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How do interest rates effect consumption in the UK?

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Abstract

This chapter analyses the link between interest rates and consumption in the UK and will allow better understanding of the relationship between these two variables, as this is extremely important to the Bank of England and the monetary policy that it adopts. Analysis of the empirical evidence from the period last 60 years has produced some interesting observations and the most significant discovery was the way consumption responds to interest rates changed over time. In the first 30 years the real interest rate had a much higher coefficient, with the lagged variable being insignificant. However, in the second period, the opposite occurred, and the lagged variable had a significantly higher coefficient. Overall, consumption and interest rates do have an inverse relationship, as in both periods the interest rate experienced a negative coefficient when regressed with consumption. Therefore, changes in consumer decision making, and the development of a lagged response to interest rate changes could alter how governments influence consumption.

JEL Classification Codes: E21, C32

Keywords: consumption, interest rate, modelling, UK

Introduction

As early as 1966, Milton Friedman noted how important interest rates are to growth and prosperity (Friedman, 1966), and his central argument focused on links between the costs of borrowing and the opportunity cost of saving. This chapter assesses how strong the link is between these two economic variables drawing upon both economic theory and empirical evidence.

Economic theory posits a strong inverse relationship between the interest rate and consumption, inferring that as the interest rate increases, consumption will inevitably fall, with the converse being also true. It is anticipated that consumer decisions to spend or save are directly impacted by changes in the interest rate. The Bank of England have used this principle to support the development of their monetary policy and regularly adjust the interest rate to regulate consumption levels.

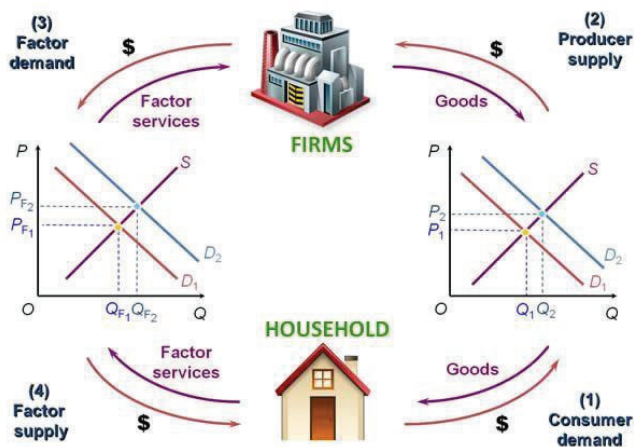
The chapter will include an analysis of UK historic interest rates and consumption data between 1960-2019, to measure the correlation between these two variables. The research has been split into two distinct 30-year time periods, allowing an in-depth examination, and highlighting any potential changes in consumption patterns.

The chapter starts with a literature review, which will provide an overview of the economic theory and related literature surrounding this topic. The next section is the econometric methodology, explaining how the OLS regressions and variables will be analysed in the model. The data section describes the reason for the selection of the variables, along with an explanation for the chosen data sources and any changes. The results section evaluates the outcomes that were obtained from the regressions, assessing the coefficient and the significance of the results. The discussion section analyses the results and discusses some potential explanations for the regression outputs, highlights the limitations of the study, and suggests some possible areas for future research.

Literature review

The circular flow model depicted in Figure 1 below illustrates how money moves within an economy and highlights two main players: households and firms. The model separates the flow of goods and factor services, helping understand how changing consumer demand can influence consumption throughout the economy.

Figure 1: Circular flow of income model



Consumption is a fundamental quantity that government needs to manage correctly; in particular, high consumption is vital in how successfully a country operates. Consumption is the largest component of aggregate income and spending, and overall prosperity relies upon it to maintain GDP and living standards at required levels. This has resulted in significant research being conducted on this topic and this has led to the analysis on the relationship between interest rates and consumption and the best policy mechanisms to manage it.

The Bank of England (2021) defines the interest rate as either the cost of borrowing money, or the return from saving. Consumers face two major decisions, whether to spend or save, and the interest rate greatly affects this choice. When the interest rate is high, it discourages spending and promotes saving. Whereas when the interest rate is low, consumers are more inclined to spend, as the reward for saving is minimal, known as an inverse relationship; Boskin (1978) reported evidence of a negative relationship between consumption and the real interest rate.

Government financial institutions have identified a range of fiscal and monetary policies designed to influence consumption and income and there are specific

monetary policies targeting the use of interest rates to control consumption. For example, in 1998, the Bank of England was given responsibility for setting interest rates to maintain suitable spending levels in the economy.

Economic theory suggests that interest rates and consumption have an inverse relationship; however, some research disagrees, with several economists recording the opposite, e.g., Weber (1970) and Springer (1975). This chapter is particularly relevant, as the UK has consistently used regular interest rate changes to stimulate the economy, with the government, through the Bank of England, regularly adjusting them, to try and enhance consumption. A significant amount of the literature on this subject is focused purely on theories of consumption, which establishes how consumption works and the best policies to influence it. The specific relationship between interest rates and consumption has not received the same level of investigation and many of the studies have produced conflicting results.

Keynes established the first main consumption theory in 1936, with his book *General Theory of Employment and Interest*. This was a key writing in the field of macroeconomics and consumption and prompted controversy. The Keynesian consumption function is based on the relationship between consumption and disposable income, as expressed in the formula below:

$$C=A+MD$$

C= Consumer spending

A= Autonomous consumption

M= Marginal propensity to consume (MPC)

D= Disposable income

The equation asserts that consumption is determined by a fixed autonomous level plus the disposable income and the marginal propensity to consume (MPC). However, Keynes adds that the effect of increasing income on consumption will eventually slow down once income reaches a high level. MPC reduces as income increases, suggesting that consumption declines as wealth increases. It is important to note that this theory was developed in the 1930s without access to large data sets on income and expenditure or computer processing

power. Keynes is certainly responsible for developing economic thinking, but his analyses is by no means comprehensive given these restrictions.

There are two elements of Keynes' theory on consumption that we need to consider. The first is the relationship between how income affects consumption, and Keynes believes that as income rises, so will consumption, but this is not a linear relationship and the rate of consumption growth reduces as higher income levels are reached. Secondly, Keynes suggests that changes in income will have an immediate impact on consumption. However, there are numerous alternative views on both elements, for example, Kuznets (1946), found a consistent relationship between income and consumption and challenges Keynes's view that consumption growth diminishes at higher income levels. Friedman (1957), Modigliani and Brumberg (1957) and Hall (1978) also disagreed with Keynes' view on the immediacy of the relationship and argued that sometimes consumption decisions were delayed. This suggests a much more complicated relationship between income and consumption, which can sometimes lead to a lag between cause and effect, which could be represented by $C_{t} = a + mY_{t-1}$.

The recent neoclassical economic literature, e.g. Lucas (1976), was critical of Keynes' theory of consumption function, believing it is not accurate and suggested adjustments or the inclusion of other variables to improve its relevancy. The Relative Income Hypothesis developed by Duesenberry (1949) argued that consumption behaviour was impacted by an individual's income relative to others, rather than absolute income. This suggests that an individual's position in the total income distribution is relevant rather than the nominal or monetary value. This theory also challenges expected consumption behaviour when income reduces, most theories suggest that a reduction in income would lead to a direct and immediate reduction in consumption. Duesenberry (1949) argued that as income reduces there is not necessarily a response in consumption as the individual would have adapted to that consumption level. This promotes the idea that consumption is based on previous consumption levels, rather than previous income. It could be inferred that Duesenberry (1949) is suggesting a level of irrational behaviour that interferes with an individual's ability to adjust consumption levels.

Next, the Random Walk Hypothesis developed by Robert Hall, (1978) offers a different perspective. Hall agrees that consumption decision making is complex

and multi-faceted and involves conscious decision making by the individual. His theory suggests that people have rational expectations and use all information available to forecast future variables including income. Hall's work offers an interesting challenge to both the impact on consumption of changes in income and its timing. His belief in rational decision making could also explain Duesenberry's observation of potential irrational behaviour because the individual is considering future potential increases in income.

The Permanent Income Hypothesis (PIH) developed by Friedman (1957), offers a crucial contribution to the development of consumption theory both in terms of the challenge of previous concepts but also its influence on latter economic literature. PIH states that consumption is dependent on permanent income and consumers respond to temporary changes in income by using saving and borrowing to smooth consumption. In this context, permanent income is defined as the level of spending consistent with the long-term and permanent level of income a household expects. This suggests that consumption is not just determined by current income but future expected income. This theory is contradictory compared to Keynes' consumption function as Keynes believes that changes in income will cause an increase in consumption, whereas Friedman believes that consumers are more rational and that temporary increases in income will not result in increases in consumption. This contrasts with Hall's view, which would suggest a more rational evaluation of options which may ultimately lead to a short-term increase in consumption. Deaton (1987) argued that permanent income theory could not offer a clear explanation as to how permanent income was a superior indicator to current income in explaining consumption smoothing.

The main limitation to Friedman's theory is that it assumes that the MPC from transitory income is zero. Parker (1999) and Souleles (1999) found some overreactions to increases in transitory income. However, some consumers are irrational and will respond to interest rate changes and increases in income with greater consumption.

The Life Cycle Hypothesis (LCH) is a consumption theory developed by Modigliani and Brumberg (1957); this theory is very similar to the PIH. The LCH states that income varies over people's lives and that individuals chose a level of consumption

that enables them to maintain a smooth consumption path over their lifetime. The formula for the LCH is:

$$C = \frac{W + RY}{T}.$$

C= consumption

W = Wealth

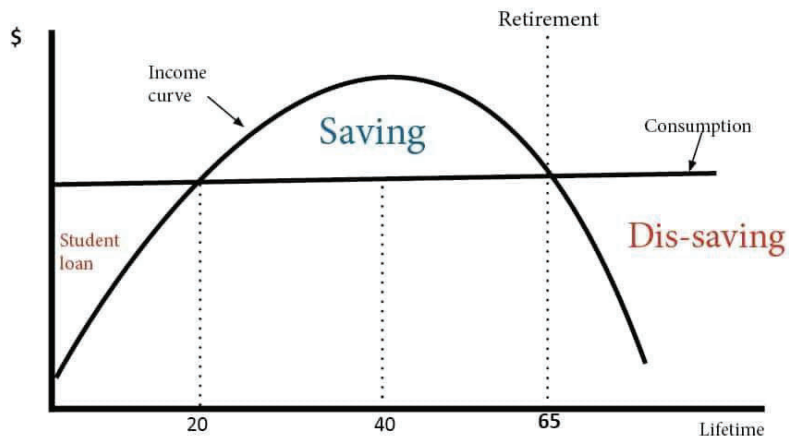
R = Years until retirement. Remaining years of work

Y = Income

T= Remaining years of life

This formula and figure 2 below highlight the importance of a wealth variable as the relationship between wealth and consumption is important in this theory. Figure 2 illustrates an example of the relationship between income and consumption, according to LCH. This demonstrates that there are periods in the life cycle, of both over and under consumption, and not the direct and immediate correlation that Keynes claimed. This once again makes the case for some level of rational decision making that takes into consideration total anticipated income levels, which allows individuals to manage their consumption in the long term. Some economists believe there are limitations of this theory, as it assumes people are rational and forward thinking, however, behavioural economics suggests that individuals can be irrational and have numerous motivations to avoid long-term financial planning. King (1982) suggested that life cycle consumption patterns can be found in approximately 75% of the population, however, 25% don't plan for the long term. King's results strongly support the existence of life cycle consumption but argues that this does not apply for a significant proportion of the population.

Figure 2: Highlights the Life Cycle Hypothesis



PIH and LCH have also been refined in a broader interpretation of consumption smoothing, Morduch (1995), suggests that individuals assign value to a stable path of consumption and find fluctuations undesirable. Changes to interest rates are just one example of fluctuations that can occur, and they can have a significant impact on consumption patterns. Consumption smoothing supports the belief of rational decision making and the desire to consider long term implications. This decision making can result in deferred consumption but equally it can lead to an increase in consumption due to the gains made from saving. This view is aligned to research from Weber (1970), who obtained similar results, but also argued that low interest rates caused an inversion of this behaviour as consumption isn't deferred. This also means that spending power hasn't been compounded with the gains of the interest and therefore total consumption is ultimately lower.

For consumers to achieve consumption smoothing, sometimes it is necessary to borrow to finance short term consumption and this is particularly attractive when interest rates are low. Conversely, when interest rates are high this can encourage high levels of savings and a dramatic decrease in consumption. This rational behaviour is a deviation from Keynes' theory and highlights the significant role that interest rates have on consumption decisions.

The principle of the income effect is that increasing income leads to an increase in consumption and price, the reverse is also true. This is related to the substitution effect which describes how this change in price can lead to a change in demand and the substitution for alternative products. However, changes in income do not

necessarily lead to changes in purchasing power due to inflation and deflation. These principles don't take into consideration Keynes' belief in the working of the MPC. In contrast, the wealth effect argues that it is insufficient to consider income as the sole influence on consumption and it is essential to incorporate overall wealth. The wealth effect is an interesting concept that incorporates several ideas from other consumption theories. It suggests the rational consideration that wealth rather than income is a better motivation for consumption, but still holds Kuznets (1946) belief of a permanent correlation between the two. Some economists argue that consumption is a function of wealth and income, and the wealth effect can be more significant with lower income households as they have a higher MPC, this is a consistent theory among the consumption literature. Berger-Thomson, Chung, and McKibbin (2010) analysed micro data in Australia and concluded that different income groups have differing marginal propensities to consume.

Other research builds on this and identifies comparatively high positive multiplier effects associated with immigrant populations compared to native populations. In the national income identity $Y = C + I + G + (X - M)$ and a positive change in any change of the independent variables will lead to a multiple expansion of Y; the quantum being determined by the multiplier (k). The example below states change in GDP is equal to the multiplier effect when there is a change in exogenous consumption (C) and more formally:

$$\Delta Y = k \Delta C$$

where: k is the multiplier and equal to $\frac{1}{1 - MPC}$ and the MPC is the Marginal

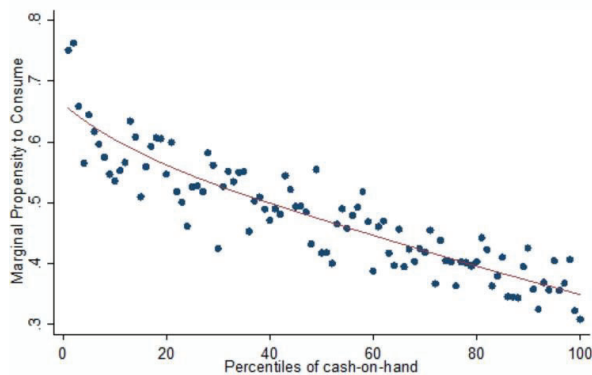
Propensity to Consume

$$k = \frac{1}{1 - MPC}$$

Where there is evidence that the MPC of an immigrant is higher than the MPC of the native population, there is likely to be a larger positive effect upon GDP and further stimulating growth, incomes, and employment. As Layard and Nickell (1994) note, the number of jobs in an economy are not fixed and therefore jobs and wages can both rise because of net positive immigration.

For example, Milbourne (1997) suggests that immigrants can raise levels of consumption and investment and so can help to boost wages for all, but the analysis is essentially theoretical and focuses on academic modelling rather than empirical research. Jappelli et al (2013) suggest there is a strong link between cash liquidity and the marginal propensity to consume: the less cash which a person has access to, the higher their MPC. The scatter graph in Figure 3 below shows, a potential link and although this data is based on Italy, there is no strong a priori reasons why a similar relationship would not also be true in the UK or indeed other developed nations.

Figure 3: Estimates of marginal propensity to consume by percentiles of cash liquidity (cash on-hand)



Source: Jappelli (2013)

The final main consumption theory is intertemporal choice developed by Fisher (1930), in his Theory of interest. Fisher proposed the timing of income is irrelevant as consumers can borrow or save across periods. Fisher assumed consumers are forward-looking and choose the optimal consumption for the present and future to maximize satisfaction. This is like theories such as consumption smoothing and the PIH which assume rational decision making and forward planning. King's (1982) findings suggest this may be partially true but casts serious doubt that this is an economic principle that applies to everyone. Fisher's theory contradicts Keynes' consumption function which argues that current income dictates consumption.

There are a range of theories which disagree with Keynes' consumption function and argue against a simple cause and effect explanation and have suggested a range of factors that influence rational decision making. There may be disagreement on which

is the most important influence, but it is commonly accepted that changes in income will ultimately affect consumption decisions. There are also numerous views that claim to have identified not only the factors that influence the level of consumption but also its timing. Interest rates have been identified as a significant influence in this debate because not only do their movements impact on income, but they are also taken into consideration as part of rational decision making.

Research on how interest rates affect consumption has generated contradicting viewpoints, whilst there is an agreement that there is a relationship, there are conflicting views on whether it is positive or negative. Wright (1967) and Heien (1972), both suggested a significant, but inverse correlation; based on detailed empirical evidence, they argued that increasing interest rates would encourage saving and reduce consumption. This is contrary to Weber (1970) and Springer (1975), who both suggested interest rates have a positive impact on consumption, but they found no evidence to suggest an inverse relationship.

Campbell and Mankiw (1989) ran a series of regressions utilising a real lagged interest rate from 1953-1986 to investigate the correlation with consumption. The results produced rejected the assumptions that a lagged variable influences the rate of growth of consumption. These results are interesting because they do not indicate delayed consumption that some of the theories such as consumption smoothing would suggest.

The initial empirical analysis of the impact of interest rates on consumption focused on aggregate consumption which was then further developed by separating durable from non-durable goods. Hamburger (1967) and Mishkin (1976) continued this investigation and reported a strong inverse relationship between nominal interest rates and consumer expenditures on durable goods. These results were replicated by Mankiw (1985) when he utilised real interest rates rather than nominal and their impact on durable good consumption. Hansen (1996) argued that the interest rate elasticity of the non-durable consumer goods is almost zero.

Most literature agrees that there is an inverse relationship between interest rates and consumption but there is little consensus on how much rational decision-making influences timing. Literature also suggests that durable consumption is more responsive to interest rate changes compared to non-durable consumption.

Econometric methodology

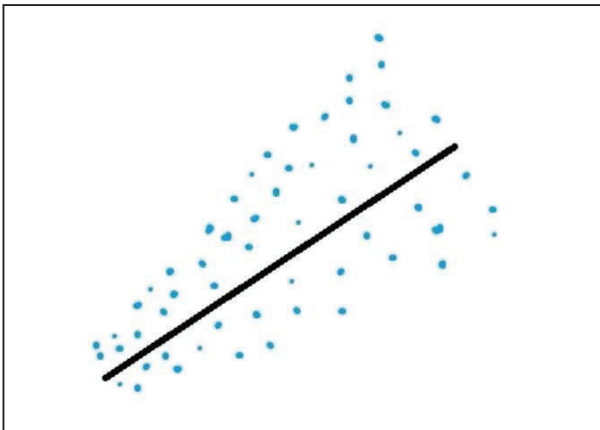
OLS has been used for econometric modelling, as it produces the most accurate results and unbiased and consistent estimators, even when time constant attributes are present. The Gauss-Markov theorem supports this view and states that OLS is BLUE, suggesting that OLS is the best linear unbiased estimator, and it has the minimum variance or the narrowest sampling distribution.

All OLS assumptions have been reviewed and their application in this research confirmed. Some of the most significant assumptions include assumption 1, that the model is 'linear in parameters', as the regressions fit the linear pattern and have the expected outcome. Past papers have used linear models and they have been able to achieve results that are robust and valid.

Assumption 4 has to do with testing for multicollinearity, or exploring when there is high intercorrelation between two or more independent variables, as this undermines the statistical significance of a variable. This has been completed and the results demonstrate that there is no multicollinearity (or perfect collinearity) in the model.

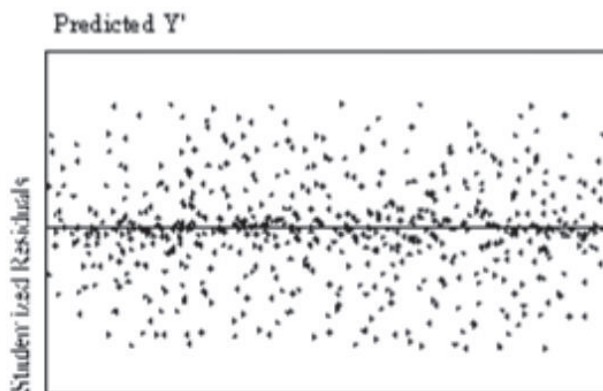
Assumption 5, homoscedasticity, requires that all the error terms are the same across all values of the independent variables. A Breusch Pagan diagnostic test was conducted to test for any heteroskedasticity, and the results show that there is no heteroskedasticity in the model as both P values are above 0.05. Also, a Durbin Watson test for serial correlation was used and the results suggested confirming that none were identified. In conclusion, all OLS assumptions have been satisfied. Overall, homoscedasticity is a key assumption underpinning the regression model and a vital condition if the estimators are BLUE and meet the Gauss Markov conditions. In contrast, heteroscedasticity means unequal scatter of residual or error terms (Downs and Rocke, 1979). In figure 4, the residuals clearly do not have equal dispersion: the spread of errors clearly increases as the explanatory variable increases.

Figure 4: An example of heteroscedasticity



It is ideal, when there has been little, if any, change in the dispersion or scatter of residuals, as shown in Figure 5 below. Optimally, all the residuals are randomly scattered around 0, the horizontal line, providing a relatively even distribution. Heteroscedasticity is indicated when the residuals are not evenly scattered around the line, as in figure 4 above, where the residuals clearly 'fan out'.

Figure 5: An example of homoscedasticity



Source: Matsuany and Adinda, 2021

In the context of these regression models, this would mean a systematic change in the spread of the residuals if heteroscedasticity is evident, this would weaken the regression model and the conclusions inferred. OLS regression assumes that all residuals are drawn from a population that has a constant variance, homoscedasticity, which links to the Gauss Markov conditions.

This research will test the following hypothesis:

$H_0: \beta_1 \geq 0$ - There is not an inverse relationship between real interest rates and consumption

$H_1: \beta_1 < 0$ - There is an inverse relationship between real interest rates and consumption

The null hypothesis would indicate that there is no inverse relationship between real interest rates and consumption, the coefficients should therefore be greater than or equal to zero. The alternative hypothesis suggests the Beta 1 coefficient (the real interest rate) should have a negative relationship when regressed with consumption and therefore be less than zero.

In addition, it is expected that the real interest rate will have a larger effect on consumption compared to the lagged variable, as economic thought and previous studies have suggested a negligible relationship between consumption and the lagged interest rate. Mankiw (1985) suggests that the interest rate will have a larger effect on consumption of durable goods, compared to non-durable and this should be reflected in a higher coefficient for durable goods.

Figure 6: Estimator and prediction for regression 1

| Prediction for the coefficient of each estimator | Estimator | Statistically significant? | | Inference and Interpretation |
|--|-----------|----------------------------|----------|--|
| | | 5% level | 1% level | |
| $\beta_1 \leq 0$ | -7924.84 | Yes | Yes | For every 1 percentage point increase in interest rates, there is a £ 7924.8 reduction in GDP consumption per capita |
| $\beta_2 \leq 0$ | -760.57 | No | No | For every 1 percentage point increase in interest rates, there is a £760 reduction in consumption per capita |
| $\beta_3 \leq 0$ | 0.73 | Yes | Yes | For every £1 increase in GDP per capita will result in an increase of £0.73 in consumption per capita |

Figure 7: Estimator and prediction for regression 2

| Prediction for the coefficient of each estimator | Estimator | Statistically significant? | | Inference and Interpretation |
|--|-----------|----------------------------|----------|---|
| | | 5% level | 1% level | |
| $\beta_1 \leq 0$ | -18881.8 | No | No | For every 1 percentage point increase in interest rates, there is a £18,881.8 reduction in consumption per capita |
| $\beta_2 \leq 0$ | -39965.3 | Yes | No | For every 1 percentage point increase in interest rates, there is a £39,965.3 reduction in consumption per capita |
| $\beta_3 \leq 0$ | 1.140877 | Yes | Yes | For every £1 increase in GDP per capita will result in an increase of £1.14 in consumption per capita |

Regression 1- OLS to estimate equation for the 1960-89 period is:

$$c_t = \alpha_0 + \alpha_1 r_t + \alpha_2 r_{t-1} + \alpha_3 G_t + u_t$$

This regression equation is used for the 1960-89 period, c_t is consumption per head, r_t is the real interest rate, r_{t-1} is the lagged real interest rate and G_t is GDP per head and u_t is the error term, α_0 - α_3 are the coefficients to be estimated in the next sections. These variables take into consideration inflation and population when analysing consumption. As the variables are expressed in real terms and are per capita, allowing for easier comparison over time and increasing the accuracy of the results.

Regression 2- OLS to estimate equation for the 1990-2019 period is:

$$c_t = \alpha_0 + \alpha_1 r_t + \alpha_2 r_{t-1} + \alpha_3 G_t + u_t$$

Regression 2 contains the same variables as regression 1 but for the period 1990-2019.

Regression 3- OLS to estimate equation for the 1990-2019 period, including unemployment:

$$c_t = \alpha_0 + \alpha_1 r_t + \alpha_2 r_{t-1} + \alpha_3 G_t + \alpha_4 un_t + u_t$$

Regression 3 is the same as regression 2 apart from the inclusion of unemployment data, denoted as un . All other variables are the same and over the same period, allowing for better comparison and isolation of the impact of unemployment on consumption.

Regression 4- OLS to estimate equation for 1998-2019 period, including unemployment and wealth:

$$c_t = \alpha_0 + \alpha_1 c_t + \alpha_2 c_{t-1} + \alpha_3 c_t + \alpha_4 c_t + \alpha_5 c_t + \alpha_6$$

Regression 4 includes household deposits used to represent a wealth variable, denoted as, d_t . This could provide interesting empirical data with which to analyse (Friedman, 1957, Modigliani and Brumberg, 1957; Hall, 1978) views that wealth has an important influence on consumption.

Regression 5- OLS to estimate equation for 1985-2019, for durable consumption:

$$\ln c_{dt} = \alpha_0 + \alpha_1 c_{dt} + \alpha_2 c_{dt-1}$$

Regression 5 analyses the impact of the real interest rate on durable consumption, denoted as, $\ln c_{dt}$. The durable consumption data is represented as a log value.

Regression 6- OLS to estimate equation for 1985-2019, for non-durable consumption:

$$\ln c_{ndt} = \alpha_0 + \alpha_1 c_{ndt} + \alpha_2 c_{ndt-1}$$

Regression 6 analyses the impact of the real interest rate on non-durable consumption, denoted as, $\ln c_{ndt}$. The non-durable consumption data is represented as a log value.

The results of these regressions are detailed in the results section and in addition graphs have been included which illustrate the relationship between various variables.

Data

Secondary data from the UK has been collected for consumption, interest rates and a selection of other variables that can influence consumption. The data that has been obtained for the regressions includes:

- Consumption data- total consumption, and durable and non-durable data which have been transformed into logs and real consumption per head. This is the dependant variable in the regression
- Interest rate data- nominal data was converted into real interest rate data by adjusting for inflation. This is the main independent variable in the regression
- Population data
- GDP data- adjusted to produce per capita data
- Household deposits- adjusted to produce deposits per head
- Unemployment data
- Inflation data

A range of variables were considered, some were discounted because of data availability, but the list above allows a comprehensive analysis of consumption and interest rates. When considering the appropriate consumption data, the empirical studies by Hamburger (1967) and Mishkin (1976) highlighted the value in investigating the data at the level of durable and non-durable, in addition to total consumption.

Nominal interest rate data was collected but converted into real interest rate data to negate the effect of inflation, this is consistent with Mankiw (1985) approach to his empirical studies in this subject.

GDP and unemployment data were captured as they increase the accuracy of the regression and are some of the main variables that effects consumption.

Household deposit data is an important variable in measuring wealth, which is considered in numerous economic theories, such as Modigliani and Brumberg (1957), as being more significant than income in influencing consumption.

Inflation data was gathered to allow consumption, interest rate, GDP, and household deposits data to be converted into real terms. Population data enabled the

conversion of numerous data sources into per capita which allows easier comparison of variables and negates the effect of changes in population.

This data has been collected from a range of reputable online sources; OECD, ONS, World Bank and the Bank of England. It was necessary to use multiple sources to make sure access to all required data for the complete period. The data obtained was a mix of monthly, quarterly, and annual, but this was standardised into an annual view for the purpose of the regression.

A date range of 1960-2019 has been used to capture the time series data. This date range was selected because it provided the opportunity to use the most current data whilst also providing 60 observations. This allows two discrete 30-year regressions, enabling direct comparisons between the two periods, producing detailed analysis of the impact of interest rates on consumption behaviour over time. Two 30-year regressions allow for 30 observations per regression, which is the minimum required to produce statistically valid results. Household deposits and unemployment data was not available for the full date range which restricted analysis for these variables.

The collection of data on other variables was considered, such as income tax and house prices, but were discounted as it was considered they were investment focussed variables. Data was also sourced from the Gini index, a measure of the distribution of income, and consumer confidence index but the analysis produced insignificant results and therefore removed from further analysis. This may be caused using index data rather than actual figures.

There have been numerous adjustments that have been made to the data to make it more accurate and mitigate potential issues with the data. Firstly, the data has been converted into real terms to account for inflation, this helps the data become more accurate as it gives a better representation of the actual effect of certain variables. For example, this is calculated by the nominal interest rate minus the inflation rate of that year, however calculated slightly different for other variables.

The data has also been converted into per head values allowing the data to take into consideration the effect of population allowing for easy comparisons with the data. The consumption data, as well as deposits and GDP, has been converted into per head. Logs were also used within my regression which allows easier comparisons

and allows for trends to become more visible, logs have been used in my regressions for non-durable and durable consumption data.

A lagged variable for the real interest rate has also been used, this reduces the chance of auto correlation and helps understand the effects of interest rates on consumption further. Capturing lagged and non-lagged real interest rate data allows further investigation building on Campbell and Mankiw (1989) where they rejected the assumption of a lag. Further to this the use of two distinct date ranges allows an opportunity to explore potential impacts. Whilst Campbell and Mankiw (1989) did not find any empirical evidence of the lagged effect, numerous consumption theories are built on the concept of delayed consumption, such as PIH. Finally, a dummy variable (time dummies) has been added, these are used to control for time effects in the equation, for example, if the 1980s had a particular event which did not occur in other periods, the time dummy will control for that.

There are restrictions on some of the data collected, for example, the household deposits data is only available from 1998. This limitation does not allow its inclusion in the main regressions; however, it was possible to run a separate regression to explore the impact of household deposits and suggest informal evidence of a link. Unemployment data was also not available for the full date range and only accessible from 1971, which meant it was only included in Figure 12 and 13. Durable and non-durable data was only available from 1985, so a single regression was developed, that would compare effective interest rates on the consumption categories.

Figures 8 and 9 illustrate the standard deviation and mean values across the two time periods. This allows a comparison of all variables across the two distinct time periods highlighting similarities and differences.

Figure 8- Avg and SD 1960-1989

| | (1960) |
|------------|---------------------|
| Rt | 0.0202 (0.0385) |
| rt1 | 0.0193 (0.0389) |
| Consph | 2478.4 (2378.3) |
| Gdpperhead | 13846.3 (2827.5) |
| <i>N</i> | 30 |

Figure 9 - Avg and SD 1990-2019

| | (1990) |
|------------|---------------------|
| Rt | 0.0237 (0.0209) |
| rt1 | 0.0255 (0.0203) |
| Consph | 18035.0 (5616.1) |
| Gdpperhead | 27009.7 (3904.3) |
| Deposiph | 14508.3 (4264.4) |
| Unem | 0.0654 (0.0182) |
| Lnnondur | 12.07 (0.316) |
| Lndur | 11.24 (0.344) |
| <i>N</i> | 30 |

mean coefficients; sd in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The first notable takeaway from the tables is the difference in consumption per head in the different time periods. Although consumption is expected to rise, as the country develops over time, the level of consumption in the second period is substantially higher, increasing from 2478.4 per capita to 18,035 an increase of 628%, suggesting rapid consumption growth. Growth is also represented in GDP per capita which has grown from 13,846 to 27,009 a growth of 95%, demonstrating a

slower rate of growth compared to overall consumption. GDP per capita as a percentage of consumption per capita has increased from 18% to 67%. This is a significant adjustment in the relationship between these two measures and may explain some of the regressions, as consumers may have been able to react quicker to changes in interest rates, during the period 1960-89. Another important observation is that the standard deviation for GDP and consumption per capita is significantly higher in the second period suggesting a larger range in the results, which may infer greater income inequality.

The nominal interest rate was higher in the 1960-89 period reaching peak levels of 14.9%. They were particularly high in the late 1970's to early 1990s, with a gradual decline from that period until the current day. However, converting the data into real interest rates produces an interesting result. The real interest rate is higher in the second period, with a rate of 0.0237 compared to 0.0202 for 1960-89. This is intriguing, as interest rates in the last decade have been historically low. This may be due to inflation being substantially lower in the second period, resulting in higher levels of the real interest rate, as compared to the first period considered. The higher real interest rates experienced in the second period are unexpected, given the higher rates of consumption growth. Interestingly, Yi and Zhang (2017) researched real interest rates in the 20 largest economies between 1955 to 2014 and also identified a decline and standardization across the last 30 years.

The standard deviation for the real interest rate in the first period is 0.038 whereas in the second it's 0.02. This can be interpreted that the fluctuations in the real interest rate from 1960-1989 are much higher compared to 1990-2019. It is also worth considering whether the degree of fluctuations has a positive or negative impact on consumption decisions, these changes in interest rates can allow consumers to respond quickly, but equally, and they can create uncertainty.

Results

The results for regression 1, the 30-year period from 1960 to 1989, as shown in figure 10, highlight the effect of all selected variables on consumption. This regression shows that rt has a significantly higher coefficient compared to $rt1$, this infers that the real non lagged interest rate has a much larger impact on consumption compared to the lagged variable. As the coefficient for the real non lagged interest rate is -7924 whereas for the lagged variable it's -760, this suggests an inverse relationship and that most of the impact of the interest rate changes on consumption is experienced in the same year. This reflects a consumption pattern that responds quickly to the change in interest rate for that year, which is consistent with the findings in Wright (1967) and Heien (1972). The results obtained in this chapter suggest that changes in the real interest rate of 1% will lead to an inverse change in consumption of £7924 per capita. The substantial difference between the interest rate coefficients suggest that consumers quickly responded to interest rate changes, this could be due to the large difference between consumption and income during this period which allowed people to adapt to the new situation quickly.

Figure 10: Regression 1

| Consph | Coefficient | Robust Std. Err. | P value |
|---------------|--------------------|-------------------------|----------------|
| rt | -7924.842 | 2674.729 | 0.007 |
| $rt1$ | -760.572 | 1832.905 | 0.682 |
| $d1960$ | -866.3469 | 340.3051 | 0.018 |
| $d1970$ | -1664.189 | 319.5848 | 0.0 |
| $gdpperhead$ | .7319154 | .0526478 | 0.0 |
| $Cons$ | -6662.801 | 894.4028 | 0.0 |

Campbell and Mankiw (1989) ran a similar regression with real lagged interest rate and they rejected the assumption that a lagged variable influences the rate of growth of consumption, this test was also conducted in similar years, as the regression was for 1953 to 1986. This is interesting, as it is consistent with the regression results which were obtained over a similar period but for a different country.

The significance values are also very interesting as the real interest rate is statistically significant with a value of 0.007, however, the lagged variable is insignificant with a value of 0.682, which is above the significance level of 0.05. This suggests that this variable is not correlated, or it could be due to an insufficient data range. The lagged data does not provide evidence of a correlation and therefore the null hypothesis would be accepted. The results obtained show an inverse relationship which is consistent with consumption theory; however, the lack of correlation in the lagged data fails to support theories suggesting consumption smoothing.

The results for regression 2, the 30-year period from 1990 to 2019, as shown in figure 11, highlight the effect of all selected variables on consumption. The coefficients are interesting in this regression, the lagged coefficient, $rt1$, is substantially higher than rt , which contrasts the results with regression 1. The lagged coefficient of -39,965 is more than double the real interest rate coefficient of -18,881. These results offer one of the most interesting insights into the relationship between interest rates and consumption and show an unexpected significance in the lagged data. As anticipated the relationship is inverse but it surprisingly shows 112% higher coefficient.

Figure 11: Regression 2

| Consph | Coefficient | Robust Std. Err. | P value |
|---------------|--------------------|-------------------------|----------------|
| Rt | -18881.71 | 11207.42 | 0.105 |
| rt1 | -39965.39 | 15868.97 | 0.019 |
| d1990 | -677.0507 | 1215.679 | 0.583 |
| d2000 | -1841.776 | 678.145 | 0.012 |
| gdpperhead | 1.140877 | .0866726 | 0.0 |
| Cons | -10474.29 | 2642.797 | 0.001 |

This is an unexpected result, as previous empirical evidence suggests that changes in interest rate have an in-year impact on consumption rather than the delayed impact these results suggest. This infers that an interest rate change will not have a

significant impact until the year after, which highlights the effect of the lag. This is very interesting, as it may change the views on the workings of the interest rates, that they have an inverse and nearly immediate effect on consumption, and if proven to be true, this may influence the Bank of England monetary policy.

The regression shows interesting significance levels: firstly, that the real interest rate has an insignificant P-value at 0.105, above the 5% significance level of 0.05, which suggests that the variable is not correlated. However, the lagged real interest rate is statistically significant at 0.019, highlighting its important dynamic correlation. This reinforces the importance of the lag, as the lagged variable in regression 2 is correlated which is in sharp contrast to regression 1 which suggested no correlation. This difference in results suggests a change in consumption behaviour over the two periods, as consumption now appears to be delayed. This could be influenced by the fact that income and consumption levels have converged, the difference has reduced from 18% to 67%, this limits consumers ability to respond to interest rate changes. It is possible this is being further compounded by greater financial awareness and access to financial information that is contributing to consumers rational decision-making.

Next, the results for regression 3, the 30-year period from 1990 to 2019, as shown in figure 12, highlight the effect of all selected variables on consumption, including the addition of unemployment data. This data should increase the overall legitimacy of the results by increasing the variables and including another factor that influences consumption. As expected, the coefficients are very similar to regression 2, however, rt_1 has a reduced value and rt has an increased which has closed the gap between them. With the coefficient for rt being -23926 and the coefficient for rt_1 being -33413, there is still a significant gap between the two variables, with the lagged variable having a larger effect on consumption.

Both results would reject the null hypothesis and accept the alternative hypothesis as there is a clear inverse relationship between interest rates and consumption. It is interesting that regression 1 supports the view that interest rates have an inverse and near immediate impact; however, the second time series used for regression 2 and 3 suggests a significant change. Regression 2 identifies an inverse and lagged

relationship and the refinements in regression 3 identify the possibility that the relationship is inverse, and both near immediate and lagged.

Figure 12: Regression 3

| Consph | Coefficient | Robust Std. Err. | P value |
|---------------|--------------------|-------------------------|----------------|
| Rt | -23926.14 | 11315.75 | 0.046 |
| rt1 | -33413.56 | 14569.14 | 0.031 |
| d1990 | -229.3727 | 1236.041 | 0.854 |
| d2000 | -1553.137 | 695.3116 | 0.036 |
| unem | 19504.66 | 12924.69 | 0.145 |
| gdpperhead | 1.252365 | .0945329 | 0.0 |
| Cons | -15054.52 | 3318.738 | 0.0 |

The significance levels for the real interest and lagged are both significant at the 5% significance level of 0.05, with a significance value of 0.046 for rt and 0.031 for rt1. Regression 3 is the only analysis which has produced two statistically significant P values for rt and rt1, highlighting the fact that both variables are correlated.

Overall, these regressions consistently show an inverse relationship between interest rates and consumption. However, each of these three regressions has produced contrasting results relating to real and lagged interest rates. The older data set in regression 1 produced results that support traditional consumption theory that consumption would not lag changes of interest rates. The more recent dataset used in regression 2 produced the opposite results, only showing a correlation with the lagged data.

Finally, regression 3 shows a correlation with both real and lagged data. These variations suggest that consumption behaviour has changed during the period analysed and this has led to a delayed response to interest rate changes. There are many explanations for this for example, there might have been a structural change or a significant event that has produced differences in behaviours. Factors like the UK

joining the EU in 1973 or globalisation could have resulted in different consumer spending patterns, as could the financial crisis in 2009. These could help explain why the lag had a stronger coefficient and was statistically significant in the second period. These results could change the way that people look at the relationship between the two variables, as it is clear that interest rates are not necessarily a quick fix for consumption stabilization. Most of the existing empirical evidence is consistent with the date range used for regression 1, which limits the ability to compare the results from regression 2 and 3 with other studies.

It is significant that the coefficients are also extremely different, in the first regression the real interest rate coefficient is -7924 whereas, in the second period it's -18881.71, this could be due to the GDP per capita increasing substantially in the second period. This is also reflected in the coefficient differences for the lagged variable, -760.572 for regression 1 and -39965.39 for regression 2. The scale of the difference in the coefficients raises the possibility that there has been a dramatic shift in consumer behaviour, and additional study would be beneficial.

The contrasting comparison in significance values is also of interest, regression 1 shows a significant value for the real interest rate, however, an insignificant value for the lagged interest rate. Regression 2 shows the opposite, with an insignificant value for the real interest rate and a significant value for the lag. These results illustrate that consumption has become deferred and then this could be a result of a switch in consumer behaviour and reinforces the idea that consumers have changed their attitudes towards the interest rate.

The GDP per capita also has a much higher coefficient in the second regression (1.14) compared to the first (0.73) which may be a result of rising incomes during the 1990's. The higher coefficient could also contribute to the higher consumption numbers seen in the second data set.

Figure 13: Regression 4

| Consph | Coefficient | Robust Std. Err. | P value |
|---------------|--------------------|-------------------------|----------------|
| Rt | 8166.246 | 4538.778 | 0.094 |
| rt1 | -9388.915 | 3928.836 | 0.031 |
| d1990 | -365.7646 | 187.2532 | 0.071 |
| d2000 | -228.8004 | 1117.9174 | 0.073 |
| depositsph | .7625491 | 0.04481 | 0.0 |
| unem | -12133.99 | 3342.77 | 0.003 |
| gdpperhead | .2878923 | .0748426 | 0.002 |
| Cons | 2125.232 | 1762.419 | 0.248 |

The results for regression 4, the 22-year period from 1998 to 2019, as shown in figure 13, highlight the effect of all selected variables on consumption, including unemployment data and the addition of household deposits. Regression 4 includes household deposits per capita, which is a variable linked to wealth and this highlights the impact of wealth on consumption. This regression has limited observations, wealth data is only available for a 22-year period, but has produced unexpected results, with a positive coefficient for the real interest rate, which was not replicated in any of the other regressions. The deposits have a positive coefficient of 0.763, with a significant P value. This regression is interesting as it reinforces Friedman's theory of a PIH (1957) and the idea of a LCH (1957), as the wealth variable shows a positive correlation with consumption. These theories suggest that wealth, and long-lasting changes in income only, will influence consumption. They also argue that consumption is determined by the value of lifetime resources and the results of this regression support this theory. A correlation test has also been conducted here, which shows that wealth and consumption have a very strong correlation.

Figure 14: Regression 5

| Lndur | Coefficient | Robust Std. Err. | P value |
|--------------|--------------------|-------------------------|----------------|
| rt | -9.346749 | 5.186066 | 0.081 |
| rt1 | -7.988578 | 5.431991 | 0.151 |
| Cons | 11.61965 | .0574571 | 0.0 |

Figure 15: Regression 6

| Lnnondur | Coefficient | Robust Std. Err. | P value |
|-----------------|--------------------|-------------------------|----------------|
| Rt | -7.868999 | 3.612524 | 0.037 |
| rt1 | -9.010003 | 3.778332 | 0.023 |
| Cons | 12.44587 | .0378844 | 0.0 |

Regression 5 explores the correlation between interest rates and consumption of durable goods between 1985-2019, these are goods that are bought for long term satisfaction typically causing them to be more expensive. The results for regression 5 produce inverse coefficients with rt higher but with insignificant P values.

Regression 6 substitutes durable goods for non-durable goods, which are fast moving consumer goods. The results for regression 6 they also produce inverse coefficients but with rt1 higher, with both variables having statistically significant P values.

The coefficient data for regression 5 suggests that changes in real interest rate has a larger effect on durable good consumption, than the lagged rate. This suggests that changes in interest rates are more likely to affect the purchase of expensive goods. This is reinforced by a higher coefficient of -9.35 for durable goods and -7.87 for non-durable, suggesting a lower impact on the consumption of non-durable.

Whereas the lagged variable has a larger effect on the non-durable consumption, suggesting people may consider the interest rate more for the year when they want to make bigger purchases as the lagged isn't significant for durable goods. With the lagged variable having a coefficient of -7.99 for durable goods and -9.01 for the non-durable goods. The significance values are illuminating as non-durable goods both

variables are statistically significant whereas for durable goods consumption both insignificant.

Studies typically show that non-durable consumption is more sensitive to income as Flavin (1981) reports that non-durable consumption is excessively sensitive to income, however, this regression shows that the interest rate does have an impact on overall consumption. Mankiw' paper on real interest rates effect on consumer durables highlights similar results as his results suggest that consumer spending on durables is very responsive to changes in the real interest rate, however his model is based in the USA, which interestingly suggests that consumer patterns and behaviours around interest rates are very similar. Finally, Breusch-Pagan tests were conducted for the two main regressions to test for heteroskedasticity in the regressions. P values of 0.55 for 1960-89 and 0.36 for 1990-2019 were produced, and this suggests that there is no heteroskedasticity in the regressions as the P values are greater than 0.05. This is important as the regressions would be inaccurate if there was any heteroskedasticity.

Graphs

Graphs have been produced to illustrate the real data for some of the main variables to track progress over time. Graphs have also been used to correlate different variables and how changes over time may be interrelated and specifically how they impact consumption.

Figure 16 and 17 portray GDP per capita (higher line) and consumption per capita (lower line) for 1960-89 and 1990-2019, respectively. Figure 16 shows a much greater differential between the two variables and for the first 15 years, growth is very slow, even for consumption which has such a low base value. However, there does appear to be a consistent correlation between their growth, and this contrasts with figure 17, which shows a clear convergence of the two variables, coinciding with the financial crisis of 2008/09. Figure 17 also highlights a much more rapid increase in both variables, which may suggest a change in consumer behaviour, but appears to contrast Keynes's view that consumption would slow as income increases, due to the lower MPC for higher income earners. Both figures include periods where GDP has fallen sharply, but this has not corresponded to a proportional reduction in consumption, suggesting the operation of consumption smoothing argued by the PIH and LCH.

Figure 16: GDP and consumption per capita for 1960-89

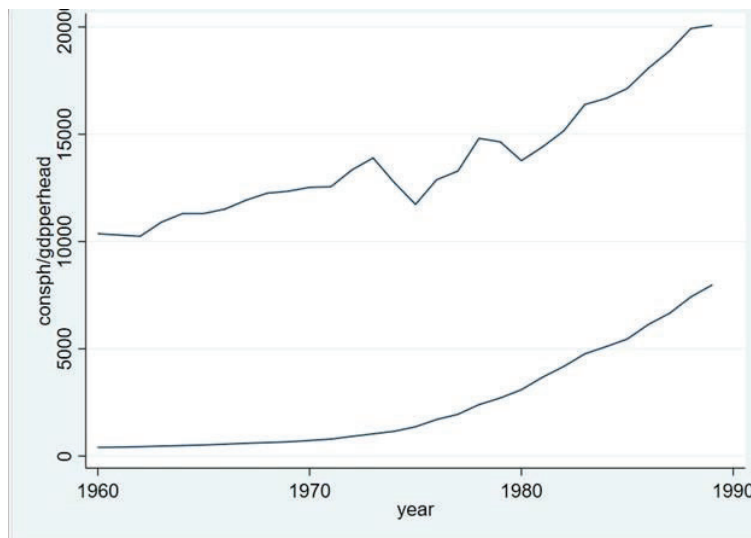


Figure 17: GDP and consumption per capita for 1990- 2019

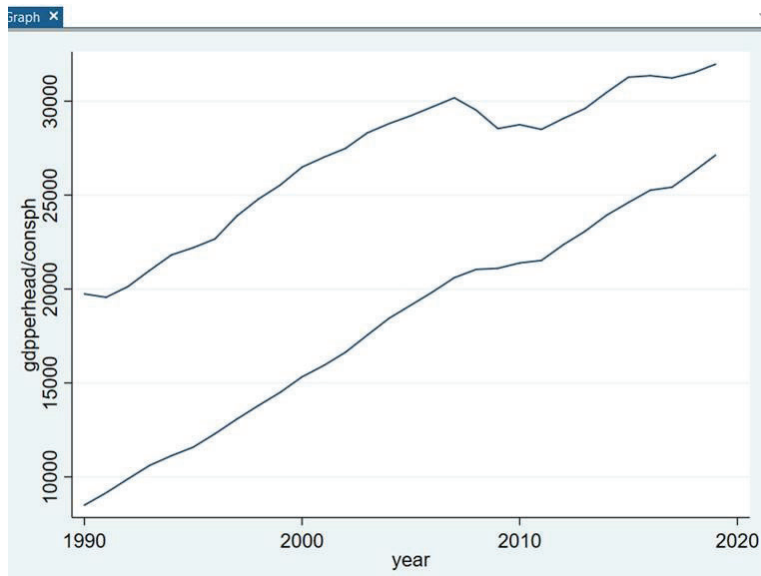
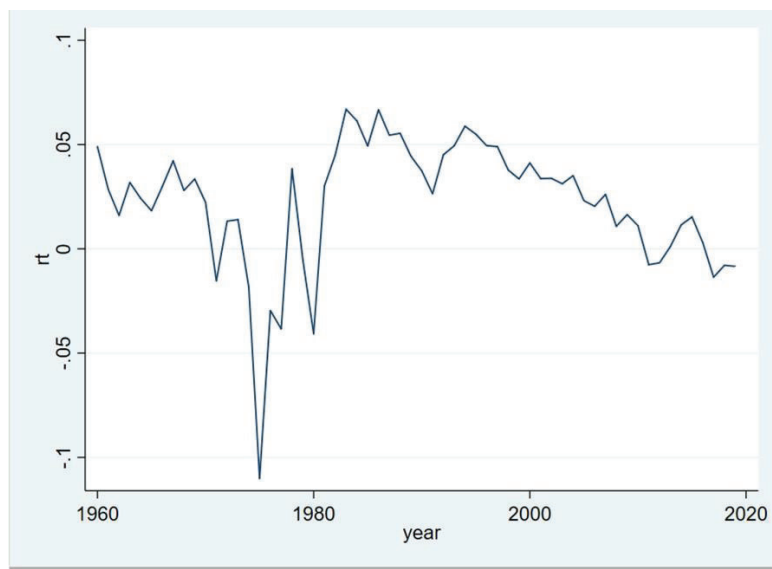


Figure 18 shows the real interest rate between 1960 to 2019, and it is noticeable how large and frequent are the fluctuations in the first 30-year period. During the second 30 years the overall trend is down and appears to be much smoother without the large variations. It is interesting that the actual average real interest rate is lower in the first period, even though the changes are greater. It is possible that the variations experienced in the first period create increased uncertainty, which may influence save or spend decisions.

Figure 18: The real interest rate from 1960-2019



Discussion

Consumption is a fundamental factor influencing economic growth, governments therefore have an interest in maintaining appropriate levels and have often looked to interest rates as part of their monetary policy. Understanding how these changes in interest rates impact consumer behaviour and consumption a key topic of economic study has been and has an impact on government policy. The UK, through the Bank of England, is a good example of a country extensively utilising interest rate changes as part of its monetary policy and has recently lowered interest rates to just above 0%. This has been used, as well as quantitative easing, to increase consumption and drive economic growth but there are concerns of a liquidity trap with consumers retaining high levels of cash deposits.

This research is therefore very relevant to current economic policy, especially as the results raise some interesting observations that challenge certain popular consumption theories. The two main regressions support the view that interest rates and consumption have an inverse relationship. However, the results show that during the first period this relationship was only statistically significant for rt . This supports Wright (1967) and Heien (1972), whose empirical evidence showed the same in-year impact. An interesting change happened in the second regression where rt was insignificant but $rt1$ became significant. This suggests a change in consumption behaviour and a move towards more delayed and rational decision making which is consistent with (Friedman, 1957, Modigliani and Brumberg, 1957; Hall, 1978).

This indicates that a change in interest rate will not necessarily influence consumption in that year and there may be other considerations that are leading to the lagged effect. Consumers now have much greater access to financial education and information which combined with the potential for more uncertainty could lead to a more cautious approach to consumption. This may be a reason for consumers not over consuming or increasing their consumption based on an interest rate change, as they are more wary of the economic climate compared to what people were in the first period. Friedman (1957) argued that consumption was based on permanent income, where consumers did not react to transitory changes in income and sometimes deferred. Modigliani and Brumberg, (1957) claimed that consumption was dependant on where the individual was in their life cycle, the desire to smooth

consumption led to periods of both under and over consumption. There is considerable empirical evidence that supports the belief that consumption is not lagged Mankiw (1989) so these results are significant. One factor that might account for the change in consumer behaviour is the structural shift in the demographic mix in the UK for this period. The change in proportion of consumers at various stages of the life cycle could have a substantial impact on consumer behaviour and rational decision making.

However, it may be because people are already consuming significantly more of their income compared to the first period as highlighted by the graphs the difference in GDP and consumption is a lot smaller in the second period. Inferring that a change in the interest rate has less of an effect, as people have less discretionary income to spend, this may be a reason why the lagged variable is more important, as it is much harder to respond to a change if there is less disposable income.

Keynes (1936) suggests that changes in consumption are a result of changes in an individual's income. However, the results suggest that wealth produces a positive coefficient which demonstrates that as wealth rises, consumption will also.

Additionally, wealth generated a higher coefficient than income, which challenges Keynes' view and supports the life cycle hypothesis, that wealth is a key determinant of consumption.

Hamburger (1967) Mishkin (1976) Mankiw (1985) argued that interest rate changes had a large effect on consumer durable expenditure, because these were more expensive purchases which may require credit. However, the results suggested an insignificant relationship between interest rates and consumer durables and showed a significant relationship with non-durable expenditure.

Limitations/Suggestions for further studies

There have been considerable empirical studies on the inverse relationship between interest rates and consumption but less focus on the possibility of lagged consumption. Whilst this study has included analysis of lagged consumption it is restricted to a single developed economy. Further research could be carried out on other countries, especially EU or other comparable developed nations.

It would be recommended for these additional studies to utilise the same date range, so that direct comparisons with the UK results could be drawn. It would be interesting to establish if the lagged consumption is just significant in the UK or if countries with a similar trajectory experienced comparable result. Identifying countries that also experience a lagged consumption and comparing with those countries that saw a more immediate change would enable the isolation of factors that produce the varying results.

Another area that would be thought-provoking to explore further is the comparison between developing and developed countries. This opportunity to contrast results in both groups will allow understanding on how interest rates affect consumption given the stage of economic maturity. Over time, this would allow monitoring changes in consumption behaviour and identify the conditions required to shift to delayed consumption. This analysis would also allow consideration of socio factors such as culture, education, and inequality. A greater understanding of these factors would enable governments to develop tailored intervention policies to support economic growth and reduce financial inequality.

The results suggest a change in consumption behaviour between the two periods and one factor that may have contributed is changes in the demographic profile. Any variation in the proportion of population in the various age categories may contribute to changes in rational decision making and therefore their consumption behaviour. Additional research into the demographic profile during the two periods may identify trends that account for these changes or help eliminate it as a contributing factor. Depending on the results of the analysis for the UK, this could be extended to other countries to explore a possible relationship between the demographic profile and changes in consumption patterns. This additional empirical evidence would enable a more comprehensive evaluation of the LCH.

In addition to the research limitation regarding UK only data, identified above, additional challenges have been identified. Ideally, multiple wealth variables would have been included, but due to limited availability, this was restricted to only household deposits, which was only available from 1998. This restricts the evaluation regarding the validity of the PIH and LCH.

There was also limited availability of unemployment data, which could only be gathered from 1971 and for durable and non-durable data which could only be collected from 1985. These restrictions meant these variables could not be included in the regressions for both time periods. The inclusion of the unemployment data increases the accuracy of the regressions, but the lack of data for the first period limits the ability of a direct comparison. The lack of durable and non-durable data, over both periods, limits the ability to compare how changes in interest rates affect these variables over time.

Conclusions

This chapter has sought to establish whether changes in the interest rate affect consumption in the UK. Current economic thinking suggests an inverse relationship, where changes in consumption have a close correlation in timing with interest rate adjustments. This study extends literature by examining how these variables interact using UK data between 1960-2019. The data has been grouped into two distinct 30-year periods, allowing the identification of any change in the relationship between the two variables.

Empirical analysis of the regressions suggests that consumption has an inverse relationship with interest rates, as the interest rate has a negative coefficient when regressed with consumption. The analysis of the data from the first period, between 1960-1989, supports conventional economic theory by producing a correlation with non-lagged interest rates. This supports the view that changes in the interest rate produce a relatively quick change in consumption. However, analysis of the second period, between 1990-2019, produces a correlation with lagged interest rates. This result is unexpected and conflicts with the view that the change in consumption is relatively quick. These results are highlighted by the change in coefficient for the lagged interest rate, as it moves from -760 in the first period, to -39,965 in the second period.

The empirical evidence for the lagged interest rate contradicts the views of Keynes

consumption function (1936) which doesn't recognize delayed consumption. These results are more consistent with the views of (Friedman, 1957, Modigliani and Brumberg, 1957; Hall, 1978), who suggested rational decision making, for a variety of reasons, would sometimes result in deferred consumption.

The results appear to validate that Keynes' consumption function was an accurate prediction of consumption behaviour during the initial period but that fundamental changes had occurred, that now supports rational decision making and delayed consumption. There may be several explanations that could account for this change in consumer behaviour. This may be part of a natural evolution experienced in more mature economies due to better informed consumer decision making and higher wealth which has been proposed in numerous economic literatures.

There were limitations with the availability of certain variables which would have increased the accuracy of the analysis and it only included data for a single country, the UK. There are numerous opportunities for additional empirical research, this could include a range of additional countries, both developed and developing. Utilising two consecutive date ranges and incorporating further wealth variables will enable further analysis of changes in the relationship between interest rates and consumption. It would be very interesting to evaluate whether other developed European countries have experienced similar trends, to the UK, in terms of the lag in the more recent period. This may suggest that it could be a natural progression for countries to experience a lag once they become more developed or the results may be unique to the UK. Investigating developing countries provides an opportunity to explore how stages of economic development may impact the relationship between interest rates and consumption, which is currently under consideration.

The chapter produces interesting results concerning potential changes in the relationship between the lagged interest rate and consumption levels. Given the results are based on the UK, they could be particularly significant to the UK government and the Bank of England. A greater understanding of the lagged relationship will impact monetary policy, both in terms of timing and scale of its potential impact. For monetary policy to be successful there needs to be additional consideration of the specific variables that influence rational decision making that leads to changes in consumer behaviour over time.

Finally, this chapter has contributed to the overall knowledge and literature

surrounding this topic. Until now, there has been limited research using data from different comparable periods, within the same country, these results suggest this is worthy of consideration in the future. The empirical evidence supports the inverse relationship but identifies that there may be conditions that produce a change in the timing and significance. Additional research can verify these results, but also needs to focus on the changes that have occurred that produce these findings.

References

Ando, A. and Modigliani, F., 1963. The "life cycle" hypothesis of saving: Aggregate implications and tests. *The American economic review*, 53(1), 55-84.

Bank of England (2021), What are interest rates London. Available from: <https://www.bankofengland.co.uk/knowledgebank/what-are-interest-rates> [Accessed 04/03/2021]

Bank of England Database (2021), LPMVWLM, London, Bank of England. Available from: <https://www.bankofengland.co.uk/boeapps/database/fromshowcolumns.asp?Travel=NlxAZxSUx&FromSeries=1&ToSeries=50&DAT=RNG&FD=1&FM=Jan&FY=1990&TD=31&TM=Dec&TY=2025&FNY=Y&CSVF=TT&html.x=66&html.y=26&SeriesCodes=LPMVWLM&UsingCodes=Y&Filter=N&title=LPMVWLM&VPD=Y> [Accessed 03/03/2021]

Berger-thomson, L., Chung, E. and McKibbin, R., 2010. Estimating Marginal Propensities to Consume in Australia Using Micro Data. *Economic Record*, 86, 49-60.

Boskin, M.J., 1978. Taxation, saving, and the rate of interest. *Journal of political Economy*, 86(2, Part 2), S3-S27.

Campbell, J.Y. and Mankiw, N.G., 1989. Consumption, income, and interest rates: Reinterpreting the time series evidence. *NBER macroeconomics annual*, 4, 185-216.

Cuthbertson, K., 1980. The determination of expenditure on consumer durables. *National Institute Economic Review*, 94(1), 62-72.

Deaton, A., 1992. *Understanding consumption*. Oxford; Oxford University Press.

Elmendorf, D.W., 1996. *The effect of interest-rate changes on household saving and consumption: a survey*, 96-27. Division of Research and Statistics, Division of Monetary Affairs, Federal Reserve Board.

- Fisher, I., 1930. Theory of interest: as determined by impatience to spend income and opportunity to invest it. Augustusm Kelly Publishers, Clifton.
- Friedman, M., 1957. The permanent income hypothesis. In *A theory of the consumption function*, 20-37. Princeton N.J.; Princeton University Press.
- Friedman, M., 2018. Theory of the consumption function. Princeton N.J, Princeton University Press.
- Gylfason, T., 1981. Interest rates, inflation, and the aggregate consumption function. *The Review of Economics and Statistics*, 233-245.
- Hall, R.E., 1978. Stochastic implications of the life cycle-permanent income hypothesis: theory and evidence. *Journal of political economy*, 86(6), 971-987.
- Hall, R.E., 1987. *Consumption* (No. w2265). National Bureau of Economic Research.
- Harvey, C.R., 1988. The real term structure and consumption growth. *Journal of Financial Economics*, 22(2), 305-333.
- Heien, D.M., 1972. Demographic effects and the multiperiod consumption function. *Journal of Political Economy*, 80(1), 125-138.
- Kijima, M., Nishide, K. and Ohyama, A., 2010. Economic models for the environmental Kuznets curve: A survey. *Journal of Economic Dynamics and Control*, 34(7), 1187-1201.
- King, M.A. and Dicks-Mireaux, L.L., 1982. Asset holdings and the life-cycle. *The Economic Journal*, 247-267.
- King, M.A., 1986. Capital market" imperfections" and the consumption function. *The Scandinavian Journal of Economics*, 59-80.
- Lundberg, E., 1971. Simon Kuznets' contribution to economics. *The Swedish Journal of Economics*, 73(4), 444-461.
- Morduch, J., 1995. Income smoothing and consumption smoothing. *Journal of economic perspectives*, 9(3), 103-114.
- Mankiw, N.G., 1985. Consumer durables and the real interest rate. *The Review of Economics and Statistics*, 353-362.
- OECD (2021) Long-term interest rates, OECD. Available from:

<https://data.oecd.org/interest/long-term-interest-rates.htm> [Accessed 21/02/2021]

ONS (2021a), durable goods: Total CP SA £m, ONS. Available from: <https://www.ons.gov.uk/economy/nationalaccounts/satelliteaccounts/timeseries/utib/ct> [Accessed 06/03/2021]

ONS (2021b) Gross Domestic Product: chained volume measures: Seasonally adjusted £m, ONS. Available from: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/qna> [Accessed 26/02/2021]

ONS (2021c), Non-durable goods: Total CP SA £m, ONS. Available from: <https://www.ons.gov.uk/economy/nationalaccounts/satelliteaccounts/timeseries/utij/pn2> [Accessed 06/03/2021]

ONS Economy (2021) UK: Total Final Consumption Expenditure: CP NSA, ONS. Available from: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abkw/ukea> [Accessed 21/02/2021]

ONS (2021d), Unemployment rate (aged 16 and over, seasonally adjusted), ONS. Available from: <https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/timeseries/mgsx/lms> [Accessed 04/03/2021]

Palley, T.I., 2008. The relative income theory of consumption: A synthetic Keynes-Duesenberry-Friedman model.

Romer, D. (2012) *Advanced Macroeconomics*. New York. McGraw Hill Irwin.

Thaler, R.H., 1997. Irving Fisher: modern behavioral economist. *The American economic review*, 87(2), 439-441.

Weber, W.E., 1970. The effect of interest rates on aggregate consumption. *The American Economic Review*, 60(4), 591-600.

World Bank (2019a), Inflation, consumer prices (annual %) - United Kingdom, The World Bank. Available from: <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=GB> [Accessed 24/02/2021]

World Bank (2019b), Population, total - United Kingdom, World Bank. Available from: <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=GB> [Accessed 07/03/2021]

Wright, C., 1967. Some evidence on the interest elasticity of consumption. *The American Economic Review*, 57(4), 850-855.

Yi, K.M. and Zhang, J., 2017. Understanding global trends in long-run real interest rates. *Economic perspectives*, 41(2), 1-20.

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