the components of wealth.

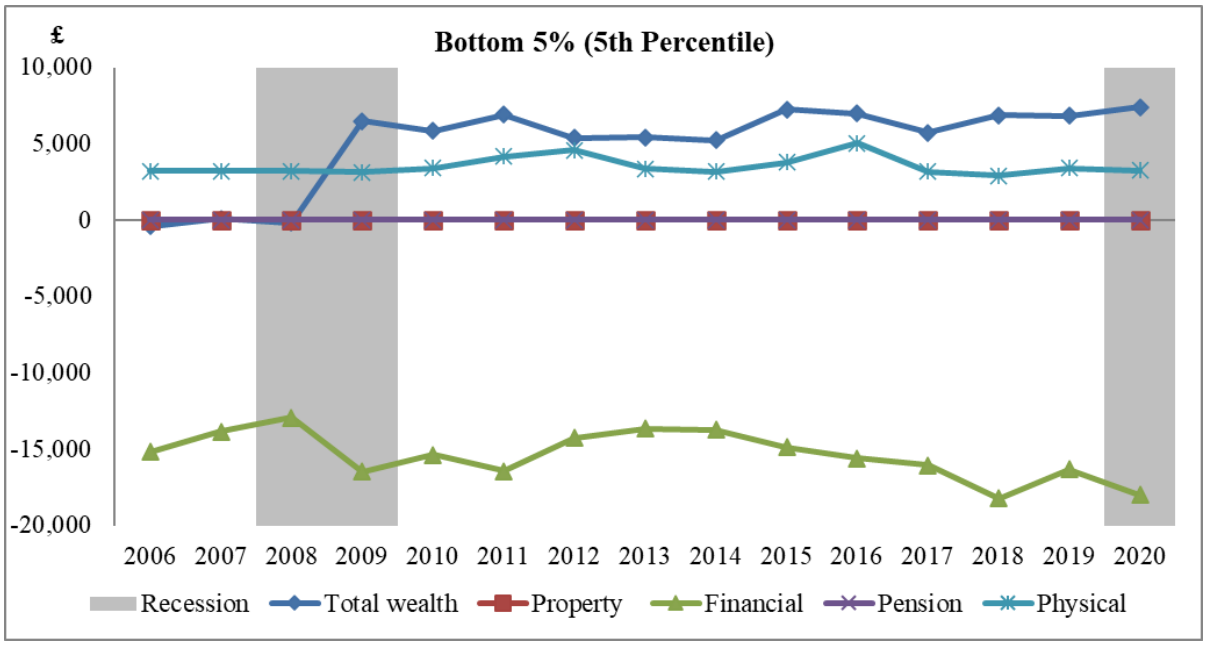
The second analysis focuses on wealth distribution and inequality by generation, using the young (25–44), the middle-aged (45–64) and pensioners (65+) as age groups. The generational analysis explores wealth inequality and distribution using total net wealth and wealth components. Wealth inequality is high within the young generation in comparison to the middle-aged and the pensioner groups. Furthermore, a correlation is observed between wealth and age. Individuals accumulate wealth as they get older, before their wealth reduces at a later stage in life. At a very old age or retirement age, people either sell their wealth holdings or bequeath their wealth to descendants. The understanding of wealth distribution and inequality in the UK has important implications for policymakers in terms of wealth redistribution and the narrowing of wealth inequality.

Appendix 3

3.A Bottom 5% (P5) and 10% (P10) Wealth Distribution

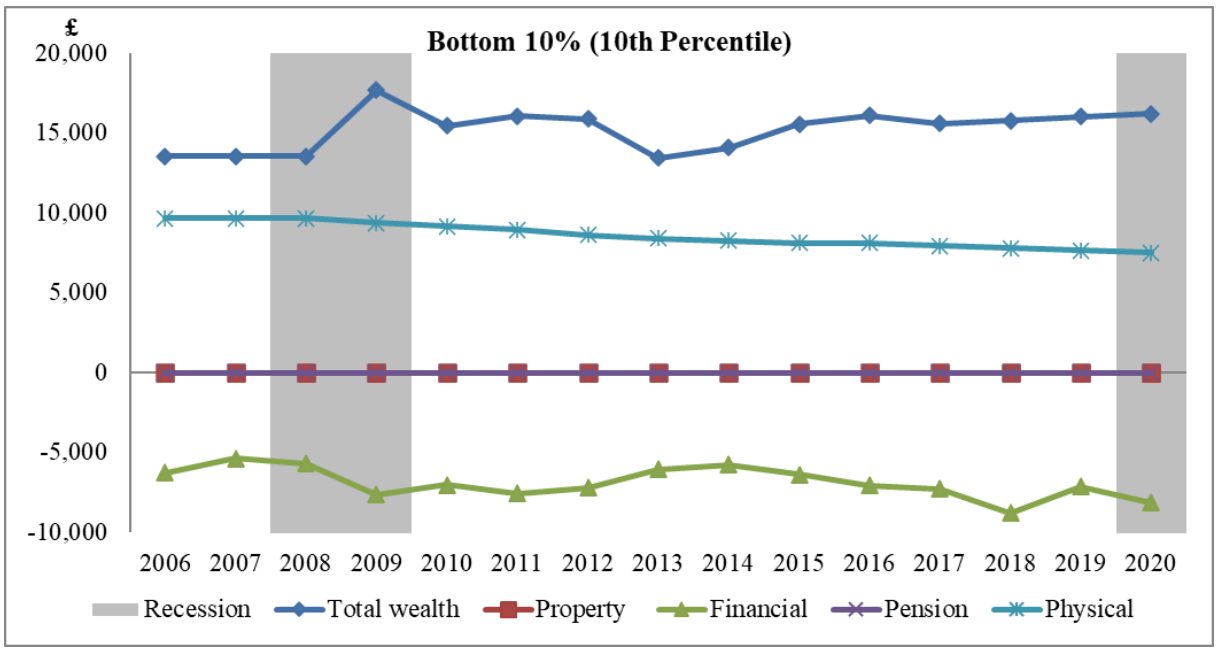
Figures 3.17 and 3.18 show that the bottom 5% and 10% of the UK population have no property wealth, pension wealth or financial wealth.

Figure 3.17 Bottom 5% (Fifth Percentile) Wealth and Wealth Component Distribution



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.18 Bottom 10% (10th Percentile) Wealth and Wealth Component Distribution



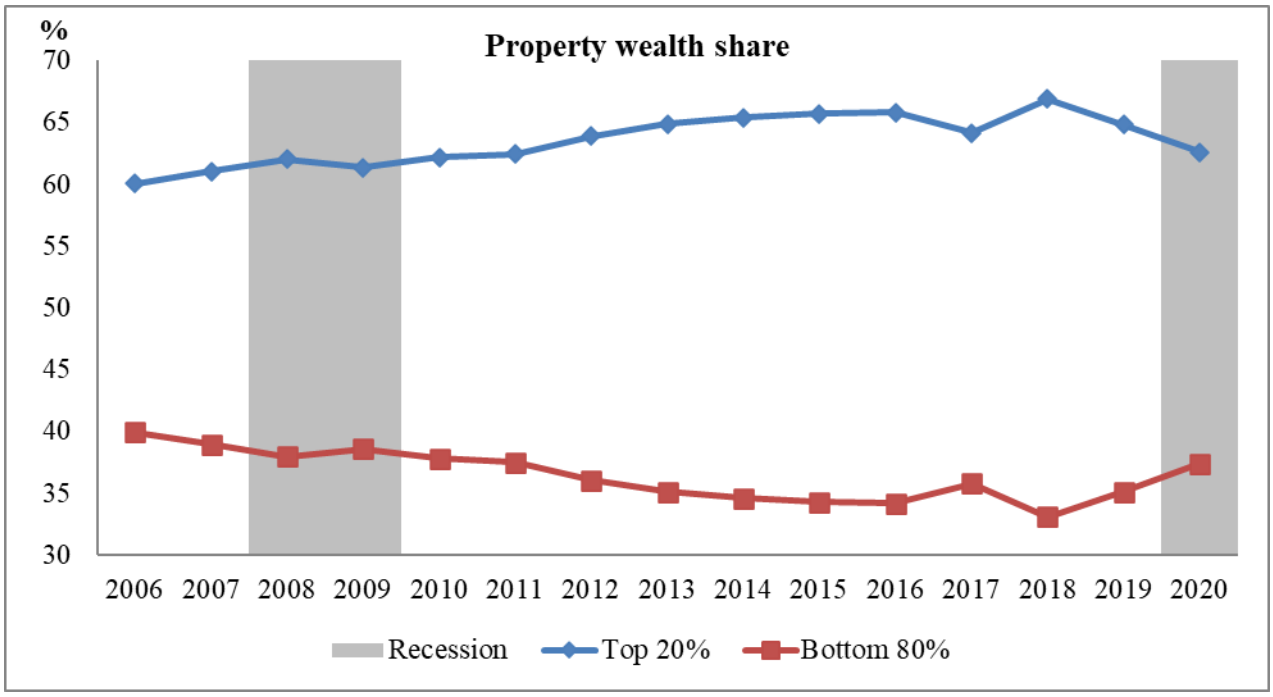
Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Physical wealth is the only component of wealth that is within the reach of the bottom 1%, 5% and 10% of the UK population.

3.B Top Percentile (20%) Share of Components of Wealth

Figure 3.19 shows the top 20% share of property wealth in the UK. The share of property wealth for the top 20% increased post-financial crisis, while the bottom 80% share decreased over the same period. In 2020, the top 20% share of property wealth is 63%, while the bottom 80% share is approximately 37%.

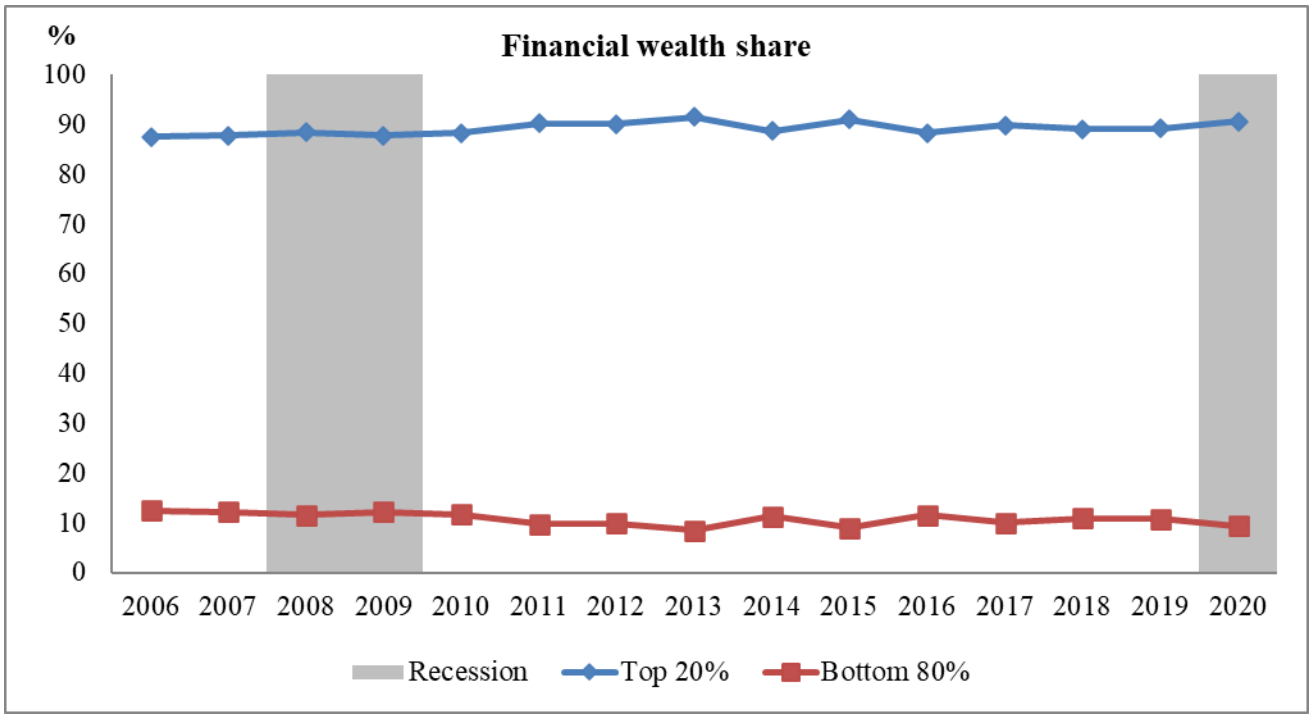
Figure 3.19 Top Percentile Share of Property Wealth



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.20 shows the top 20% share of financial wealth in the UK. The top 20% has increased its share of financial wealth. In 2006, the financial wealth share was 88%; by 2020, it had increased to 91%. The bottom 80% shows a decline from 12% in 2006 to 9% in 2020.

Figure 3.20 Top Percentile Share of Financial Wealth



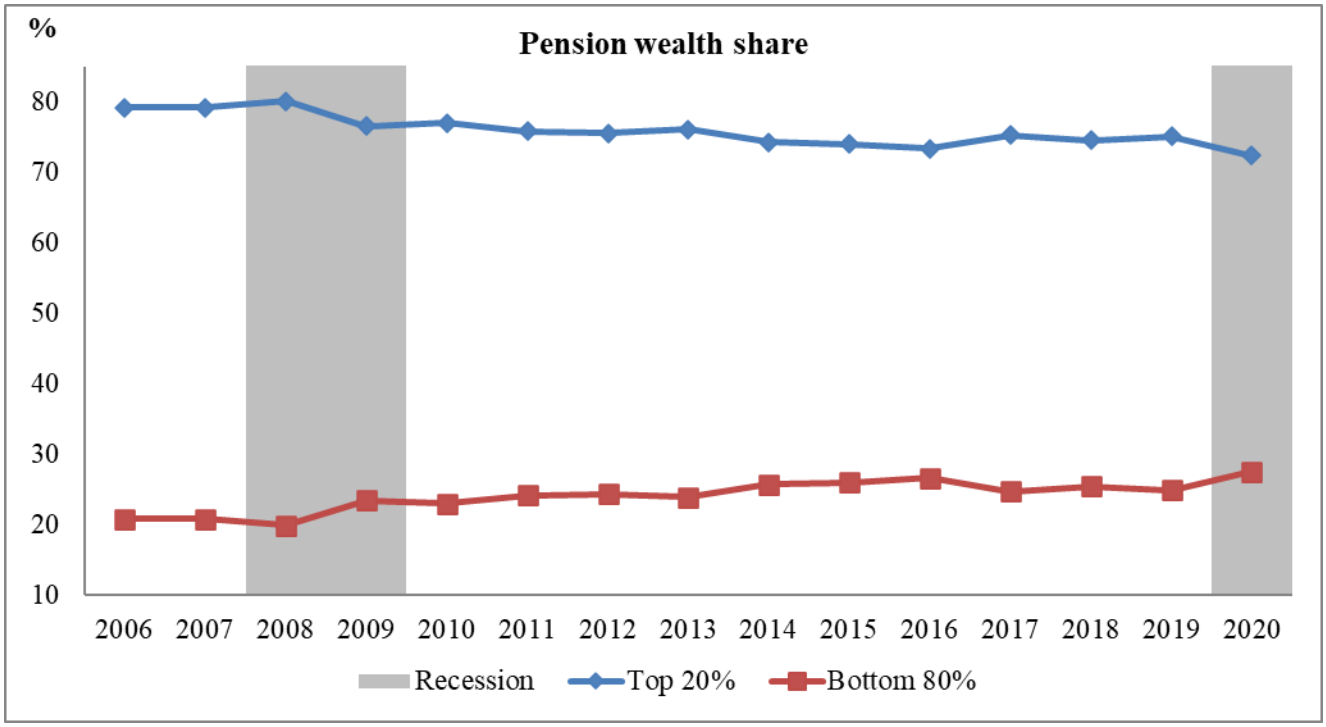
Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.21 shows the pension wealth share for the top 20% and the bottom 80% of the UK population. The top 20% share of pension wealth decreased from 79% in 2006 to 72% in 2020, while the bottom 80% share increased over the same period. This may be due to the workplace pension auto-enrolment policy introduced by the UK government in 2012. This could also be due to increased awareness around saving for pensions due to pressures on the public pension system and the health and social care crisis.

Figure 3.22 shows the physical wealth share for the top 20% and the bottom 80%. From 2006 to 2017, the top 20% share of physical wealth was lower than the bottom 80%. This is in stark contrast to the share of total wealth (Figure 3.6), property wealth, financial wealth and pension wealth (Figures 3.19, 3.20 and 3.21). Since 2018, however, the situation has reversed, with the top 20% now holding the majority of the physical wealth share, while the bottom 80% share of physical wealth has declined. In 2006, the top 20% share of physical wealth was 48%; by 2020, this share had increased significantly to 51%. Since 2018, the physical wealth share for the top 20% shows a similar trend to the total wealth share, property

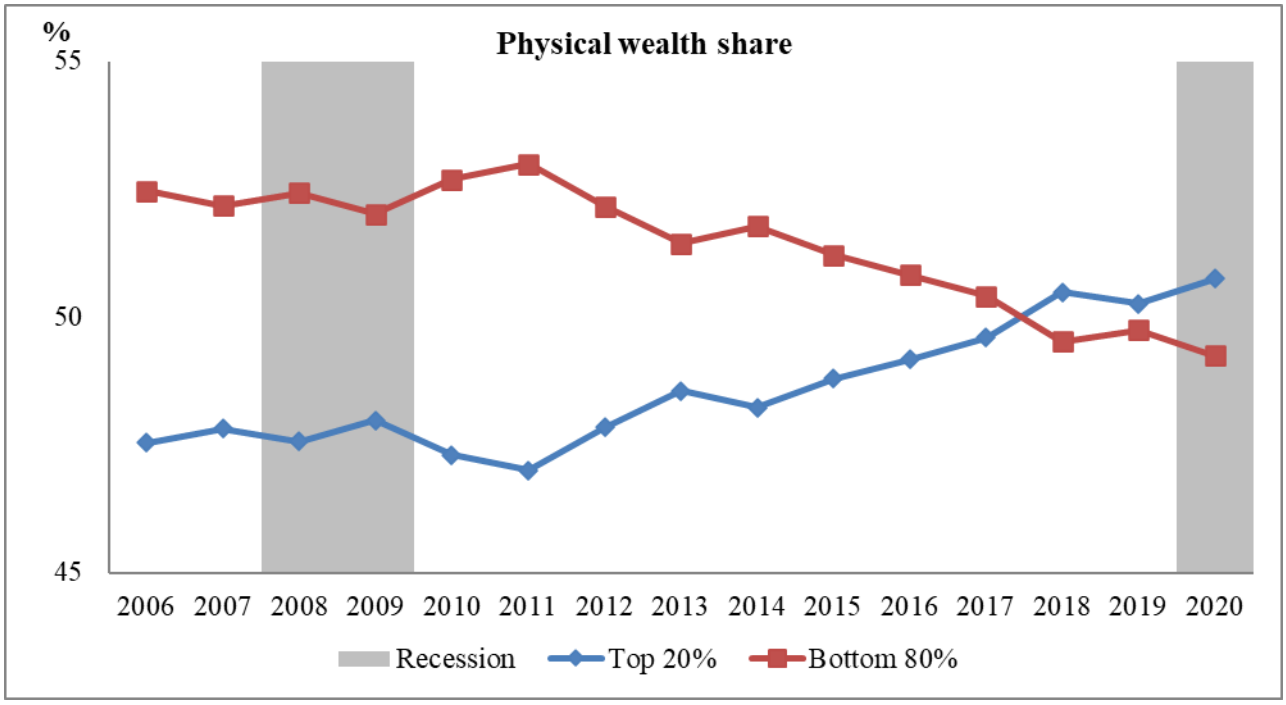
wealth share, financial wealth share and pension wealth share. These findings imply that the top 20% holds the majority of total wealth share as well as the components of wealth.

Figure 3.21 Top Percentile Share of Pension Wealth



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.22 Top Percentile Share of Physical Wealth

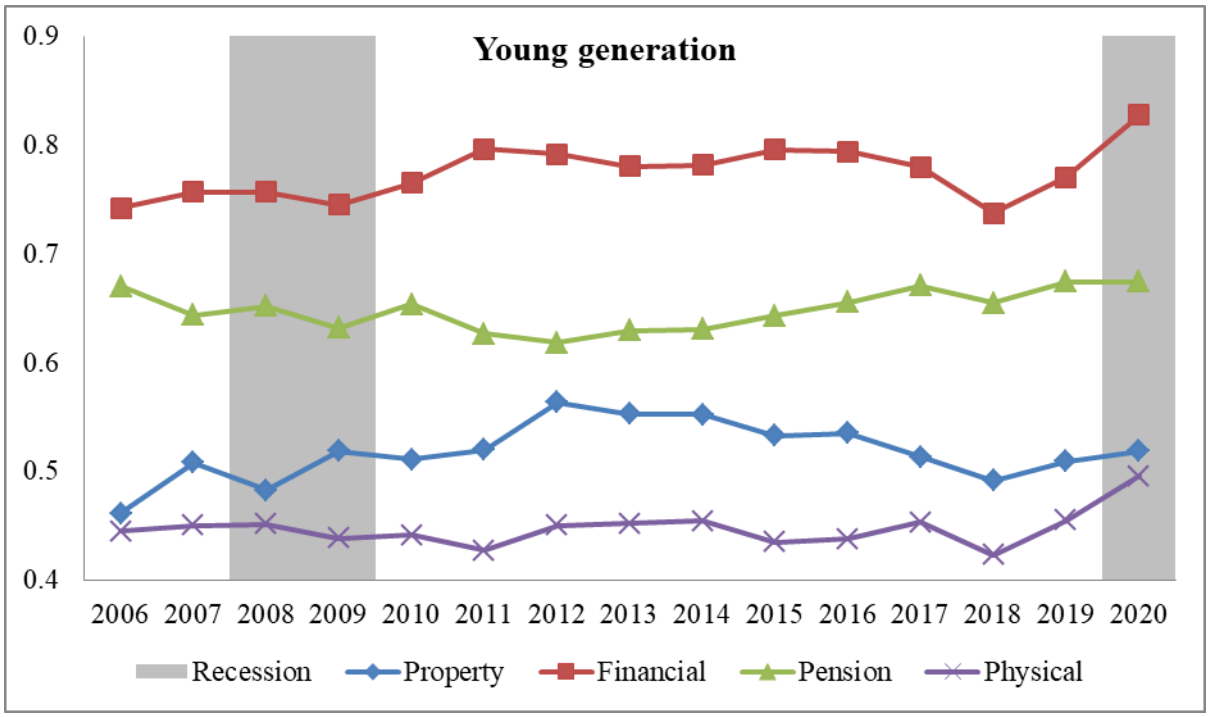


Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.C Components of Wealth Distribution by Generation

Figures 3.23, 3.24 and 3.25 show the components of wealth distribution within the young, the middle-aged and the pensioner groups. From highest inequality to lowest inequality, financial wealth ranked first and pension wealth ranked second within all generations.

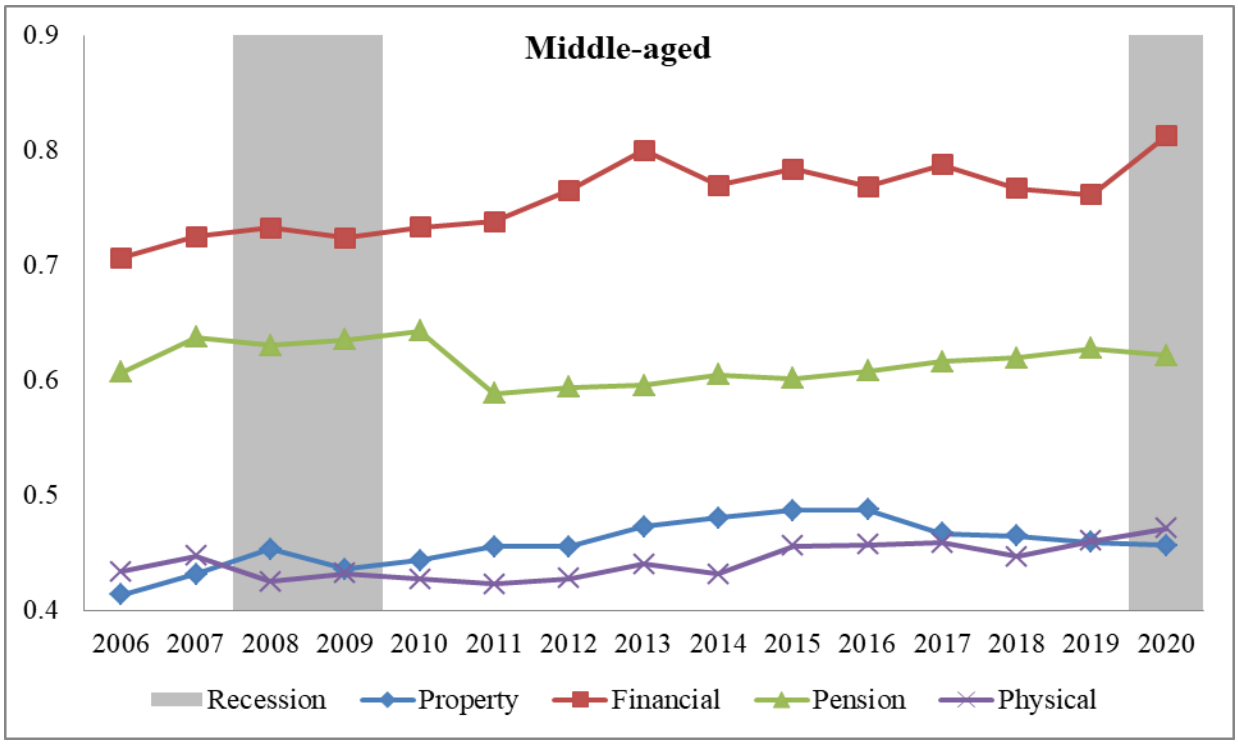
Figure 3.23 Wealth Component Distribution Within Young Generation



Source: Author's data analysis and WAS.
Note: Weighted sample; Wealth data are converted into real terms using CPIH.

The results for property wealth and physical wealth are mixed. For the young and the middle-aged, property inequality ranked third, with the lowest inequality in physical wealth (Figure 3.23 and Figure 3.24). For the pensioner group, the lowest inequality is in property wealth, while physical wealth ranked third (Figure 3.25).

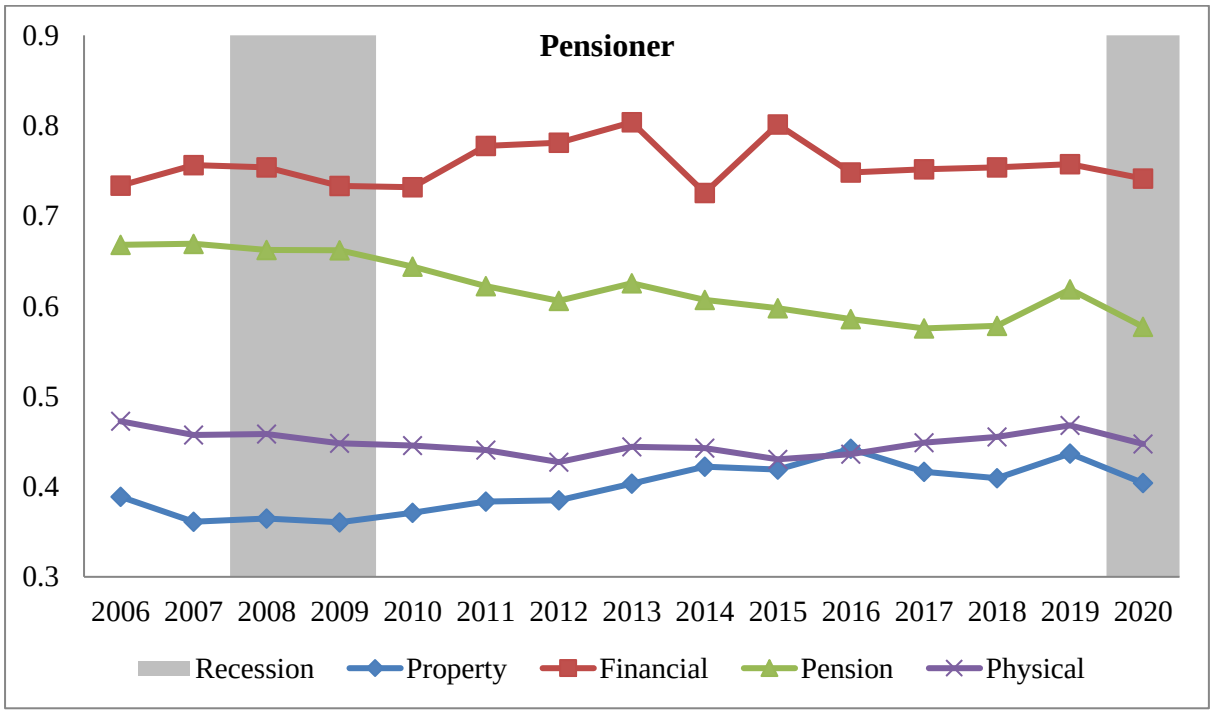
Figure 3.24 Wealth Component Distribution Within Middle-aged Group



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

Figure 3.25 Wealth Component Distribution Within Pensioner Group



Source: Author's data analysis and WAS.

Note: Weighted sample; Wealth data are converted into real terms using CPIH.

3.D Year of Birth Cohort Wealth Distribution and Inequality

The year of birth cohort is similar to the age decomposition and generational wealth distribution reported in the main text. The year of birth cohort is an alternative way of examining wealth distribution and inequality by generation and age. People born in the later years represent the young generation; people born in the earlier years are the pensioners, and those in between (or the middle years) are the middle-aged generation.

This study explores the data further by constructing the Gini coefficient and the mean and median wealth based on the date of birth cohorts. This allows for comparison in inequality, distribution and trend in wealth among the people born in the following decades: 1920s, 1930s, 1940s, 1950s, 1960s, 1970s, 1980s and 1990s. The year of birth cohort allows for the comparison of groups with fairly similar ages. Table 3.10 shows the Gini coefficient by year of birth. Wealth inequality decreases among those born in the 1980s between 2006 and 2020.

Table 3.10 Total Wealth Gini Coefficient by Year of Birth

	Total wealth Gini coefficient by year of birth							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	0.59	0.54	0.51	0.53	0.54	0.59	0.75	
2007	0.55	0.54	0.54	0.55	0.55	0.63	0.72	
2008	0.54	0.55	0.55	0.57	0.56	0.58	0.75	
2009	0.54	0.54	0.57	0.55	0.55	0.60	0.62	
2010	0.55	0.51	0.54	0.57	0.57	0.58	0.55	0.65
2011	0.54	0.54	0.54	0.53	0.55	0.56	0.57	0.63
2012	0.50	0.53	0.52	0.53	0.58	0.59	0.55	0.59
2013	0.55	0.53	0.57	0.56	0.58	0.58	0.57	0.83
2014	0.50	0.52	0.52	0.55	0.60	0.60	0.57	0.64
2015		0.53	0.58	0.56	0.57	0.57	0.55	0.63
2016		0.52	0.54	0.54	0.57	0.52	0.58	0.68
2017		0.52	0.54	0.55	0.58	0.56	0.58	0.83
2018		0.54	0.52	0.55	0.57	0.54	0.54	0.66
2019		0.54	0.57	0.55	0.59	0.57	0.54	0.61
2020			0.51	0.52	0.56	0.56	0.57	0.59

Source: Author’s data analysis and WAS.

Wealth inequality is higher in those born between the 1960s and the 1990s in comparison to those born in earlier years.[53]

The mean total net wealth by year of birth is displayed in Table 3.11. The mean net wealth for those born in the 1920s decreased from £448,666 in 2009 to £392,447 in 2014. The mean net total wealth by year of birth shows that as the year of birth decreases, starting with the 1990s, more wealth is accumulated. The peak of wealth occurs for the individuals born in the 1940s; thereafter, a decumulation in wealth is observed. Wealth accumulation increases with age; at an older age, retirement age, wealth holdings are reduced.

Table 3.11 Mean Total Net Wealth by Year of Birth

	Mean total net wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	420,367	547,825	694,374	527,437	304,454	122,332	40,409	
2007	428,293	580,267	767,614	531,216	313,253	141,920	38,063	
2008	416,527	641,520	694,021	550,706	290,311	113,589	38,481	
2009	448,666	636,884	890,289	624,339	363,674	176,218	36,307	
2010	327,529	449,207	703,911	887,964	657,233	354,510	148,057	44,480
2011	281,711	466,957	621,193	748,825	490,190	280,017	114,333	24,990
2012	346,156	459,147	672,681	775,597	554,327	272,898	121,692	25,902
2013	315,705	470,273	752,076	776,631	532,585	262,682	106,240	54,395
2014	392,447	499,829	768,679	845,469	565,312	294,439	123,944	21,543
2015		473,474	825,955	890,890	548,263	311,232	121,145	23,780
2016		534,302	890,350	953,175	602,781	404,352	143,869	26,749
2017		571,005	841,629	905,024	589,295	325,734	127,951	106,932
2018		581,418	864,038	866,086	612,167	314,478	128,890	64,779
2019		594,999	918,541	916,002	612,929	320,421	137,307	52,293
2020		599,294	926,434	888,592	568,360	395,225	153,364	73,703

Source: Author's data analysis and WAS data.

Table 3.12 shows the median value of total wealth by year of birth. Those born in the 1990s have the least value in total net wealth, although the value of median total net wealth increased for this group from £15,616 in 2010 to £76,807 in 2020. Those born in the 1940s and 1950s have a greater amount of wealth than those born in other decades. The value of the

[53] The WAS age of the head of household representative person (HRP) is banded. The median age of this age band was used to estimate the year of birth for the household.

median total wealth for those born in the 1940s and 1950s in 2020 is £443,779 and £645,446, respectively. As the year of birth decreases by a decade, starting with the 1990s, wealth accumulation increases. Towards the end of the earlier decades, a decumulation in wealth is observed for those born in the 1920s and 1930s.

Table 3.12 Median Total Net Wealth by Year of Birth

	Median total net wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	265,843	359,667	490,585	351,647	195,678	62,122	8,013	
2007	291,094	381,532	486,546	344,676	202,778	62,410	9,900	
2008	297,728	391,469	445,889	324,592	184,588	63,356	6,886	
2009	307,983	421,491	535,635	393,751	233,540	90,064	14,701	
2010	266,435	336,363	454,375	532,693	402,873	223,769	89,618	15,616
2011	211,939	312,375	409,326	509,819	332,343	170,466	69,069	10,234
2012	265,509	307,625	452,605	503,099	340,776	158,728	72,220	12,340
2013	219,520	319,181	476,392	508,363	327,126	155,532	64,288	8,434
2014	287,245	361,868	530,517	543,950	338,161	160,050	68,909	9,537
2015		324,600	489,571	600,221	324,279	193,516	77,178	12,960
2016		382,782	616,933	639,831	365,285	208,808	81,072	9,288
2017		392,253	541,057	616,854	353,143	194,669	68,733	16,865
2018		396,947	599,466	542,235	377,842	204,890	71,246	18,335
2019		391,872	563,507	601,928	379,682	190,230	88,774	24,388
2020			443,779	645,456	546,784	376,991	250,762	76,807

Source: Author's data analysis and WAS data.

Year of Birth Cohort – Wealth Component Distribution

This paper examines wealth inequality and distribution by year of birth using the four components of wealth: property wealth, financial wealth, private pension wealth and physical wealth.

Table 3.13 illustrates the property wealth Gini coefficient by year of birth between the 1920s and the 1990s. As the year of birth increases by a decade, starting with the 1920s, property wealth inequality increases, although it decreases slightly among those born in the 1980s. Those born in the 1990s experience a series of increases and decreases in the property wealth Gini coefficient. For the remaining years of birth, no significant differences in property wealth Gini coefficient are observed within the year of birth cohorts.

Table 3.13 Property Wealth Gini Coefficient by Year of Birth

	Property wealth Gini coefficient by year of birth							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	0.39	0.40	0.40	0.42	0.43	0.44	0.57	
2007	0.35	0.37	0.41	0.45	0.46	0.56	0.69	
2008	0.33	0.39	0.44	0.46	0.45	0.48	0.51	
2009	0.36	0.36	0.43	0.44	0.45	0.62	0.64	
2010	0.30	0.32	0.41	0.43	0.46	0.47	0.51	0.29
2011	0.34	0.38	0.39	0.43	0.47	0.49	0.52	0.61
2012	0.31	0.36	0.41	0.43	0.48	0.50	0.49	0.33
2013	0.37	0.37	0.42	0.45	0.49	0.53	0.52	0.56
2014	0.34	0.39	0.45	0.46	0.49	0.54	0.53	0.27
2015		0.40	0.44	0.47	0.50	0.51	0.47	0.47
2016		0.40	0.47	0.46	0.48	0.45	0.48	0.51
2017		0.40	0.43	0.45	0.47	0.49	0.49	0.70
2018		0.38	0.43	0.45	0.47	0.49	0.43	0.50
2019		0.43	0.45	0.45	0.47	0.49	0.48	0.59
2020			0.39	0.42	0.44	0.47	0.49	0.53

Source: Author's data analysis and WAS data.

The median property wealth by year of birth is displayed in Table 3.14. Between 2009 and 2019, no median property value is shown for people born in the 1990s; by 2020, the median property wealth has risen to £15,000. The median property wealth for those born in the 1980s increases from £11,900 in 2011 to £66,000 in 2020.

Table 3.14 Median Property Wealth by Year of Birth

	Median property wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	162,000	201,313	214,650	162,000	108,000	13,500	-	
2007	184,800	210,672	221,760	165,000	99,000	22,440	-	
2008	193,500	212,850	206,400	159,960	90,300	12,894	-	
2009	174,425	187,499	187,500	127,499	72,499	12,499	-	
2010	148,129	183,000	195,199	183,000	134,200	61,000	6,100	-
2011	136,850	178,500	178,500	180,285	119,000	61,285	11,900	-
2012	161,000	172,500	184,000	174,800	115,000	49,450	1,150	-
2013	123,200	168,000	173,600	168,000	108,080	50,400	-	-
2014	169,400	187,000	198,000	170,500	104,500	50,600	2,200	-
2015		172,800	185,868	177,120	98,280	54,000	-	-
2016		194,400	209,520	173,880	116,748	64,800	5,400	-
2017		190,800	204,050	181,260	113,950	63,600	2,650	-
2018		176,800	208,000	176,800	107,120	67,600	-	-
2019		204,000	204,000	179,520	117,300	55,080	13,260	-
2020			200,000	220,000	177,000	110,000	66,000	15,000

Source: Author's data analysis and WAS data.

Property wealth increases from the later years of birth to the earlier years of birth, peaking in the 1940s and then declining.

Table 3.15 shows the mean property wealth by year of birth. The mean property value for those born in the 1930s was £249,512 in 2008; by 2019, this value has increased to £287,254. The average property value by year of birth increased between 2009 and 2020.

Table 3.15 Mean Property Wealth by Year of Birth

	Mean property wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	214,597	249,512	271,277	214,260	149,497	56,330	18,695	
2007	209,532	245,650	288,261	232,621	154,172	77,696	18,033	
2008	209,718	265,824	289,965	238,926	141,130	53,968	16,079	
2009	198,949	220,362	253,872	182,624	116,547	64,366	4,821	
2010	169,611	204,114	257,351	253,746	200,462	111,956	44,016	10,166
2011	164,340	215,336	236,061	250,005	181,694	115,589	45,874	6,008
2012	178,651	198,550	252,943	246,374	187,095	101,996	45,394	6,756
2013	162,394	209,730	245,111	241,752	173,784	108,531	37,061	8,550
2014	205,348	225,225	286,423	258,667	189,945	115,991	52,282	4,697
2015		223,999	270,221	271,790	184,086	119,204	39,792	7,090
2016		236,386	346,218	280,742	194,057	173,548	65,504	4,809
2017		259,513	296,765	273,501	195,357	134,819	54,117	53,542
2018		256,259	310,191	275,240	190,745	126,118	46,205	34,310
2019		287,254	309,663	272,649	201,177	120,582	53,735	22,353
2020			258,944	303,613	256,461	190,495	136,675	61,746

Source: Author's data analysis and WAS data.

Table 3.16 tracks the evolution of net financial wealth inequality for those born in different decades (starting from the 1920s) using the Gini coefficient. The financial wealth Gini coefficient is fairly similar across the years of birth. For those born in the 1920s to the 1980s, the financial wealth Gini coefficient is greater than 0.70, and no significant difference is evident over the period. In contrast, the 1990s year of birth cohort shows fluctuations in the net financial wealth Gini coefficient, with a series of increases and decreases over the years.

Table 3.16 Financial Wealth Gini Coefficient by Year of Birth

	Financial wealth Gini coefficient by year of birth							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	0.76	0.71	0.70	0.71	0.70	0.80	0.86	
2007	0.76	0.75	0.72	0.73	0.74	0.74	0.80	
2008	0.75	0.76	0.72	0.74	0.74	0.78	0.85	
2009	0.73	0.72	0.71	0.74	0.74	0.74	0.80	
2010	0.71	0.71	0.73	0.73	0.74	0.76	0.77	0.81
2011	0.75	0.79	0.76	0.73	0.73	0.79	0.78	0.75
2012	0.72	0.77	0.73	0.72	0.80	0.79	0.78	0.73
2013	0.74	0.77	0.82	0.78	0.82	0.77	0.79	0.95
2014	0.70	0.75	0.71	0.73	0.80	0.78	0.74	0.77
2015		0.75	0.83	0.79	0.77	0.77	0.82	0.79
2016		0.73	0.75	0.75	0.75	0.79	0.73	0.68
2017		0.76	0.74	0.76	0.81	0.76	0.79	0.88
2018		0.75	0.70	0.75	0.75	0.72	0.75	0.59
2019		0.74	0.77	0.76	0.75	0.76	0.77	0.80
2020			0.74	0.74	0.82	0.81	0.83	0.69

Source: Author's data analysis and WAS data.

The median financial wealth for those born in the 1990s is negative for a few years before 2016. Since 2016, the median net financial wealth by year of birth is positive, as shown in Table 3.17.

Table 3.17 Median Financial Wealth by Year of Birth

	Median net financial wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	14,310	19,575	25,566	12,189	3,443	675	-	
2007	14,256	17,292	25,938	9,913	3,960	792	132	
2008	14,115	18,705	20,511	10,694	2,968	839	365	
2009	18,750	20,000	25,000	8,565	2,888	325	- 570	
2010	14,772	17,446	23,790	22,326	8,359	1,870	756	333
2011	13,090	16,303	18,564	20,426	5,593	2,062	440	- 36
2012	17,250	17,075	23,229	14,778	3,493	1,520	575	- 631
2013	14,560	18,659	23,520	15,917	4,234	1,870	745	34
2014	24,200	22,264	30,894	18,700	3,410	2,530	715	- 660
2015		19,462	25,920	14,472	3,758	2,498	854	- 132
2016		27,270	36,342	17,820	5,508	3,448	671	216
2017		24,009	27,785	14,236	3,498	3,657	726	187
2018		24,440	29,016	16,307	6,724	4,324	447	624
2019		22,440	25,978	16,541	4,892	3,672	328	82
2020			34,009	31,000	10,224	4,720	2,900	842

Source: Author's data analysis and WAS data.

The median financial wealth for those born in the 1990s is very small in comparison to the other years of birth. Those born between the 1920s and the 1950s have greater financial wealth than the 1960s to 1990s year of birth cohorts.

Table 3.18 shows the mean net financial wealth by year of birth. The mean financial wealth is majorly negative for the 1990s year of birth cohort between 2010 and 2016.

Table 3.18 Mean Net Financial Wealth by Year of Birth

	Mean net financial wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	68,641	76,667	88,487	62,903	35,041	15,109	5,932	
2007	68,972	78,762	99,857	64,476	42,103	11,611	2,631	
2008	61,097	84,780	86,327	68,426	31,917	19,078	7,380	
2009	67,793	76,409	95,121	59,217	33,771	11,911	- 1,787	
2010	51,041	62,407	89,644	93,530	61,243	27,002	12,982	9,980
2011	53,514	84,759	93,086	97,443	48,069	36,569	10,240	- 3,628
2012	56,936	82,387	92,303	80,255	59,965	31,937	12,260	- 263
2013	61,830	84,560	147,513	99,775	64,674	24,169	11,617	25,824
2014	69,696	87,634	111,396	102,008	67,509	35,034	9,226	- 5,240
2015		82,662	168,805	100,906	46,748	29,043	14,187	- 5,522
2016		83,537	123,299	109,785	51,643	39,204	7,028	- 1,433
2017		98,367	124,961	96,829	59,705	36,460	10,739	22,396
2018		116,819	114,066	95,802	56,483	37,410	15,677	3,448
2019		96,340	131,293	101,461	52,179	36,595	8,799	2,316
2020			113,557	128,939	106,855	74,737	52,269	4,811

Source: Author's data analysis and WAS data.

Net financial wealth is the highest in 2015 for those born in the 1940s, at a value of £168 805, although this decreases to £113,557 in 2020. In the same period, the mean net financial wealth of the 1950s year of birth cohort increases from £100,906 to £128,939 (Table 3.18).

Table 3.19 shows the private pension wealth Gini coefficient by year of birth. Private pension wealth inequality slightly decreases for those born between the 1920s and the 1950s. However, for people born in the 1980s, private wealth inequality declines over a number of years, before gradually increasing in 2012. The private pension wealth Gini coefficient for the 1960s and 1970s year of birth cohorts decreases between 2006 and 2020.

Table 3.19 Private Pension Wealth Gini Coefficient by Year of Birth

	Private pension Gini coefficient by year of birth							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	0.73	0.60	0.57	0.64	0.64	0.67	0.70	
2007	0.67	0.63	0.63	0.63	0.60	0.67	0.62	
2008	0.68	0.66	0.60	0.65	0.65	0.59	0.75	
2009	0.65	0.61	0.64	0.62	0.61	0.61	0.53	
2010	0.69	0.63	0.60	0.64	0.64	0.62	0.63	0.47
2011	0.63	0.61	0.56	0.55	0.60	0.60	0.57	0.74
2012	0.65	0.55	0.56	0.56	0.61	0.62	0.58	0.45
2013	0.65	0.64	0.55	0.58	0.60	0.59	0.62	0.73
2014	0.54	0.53	0.53	0.57	0.62	0.57	0.56	0.67
2015		0.60	0.54	0.58	0.60	0.61	0.62	0.71
2016		0.55	0.55	0.58	0.62	0.63	0.64	0.86
2017		0.55	0.55	0.58	0.63	0.61	0.65	0.74
2018		0.56	0.53	0.58	0.63	0.63	0.64	0.75
2019		0.57	0.60	0.59	0.65	0.65	0.61	0.67
2020			0.56	0.53	0.59	0.63	0.64	0.66

Source: Author's data analysis and WAS data.

Table 3.20 shows the median private pension wealth by year of birth. The value of median pension wealth for those born in the 1990s is £53 in 2017 and £16,470 in 2020. Those born in the 1950s have more median pension value than any other year of birth cohort, with a median pension value of £228,502 in 2020. The median private pension wealth of the 1960s year of birth cohort increases from £61,433 in 2009 to £205,450 in 2020.

Table 3.20 Median Private Pension Wealth by Year of Birth

	Median private pension wealth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	26,092	83,712	135,000	75,119	28,408	6,464	-	
2007	38,334	90,352	133,893	68,080	29,040	5,093	-	
2008	35,481	100,121	115,098	64,344	25,684	3,986	-	
2009	46,976	129,312	182,282	128,372	61,433	15,297	-	
2010	18,460	51,125	141,683	188,211	118,234	42,985	11,063	-
2011	5,029	50,794	114,655	173,244	84,015	32,130	8,186	-
2012	20,853	59,976	136,197	187,871	105,759	31,670	10,522	-
2013	10,371	42,814	153,034	167,188	94,911	29,120	4,480	-
2014	26,782	69,297	175,217	188,447	91,791	39,252	9,188	-
2015		43,906	164,719	219,026	103,706	40,714	7,263	-
2016		75,886	199,952	237,201	110,096	53,757	8,910	-

Table 3.20 (continued**)**

2017		71,745	170,331	224,830	97,252	42,400	9,540	53
2018		69,183	175,512	209,770	127,919	47,092	16,848	229
2019		71,428	182,563	222,360	101,649	39,683	12,793	167
2020			72,325	228,502	205,450	86,588	45,000	16,470

Source: Author's data analysis and WAS data.

The mean private pension wealth follows a similar trend to the median wealth value. Those born in the 1990s have the lowest-value average private pension wealth at £5,289 in 2010 and £60,753 in 2020, as shown in Table 3.21.

Table 3.21 Mean Private Pension Wealth by Year of Birth

	Mean private pension wealth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	115,447	192,733	299,539	218,992	91,962	31,364	4,920	
2007	121,731	222,253	339,637	193,452	83,337	29,834	3,376	
2008	123,968	261,484	285,459	210,258	90,515	23,162	5,814	
2009	135,658	286,706	478,847	323,352	163,487	64,210	13,698	
2010	67,694	136,906	297,976	479,792	337,076	165,890	55,231	5,289
2011	25,537	115,821	234,823	338,525	200,307	76,896	22,736	2,820
2012	68,496	128,405	267,932	386,681	248,186	90,133	29,643	1,496
2013	54,561	128,088	300,234	375,216	238,093	84,394	26,151	5,178
2014	75,819	136,754	312,930	423,462	250,590	95,866	29,440	7,410
2015		119,939	324,928	451,843	260,853	118,144	38,378	7,430
2016		159,654	431,677	497,713	291,412	141,533	37,923	10,945
2017		160,921	356,881	472,168	275,663	106,077	28,733	9,104
2018		165,787	348,685	448,509	311,483	105,517	46,794	5,150
2019		158,825	413,463	478,501	303,455	119,000	39,225	6,880
2020			176,474	430,740	464,452	242,934	151,158	60,753

Source: Author's data analysis and WAS data.

Table 3.22 shows the physical wealth Gini coefficient by year of birth. The Gini coefficient is relatively similar over the years for those born between the 1920s and the 1980s, especially from 2011 onwards.

Table 3.22 Physical Wealth Gini Coefficient by Year of Birth

	Physical wealth Gini coefficient by year of birth							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	0.47	0.44	0.42	0.45	0.43	0.45	0.52	
2007	0.47	0.43	0.44	0.45	0.43	0.45	0.52	
2008	0.48	0.45	0.44	0.48	0.44	0.45	0.52	
2009	0.45	0.42	0.43	0.43	0.42	0.45	0.49	
2010	0.50	0.41	0.45	0.42	0.41	0.44	0.42	0.48
2011	0.43	0.46	0.42	0.43	0.42	0.42	0.42	0.51
2012	0.42	0.43	0.42	0.41	0.44	0.46	0.41	0.47
2013	0.45	0.42	0.45	0.44	0.44	0.44	0.44	0.55
2014	0.41	0.45	0.40	0.42	0.44	0.46	0.42	0.55
2015		0.40	0.44	0.47	0.44	0.42	0.42	0.49
2016		0.46	0.43	0.44	0.45	0.44	0.44	0.51
2017		0.44	0.45	0.46	0.45	0.44	0.46	0.62
2018		0.47	0.44	0.45	0.44	0.40	0.43	0.55
2019		0.46	0.47	0.45	0.46	0.45	0.45	0.45
2020			0.44	0.45	0.49	0.45	0.48	0.43

Source: Author's data analysis and WAS data.

Table 3.23 shows the median physical wealth by year of birth. In 2020, the median value of physical wealth for those born in the 1940s, 1950s and 1960s is £35,500, £50,000 and £45,250, respectively.

Table 3.23 Median Physical Wealth by Year of Birth

	Median physical wealth by year of birth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	3,375	6,750	10,125	4,050	6,210	3,375	3,375	
2007	11,484	19,800	22,440	21,054	19,800	10,296	4,092	
2008	35,475	45,150	49,665	50,052	43,860	29,670	9,675	
2009	33,750	45,000	49,375	47,500	40,625	26,875	11,875	
2010	30,500	37,820	45,140	50,020	48,282	39,040	30,500	11,590
2011	29,750	41,650	45,815	51,765	49,694	42,840	29,750	9,282
2012	29,555	40,250	49,450	52,325	44,160	39,675	28,750	11,443
2013	28,000	39,200	47,600	48,160	44,464	36,960	22,512	8,400
2014	38,500	38,610	50,600	49,500	44,330	37,904	26,950	8,294
2015		37,800	48,816	49,680	45,360	37,800	22,247	8,208
2016		38,934	50,760	50,220	46,278	39,960	27,000	8,100
2017		39,750	47,700	48,103	43,990	37,630	26,500	8,586
2018		36,400	48,880	46,800	44,720	38,532	24,502	7,800
2019		37,740	46,920	47,940	43,350	31,824	27,030	16,524
2020			35,500	50,000	45,520	48,000	39,500	22,700

Source: Author's data analysis and WAS data.

The mean physical wealth is presented in Table 3.24. Average physical wealth increases for all the year of birth cohorts between 2006 and 2020. As the year of birth decreases by a decade (starting from the 1940s), physical wealth decreases.

Table 3.24 Mean Physical Wealth by Year of Birth

	Mean physical wealth (£)							
Year	**1920s**	**1930s**	**1940s**	**1950s**	**1960s**	**1970s**	**1980s**	**1990s**
2006	21,683	28,912	35,071	31,281	27,954	19,529	10,863	
2007	28,058	33,602	39,859	40,668	33,641	22,779	14,023	
2008	21,744	29,432	32,269	33,096	26,749	17,381	9,209	
2009	46,266	53,407	62,448	59,146	49,869	35,731	19,575	
2010	39,183	45,780	58,940	60,897	58,452	49,662	35,828	19,045
2011	38,321	51,042	57,223	62,852	60,119	50,963	35,482	19,790
2012	42,074	49,806	59,502	62,288	59,081	48,832	34,395	17,913
2013	36,920	47,895	59,218	59,889	56,035	45,587	31,410	14,842
2014	41,584	50,216	57,929	61,332	57,268	47,548	32,995	14,676
2015		46,874	62,001	66,351	56,576	44,842	28,788	14,781
2016		54,726	65,299	64,934	58,922	50,067	33,414	12,428
2017		52,205	63,022	62,525	58,570	48,378	34,362	21,890
2018		53,205	62,819	64,621	58,681	45,434	33,933	18,738
2019		52,579	64,122	63,392	56,119	44,244	35,547	20,743
2020			50,319	63,142	60,825	60,194	55,124	26,054

Source: Author's data analysis and WAS data.

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