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Summary of WP Student Team

The impact of interest rate spike on household finances

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The thesis is organized in the following structure:

Group part - The macroeconomic context of interest rate spikes

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Individual apendix following the same order of students

A Work Project, presented as part of the requirements for the Award of a Master's degree in Finance from the Nova School of Business and Economics.

The impact of the interest rate spike on household finances

MAFALDA LORIENTE MALHEIRO DA SILVA ABADE - Tenure choice and housing cost burden in the United Kingdom

MARIA RITA ALMEIDA APARÍCIO - Household Factors Influencing the Mortgage Equity Withdrawal Decision in the Netherlands

TOMÁS ALDEIA GOMES - Analyzing Income, Asset Holdings, Mortgage Contract and Liquidity Constraints on Saving

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Analyzing Fixed and Variable Interest Rates Preferences in the United Kingdom

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17-12-2024

ABSTRACT PAGE

GROUP PART

This thesis explores the impacts of rising interest rates on household finances through group and individual analyses. The group study highlights the macroeconomic context of interest rate spikes, their effects on borrowing, savings, and financial stability across households. It examines how these changes influence housing markets, mortgage costs, and consumer behavior in an environment of economic uncertainty.

Tenure Choice and Housing Cost Burden in the UK: This analysis highlights how renters face higher financial strain compared to homeowners, during periods of rising housing costs.

Household Factors Influencing Mortgage Equity Withdrawal in the Netherlands: This study reveals that older homeowners and households facing liquidity constraints are more likely to use mortgage equity withdrawal as a financial strategy.

Preferences for Fixed vs. Variable Interest Rates in the UK: The analysis identifies a clear preference for fixed-rate mortgages during rising interest rates, driven by economic uncertainty and demographic factors.

Impact of Income, Assets, and Liquidity Constraints on Savings: This research uncovers how income levels, mortgage contracts, and liquidity constraints shape savings behavior, particularly among households facing financial pressure.

Keywords: Housing, Mortgages, Interest Rates, Savings

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Introduction

Relevance of Interest Rates & Mortgages

The macroeconomic environment is composed of several forces and dynamics among all countries on the globe, encompassing gross domestic product, unemployment rates, inflation, and many others. Small changes have effects on a global scale and impact households' and companies' everyday lives.

Yearly inflation, a general and prolonged increase in prices, is ideally stable at 2% per year, but this is not always the case, as many factors contribute to and influence its growth. In the context of high inflation, increasing interest rates is an often-used countermeasure by monetary policymakers. By increasing borrowing costs, both households and businesses will have higher interests to pay and consequently spend less on other things. Because it is less attractive to spend money, prices must go down as demand decreases, and so inflation is regulated. As inflation declines, so will interest rates until an equilibrium is reached.

The increase in rates at the central bank level affects commercial banks, consequently impacting households. The repercussions are many for businesses and households, with loans, savings and investments all being affected. In this context, borrowing costs are higher, thus disincentivizing businesses from making investments, slowing growth and job creation.

For families and households, this change in borrowing costs means adapting your spending and/or savings if you have loans, or disincentivizes you from getting loans for house or car purchases. Since many households resort to mortgages to get a house, and since this is the highest liability on their balance sheet, changes in interest rates could greatly impact the families' finances.

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At the end of 2021, as a response to the increasing inflation, interest rates were increased, which has affected households in a variety of ways. We will explore the topics of variable vs fixed interest rate choice, housing cost burden in different tenure types, consumption and saving changes when mortgage payments increase, and equity withdrawal through the years 2017 to 2023.

During 2011 until 2018, the global economy was recovering from the 2008 financial crisis. The economic output of most countries was well below the levels that would have prevailed if the output has followed the pre 2008 crisis trend. 85% of the economies which suffered from the banking crisis are currently operating bellow the pre-crisis output trend. This crisis affected fertility rates, and migration rates in advance economies, which led to a reduced labour force growth in the future. The crisis also reinforced pre-existing trends of inequality, exacerbating political and social tensions (Chen, Mrkaic, & Nabar, 2018).

The countries with better supervised regulated banks and flexible exchange rates were the ones which suffered less damage. Unfortunately, that was not the landscape for most banks, being this crisis, the wakeup call they needed to change policies. Banks started to create stricter banking regulations and received capital injections to cushion output losses which supported their recovery. Major banks such as the central banks significantly lowered their interest rates to stimulate economic activity by making borrowing cheaper and incentivizing investing and spending.

The global economy slowly recovered from the 2008 financial crisis and global GDP growth averaged a little more than 3.5% per year. Growth in Europe continued to be tentative, helped by fiscal consolidation and structural reforms. Both the UK and the Netherlands experienced comparable positive trajectories economically, though, neither country was inscrutable to external interventions by way of both the Eurozone crisis, and latterly through Brexit.

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Inflation and Interest rates 2011-2018

Since 1992, the UK economy has experienced consistent growth (measured by adding up the value of the goods and services produced in the country). However, from April to June 2008, the economy started contracting, The GDP started to decrease, and the UK entered a recession. During this period, the UK´s GDP decreased by over 5%. The UK economy took five years to return to its size before the recession. Between October 2007 and April 2009, the Official Rate from the Bank of England went from 5.75% to 0.5% and the Bank of England initiated "Quantitative Easing" to stimulate the Economy.

From the end of 2009 until 2011, the UK gradually emerged from the recession, facing challenges related to high public debt, weak global demand, and low consumer confidence. The recovery from the 2008 crisis was also hindered by the beginning of the Eurozone debt crisis in 2010. The CPIH (Consumer Prices Index including Housing Costs) rate was at 1% in September 2009, and a 3-year high was reached in September 2011 with the CPIH rate being 4.5%. This increase happened mainly because gas, electricity, and fuel prices rose significantly higher than the year before. Lots of people lost their jobs, employers stopped hiring, and by the end of 2011. By the end of 2011, almost 2.7 million people were looking for work. The quarterly unemployment rate reached 8.4%, the highest rate since 1995. The interest rates were kept low with the main goal of stimulating economic growth after the financial crisis. The bank continued its QE program, injecting an additional 75 billion pounds into the banking system, exceeding economists' expectations. QE was aimed at stimulating economic growth, it is debated whether it contributed to inflationary pressures, in the context of rising energy prices. The interest rates were kept at 0.5%, with the primary goal of stimulating the economy. The low interest rates also allowed the recovery of the housing market.

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In 2011, the UK saw a return to growth, and 2012 saw a slip backward into negative territory (also called a “double dip” recession). The euro-area economy remained weak, but global activity continued to expand at a moderate pace. The period of weak demand paired with stagnant productivity meant that CPI inflation was still above the 2% target. By October 2012, the Bank of England had bought 375 billion pounds worth of assets, primarily government bonds.

From June 2013 until December 2013, inflation decreased from 2.9% to 2%, hitting the desired target value. This happened mainly because of the appreciation of sterling and a revival in productivity growth. The rates were kept low with the intention of stimulating economic growth and consequently, mortgage rates were accessible.

2014 was a year marked by the fastest economic growth since 2006, growing faster than previously estimated. ONS figures showed that Household disposable income grew by 4.5% during the year. Asset and commodity prices fell again and inflation at the end of the year was inferior to 1% (0.5%).

In February 2015, Britain recorded its first instance of zero since data collection began. According to the MPC, two-thirds of the deviation from the 2% goal could be attributed to unusually low contributions from movements in energy, food, and other goods prices, and around a third of the deviation of inflation from the target reflected on more generalized subdued inflationary pressures resulting from weak growth in domestic costs. The MPC voted by a majority to maintain the Bank Rate at 0.5%. They projected moderate growth in global demand, with a significant increase in private domestic demand in the UK. Increased household spending was supported by rising real incomes due to lower food and energy prices. Wage growth and credit conditions were favorable; however, slow global growth could weigh on the economy. Maintaining the current interest rate was seen as necessary to ensure growth continued at the same pace.

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The UK ended 2015 as one of the fastest growing of the major developed economies. Unemployment was falling, the housing market was performing well, and household spending was strong. The same thing was expected for the first half of 2016, with some uncertainty for the second half of the year mainly due to the Brexit referendum. This historic vote would determine whether the UK remained in the European Union, introducing a potential shift in trade relationships, foreign investment, the labor market, regulatory measures, and currency stability.

On 23 June 2016, the British electorate voted to leave the European Union with a majority of approximately 52%. As soon as the results were clear, the pound depreciated sharply against the US dollar and the euro, and the outlook for growth in the short to medium term weakened significantly. After this, inflation was predicted to increase since the currency rates fell and import prices would be much higher. The inflation ended up increasing surpassing the 2% target in February 2017. During this period, the MPC chose to decrease the interest rates again reaching 0.25%, due to a weakness in demand relative to the available supply. The MPC was limited in what it could do to stimulate the economy since the rates were already low and it would be hard for certain banks to reduce even more the deposit rate. They complimented this decrease on rates with an expansion of the asset purchase scheme for UK government bonds of 60 billion pounds.

From this period onwards, the decisions made were marked by negotiations between the UK and the EU to establish what would be the terms of the UK´s withdrawal. Inflation was determined by the effects on import prices of the referendum-related fall in sterling. The uncertainty of these discussions caused market participants to downgrade their expectations about the future performance of the UK economy.

2018 went on to be the weakest year in terms of economic growth since 2012, with Brexit and global worries declining sharply the investment done. GDP growth dropped significantly in the

final quarter of 2018, to a rate of 0.2 percent from 0.6 percent in the quarter before. In the final months of 2018, major economies were affected by increasing trade tensions between the U.S.A and China, with Brexit being a major challenge for Britain.

In early 2020, COVID-19 caused an unprecedented economic crisis. Strict Lockdown measures were implemented, GDP contracted, and household consumption collapsed. To diminish the impact that this recession had, there were interest rate cuts.

In March 2020, the Bank of England reduced the Bank rate from 0.75% to 0.25% and a little after, to a historical low of 0.1%.

2021 was a year marked by a significant recovery for the UK economy with a GDP growth of 7.5%, one of the highest since World War II.

2022 and 2023 were marked by significant interest rate hikes, with the Bank of England shifting to a strategy of monetary tightening. In 2022, inflation peaked at 11.1% in October 2022 with interest rates ending at 3.5% by December 2022. In 2023, Inflation began to stabilize, falling to 6% late in the year. The inflation remained above the 2% target, leading to further interest rate increases. In August 2023, the Bank Rate peaked at 5.25%, a 15-year high. This shift in monetary policy had greater implications for mortgage holders, especially those with ARMs. The increase in rates resulted in a significant payment hike for them. These borrowers, who initially benefited from lower-interest rates, experienced an immediate reduction on their household budgets, in contrast with mortgage payers with FRMs.

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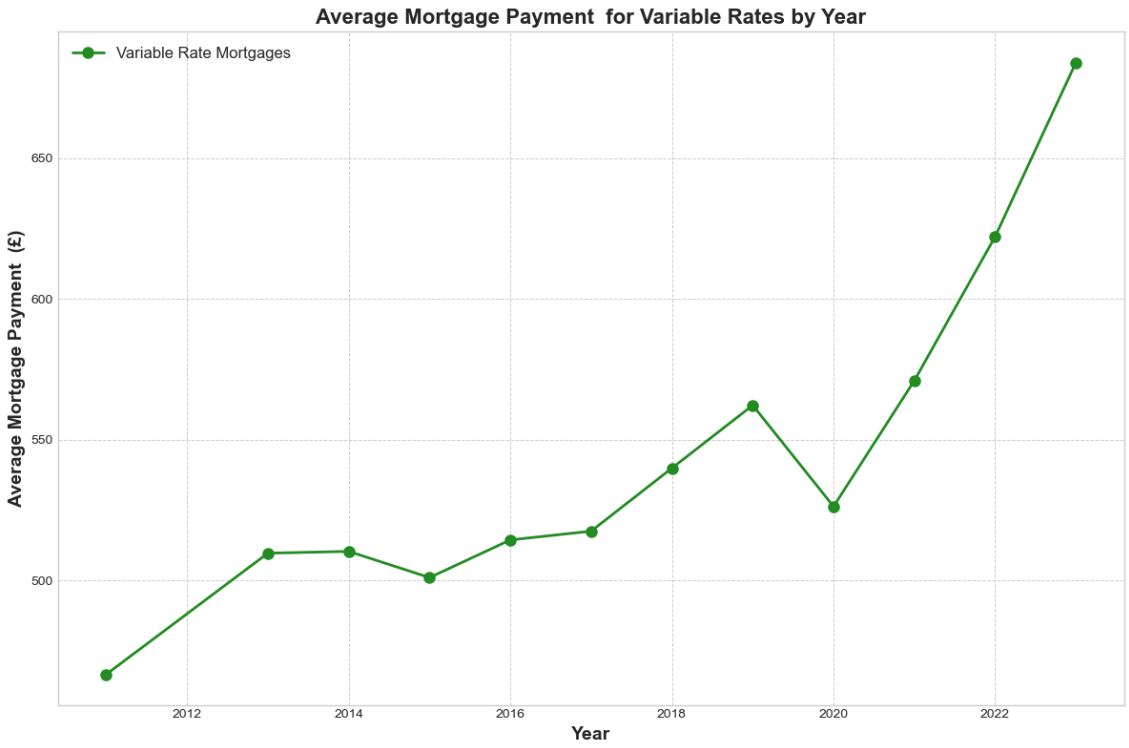

Figure 1 - Average Mortgage Payment for ARMs per year

There was a general increase in the average Mortgage Monthly Payments from 2011 forward, with a constant growth until around 2020. After 2020, there was a sharp rise in the average mortgage payment. This increase in Monthly Mortgage Payments from our data reflects the interest rate increases, especially from the start of 2022 until the 5.25% achieved in September 2023. These payments were even harsher for the households since the annual inflation for 2022 and 2023 was 9.1% and 7.3% respectively.

This increase in monthly mortgage payments is significant, but it is especially harsher on people whose household falls into the first annual income quintile (from 0 to 14,500). For these people, the monthly mortgage payment is majorly impactful on the monthly budget and can even lead to cuts in consumption.

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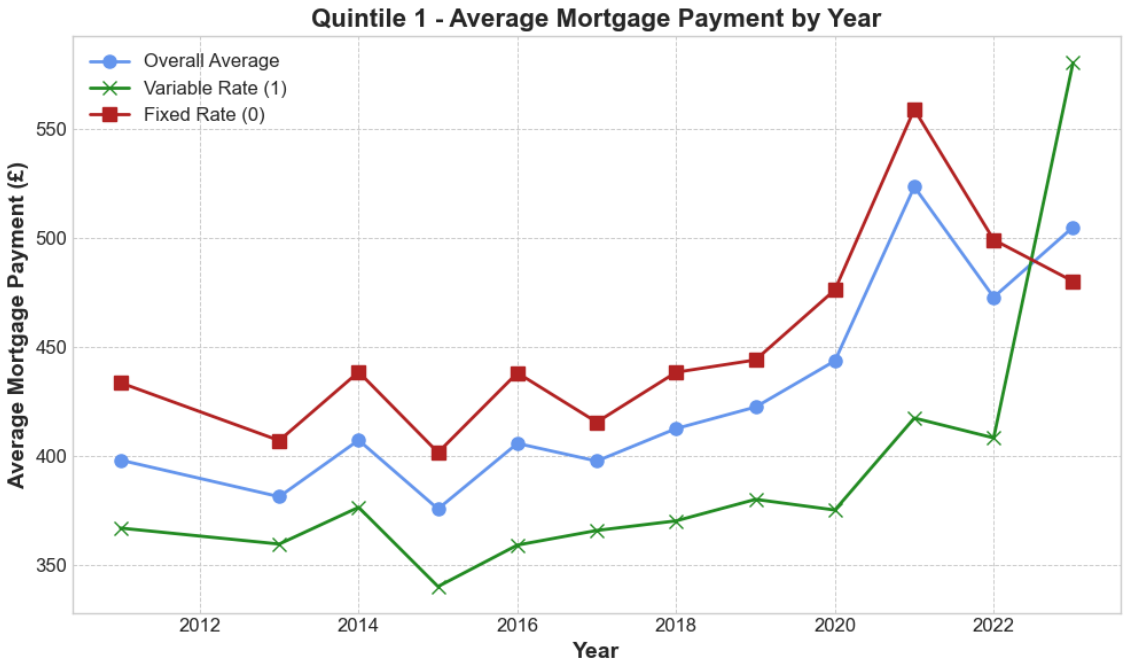

Figure 2 - Average Mortgage payment per year: ARMs VS FRMs (Quintile 1)

Like the previous graph, between 2011 and 2019, the mortgage payments for all three groups remained relatively stable, around 400 £ per month. There was a significant difference between both rates. Starting in 2021, there was a spike in fixed payments while the variable mortgages were still relatively close to the previous prices. In 2022 and 2023, This group had the steepest rise due to the interest rate hikes. In 2023, the monthly mortgage payments for ARMs were close to 600£. Now, imagine a household in this income group, where the monthly income, deriving from the first quintile of annual income of 14500£, corresponds to a monthly income of around 1200£. When we compare this to a monthly mortgage payment of 600£, we find that it takes up about 50% of their monthly income. This shows how much financial pressure these households are under, making it harder for them to keep the same consumption level and pay for other necessary expenses.

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Previously, I utilized the variable be23 as an indicator of household liquidity constraints. I used this variable to analyse the relationship between changes in ARMs payments and the proportion of households with variable rates experiencing liquidity constraints.

Figure 3 - Liquidity constrained households with variable rate

Firstly, we see that from 2011 until 2015, the percentage of liquidity-constrained households declined, reaching almost 20%. There was a slight increase from 2015 until 2018, and from 2018 until 2020 there was a significant decline. This trend is following the changes in the interest rates since in 2020 we reached a historic low of 0.1%. In this year, the percentage of liquidity-constrained households dropped to 15%, a distant value from the one we would observe in 2023. From 2020 onwards, there was a massive increase, reaching a peak value of 35% in 2022. This again reinforces the previous claim that variable mortgage rates for low-income households increase their financial pressure significantly.

Mortgage and Renting Evolution 2011-2018

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In the United Kingdom, in 2012, the ownership of residential stock corresponding to households (including private renting) and non-profit organizations (excluding housing associations) was estimated at £4,223 billion (Mitchell 2014). In mid-2013, ONS estimated the whole UK's residential market to be £4,615 billion, which has been growing steadily since the 2008 crisis.

In the UK, similar to the rest of the globe, the two most common options for housing tenure are owning and renting, flats or houses.

In 2011, out of the 22.8 million dwellings, 65% were owner-occupied and 18% were rented to private landlords, these numbers staying consistent in 2012 (Ministry of Housing, Communities & Local Government 2013, Ministry of Housing, Communities & Local Government 2014). Furthermore, tenure depends significantly on age, with most renters being more than 92 years of age, although this number has been decreasing, followed by 21-year-olds or younger, a number which, on the other hand, has been growing.

For all tenure types, suburban residential is the most common area, consistently in the following years, with 54% of all homes being terraced or semi-detached houses. When looking at housing conditions, in 2011 and 2012, private rented homes and converted flats were the most likely to be the worst category in the dwelling condition scale, representing another cost for the household. Still, a downward trend in overall repair costs can be seen over the years.

Over the years, privately rented dwellings have been increasing, while owner-occupied has remained fairly stable. In 2013, dwellings had increased to 23.3 million, 63% owner-occupied, 19% privately rented and 17% rented from social landlords 2012 (Ministry of Housing, Communities & Local Government 2014). Three years later, in 2016, owner-occupied dwellings stayed consistent at the same %, representing an increasing number of people over 65 years of age,

and a decreasing number of people 35 or under (Ministry of Housing, Communities & Local Government 2017).

On what concerns first-time buyers, in 2015, 61% were between 25-34 years old, this age group increasing over the years compared to 16-24, and nearly 50% are a couple with no children. This household is also most likely within the fourth- or fifth-income quintile, as 72% of first-time homebuyers are, compared to private renters who follow a relatively uniform distribution, slightly normally shaped (Ministry of Housing, Communities & Local Government 2016).

Moreover, in 2016, the privately rented sector had the highest housing costs, at a weekly cost of £184, followed by mortgagors at £159. Going further, if we look at the London area alone, it was cheaper to have a mortgage than to rent, as compared to European countries and cities, London's rent prices were by far the highest. Additionally, the proportion of income spent on housing was much greater in the city, in the case of mortgagors, 22%, and renters 45% of income, while in the whole of the UK, mortgage expenses represent 18% of income and rent 35%. These numbers change significantly depending on whether the couples have dependent children (Ministry of Housing, Communities & Local Government 2017).

In this same year, 94.6% of mortgagors had no difficulty in keeping up with payments, while 9% of renters were in arrears, other debts or responsibilities being the main factor (26%), followed by unemployment (21%) (Ministry of Housing, Communities & Local Government 2017).

In 2017, out of the 64% of owner-occupiers, 53% outright owned their home, more commonly couples without children, while the others had a mortgage. The following year, the portion of household income spent on housing remained the same for mortgagors but increased to 41% for

private renters (Ministry of Housing, Communities & Local Government 2018; Ministry of Housing, Communities & Local Government 2019).

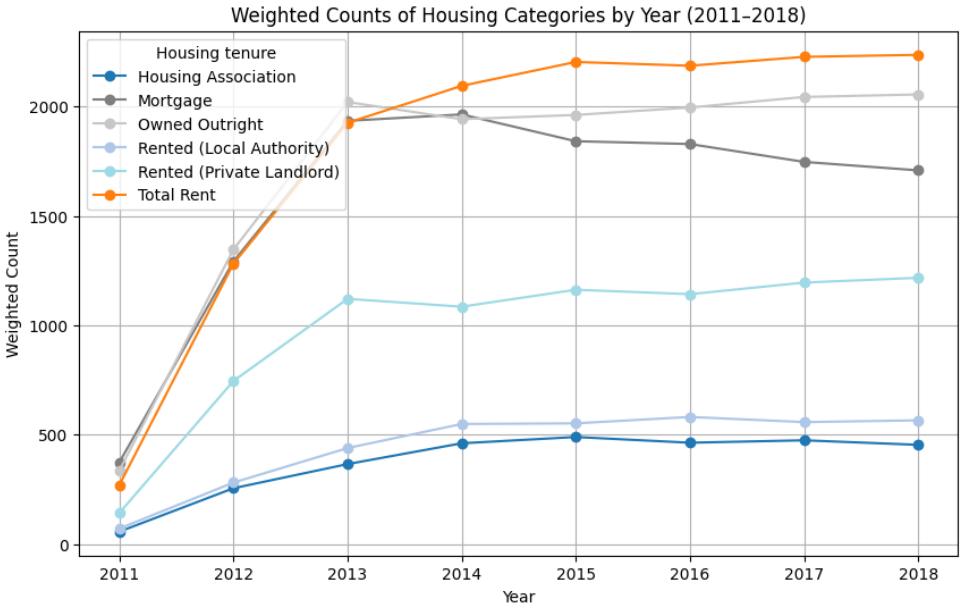

Figure 4: Housing categories over the years 2011-2018

Looking at salaries per housing tenure type for 13,758 observations in our dataset, they have been increasing for owner-occupiers and mortgagors in the years 2016, 2017 and 2018, but that was not the case for households renting to local authorities or renting to private landlords, which had a decrease in average salary in 2017, and a raise in 2018. In this last year, the average salary for outright owners was £4,455 per month, while mortgagors and private landlord renters earned an average of £3,348 and £2,971.

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In our dataset, looking at the housing cost burden[1] over the years 2016, 2017 and 2018, the average was 0.1227. Mortgagors had an average burden of 0.162, 0.171 and 0.164 in 2016, 2017 and 2018, while private landlord renters had 0.306, 0.318 and 0.295, for the same years. The maximum burden was consistently higher for this rent type compared to households with a mortgage.

Over the years 2011 to 2018, when asked if the household feels heavily, somewhat, or not burdened, by loan and interest payments, the most common response was always not burdened. Still, from 2016 to 2018, a growing trend of households who feel heavily burdened can be identified, especially compared to the decrease in households that feel somewhat and no financial pressure at all (Figure 5).

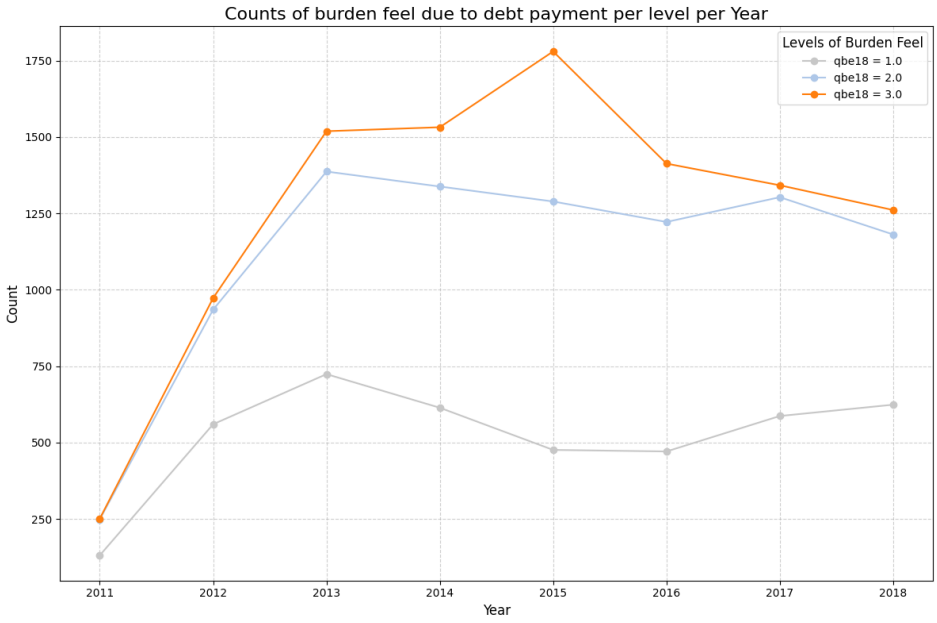

Figure 5 - Number of burden feel due to debt payment per year

[1] For renters: monthly rent payment/monthly income; for mortgagors: monthly mortgage payment/ monthly income.

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House Price Trends and Regional Variations

The period after the 2008 financial crisis was a period of recovery, the lower the interest rates allowed for cheaper mortgages which helped to stabilize the housing markets that were severely impacted by the crisis. The Bank of England reduced their bank rate from 5% in October 2008 to 0.5% by March 2009, where it remained until 2016 (Bank of England).

By December 2019, the average price for a property in the UK was £230,776, representing a 2.5% annual price increase for that year. This was the lowest annual growth for the UK since July 2013. The house price growth was the strongest in the Northern Ireland, followed by Wales and West Midlands. On the contrary, due to the 2016 Brexit referendum, London experienced a slowdown in house price growth, showing a consistent decrease in prices each month since July 2018. This shows a clear regional divide in the UK housing market.

On the other hand, the Dutch housing market experienced a house price decrease of 20% right after the 2008 financial crisis in the years of 2012 and 2013. This decrease followed by an extremely low-interest-rate environment due to the ECB monetary policies, led to an increase in housing demand post-crisis. In 2018, new-build Dutch homes showed a price increase of 13% (Statistics Netherlands (CBS), 2019). The recovery was perceived on the major cities, with Amsterdam and Utrecht showing the highest price increase, exceeding 10% annually by the late 2010s (Rabobank, 2018). The rural areas showed less housing demand, leading to slower housing price growth, reflecting the disparities in demand and economic activity.

The mortgage markets have a significant impact on housing prices and affordability through the cost of credit and mortgage availability.

GROUP PART

In the UK, a Mortgage Market Review was implemented by the Financial Conduct Authority in 2014. The MMR introduced more stringent checks on borrowers' affordability, to avoid irresponsible lending practices and prevent over-extending borrowers beyond their means. These new lending standards mandated borrowers to prove themselves capable of maintaining repayments, both at existing rates of interest but also during potential future rate increases, hence effectively stress-testing their finances (Financial Conduct Authority). These checks and tests made the access to liquidity inaccessible to certain individuals, which motivated new innovations such as buy-to-let mortgages and equity release products. The buy-to-let mortgage was designed to accommodate the landlords seeking to expand their property empire. The equity release products allowed older borrowers to access extra income without having to move or sell their current property. By 2018, a raft of specialist lenders emerged to take advantage of its ability to cater for more complex borrower profiles, such as self-employed, contractors and older borrowers. Growth in the later-life lending market was driven by the increasing numbers of specialist products that met the individual needs of borrowers aged 55-plus, enabling them to generate income in retirement or fund retirement itself through tailored solutions (UK Finance, 2019).

In the Netherlands, banks remain the dominant mortgage providers, holding approximately 69% of outstanding mortgage loans by the end of 2018. According to the statistics from De Nederlandsche Bank (DNB), interest-only mortgages accounted for more than half of outstanding mortgage debt as of the second quarter of 2017, reflecting a preference for lower initial payments among borrowers and the tax incentives, resulting in high loan-to-values.

In the last years, although, the Dutch housing market has undergone significant changes in lending standards. Such measures included reducing the maximum allowed LTV ratio from 106% to 100%

by 2018 and limiting mortgage interest tax deductibility to curb debt growth (Dutch Securitisation Association, 2022).

These new lending standards have made housing less affordable, with homeownership becoming more prevalent among higher-income households, underlining a growing disparity in housing wealth distribution. More than half of the Dutch housing stock is owner-occupied, while the rest belongs to the rental sector. The rental market is divided into a relatively large social housing segment and a smaller private rental segment. It is important to note that the share of social housing in the Netherlands is higher than in neighboring countries such as Belgium and Germany.

Dutch house prices are more volatile, while their supply is more inelastic compared to neighboring countries.

Looking at the period after the COVID-19 pandemic, there were significant changes in the way people behave. The option to work remotely remained a viable alternative for most corporations. This led people to stay longer periods at a time in their houses, and fewer commutes allowed these individuals to opt for housing further away from the city center. These results led to a flattening of the variation on the housing prices according to the distance from the city center (OECD, 2023).

This behavior of moving further away from the city and looking for a bigger house can be seen in the UK where detached house prices saw a growth of 25.9% which compared to the 13.3% growth in the prices of flats is much lower (Lloyds Banking Group, 2023).

On the other hand, Dutch house pricing has been increasing due to the high demand and low supply. The interest rate has been decreasing, allowing people to purchase their houses with an NHG

guarantee[2] at a cheaper price. Previously this guarantee would've cost the buyer 4.55% for a 10-year fixer period, and now it decreased to 3.6%. To fix the low supply, smaller landlords are getting impacted by rent control system and higher taxes on property ownership, motivating them to sell their properties to the tenants (IAmExpat, n.d.).

Looking at the mortgage equity withdrawal in the UK, in 2022 there was a 31% increase of new equity being released, totaling £5.58 billion. These releases can arrive in different schedules and amounts, although 63% are now being delivered in fixed amounts and only 3% are variable. These new features on equity release products have increased its adoption. The Equity Release council has acknowledged the need for flexibility with such products, introducing the new rule of ad hoc capital repayments. For instance, homeowners can now have an active management of their borrowing process, which allows the customers to pay back some of the loan when they choose to, reducing the amount of interest accrued over time and improving their ability to manage their debt (Professional Paraplanner, 2023). Previously, such products would not allow such repayment until the property was sold.

In the Netherlands, equity withdrawal products are limited in availability. However, it is expected for the interest in these products to grow as the population ages and the need for retirement funding solutions increases (Netspar, n.d.). As the global mortgage equity release market is projected to reach $50 billion by 2033, there is an incentive to develop this market in the Netherlands. This growth is sustained by the rising costs of living, which amplifies the need for products that allow

[2]The National Mortgage Guarantee is a government-backed insurance program designed to shield borrowers from residential debt in cases where they are unable to meet their monthly payment obligations.

homeowners to access their home equity (European Pensions and Property Asset Release Group [EPPARG], n.d.). The introduction of flexible options like the Home Equity Mortgage by ABN AMRO indicates a shift towards providing homeowners with more control over their finances, particularly in retirement.

Currently, equity release products are mainly offered by insurance companies, with very few banks involved, due to lack of funds and the nature of their business (Money Release, n.d.). If the funds were no impediment this could be a major opportunity for banks, due to the close relationship they gain with their clients throughout their lives.

Mortgage Fixed and Variable Rate Evolution 2011-2018

There is no doubt that the size and shape of the mortgage market have changed considerably over the last decade since the global financial crisis. Significant conduct and regulation changes were brought by the crisis to shield borrowers and businesses against the possibility of a future recession or economic shock (Bank of England 2024a).

Between 2011 and 2018, the UK mortgage market experienced a significant shift in preferences between fixed and variable-rate mortgages, influenced by a combination of economic conditions, policy decisions, and broader market trends (UK Finance 2024).

From 2011 to 2012, the UK was still recovering from the 2008 financial crisis. The Bank of England had set the base interest rate at a low 0.5% in 2009 to stimulate economic recovery, and this low rate remained in place until 2012 (Bank of England 2024a). Given this low and stable rate, variable-rate mortgages became a popular choice because they offered lower monthly payments than the relatively higher fixed rates, which were averaging around 4.5% at the time (UK Finance 2024). For many borrowers, the appeal of reduced initial costs outweighed the security of locking

in a fixed rate. Economic recovery was gradual, and there was little expectation that the Bank of England would raise interest rates soon, further reinforcing the attractiveness of variable rates for those looking to save on their mortgage costs (Financial Times 2024).

As the economy showed signs of recovery around 2013, fixed-rate mortgage rates began to decline, averaging around 4% by 2014 (Bank of England 2024a). Meanwhile, the Bank of England's commitment to a low base rate kept variable rates steady and affordable, allowing borrowers to continue benefiting from reduced monthly payments (ONS 2024). On the other hand, the fall in fixed-rate mortgage rates attracted more borrowers who were interested in securing a low rate over a long period (UK Finance 2024). The stabilization of the economy allowed the possibility of future rate increases, making fixed rates appear more attractive even to individuals who previously selected variable rates (Financial Times 2024). Consequently, a gradual change started as more and more borrowers chose the stability of fixed-rate mortgages (BBC Business News 2024).

The trend towards fixed rates became more pronounced in 2015 and 2016, as fixed mortgage rates dropped to historic lows, reaching around 3.7% (UK Finance 2024). The Bank of England maintained the base rate at 0.5%, and competitive mortgage products offered by lenders pushed both fixed and variable rates down (Bank of England 2024b). However, in August 2016, shortly after the Brexit referendum, economic uncertainty and concerns about potential impacts on growth led the Bank of England to take further action. To support economic stability, it reduced the base rate from 0.5% to 0.25%, marking the lowest rate in UK history at that time (Bank of England 2024a). Borrowers were able to affordably secure long-term stability with fixed rates at all-time lows. The certainty that their rates would not rise abruptly encouraged more borrowers to choose fixed-rate agreements, which accounted for most new mortgage contracts (BBC Business News 2024).

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As inflation signaled a growing economy in 2017, the Bank of England hinted at a possible change in its low-rate policy. This expectation came true in November when the base rate increased from 0.25% to 0.5% (Bank of England 2024b). Although fixed rates increased slightly, they remained attractive to borrowers who were cautious about additional rate hikes (UK Finance 2024). Furthermore, the impending uncertainty surrounding the Brexit discussions contributed to a more conservative economic environment, with many borrowers viewing fixed-rate mortgages to protect their finances from the potential instability caused by the UK's exit from the European Union (Financial Times 2024).

By 2018, the trend toward fixed-rate mortgages was observed more clearly. In August, the Bank of England raised the base rate again, from 0.5% to 0.75%, leading many fixed-rate mortgages to average around 4.36% (Bank of England 2024a). Despite the increase, fixed-rate options remained the top choice for many borrowers due to their predictability (UK Finance 2024). With the escalation of Brexit negotiations and the possibility of economic disruptions, fixed-rate mortgages' predictability became even more appealing, even with rising costs (BBC Business News 2024). The Bank of England's shift toward higher rates and the economic uncertainty surrounding Brexit solidified fixed-rate mortgages as the dominant choice for UK borrowers. Conversely, borrowers now viewed variable rates as riskier due to concerns that additional rate increases would cause a significant rise in their mortgage payments (ONS 2024). In summary, the period from 2011 to 2018 saw a clear shift in the UK mortgage market, as fixed-rate mortgages increasingly outpaced variable rates in popularity. Early in the decade, borrowers leaned toward variable rates due to low costs and stable economic conditions. However, as fixed rates declined and the possibility of future rate increases grew, borrowers leaned toward the predictability and stability of fixed-rate mortgages (UK Finance 2024). By the end of 2018, fixed-rate mortgages had become the preferred

choice, reflecting the impact of economic signals, Bank of England policy shifts, and Brexit related uncertainty on the choices of UK borrowers. This trend underscored the value of stability in a volatile economic environment (BBC Business News 2024).

Figure 6 - Interest rate type choice (2011-2018)

The graph confirms the trends described in the text, showing a clear shift in mortgage preferences between 2011 and 2018. Early in the period, variable rates were more popular, but from 2014 onward, fixed-rate mortgages became dominant as rates declined and economic uncertainty grew. By 2018, the preference for fixed rates, driven by concerns over rising interest rates and Brexit-related uncertainty, is clearly reflected in the graph

Introduction

The evolution of UK households between 2021 and 2023 was significantly influenced by the COVID-19 pandemic and subsequent economic challenges like housing affordability and demographic changes that shaped the composition and financial stability of United Kingdom households during this period (ONS 2024).

One of the most important decisions a household can make is which mortgage rate to take during the duration of the loan. A mortgage is a loan used to buy a house or property, where the borrower agrees to repay the loan over time, with interest (Forbes Advisor 2024).

Traditional mortgages have two main types that differ on the interest rate the borrower is paying: fixed-rate mortgages and variable-rate mortgages. A fixed-rate mortgage offers stability to the borrower's financial planning, since they commit to paying back the loan in equal instalments with an unchanging interest rate for the whole duration of the contract. A variable-rate mortgage is defined by an interest rate that can change based on how some reference indices, like the Euribor rate or the Central Bank reference rate, evolve (Albertazzi, Fringuellotti, and Ongena 2019). The payments instalments in this instance could change over time, which increases the exposure of the variable-rate mortgage to changes in the financial markets. In contrast, in a situation where interest rates are down, this kind of mortgage might be helpful since it gives the borrower better terms for repayment (Forbes Advisor 2024).

It is very important to acknowledge that the way fixed and variable mortgages work is different from country to country. In the UK, a fixed-rate mortgage is typically for two or five years and after the deal ends, if the borrower does not shop for a new mortgage deal, it will be automatically moved on to the lender’s standard variable rate. The variable-rate mortgage is typically higher than

the fixed rate, leading to an increase in monthly mortgage payments. This transition creates a financial risk for borrowers who do not act in time to renegotiate or refinance their mortgage, particularly in a rising interest rate environment (Sotheby's International Realty 2024).

Lower mortgage rates boost demand among homebuyers and increase their buying power, while higher rates lead to higher monthly payments, making homes less affordable. Typically, borrowers with a high credit score and a larger down payment qualify for the best mortgage rates. With this being said the decision between a fixed or an adjustable mortgage rate is very important, and the borrower should analyze carefully every aspect related to it (UK Finance 2024).

In this section, I explored data from the Bank of England Household Survey conducted between 2021 and 2023 to understand the factors driving the choice between fixed and adjustable mortgage rates among UK borrowers. This analysis aims to identify the primary factors influencing borrower decisions during a period marked by significant economic volatility and rising interest rates. The focus is to uncover how household characteristics, such as income, age, geographic location, and economic expectations, interact with market conditions to shape mortgage choices. By analyzing these patterns, this study contributes to a broader understanding of household financial behavior in response to changing economic conditions.

Interest Rates History

From 2021 to 2023, many shifts occurred in the UK mortgage market due to economic uncertainty, rising inflation, and strict monetary policy tightening by the Bank of England. This period initiated a turning point, shifting from historically low interest rates to a significant rise in borrowing costs, which deeply affected the mortgage landscape (The Times 2024).

In December 2021, the Bank of England increased its base rate from the extraordinarily low 0.1%, a rate held since the initial phases of the COVID-19 pandemic, to 0.25% (Bank of England 2024a). This marked the beginning of a series of rate hikes targeted at containing rapidly rising inflation, which resulted from a combination of post-pandemic supply chain disruptions, soaring energy prices, and labor shortages (ONS 2024). This initial increase signaled an important policy shift, with mortgage lenders promptly adjusting rates in anticipation of further hikes (UK Finance 2024).

In 2022, the Bank of England intensified its efforts to combat inflation, implementing several base rate increases. By August 2022, the base rate climbed to 1.75%, prompting many mortgage lenders to respond immediately by raising both fixed and variable mortgage rates (Bank of England, 2024b). Borrowers on variable-rate mortgages experienced the greatest effect, as their monthly payments rose with each base rate increase (Financial Times 2024). Homeowners with fixed-rate deals were temporarily shielded but faced significantly higher rates when their fixed terms expired (BBC Business News 2024).

By August 2023, the Bank of England raised the base rate to 5.25%, marking the highest level in over a decade (Bank of England 2024a). This aggressive tightening of monetary policy led to a steep rise in mortgage rates. By December 2023, the average two-year fixed-rate mortgage, previously at 2.34% in December 2021, climbed to 6.04% (UK Finance 2024). Homeowners whose fixed-rate terms ended during this period experienced considerable financial strain, as they had to remortgage at much higher rates, causing steep increases in monthly payments (Financial Times 2024). Meanwhile, those on tracker or standard variable-rate mortgages faced immediate and substantial rate hikes following each policy decision by the Bank of England (BBC Business News 2024).

Borrower behavior was significantly influenced by the rapid rise in interest rates. Many existing homeowners hurriedly sought to secure fixed-rate deals before rates increased further (UK Finance 2024). As fixed-rate mortgages became very costly, some borrowers began exploring tracker mortgages, anticipating that the Bank of England might eventually lower rates once inflation came under control (Financial Times 2024). Financial advisors recommended a range of strategies, including choosing short-term tracker deals or staying on a lender's standard variable rate, hoping to benefit from potential future rate reductions (BBC Business News 2024a).

Sustained inflation, uncertain monetary policy, and escalating mortgage costs created an extremely challenging environment for homebuyers and homeowners alike (ONS 2024). Given the volatile economic outlook, borrowers had to weigh the trade-off between the stability of fixed-rate mortgages and the potential savings from variable or tracker deals (Bank of England 2024b). By the end of 2023, the UK mortgage market had shifted dramatically, as interest rates soared to levels not seen since before the financial crisis, fundamentally reshaping the country's borrowing dynamics (Financial Times 2024).

Literature Review

Important attention has been given to the study of mortgage choice in economic as well as financial literature, owing to its important implications for household welfare, financial stability, in addition to macroeconomic policy. A range of topics, including risk preferences, macroeconomic conditions, borrower heterogeneity, as well as financial literacy, have been explored by researchers due to their investigation into the factors influencing borrowers' choices between fixed-rate mortgages and variable-rate mortgages (Albertazzi, Fringuellotti, and Ongena 2019; Campbell and Cocco 2014).

The literature on mortgages emphasizes the importance of household decisions and its sources of risk: house prices, labor income, inflation, and interest rates (Campbell and Cocco 2014). These risks often act simultaneously, creating a complex landscape where borrowers must evaluate trade-offs between financial flexibility and stability. For example, labor income uncertainty or inflation volatility can heavily influence decisions on whether to lock in rates or accept adjustable payments.

Mortgage decisions also affect broader economic outcomes, as aggregate borrowing choices impact financial market stability and central bank policy responses.

In relation to risk, it is important to consider borrower heterogeneity given the fact that some borrowers are quicker or slower to act based on market conditions and their individual financial situation (Deng, Quigley, and Van Order 1999). Borrower responsiveness is also shaped by external shocks, such as sudden interest rate hikes or periods of economic recession, which exacerbate inequalities in financial knowledge and preparedness. Alm and Follain (1987) suggest that borrower risk aversion is a primary factor determining mortgage choice. Consumers who are more willing to accept the uncertainty of future rate adjustments are more likely to opt for variable-rate mortgages, especially when market conditions make fixed-rate mortgages appear expensive or when they expect future income growth to cover possible increases in mortgage payments. Borrowers' ability to forecast future economic conditions also plays a critical role, as those with better financial literacy or access to professional advice are better equipped to make optimal decisions.

Variable-rate mortgages are more sensitive to interest rate increases, leading to higher default rates when rates rise. Fixed-rate mortgages, by contrast, experience higher default rates when house prices decline and interest rates fall, preventing borrowers from refinancing. These dynamics highlight the intertwined risks faced by borrowers and lenders, with significant implications for

financial institutions' risk management strategies. Additionally, borrowers with higher labor income risk tend to default more frequently, especially with variable-rate mortgages, where their income is closely tied to interest rate fluctuations (Campbell and Cocco 2014). This underscores the importance of tailoring mortgage products to meet the needs of diverse borrower profiles.

It is also important to emphasize the influence of the prevailing interest rate environment. When interest rates are high, consumers tend to favor variable-rate mortgages due to the potential for future rate declines, which could lead to lower payments over time. Conversely, in a low-interest-rate environment, borrowers may opt for fixed-rate mortgages to lock in the current rates and avoid future increases (Alm and Follain 1987). These patterns are not static and often reflect broader economic cycles and the monetary policy stance of central banks. For borrowers, the decision between fixed-rate and adjustable mortgages is influenced by the relationship between their future income and inflation. Borrowers whose income is either fixed or uncorrelated with inflation are more likely to prefer adjustable mortgages, which offer lower interest rates but variable payments. Conversely, borrowers with income streams tied to inflation may prefer fixed-rate mortgages, as these offer predictability despite potentially higher interest rates (Baesel and Bigger 1980). The distinction between short-term savings and long-term financial stability often defines borrower preferences, particularly in volatile economic conditions.

Albertazzi, Fringuellotti, and Ongena (2019) conducted an in-depth study of mortgage market heterogeneity across the euro area, focusing on the balance between fixed-rate mortgages and variable-rate mortgages. They argued that the wide variation in mortgage type prevalence stems largely from local demand conditions rather than supply-side constraints. Using a sample of 103 banks across 12-euro area countries, they found that demand factors such as inflation volatility, unemployment rate correlations, and financial literacy explained approximately 72% of the

observed variation, while only 19% was attributable to bank supply factors. This finding underscores the importance of borrower-specific characteristics in driving mortgage selection. The study concluded that national financial systems tailor their mortgage offerings based on historical economic experiences, regulatory environments, and household behavior. Additionally, the structure of banking systems and funding sources (such as reliance on fixed versus floating-rate bonds) also influence the prevalence of certain mortgage products in different countries.

Despite the inflation volatility, the UK mortgage market traditionally favors fixed-rate mortgages, especially for those seeking long-term payment stability (UK Finance 2024). Throughout 2021-2023, many homeowners sought fixed-rate mortgages to lock in historically low rates before the Bank of England started raising rates. The rise in inflation and interest rates heightened uncertainty, leading more borrowers to favor fixed-rate mortgages to hedge against future rate increases (BBC News 2024). Borrowers' behavior during this period reflected broader concerns about affordability, with many households opting for longer fixed-rate periods to secure predictable payments in an unstable economic environment. This trend also demonstrated the impact of macroeconomic policy on individual financial behavior, with Bank of England rate hikes playing a significant role in shaping mortgage choices.

Building on this, the psychological dimensions of mortgage choice were further examined by Botsch and Malmendier (2015), who precisely linked past inflation experiences to borrowers' preferences. High inflation periods dramatically increased the likelihood that those who experienced them would strongly prefer fixed-rate mortgages, despite the lower costs offered by variable-rate mortgages. Past inflation experiences strongly shape expectations of future inflation. This importantly influences borrowers to pay a substantially higher premium for financial stability because of "inflation memory" (Botsch and Malmendier 2015). The psychological impact of past

economic events is particularly pronounced in countries with high historical inflation volatility, where borrowers exhibit strong preferences for stability even during periods of economic recovery. Many studies show that macroeconomic conditions importantly influence individual financial choices, despite contrary signals from present market trends (Albertazzi, Fringuellotti, and Ongena 2019). Behavioral factors, such as overconfidence in predicting future rates or aversion to uncertainty, further complicate the decision-making process, underscoring the need for financial education to support borrowers in making informed choices.

Data Preparation

The dataset I worked with is from the Bank of England Household Survey during the period of 2021 until 2023. Initially, the dataset had data starting in 2011 and ending in 2023 with 5913 columns and 71142 observations, but the group decided to work only with the data from 2021 onwards. This decision has to do with the lack of observations in the years before 2021 in some variables that are key for the analysis. Given this, the database remained with the same 5913 columns but only with 18017 observations. After filtering the database to stay only with 2021 onwards, the next step was to choose which variables were key for the analysis I wanted to do.

In this survey, respondents are asked to answer questions by selecting the number that corresponds to the option that best represents their situation or opinion. Each option is associated with a specific number, making it easier for respondents to provide their answers. The only variable I transformed into object was be09.

After choosing the variables I wanted to work with, I noticed that one of the most important ones (be09) only had 4525 observations instead of 18017 like the others. The reason why this happened was because the variable “be09” referring to the type of interest rate had a condition in the survey:

only answered if the respondent is paying a mortgage and if he is mainly responsible for the household decisions. The final dataset had 14 columns and 4525 observations.

The variable ‘be09’, our target variable, was transformed into categorical. Capped, discounted, and base rate tracker are all variations of variable-rate mortgages. Each of these options has a variable component, meaning that the interest rate can change in response to changes in the lender’s standard variable rate or the central bank rate. That is why I decided to join them all in the same category: “Standard Variable Rate”. By combining the three types into the same category, we simplify our analysis in general, making it easier to draw conclusions from the model. Furthermore, this decision allows us to focus on the decision between fixed and variable rate types without getting lost in each variable rate variant and improves the model’s ability to predict between fixed and variable types.

There are three more categories, but they are not used in any of the modelling parts, because the options “Do not know” and “Prefer not to state” do not add any value to our analysis and the option “Other” only has 39 observations. With this being said, I decided to delete them from the dataset.

However, these weren’t the only changes made to variables. The variable regarding gender, ‘fgen’, was transformed into a dummy variable called ‘fgen_dummy’ and the variable ‘otheradults’ (now named ‘numberofadults’) had a little alteration: now it counts the adults in the house including the one answering the survey to be clear how many adults live in the house. To be easier to visualize there is a variable codebook in the Appendix (Table 1)

Exploratory Data Analysis

In this section, an initial exploration of the dataset was conducted to uncover patterns and trends within the dataset. The analysis focuses on understanding the distribution of key variables and identifying categorical relationships.

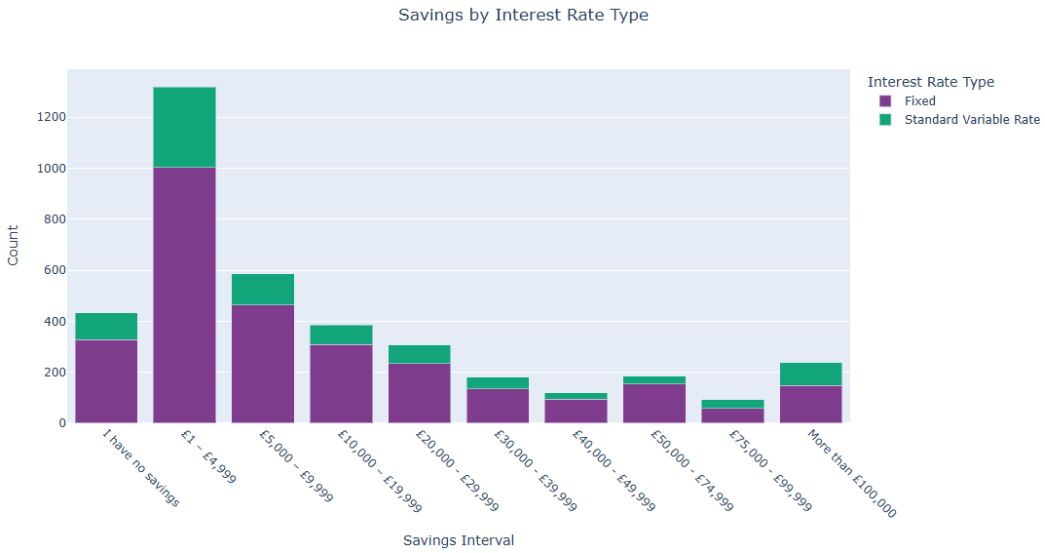

Figure 1 – Savings by Interest Rate Type

The first graph shows how savings interact with mortgage interest rate types. The results clearly show a strong pattern in how people prefer interest rate types across multiple saving categories. People with very little or no savings mostly choose fixed rates. Many people with limited financial reserves prefer financial predictability since fixed rates provide stability in monthly payments, which helps reduce potential financial risk.

When savings exceed £50,000, many people notice that the pattern changes in higher saving categories. Although fixed rates are still having a strong presence, it is observed that the proportion of people choosing standard variable rates is steadily increasing. Greater financial flexibility among higher savers may reflect their confidence in managing payment fluctuations along with leveraging market trends to their advantage.

The graph shows a strong link between savings levels as well as mortgage type preferences. Fixed rates appear more often for people with lower savings while standard variable rates attract those with higher savings. The underlying financial behaviours as well as risk tolerance related to different savings levels are adjusted with these patterns.

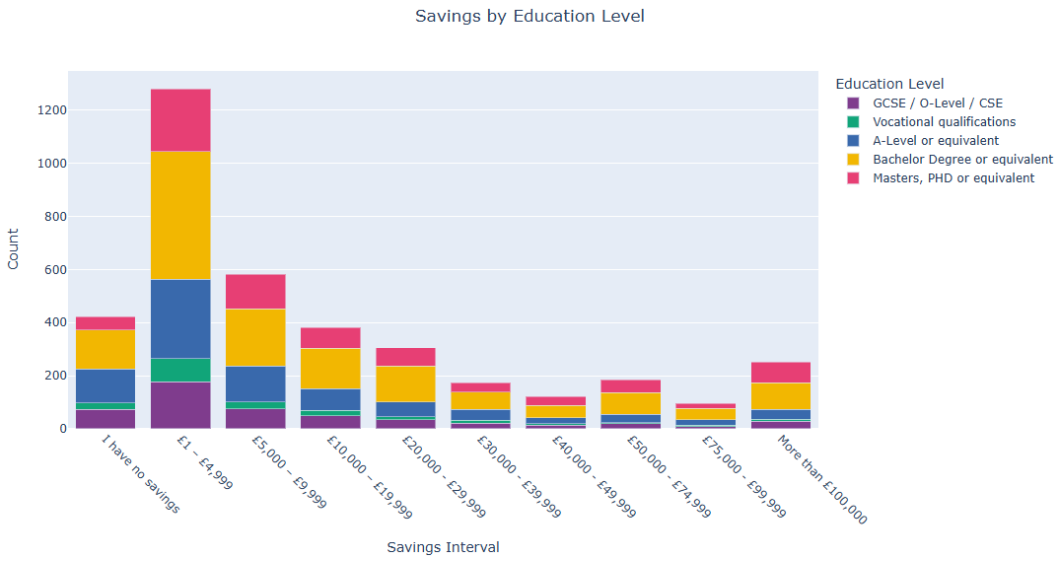

Figure 2 – Savings by Education Level

The last graph represents the distribution of savings across different savings intervals categorized by education level. The first observation is that the “I have no savings” category is significant across all education levels. This could indicate that individuals with lower educational level are more likely to have no savings, possibly due to lower income levels or limited financial literacy. In contrast, higher education levels have fewer individuals with no savings, suggesting better financial stability.

The savings interval "£1 – £4,999" contains the highest number of individuals across all education levels. This shows that a large proportion of the population, regardless of education, keeps savings within this range. However, individuals with “Bachelor Degree or equivalent” and “Masters, PHD

or equivalent" qualifications contribute significantly to this interval. This pattern could reflect cautious saving habits among educated groups or income constraints for certain professionals.

The data also highlights those individuals with "Vocational qualifications" and "A-Level or equivalent" are more evenly distributed across the lower and mid-tier savings intervals, with fewer representations in the highest savings categories. This suggests that these groups may have moderate earning potential and limited opportunities to accumulate wealth compared to those with university degrees.

Overall, the graph underscores the strong association between education level and savings behavior. Higher education is positively linked to greater financial security and the ability to accumulate substantial savings, while lower education levels are more associated with financial vulnerability. This relationship likely reflects the broader economic benefits of education, including higher earnings, better financial planning, and access to opportunities for wealth accumulation.

Modeling Part

In the dataset, certain variables represent multiple-choice questions where each respondent selects one option among the available choices (e.g., options 1, 2, 3, or 4). Each of these numbers corresponds to a specific response option chosen by the respondent. For example, a respondent might select option 1, 2, or 3, depending on their preference.

However, when implementing a machine learning model, keeping these variables in their original numeric form can introduce unintended bias. This is because the model may interpret higher numbers as more important or weighted compared to lower numbers. For instance, the model might treat option 3 as more "significant" than option 1 simply because 3 is numerically greater than 1.

This could skew the model's predictions, especially if the response options are ordinal but don't necessarily represent an increasing level of importance.

To address this, I transformed these variables into categorical form, which allowed me to treat each option as a distinct category rather than a numerical value. After converting them to categorical, I used one-hot encoding to create dummy variables. This encoding process converts each category into its own column, with binary indicators (0 or 1) representing whether a respondent selected that specific option.

This approach ensures that all options are treated equally in the model, without assigning any implicit weight based on numerical order. The model now interprets each option as a distinct feature, preserving the original intention of the multiple-choice format and avoiding any bias from numeric values. The variables submitted to this process were 'qregion', 'recent_workingstatus', 'numberofadults', 'incomev2comb', 'be2a', 'qual', 'be13', 'be23', 'boe65a' 'boe50'.

I decided to implement a machine learning model to classify mortgage interest rate types, specifically to distinguish between "Fixed" and "Standard Variable Rate" mortgages, using a decision tree classifier. This process begins with excluding columns representing specific time periods (the ones regarding 'boe50'), which refer to years far from the period we are currently analyzing, since these older timeframes are not directly relevant to understanding current trends or behaviors.

Given the fact that the dataset is unbalanced (much more individuals with fixed-rate mortgages than variable-rate mortgages), I used an under-sampling technique to make sure that both mortgage types are equally represented, improving the model's ability to learn patterns for each class.

The factors influencing mortgage preferences (Fixed vs. Standard Variable Rate) were modelled using a Decision Tree Classifier, owing to its interpretability and flexibility. This makes it well-suited for understanding the effect of quite important variables such as geographic location and borrower demographics. Nonlinear relationships, and interactions between variables are caught, allowing for a subtle analysis of the complicated factors shaping mortgage choices.

Recency's importance in shaping mortgage preferences is highlighted by the decision tree (Fig. 3), particularly concerning the macroeconomic environment along with evolving borrower behavior. The meaningful influence of the mortgage origination period is shown by the root node (‘boe50_2021-2022’) along with subsequent temporal splits (‘boe50_2019-2020’).

Mortgages from the recent 2021-2022 period importantly draw attention to the importance of the ‘boe50_2021-2022’ split at the root node. Important monetary policy changes defined the economic environment for many borrowers between 2021 and 2022. To combat rising inflation, the Bank of England raised interest rates, causing borrowers to urgently seek fixed-rate mortgages. Immediate market conditions, heavily influencing many borrower decisions, analytically reflect these very recent events. The prospect of continued rate hikes caused many borrowers in this timeframe to lock in fixed rates, safeguarding against future increases.

Historically low interest rates, along with their stability, characterized the economic context in which many borrowers, especially those from 2019-2020 (‘boe50_2019-2020’), operated. Record-low Bank of England base rates spurred many borrowers to choose many variable-rate mortgages with cheaper upfront costs. The attractiveness of fixed versus variable mortgage products is strongly affected by recency, or the evolving nature of economic conditions, as shown by these observations.

Borrower demographics, along with geography, increasingly influence the importance of recency as the decision tree advances. Borrowers outside Greater London concentrated on stability during 2021-2022, preferring fixed-rate mortgages, which shows their sensitivity to recent economic instability. High property prices plus a very high cost of living characterize Greater London.

Recency importantly shapes preferences, as shown by specific demographic breakdowns. Fixed-rate mortgages appeal to older borrowers. These borrowers, aged 75.5 or less, have faced past inflation or economic uncertainty. Decision-making is heavily influenced by recent or past impactful economic experiences, quite clearly reflecting the concept of "recency bias" (Investopedia 2024). Even during calm economic times, experience with importantly high inflation or dramatically volatile interest rates might strongly influence some borrowers to avoid the risk of variable-rate mortgages. This finding aligns with the work of Botsch and Malmendier (2015), who demonstrate that past inflation experiences dramatically shape borrowers' preferences, making them more likely to opt for fixed-rate mortgages. This psychological imprint, referred to as "inflation memory," underscores the lasting impact of past economic conditions on mortgage decision-making, linking borrower behavior not only to current conditions but also to their historical financial experiences (Botsch and Malmendier 2015).

Rising rates and inflationary pressures have deeply affected recent mortgage choices, as evidenced by the root node and temporal splits, with borrowers in the most recent periods preferring fixed-rate mortgages. Recency dynamically drives borrower behavior, geographic and demographic factors plus a changing economy importantly shape mortgage decisions.

The Decision Tree model achieved an overall accuracy of 74%, indicating it performs well in predicting mortgage preferences but with some limitations. The model shows stronger performance in identifying variable-rate mortgages, with a recall of 84%, meaning it correctly captures 84% of

these cases. However, its precision for this class is lower at 69%, suggesting that some predictions identified as variable-rate mortgages were fixed-rate mortgages. In contrast, for fixed-rate mortgages, the model achieves a higher precision of 82%, meaning most of the predictions for this class are accurate, but the recall drops to 65%, as it misses a significant portion of actual fixed-rate cases (Table 2).

The confusion matrix confirms this pattern, with 215 fixed-rate cases correctly classified but 116 misclassified as variable-rate mortgages. Similarly, 257 variable-rate mortgages cases were correctly identified, with 46 misclassified as fixed. This imbalance suggests the model leans toward identifying variable-rate mortgages, likely due to stronger patterns in the data. Despite this, the F1-scores of 0.73 for fixed-rate mortgages and 0.76 for variable-rate mortgages reflect balanced overall performance, making the Decision Tree a reliable model for understanding the factors influencing mortgage preferences (Table 2)

Limitations

The use of the Decision Tree Classifier in this analysis provided valuable insights into mortgage preferences, but some limitations emerged due to the nature of the model and the scope of the analysis. These limitations are related to the characteristics of the model itself, challenges associated with the available data and the interpretation of results.

One of the primary limitations of the Decision Tree Classifier lies in its inherent tendency toward overfitting. The model can become highly specific to the training data, capturing noise rather than meaningful patterns if its depth is not carefully controlled. In this analysis, this issue was mitigated by limiting the maximum depth of the tree. However, while this adjustment reduced overfitting, it also restricted the model's ability to capture more complex interactions between variables,

potentially oversimplifying the factors influencing mortgage preferences (Scikit-learn Developers 2024).

The quality and scope of the dataset also imposed certain limitations. While the analysis included relevant demographic, geographic, and temporal features, certain critical financial variables were unavailable. Additionally, the dataset may have been imbalanced, requiring under-sampling, which reduced the number of observations available for training and testing. This may have limited the generalizability of the results to a broader population.

Another key limitation relates to the interpretability and generalizability of the Decision Tree Classifier (Scikit-learn Developers 2024). While the model's visual structure made it easy to interpret, its simplicity may affect its applicability beyond the analyzed dataset. The model's findings are time-sensitive, reflecting borrower behavior specific to the UK mortgage market from 2021 to 2023. These findings may not hold in different economic contexts or in regions with distinct mortgage market structures.

In conclusion, while the Decision Tree Classifier successfully revealed meaningful patterns and relationships among variables, its reliance on simple decision rules, sensitivity to data changes, and limited capacity for handling variable interactions restricted its ability to fully explain mortgage preference behavior. Future research could address these limitations by incorporating additional financial and psychological variables, using alternative machine learning models, and applying more robust data sampling techniques to ensure broader generalizability and improved predictive accuracy.

Conclusion

This thesis examined key factors influencing mortgage preferences in the UK from 2021 to 2023, emphasizing the roles of temporal, geographic, and demographic variables. The findings confirmed that the time of mortgage origination significantly shaped preferences, with fixed-rate mortgages becoming more popular during periods of economic uncertainty driven by inflation and interest rate hikes.

Geographic differences also played a role, with borrowers outside Greater London favoring fixed-rate mortgages, likely due to more stable housing markets. Demographic factors such as age and household size further influenced choices, with older borrowers and smaller households showing a stronger preference for fixed-rate products.

These findings align with psychological theories like inflation memory, where past inflation experiences drive risk-averse financial behavior. Overall, the study highlights how borrowers' preferences are shaped by a combination of economic, geographic, and personal factors, offering valuable insights for lenders and policymakers navigating the UK mortgage market.

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Appendix

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Variable	Type	Description
id_abs	float	represents the unique identifier for observations
Year	integer	represents the year of the observation
we_factor	float	weighting factor for each observation
fgenage_1	integer	represents the age of each respondent
qregion	categorical	provides regional categorization within the UK
fgen_dummy	dummy	represents the gender of the respondent (male=1, female=0)
recent_working_status	categorical	represents the respondent's working status
nochildren	integer	represents the number of children living in the house (under 16)
numberofadults	integer	represent the number of adults living in the house, including the one answering the survey
incomev2comb	categorical	represents the combined income of the household
qual	categorical	represents the level of education
be09	categorical	represents the type of interest rate that is being paid on the mortgage
boe65a	categorical	asks if the respondent could state how much (and all other members of your household) currently have in total, saved up in savings accounts
boe50	categorical	asks when the respondent last took out a mortgage or secured loan on your main home, or made a change to the amount borrowed on an existing mortgage or secured loan on his property

Table 1 – Variable Coodebook

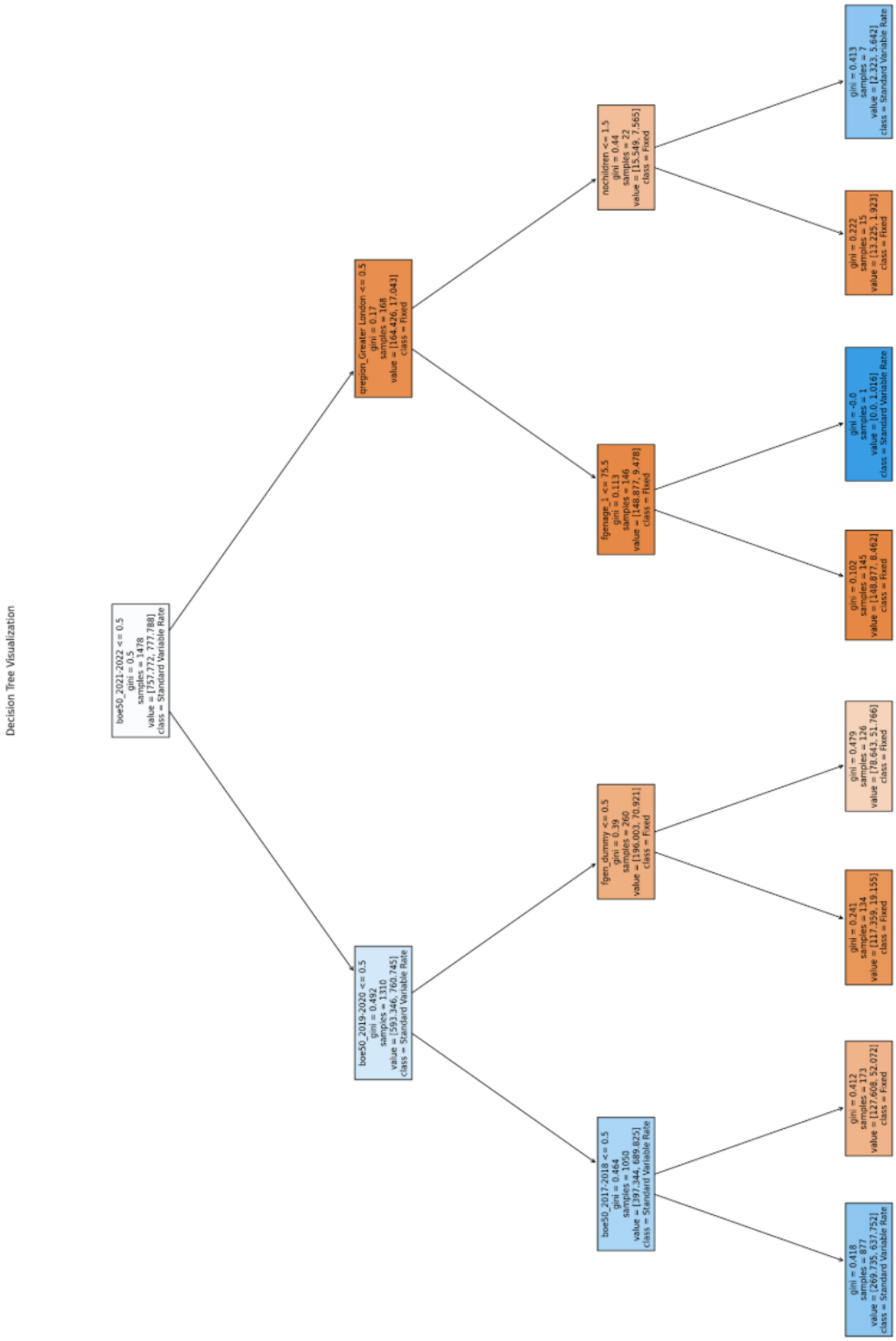

Figure 3 – Decision Tree Classifier

Decision Tree Performance:

Accuracy: 0.7431

Classification Report:

	Precision	Recall	f1-score
Fixed	0.82	0.65	0.73
Standard Variable Rate	0.69	0.84	0.76
accuracy			0.74
macro avg	0.75	0.75	0.74
weighted avg	0.76	0.74	0.74

Confusion Matrix for Decision Tree:

	Fixed	Standard Variable Rate
Fixed	215	116
Standard Variable Rate	46	257

Table 2 – Decision Tree Performance