

**ECONOMIC POLICY UNCERTAINTY AND  
CONSUMER SENTIMENT: INSIGHTS FROM  
DIFFERENT AGE DEMOGRAPHICS**

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**ABSTRACT**

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<p>This study investigates the influence of Economic Policy Uncertainty (EPU) and four other macroeconomic variables on consumer sentiment across three different age groups in the United States from 1985 to 2023. The study is conducted by using a Vector Autoregression (VAR) model and Granger causality test. The research explores the dynamics between EPU, Industrial Production Index, Consumer Price Index, and unemployment rate and their effects on consumer sentiment among three age groups, 18-34, 35-54, and 55+. The dynamics between variables are examined as a group and individually.</p> <p>The results reveal that EPU significantly impacts consumer sentiment across all age groups, with young adults showing the most immediate reactions. Middle-aged consumers exhibit substantial sensitivity to EPU, while older adults demonstrate a more persistent but less intense response. Additionally, other economic variables such as CPI, IPI, and the unemployment rate also significantly affect consumer sentiment, with varying impacts across age groups. Additionally, impulse response functions indicate that younger adults are more negatively affected by inflation, while industrial production boosts sentiment across all groups. The Granger causality tests confirm that EPU precedes changes in consumer sentiment, emphasizing its role as a leading indicator.</p>	
Key words Economic policy uncertainty, vector autoregression, Granger-causality, consumer sentiment, industrial production index, consumer price index, unemployment rate	
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# 1 INTRODUCTION

Consumer sentiment is a crucial determinant of a nation's economic health. The choices and decisions made by individuals and households regarding spending, saving and their overall economic sentiment collectively shape the economic landscape of a country. These choices, in turn, are influenced by a multitude of factors, ranging from personal financial circumstances to broader economic and political forces. One such potent force that has been the subject of increasing attention in recent years is economic policy uncertainty (EPU).

Consumer sentiment is a widely researched topic but very few if any studies focus on the sentiment directly from the age group perspective. This master's thesis aims to examine the impact of EPU on consumer sentiment across different age groups in the United States from 1985 to 2023. The primary objective is to understand how EPU, along with other economic variables such as the unemployment rate, Consumer Price Index (CPI), and Industrial Production Index (IPI), influences the sentiment of three distinct age demographics: young adults (18-34), middle-aged adults (35-54), and older adults (55+). This research not only provides insights into the direct effects of EPU on consumer confidence but also explores the differential impacts across various life stages.

To conduct an analysis of the variables and study their dynamics a vector autoregression (VAR) model and Granger causality tests are conducted. They allow to analyze the variables individually and as a group.

Since the 1940s, there's been an ongoing debate about how useful consumer sentiment surveys are for predicting economic trends. This debate gained momentum after the 1990-91 recession when some argued that a drop in consumer confidence might have made the recession worse. Recently, studies have been looking at how overall consumer spending relates to two main sentiment indices: the Michigan Index of Consumer Sentiment (ICS) and the Consumer Board Consumer Confidence Index (CCI) (Souleles, 2004).

Between the CCI and the ICS, there is a notable fluctuation in the relationship. Differing survey methodology and data gathering may have led to differing assessments of consumer sentiment toward the economy. The CCI's distinctive behavior is probably influenced by its emphasis on unemployment, even though both are important. If these polls want to be used to forecast consumer spending, one needs to be familiar with the differences (Kellstedt et al., 2015).

This research is conducted using sentiment data provided by the University of Michigan. Another source for similar sentiment data can be found from the Conference Board's Consumer Confidence Index which is also followed closely. However, the data provided by the University of Michigan is more often used in previous literature. They both also measure the same thing, but the questions asked by individual U.S. consumers differ (Ludvigson, 2004).

## 1.1 Research objective

The aim of this study is to examine how consumer sentiment among different age groups is affected by economic policy uncertainty, unemployment rate, consumer price index, and industrial production index in the US. From the four variables, the results from EPU's effect on consumer sentiment are considered the most important. The research is conducted from 1985 to the end of 2023. The age groups are 18-34, 35-54, and 55-year-olds and older. The factors are chosen based on previous literature. The research questions can be specified as:

*How does economic policy uncertainty impact consumer sentiment across three different age groups in the US?*

To answer this question three investigative questions are used which are:

1. *How do the results vary between different age groups?*
2. *Are there lead-lag relationships?*
3. *How significant are the effects of other variables on age group sentiments compared to the influence of EPU?*

## 1.2 Research methods

This research uses Vector Autoregression (VAR) and Granger Causality tests to explore how different variables interact. They enable to clarify how a change in one variable affects another. The impulse response functions from the VAR model reveal how shocks to variables impact consumer sentiment in different age groups over time. By plotting these results, they are easier to understand for the reader.

In addition to VAR model, the lead-lag relationships between variables are tested through Granger causality tests. The discussed methods are the most appropriate to use to answer the research question. Understanding how different age groups react to economic uncertainty helps to understand differences in life stage, risk tolerance and financial conditions.

Both the VAR model and Granger causality tests address the first and second investigative questions. Granger causality is especially useful as it directly shows if one variable causes a change in another over time. The third question, about the significance of other variables compared to EPU's impact on age group sentiments, can also be explored using the VAR model and Granger causality tests. This approach gives a thorough view of how different economic factors affect consumer sentiment.

### **1.3 Structure of thesis**

This master's thesis is structured to provide a comprehensive overview of the impact of the chosen macroeconomic variables on consumer sentiment. The structure of the master's thesis is the following. Chapter 2 includes the theoretical framework where two main variables are discussed thoroughly. Chapter 3 provides information regarding previous studies and their results. Chapter 4 presents the data and used methodology and chapter 5 provides the computed results. Chapter 6 includes an additional discussion of the results and chapter 7 concludes the study.

## 2 THEORETICAL FRAMEWORK

In this section, the two key variables of the study, economic policy uncertainty, and consumer sentiment, are discussed thoroughly. The chapter discusses each variable individually, their backgrounds, and possible relationships.

### 2.1 Economic policy uncertainty

EPU refers to the level of ambiguity and unpredictability surrounding economic policy decisions, including fiscal policies, monetary policies, tax regulations, and government interventions. It is an index that quantifies the degree of uncertainty individuals and businesses face in navigating the economic landscape. Economic policy decisions have far-reaching consequences on the financial well-being of households, job security, and economic prospects, thus making EPU a critical aspect of consumer sentiment analysis (Baker et al., 2016).

Geopolitical events and their associated risks have increasingly become intertwined with EPU and consumer sentiment. Geopolitical crises and conflicts occur now and then, and the impact of such events on EPU and, by extension, consumer sentiment is critical. These external shocks can create a sense of unpredictability and heightened uncertainty, influencing consumer sentiment.

The construction process of the economic policy uncertainty index by Baker et al. (2016) entails three primary components. One component includes newspaper coverage by analyzing articles mentioning economic policy uncertainty or similar terms. Ten major newspapers, including USA Today, the Miami Herald, and the Wall Street Journal, provide such data and creators look for publications that contain terms like "uncertainty," "economic," "congress," and "federal reserve". Secondly, they aggregate the scheduled expirations of federal tax code provisions. In addition, the level of disagreement among forecasters concerning macroeconomic factors, such as government spending and inflation, is measured. These three components are then integrated to form the EPU index, which serves as a valuable metric for gauging the degree of uncertainty surrounding economic policy decisions (Baker et al., 2016).

In addition, to the three-component index, Baker et al. (2016) also provide an index that is only based on data gathered from the newspapers. The one-component index is constructed the following way: The percentage of articles about uncertainty to all articles in each paper and month is then determined. They generate a multi-paper index by adding these values across all newspapers after normalizing them. To ensure measurement consistency, this index is then re-normalized to have a standardized average value for a given period (Baker et al., 2016).



The EPU index using one or three components is useful in economic analysis and is widely accepted by academics and market forecasters. The one-component index provides a direct measure of public perception and its influence on economic decision-making because it only measures EPU as it is represented in media coverage. The usage of the news-based policy uncertainty index can teach more about how market dynamics, investor behavior, and consumer mood are influenced by media representations of economic policy. In addition, it provides an understanding of economic conditions by assisting in the identification of times of increased uncertainty that may not be represented by conventional economic indicators (Baker et al., 2016).

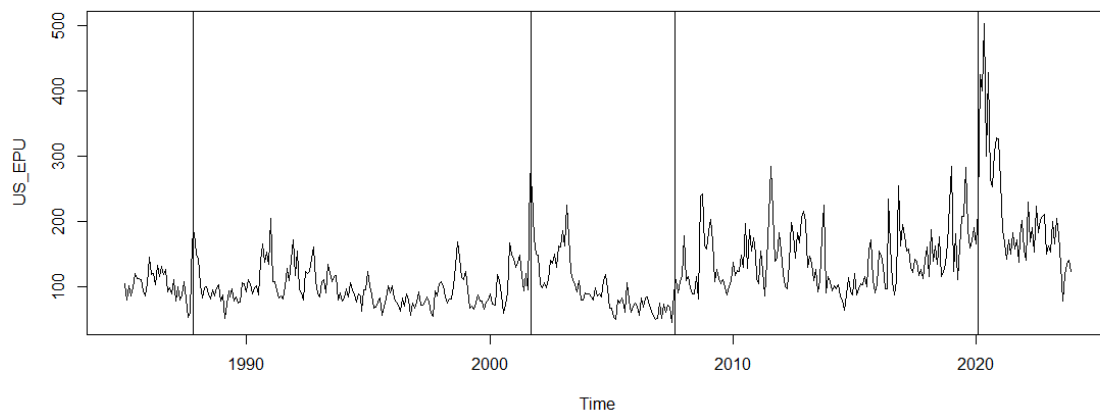


Figure 1 US EPU index 1985-2023

Figure 1 above presents the EPU index for the chosen period in this study. The vertical lines point out events that have caused a significant increase in the EPU index. The events in order are Black Monday, 9/11 attack, the financial crisis, and Covid-19. As seen in figure 1 the EPU index visualizes the effects of such events.

The reason for EPU being significant is that it shapes investment decisions and influences overall economic activity. The hesitancy of businesses to commit to investments and expansion plans during higher periods of EPU affects economic growth. High EPU causes businesses to reduce their investments in the long and short term (Chen et al., 2019). Various studies have researched this topic and concluded with similar outcomes. The impact of EPU in financial markets is seen on investor sentiment and asset pricing. Notably, increased uncertainty often translates into heightened market volatility, causing fluctuations in stock prices and altering risk perceptions among investors. Moreover, the macroeconomic consequences of EPU are profound, influencing factors such as employment, inflation, and GDP growth. This interplay is important for policymakers seeking to foster economic stability through informed decision-making (Pástor & Veronesi, 2012).

In research by Pástor & Veronesi (2012) stock prices drop when government policy changes, especially when new policies are announced. This decrease is particularly noticeable when there is increased unpredictability and unstable

economic conditions. Changes in EPU also reflect the interdependence of market dynamics by increasing volatility and correlations among stocks. When policy actions have a positive jump risk premium attached to them, it means that investors need to be compensated for the uncertainty and possible volatility in the market that these changes may cause.

Due to globalization, the consequences of EPU extend beyond national boundaries, influencing international trade, capital flows, and the broader dynamics of the global economy. For businesses navigating through uncertain economic landscapes, EPU directly affects decision-making processes and strategic planning. Understanding how EPU intersects with corporate strategies is important for firms seeking persistence in an unpredictable environment. Rodrik (1991) finds that Reforms in developing countries can cause delays with investments, as uncertainty about the reform's success needs to be resolved before businesses feel confident to proceed.

Consumer sentiment and spending behavior are also affected by EPU. During higher periods consumers often adopt a more cautious approach, resulting in shifts in spending patterns and an inclination toward saving (Ludvigson, 2004).

In addition, policymakers' decisions are affected by EPU. For example, when things are uncertain, they might have to take action to reduce risks. This, in the end, affects the choices they make about how the government spends its funds and manages the overall economy. Hassett & Metcalf (1999) Find that uncertainty affects the economy through government spending and tax policies. When businesses are confident about getting tax credits and adjustments in the budget, it acts as an encouragement for them to invest. However, when there are unexpected ups and downs in government spending it can cause issues to the overall economic activity.

The EPU index by Baker et al. (2016) is preferred over alternatives like the index by Alexopoulos & Cohen (2015) due to several key factors. The EPU index is commonly used in research that discusses uncertainty which indicates its credibility and acceptance. Such usage provides validation for the index and highlights its reliability in capturing economic policy uncertainty. Moreover, Baker et al. (2016) have implemented detailed validation measures, including human audits of the index, to ensure its accuracy and mitigate potential biases. Additionally, the availability of the index on its website, its accessibility, and usability for researchers are beneficial.

The EPU index is commonly used in academic research, yet it has some limitations. The index focuses more on advanced economies than on developing economies. As the index is quite new, some data is also quite new which can limit the researched time periods. The method used to scale the EPU index may not be consistently applicable across all regions, particularly for newspapers outside the United States. Even though these limitations suggest being cautious when using the EPU index it does work well with data regarding this thesis as it focuses on the U.S. However, alternative measures can be used.

## 2.2 Consumer sentiment

The index of consumer sentiment (ICS) measures and reflects individuals' confidence in the economic environment. EPU has the potential to shift consumer sentiment, affecting consumers' willingness to invest, spend, and participate in the economy. Examining these shifts in consumer sentiment in response to changes in EPU across different age demographics, their relationship can be examined thoroughly. In addition, to consumers' willingness to participate in the economy, it has been discovered that the ICS can provide insights into political landscapes and outcomes in addition to economic trends (Kellstedt et al., 2015).

The University of Michigan has measured consumer sentiment since 1978. Which started as a project and is now one of the most significant sources of consumer sentiment. The data regarding consumer sentiment in the United States is published monthly based on surveys. The Surveys of Consumers consists of five questions and is an ongoing, nationally representative survey conducted through approximately 600 telephone interviews with individuals residing in households across the United States. To enhance the study, the survey employs a rotating panel sample design, drawing an independent cross-section sample of households each month. Respondents selected in this process are reinterviewed six months later, creating a rotating panel, with two-thirds of the sample consisting of new respondents and one-third interviewed for the second time. The five questions are listed in a separate appendix (Cervantes et al., 2024). The five questions are listed in Appendix 1.

Consumer sentiment can be further divided into different groups. The University of Michigan has collected data from 1978 about consumer sentiment from various aspects such as age, income, region, gender, education, and political party. This allows more detailed research between different groups. By investigating the relationship between consumer sentiment in different age demographic groups and EPU insights into generational variations in economic outlook, risk perception, and behavioral responses can be discovered.

As seen from the figure 2 the confidence towards the economic environment has similar movement but indices differ between different age groups. As consumer sentiment is based on factors such as market conditions, wages, interest rates, expected inflation, and unemployment rates, one reason for differences can be due to risk. Younger individuals are less risk averse compared to older individuals, which causes the ICS index of 18-34-year-olds to be higher than the index for 55+ year-olds (Johnson & Naka, 2014).

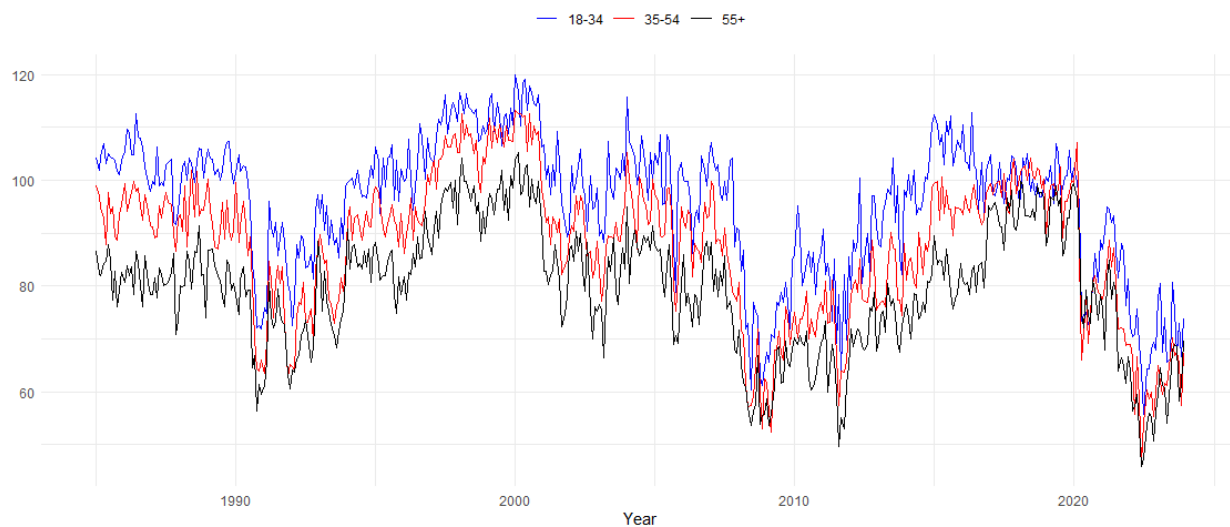


Figure 2 Index of consumer sentiment within age groups

Based on previous studies it can be concluded that consumer sentiment influences equities, GDP, and the overall economic well-being. For example Matsushita & Sbordone, (1995) have discovered a correlation between ICS and the growth of GDP. Moreover, various studies show that consumer sentiment can forecast the general health of the economy. Akhtar et al. (2011) conclude that in Australia consumer sentiment index affects stock market returns. This means that changes in consumer confidence can impact on how the stock market performs. However, they also found that positive shock in CSI does not have a significant effect. In simpler terms, while overall consumer sentiment trends can affect the stock market, sudden boosts in consumer confidence do not seem to make a big difference in stock returns.

In addition to the correlation between ICS and GDP, the correlation between ICS and equity returns has been studied. For stock returns a negative change for ICS in all age groups is more significant than a positive change for ICS. In addition, the ICS index can be used to forecast short-term returns better than long-term returns. This was concluded by Johnson & Naka (2014) using a long-horizon regression method to test the short- and long-term effects of the consumer sentiment index on the stock market. The formula is in more detail below.

$$r_{i,t+1} + \dots + r_{i,t+K} = \alpha(K) + \beta(K)\Delta ICS_t + \varepsilon_{t+K} \quad k = 1, 3, 6, 12, 24$$

In their formula, excess returns are defined as the equity returns minus the risk-free rate and the risk-free rate is the monthly yield on a 30-day treasury bill.  $r_{i,t+1}$  stands for excess return of equity index  $i$  over  $K$  month periods.  $\Delta CSI_t$  is the monthly percentage change in the CSI and  $\varepsilon_{t+K}$  is the residual term for horizon  $k$ . (Johnson & Naka, 2014)

Consumer spending is the engine that drives economic growth and well-being. The strength of demand is built upon prices and interest rates (Hsu, 2023).

When individuals feel confident about the future economic landscape, they are more likely to spend money on goods and services, increasing economic expansion. However, during times of heightened EPU, consumers may be more cautious, leading to shifts in spending patterns (Jin et al., 2022).

Saving is another crucial aspect of consumer financial decisions. Economic policy uncertainty can influence households to increase their savings as a precautionary measure against uncertain times. Understanding how EPU impacts saving habits is essential for understanding the broader economic landscape (Fan & Yavas, 2020).

Consumer sentiment, influenced by factors like income expectations and political uncertainties, serves as a crucial barometer for broader economic conditions. As consumers perceive challenges, particularly in income and political stability, their cautious outlook can impact spending and investment sentiment, potentially influencing job market growth and overall economic expansion. The significance of consumer sentiment lies in its reflective nature and its potential to shape and impact the trajectory of the economy beyond individual jobs and incomes (Curtin, 2013).

From recent events, Hsu (2023), stated that the significance of consumer sentiment becomes apparent in its interplay with the Federal Reserve's interest rate policies and their effects on inflation. Although there is relief in the form of a slowdown in inflation, consumers are increasingly expressing concerns about the rising interest rates. Despite the labor market's current and anticipated strength offering some support to consumer spending amid elevated costs, the transmission of interest rate policies to the broader economy takes time.

Consumers, even without closely monitoring Federal Open Market Committee (FOMC) announcements demonstrate heightened sensitivity to changes in interest rates due to extensive borrowing. Recent empirical data, presented by Hsu (2023), reveal that nearly two-thirds of consumers anticipate a sustained increase in interest rates over the coming year. This heightened apprehension, especially concerning interest rates for housing, surpasses historical concerns about high prices. Despite historically elevated levels, these apprehensions have shown relative stability at that time, even during rate hikes by the Federal Reserve.

In the current landscape, the significance of consumer sentiment raises interest due to its potential impact on consumer spending behavior. Despite historically elevated concerns about interest rates, recent trends suggest a certain degree of stability. However, the prospect of a spending pullback looms, particularly among households with higher incomes, if borrowing costs continue to rise. This emphasizes how important consumer sentiment is in shaping how much people spend and influencing the broader economy (Hsu, 2023).

## 2.3 Relationship between consumer sentiment and EPU

Prior research suggests consumer sentiment is shaped by economic conditions, employment outlook, inflation, and political events. Throop (1992), states that variations in consumer sentiment are typically driven by economic factors, and there is a consistent correlation between consumer sentiment and few economic indicators. Thus, consumer sentiment is often an expression of economic challenges or prosperity, acting as an enhancing factor rather than a catalyst for business cycles. As a result, consumer sentiment tends to mirror the occurring economic conditions, emphasizing its role in amplifying rather than instigating shifts in business cycles.

Baker et al. (2016) present their findings aligning well with theories emphasizing the negative economic consequences caused by sudden uncertainties. Increased EPU in both the United States and Europe in recent years could have negatively impacted overall macroeconomic performance. Overall EPU has great effects on the variations in variables such as stock price volatilities, employment growth, and investment rates.

Going through previous studies, a microlevel study from China by Jin et al. (2022) discover that increasing EPU causes consumption to decrease in emerging countries. Dalwai (2023), suggest that during the Covid-19 pandemic firms in India prioritize savings rather than new investments and new debt. Thus, describing the overall sentiment or mood as risk-averse and cautious to manage through uncertainty. As companies delay new investments, recruitment, or even lay off staff, such events influence individual consumers. Thus, during times of financial distress, a consumer similar to companies is willing to postpone consumption and hold on to liquid assets such as cash (Mishkin et al., 1978).

This behavior aligns with Prospect Theory, developed by Kahneman & Tversky (1979), which describes how people make decisions under risk. According to this theory, individuals weigh potential losses more heavily than gains. This asymmetry can lead to significant changes in consumer sentiment in response to economic policy uncertainty, as consumers may perceive greater potential losses, thereby reducing their confidence.

Furthermore, the Life Cycle Hypothesis, proposed by Franco Modigliani and Richard Brumberg, posits that individuals plan their consumption and savings over their lifetime to smooth consumption (Kurihara, 2003). Middle-aged consumers, who are at the peak of their earning potential, may be more sensitive to economic fluctuations as they balance saving for retirement and current expenditures. This sensitivity aligns also with findings from Deaton et al. (2000), where economic uncertainty influences consumer sentiment.

Figure 3 illustrates the 12-month changes in the EPU index and the ICS in 1985-2023, revealing an inverse relationship between these two indices. When the EPU spikes, indicating higher economic policy uncertainty, the ICS often declines, reflecting reduced consumer confidence. After 1990, there are three noticeable periods where the EPU spikes sharply, and correspondingly, the ICS shows a

decline during these periods, indicating that higher economic policy uncertainty negatively impacts consumer sentiment. Between approximately 1993 and 1998, the EPU remains relatively low and stable. During this period, the ICS showed a steady increase, suggesting that consumers felt more confident about future economic conditions when uncertainty was minimal.

Around the year 2000, the ICS starts to decline, coinciding with the burst of the dot-com bubble and subsequent economic slowdown. This downward trend accelerates sharply during the global financial crisis of 2007-2008 when the EPU rises significantly. Despite multiple spikes in the EPU index between 2007 and 2020, the ICS generally remains stable indicating a gradual recovery in consumer confidence post-financial crisis. Notable exceptions include the euro crisis around 2010-2012, where the ICS dipped temporarily before recovering. The most recent spike in the EPU occurred in 2020 due to the COVID-19 pandemic. This spike corresponds with a significant drop in the ICS, demonstrating the immediate negative impact of the pandemic-induced uncertainty on consumer sentiment.

The chart clearly shows that the ICS reacts negatively to spikes in the EPU index, with consumer confidence dropping during periods of heightened economic policy uncertainty. While there are periods of steady improvement in the ICS when the EPU is low, major economic events and crises can cause significant and sometimes long-term declines in consumer sentiment. The recent COVID-19 pandemic highlights the sensitivity of the ICS to sudden increases in uncertainty, confirming the inverse relationship between these two indices.

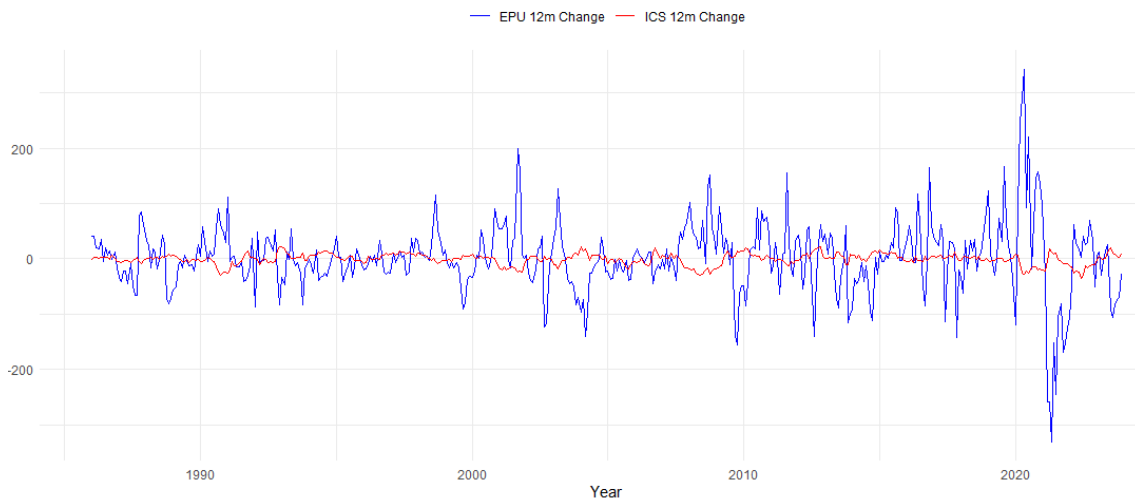


Figure 3 Relationship of the 12-month change in US EPU and ICS in 1985-2023

## 2.4 Wealth levels among age groups

To further understand the performance of sentiment groups, age, and wealth statistics are worth inspecting. Figure 4 below presents the amount of people in each generation in the US. For the first time the millennial generation, which is the generation that has the highest income and consumption has become the largest age group in the US surpassing the Baby Boomer Generation.

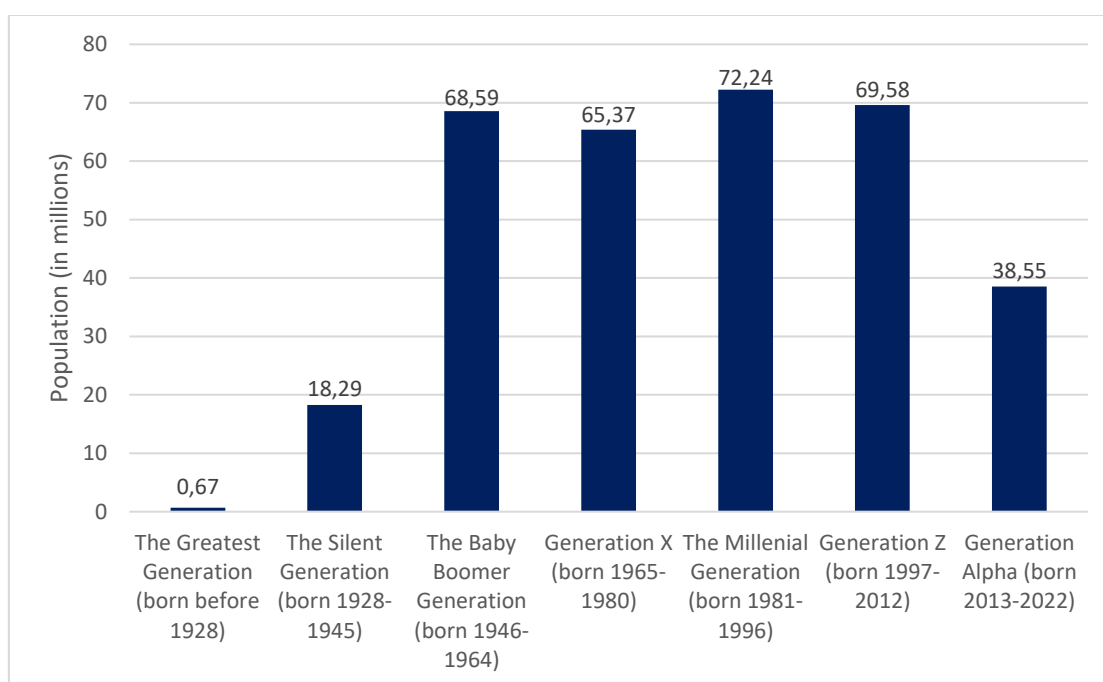


Figure 4 Population divisions between generations in the US. Source: Statista, 2024

In 2009 median net worth for 55–64-year-olds was \$162,065.00 and \$170,494 for 65 years old and older (Pew Research Center., 2011). The Baby Boomer generation is the wealthiest generation to retire. This can be a positive catalyst for higher sentiment for the oldest age group, 55 years old and older. As the majority of individuals retiring have significant amounts of wealth and in addition, gain pension the economy is likely to remain healthy and perform well. In addition, as mentioned previously the Millennial Generation is currently the largest, they are likely to boost economic growth through consumption as they are the generation that earns and consumes the most. Below in figure is a full table of median household net worth in the US in 2009. A clear trend can be seen that net worth within households increases with older age groups.



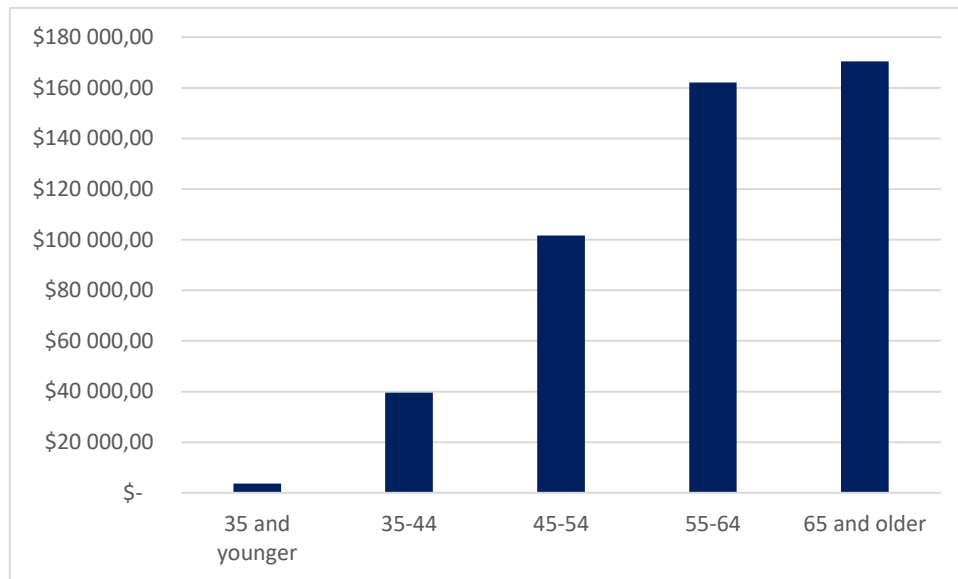


Figure 5 Median household net worth in the US in 2009. Source: Pew Research Center, 2011

Figure 6 below presents the cumulative net worth growth in the US in 2019 and 2023. Net worth under 40-year-olds grew significantly faster than the net worth of 40–54-year-olds and 55-year-olds and older. One reason for such a quick rise in net worth for under 40-year-olds was that during that period they invested in equities and mutual funds more than the other two groups (Federal Reserve Bank of New York, 2024). Thus, based on this data the sentiment is likely to perform positively in the long term.

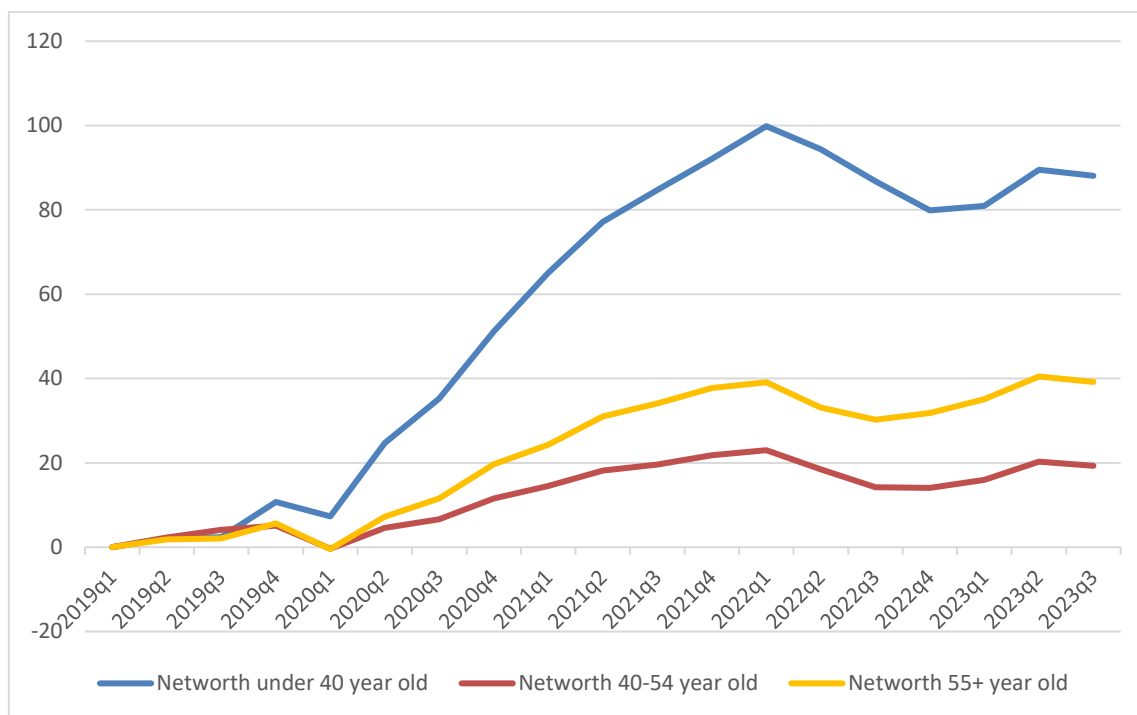


Figure 6 Cumulative net worth growth in different age groups in the US (in percentage). Source: Federal Reserve Bank of New York, 2024

Research by Blanchflower & Oswald (2004) found that higher wealth levels are strongly correlated with increased well-being and consumer confidence. This is particularly relevant for older age groups who possess higher median net worth and thus may exhibit more stable and positive sentiment. Lifetime to smooth out their consumption levels. This theory explains why older individuals, who are generally wealthier, may have higher consumer sentiment due to their accumulated savings and assets, providing a buffer against economic uncertainties.

The Millennial generation, which has recently become the largest age group, demonstrates distinct financial behaviours compared to previous generations. According to a study by the Pew Research Center, Millennials are more likely to delay major life events such as purchasing homes and starting families, partly due to economic challenges such as student loan debt and higher living costs (Pew Research Center, 2020). Despite these challenges, Millennials have shown a strong tendency to invest in equities and other financial assets, which has contributed to their significant net worth growth in recent years.

Generation Z, following closely behind Millennials in population size, is beginning to enter the workforce and exhibit their financial behaviours. Early indications suggest that Gen Z values financial security and is cautious with spending, which may influence their consumer sentiment differently from Millennials and older generations (Deloitte, 2024).

### 3 LITERATURE REVIEW

Consumer sentiment is a central driver of economic activity, influenced by various factors. Among these, EPU plays a pivotal role in shaping consumer choices, impacting consumer spending, saving patterns, and overall sentiment. This literature review provides an overview of key research studies that examine the relationship between EPU and consumer sentiment in the United States. In addition, the rest of the independent variables are reflected in the economy.

All in all, higher EPU causes firms to reduce investments and postpone them (see e.g. Aghion et al., 2010; Chen et al., 2019; Converse, 2018). Similarly increased EPU causes individuals to reduce consumption (see e.g. Bansal & Yaron, 2004; Hansen et al., 1999). In addition, higher EPU reduces households' expectations about their future financial situations and increases savings which can in turn reduce economic growth through capital outflows. However, households with debt increase economic growth in the short run compared to households without debt (see e.g. Andersen et al., 2016; Bacchetta & Gerlach, 1997; Bergman & Worm, 2021; Jin et al. 2022; Ludvigson, 1999).

increased EPU causes businesses to reduce their investments for the long and short-term (Chen et al., 2019). Various studies have researched this topic and concluded with similar outcomes. The existing body of research has extensively examined the link between EPU and business investments, primarily concentrating on the long-term span. Long-term investments, involving assets like machinery and inventories, are pivotal for a firm's stability, often fluctuated by perceptions of economic policy stability or uncertainty (Gulen & Ion, 2016).

Studies by Chen et al. (2019) and Gulen & Ion (2016) have underlined the influence of policy uncertainty on long-term investment. In more detail, Gulen & Ion (2016) use VAR models to examine how shocks in EPU influence business investments over time. The VAR model captures the dynamic interactions between multiple time series variables, to explore the impact of EPU on business investment decisions. In addition to long-term investments, it is important to examine short-term investments as well as they offer advantages such as revenue creation and liquidity enhancement.

The theoretical model by Converse (2018), suggests that heightened uncertainty prompts firms to scale back investments, sometimes prompting a shift from long-term to short-term investment projects. Aghion et al. (2010) have also examined this idea and presented a model that incorporates both short- and long-term investments. Their findings suggest that during periods of economic volatility and imperfect credit markets, firms might redirect capital from long-term to short-term investments. Consequently, EPU could directly and indirectly influence a firm's short-term investments, exerting a positive effect on these more flexible and liquid assets.

By adding different methodologies, a comparative perspective on how EPU and other independent variables impact consumer sentiment can be researched. As already mentioned, various studies employ VAR models, Granger causality tests, and other advanced econometric techniques to explore these relationships. For instance, Cecchetti et al. (2006) analyze the efficiency of monetary policy across multiple countries by examining inflation and output variability, focusing on changes in economic structures and policy efficiency. Gelper et al. (2007) employed Granger causality tests to investigate whether consumer sentiment can predict future consumption patterns across categories such as total real consumption, durables, non-durables, and services. This method is particularly useful for identifying lead-lag relationships, offering a clear view of the temporal dynamics between consumer sentiment and economic variables.

Moving from businesses to consumers, it can be stated that the results are somewhat similar. The standard rational expectations-lifecycle/permanent income hypothesis forms a theoretical background, asserting that rational individuals, assuming complete financial markets, strategically smooth and adjust their consumption patterns over time, optimizing their expenditures across their expected lifetimes (Jin et al., 2022).

Based on the study by Jin et al. (2022) in China, higher EPU negatively impacts household consumption, particularly among households with high levels of debt. A similar examination in the United States was conducted by Bordo et al., (2016), which highlighted the negative effects of EPU on bank credit growth. According to their research heightened EPU restricts credit availability, thereby decreasing household consumption due to reduced borrowing capabilities.

Based on these two research papers, EPU can constrain household consumption by limiting access to credit. Thus, making them essential for understanding consumer sentiment in two different economies. These findings provide a similar outcome and a comprehensive view of how EPU influences household financial behaviors across two different economic environments in the USA and China.

The link between the size and growth rate of mortgage debt and its influence on the consumption and saving behaviors of households holds profound implications for policymakers, particularly considering housing's substantial contribution to the economy. Housing not only constitutes a significant portion of household expenditure but also plays a pivotal role in shaping household total wealth.

As Fan & Yavas (2020) illustrate, households with a mortgage tend to consume a higher portion of their income compared to those without a mortgage. This highlights how mortgage debt impacts overall consumption and savings behavior, which is crucial for effective policymaking.

The close association between the national savings and investment rates adds another layer of complexity to these questions. A low saving rate not only constrains the capacity for economic investment but also has far-reaching implications for government policies that give incentives for those with mortgage debt and home ownership. The welfare implications of such policies become a focal

point for economists and policymakers. Additionally, the size and growth rate of mortgage debt emerge as key factors influencing the effectiveness of monetary policy (Calza et al., 2013).

As discussed, Fan et al. (2020) find noteworthy patterns in household behavior related to mortgage debt. Households with a mortgage debt tend to allocate a higher proportion of their income to consumption, aligning with the argument that having a mortgage reduces uncertainty surrounding monthly savings for housing purposes. However, within the selection of households with a mortgage, a contrastive trend emerges. Those allocating a larger share of income to mortgage payments exhibit reduced consumption, reflecting the crowding-out effect of mortgage payments on household spending (Fan & Yavas 2020).

Contrary to conventional views, borrowing plays a pivotal role in achieving optimal consumption smoothing, particularly in early life stages when incomes are relatively low. The impact of household debt on the financial decisions and consumption patterns of various age groups can be immediately observed. Also, the choices made about housing, especially mortgage debt, have a significant impact on household investment, wealth creation, and general spending patterns, which likely differ depending on the age group. As noted by Dynan et al. (2012) and Mian & Sufi (2011) households with higher debt-to-income ratios are more vulnerable to economic shocks, leading to significant reductions in consumption during downturns. The amount of mortgage debt becomes an important variable shaping the efficiency of monetary policy and may also influence the financial health and consumption patterns of various age groups.

As mentioned, the two most known measurements for consumer sentiment are the index of consumer sentiment and the index of consumer confidence (ICC). The ICS is more common than the ICC when it comes to academic research (Ludvigson, 2004). A study by Kellsted et al. (2015) investigates the usefulness of the ICS. The study aims to explain the role of consumer sentiment and point out possible issues about the reliability of consumer sentiment measures. Although apart from its components the index shows strong face validity but the measure's predictive validity for expenditure on durable goods is lacking. If the index is meant to measure durable goods spending, a better index could be constructed. To summarize, the research concludes that the ICS does not capture the individual's willingness to consume. Thus, making it more appropriate to measure the overall sentiment or mood regarding the economy.

Souleles (2004), used household data from the Michigan Index of Consumer Sentiment to examine whether consumer expectations are rational and useful for predicting spending. The study discovered that consumer expectations tend to be biased and inefficient. For example, people underestimated the impact of early 1980s disinflation and recent economic downturns. In addition, it was found that individuals' forecast errors are linked to their demographic characteristics, partly due to changes in group-level shocks over time. Additionally, the study found that consumer sentiment plays a role in predicting consumption growth. The results challenge the permanent income hypothesis, with some of

the deviations attributed to systematic demographic factors influencing forecast errors.

Gelper et al. (2007) investigate the relationship between the consumer sentiment index and real consumption by employing various prediction models. Conducting the Granger causality at different time lags, they explore how consumer sentiment influences consumption patterns across four categories: total real consumption, real consumption of durables, non-durables, and services. Their findings reveal that the consumer sentiment index is closely linked with real consumption, thus they use error-correcting models. As for the results, the consumer sentiment index has a key role in predicting future consumption, and the index holds more predictive power for the consumption of services compared to durables or non-durables. Also, the index serves as a predictor not only in the short term but also maintains predictive power over larger time horizons. The average time lag in predicting future consumption is approximately 4-5 months.

Based on the studies by Kellsted et al. (2015), Gelper et al. (2007), and Souleles (2004), there are mixed results regarding the effectiveness of the ICS in predicting consumer sentiment and economic trends. Kellsted et al. (2015) suggest that while the ICS exhibits strong face validity, its predictive validity for expenditure on durable goods is lacking. This suggests that while the index seems to gauge consumer sentiment rather well, it might not be able to forecast spending trends with any degree of accuracy, especially when it comes to durable items.

On the other hand, Gelper et al. (2007) find that the consumer sentiment index is closely linked with real consumption, especially for services. Their findings indicate that the index has significant predictive power for future consumption across various timeframes, suggesting its usefulness in forecasting consumption behavior.

However, Souleles (2004), presents contrasting findings, indicating that consumer expectations, as captured by the Michigan Index of Consumer Sentiment, tend to be biased and inefficient. Predictions of consumption growth are frequently incorrect as individuals tend to underestimate the effects of economic shifts, such as disinflation and recessions. Overall, these studies highlight the usefulness of ICS but provide mixed results that the index itself measures in more detail.

A study by Bergman & Worm (2021) uses similar research methods that are conducted in this research. VAR model with three variables which are Danish EPU index, consumer confidence index, and Denmark's composite leading indicator. In addition, the Granger causality test is concluded to test relationships between variables. They constructed a similar EPU index to Denmark by using newspaper data to observe how it affects consumer confidence in Denmark. Their results suggest that the Danish EPU index has an impact on Danish consumers' expectations regarding their financial situation for the next 12 months. Heightened uncertainty is correlated with less favorable expectations and lower uncertainty is seen as a more positive outlook for the economy in Denmark.

A more focused study on how consumer sentiment is affected by using Granger causality is conducted by Jansen & Nahuis (2003). They studied how

developments in the stock market affect their relationship with consumer confidence. The study is from 1986 to 2001 and uses 11 European countries. According to the results, 9 countries have positive correlation effects and 2 negative correlation effects. Most importantly they discover that stock returns granger-cause consumer confidence. At least for short periods from 2 weeks to 1 month. Similarly to this study, a relationship between the EPU index and the age sentiment sub-groups can be examined using the Granger causality tests.

As mentioned in the research objective, this research also uses other variables in addition to EPU, including the Industrial Production Index, the Consumer Price Index, and the unemployment rate. The inclusion of these variables is supported by existing literature which highlights their significant impact on consumer sentiment. Stock & Watson (1989) demonstrated that industrial production is closely tied to economic fluctuations, making IPI a crucial indicator. Souleles (2004) and Ludvigson (2004) have shown that CPI, reflecting inflation, affects consumer purchasing power and sentiment. Moreover, the unemployment rate is a vital measure of economic health, as periods of high unemployment are often associated with lower consumer confidence (Clark & Summers, 1982).

Table 1 Summary of literature

Author(s)	Aim of the Research	Data	Methodology	Results
Aghion et al. (2010)	Volatility and growth: Credit constraints and the composition of investment	Quarterly, 1980-2008	Econometric analysis	Credit constraints and economic volatility interact to affect the composition and effectiveness of investment.
Andersen et al. (2016)	Analyze the relationship between pre-crisis debt levels and the development in household spending in Denmark	Yearly 2003-2011	OLS regression	Highly levered households spent a larger share of their income than less-levered households prior to the financial crisis, resulting in larger increases during that time.
Bacchetta & Gerlach (1997)	Examines the relationship between aggregate consumption and measures of the tightness of credit	Monthly 1/1970-3/1995	The extended Kalman filter (EKF)	Credit aggregates are a determinant of consumption but the wedge between borrowing and lending rates is as well.
Bergman & Worm (2021)	Study the interrelationships between uncertainty, consumer confidence, and household expectations	Monthly 1991-2019	VAR	Uncertainty affects household expectations about their financial situation and the Danish economy.
Bergman & Worm (2023)	University of Copenhagen, Denmark	More than one time period	Survey analysis	Analysis of policy uncertainty and its impacts on consumer behavior and economic conditions.

Bloom (2009)	Analyze the impact of uncertainty shocks	Monthly 6/1962- 7/2008	VAR	Suspension in firm investments. Shocks can cause rapid drops in employment and output.
Calza et al. (2013)	Housing finance and monetary policy	Quarterly, 1995-2011	VAR	Housing finance conditions significantly influence the transmission of monetary policy to the real economy.
Cecchetti et al. (2006)	Has monetary policy become more efficient? A cross-country analysis	Various (Cross-country data)	VAR	Monetary policy efficiency has improved over time across various countries, with reduced volatility in economic outcomes.
Chen et al. (2019)	Economic policy uncertainty and firm investment: Evidence from the U.S. market	Monthly, 1985-2016	Panel regression	Higher economic policy uncertainty is associated with lower levels of firm investment in the U.S.
Clark & Summers (1982)	The dynamics of youth unemployment	More than one time period	Econometric analysis	Youth unemployment is characterized by significant flows into and out of employment, rather than long-term joblessness.
Converse (2018)	Uncertainty, capital flows, and maturity mismatch	Monthly, 1980-2016	Panel regression	Higher uncertainty leads to increased capital flow volatility and maturity mismatch in international finance.
Gelper et al. (2007)	Consumer sentiment and consumer spending: Decomposing the Granger causal relationship in the time domain	Monthly, 1987-2004	Granger causality analysis	Consumer sentiment has both short-term and long-term causal effects on consumer spending.
Gulen & Ion (2016)	Policy uncertainty and corporate investment	Quarterly, 1962-2011	Panel regression	Policy uncertainty leads to significant reductions in corporate investment, especially during periods of high uncertainty.
Jin et al. (2022)	What is the effect of EPU on the consumption response to household debt using household-level data from China	Monthly 2009-2018	Panel regression	Positive correlation between household debt and consumption. Household debt fuels short-run economic growth early on, such as in developing countries, but eventually results in lower GDP growth in the long run.
Kang et al. (2014)	The effect of EPU and its components on firm-level investment	Daily, Monthly 1985-2010	Error correction model (ECM)	On firm-level uncertainty firms investments decrease in short- and long-term. No effect on the very largest firms (about 20% of listed firms).



Kellstedt et al. (2015)	The usefulness of consumer sentiment: Assessing construct and measurement	More than one time period	Survey analysis	Consumer sentiment is a valid and reliable predictor of various economic behaviors and outcomes.
Ludvigson (1999)	Study the optimal consumption behavior of individuals who face borrowing limitations that vary stochastically with their income	Quarterly 1953-1993	Panel regression	Positive correlation between consumption growth and growth in consumer credit.
Ludvigson (2004)	Consumer confidence and consumer spending	Quarterly, 1967-2002	Time-series analysis	Changes in consumer confidence have significant predictive power for future consumer spending.
Ogawa & Wan (2007)	Examine how household debt influenced consumption during and after the financial bubble in Japan	Monthly, Yearly 1989-1999	OLS regression	Debt-asset ratio had a significantly negative effect on consumption after the asset price bubble burst in Japan.
Rapach et al. (2013)	Investigate lead-lag relationships among monthly country stock returns and identify a leading role for the United States	Monthly 2/1980-12/2010	Granger causality	Lagged U.S. returns significantly predict returns in numerous non-U.S. industrialized countries, while lagged non-U.S. returns display limited predictive ability in contrast to U.S. returns.
Souleles (2004)	Expectations, heterogeneous forecast errors, and consumption: Micro evidence from the Michigan Consumer Sentiment Surveys	Monthly, 1978-1996	Microeconomic analysis	Consumers' expectations and forecast errors play a critical role in shaping their spending behavior.
Fan & Yavas (2020)	How does mortgage debt affect household consumption? Micro evidence from China	Household survey data, 2013-2017	Microeconomic analysis	Mortgage debt significantly affects household consumption patterns, with implications for economic stability.
Stock & Watson (1989)	Create new indices for tracking and predicting economic activity	Monthly, 1959-1982	Econometric analysis	Developed new indices that track and predict economic activity and trends.

## 4 DATA AND METHODOLOGY

### 4.1 Data

The study is conducted using monthly data from the beginning of 1985 to the end of 2023. Such a period includes various circumstances and shocks in the global economy thus providing more valuable results. Previous studies that have studied similar topics with similar variables have also used a longer period when conducting their study. This allows to capture of possible long-term trends and cycles, which in turn can result in more robust results. In addition, long period mitigates noise and short-term fluctuations which can cause misleading results.

The variables used in this study are the index of consumer sentiment within age subgroups 18-34, 35-54, and 55+. In addition, variables US economic policy uncertainty index, unemployment rate, industrial production index, and consumer price index are used. All variables are measured from the US and are transformed to present the 12-month change. Tables 2 and 3 however are created based on the raw data. After transforming the data, all variables were stationary.

The data regarding consumer sentiment for each age subgroup is from the University of Michigan website, which is the party that measures and provides the data. The US economic policy uncertainty index by Baker et al. (2016), is from its website, [www.policyuncertainty.com](http://www.policyuncertainty.com). Unemployment rate, industrial production index, and CPI data are sourced from a public database, Federal Reserve Economic Data (FRED).

Table 2 Descriptive statistics

	(18-34)	(35-54)	(55+)	EPU	Unrate	IPI	CPI
SD	12.72	13.44	11.85	57.22	1.67	16.18	1.61
Mean	95.80	87.55	79.52	123.49	5.82	85.71	2.81
Min	55,80	46.6	45.8	44.78	3.4	54.44	-1.96
Max	120	113.3	105.3	503.96	14.8	104.12	8.99
Kurt	3.00	2.70	2.65	11.36	5.15	1.91	4.99
Skew	-0.76	-0.52	-0.28	2.24	1.15	-0.67	0.81

Table 2 presents the descriptive statistics. (18-34), (35-54) and (55+) are the consumer sentiment age group variables. EPU is economical policy uncertainty index, Unrate is unemployment rate, IPI is industrial production index and CPI is consumer price index or inflation. Data is monthly from 1985-2023.

Table 2 above provides descriptive statistics for the variable's raw data. Regarding consumer sentiment statistics across different age groups, one can observe variations in the distribution characteristics. For example, the mean for the youngest age group (18-34) is higher at 95.80 compared to 87.55 for the middle-

aged group (35-54) and 79.52 for the older age group (55+). The standard deviation is highest at 13.44 for the age group 35-54, thus indicating its sentiment is the most volatile of all three. However, it does not have large differences indicating that they have similar movements. Despite differences in means, the skewness values for all age groups are negative, indicating a slight leftward skew in the distribution of sentiment scores. The kurtosis values suggest that the distributions are moderately peaked for all age groups.

EPU index displays substantial variability, with a wide range from 44.78 to 503.96. The mean EPU level is at 123.49, indicating potential fluctuations and concerns in economic policy perceptions. The positive skewness in the variable suggests a rightward tail in the distribution. The standard deviation is high for EPU suggesting higher volatility and heightened periods of uncertainty for the index as seen in figure 2. Moreover, the high kurtosis value indicates a highly peaked distribution, underscoring the occasional extreme values observed in EPU levels.

The Unemployment Rate, Industrial Production Index, and Consumer Price Index also exhibit distinct patterns. The Unemployment Rate demonstrates a moderate range from 3.4 to 14.8, with a mean of 5.82. Both the IPI and CPI display similar ranges with a minimum value of 54.44 for IPI and -1.96 for CPI and maximum values of 104.12 for IPI and 8.99 for CPI. Thus, all three variables indicate relatively different circumstances for economic conditions. CPI having the lowest standard deviation of all the variables also has the lowest volatility. The unemployment rate also has low volatility and should only be affected by shocks. IPI has a standard deviation of 16.18 thus indicating similar movement as the consumer sentiment age subgroups. Kurtosis and skewness for the unemployment rate are 5.15 and 1.15, for IPI 1.91 and -0.67, and for CPI 4.99 and 0.81. Thus, the unemployment rate and CPI have a more peaked distribution than IPI and have a rightward tail in the distribution similar to the EPU variable.

Table 3 Augmented Dickey-Fuller Test and Phillips-Perron Test

	(18-34)	(35-54)	(55+)	EPU	Unrate	IPI	CPI
ADF	-3.42***	-3.48***	-3.80***	-5.97***	-3.54***	-1.63	-4.31***
PP	-4.38**	-3.90***	-4.38***	-7.23***	-3.51***	-1.65	-3.21**

Statistical significance levels noted as (\*\*\*) = 0.01, (\*\*) = 0.05, (\*) = 0.10.

Based on the ADF and PP test results, both tests are used to assess the stationarity of the time series data. The PP test loosens the assumptions a little bit, but it is comparable to the ADF test. The fact that the PP test is a variant of the ADF test is noteworthy. It implies that compared to the ADF test, it does not make the same rigorous distributional assumptions. Heteroscedasticity and autocorrelation residuals are permitted in the PP test. In theory, this test is comparable to the ADF test, but it eases assumptions.

For the variables (18-34), (35-54), and (55+), the ADF test indicates statistically significant results at the 1% level. Also, with the PP test the results indicate

a rejection of a unit root at 1% level except for the variable (18-34) which is significant at level 0.05 still however rejecting the null hypothesis. Overall, the result for these variables suggests strong evidence against the presence of a unit root, indicating stationarity in the series.

Similarly, for the EPU and Unemployment rate variables, both tests yield statistically significant results at the 1% level. The ADF test statistics are -5.97 and -3.54 for EPU and unemployment rate, respectively, while the PP test statistics are -7.23 and -3.51. Thus, the results support the stationarity of these two variables.

Similarly to variables (18-34) CPI's ADF test indicates statistically significant results at the 1% level but for the PP test the results are significant at 0.05 level and rejecting the null hypothesis. ADF test and PP test do not confirm stationarity for the IPI variable.

Table 4 Correlation coefficient

	(18-34)	(35-54)	(55+)	EPU	Unrate	IPI	CPI
(18-34)							
(35-54)	0.920***						
(55+)	0.847***	0.926***					
EPU	-0.451***	-0.389***	-0.289***				
Unrate	-0.360***	-0.411***	-0.422***	0.215***			
IPI	-0.166***	-0.114*	-0.045	0.274***	-0.280***		
CPI	-0.285***	-0.288***	-0.306***	-0.048	-0.322***	-0.190***	

*Computed correlation used pearson-method with listwise-deletion.*

Statistical significance levels noted as (\*\*\*) = 0.01, (\*\*) = 0.05, (\*) = 0.10.

The table above displays the correlation coefficient negative correlation with each consumer sentiment age subgroup. The strongest negative correlation of -0.451 is with the youngest age group and the least negative with the oldest age group. This implies that higher unemployment rates tend to correspond to lower sentiment levels across age groups.

Vice versa the unemployment rate has the strongest negative correlation with the oldest age group and the least negative correlation with the youngest age group. Higher unemployment rates tend to correspond to lower sentiment levels across age groups.

IPI demonstrates mixed correlations with sentiment levels. While there are negative correlations with (18-34) and (35-54) sentiment levels, these correlations

are relatively weaker and only the correlation with (18-34) sentiment is statistically significant at the 0.01 level. Interestingly, there is a positive correlation between IPI and (55+) sentiment, although it is not statistically significant.

CPI exhibits negative correlations with sentiment levels across all age groups, ranging from -0.190 to -0.322, all significant at the 0.01 level. This suggests that higher consumer price index levels are associated with lower sentiment levels across age groups.

## 4.2 Methodology

To analyse the relationship between the dependent and independent variables the data is transformed to reflect their 12-month changes. This is done similarly to Neely (2023), which employed year-over-year changes in economic variables to capture their dynamic effects over time. This transformation normalizes seasonal variations and highlights longer-term trends, making it easier to compare across time periods. The following formula was used to compute the 12-month absolute changes for each variable except for the CPI, which was already in the required form:

$$\text{Variable 12m change}(t) = \text{Variable}(t) - \text{Variable}(t-12) \quad (1)$$

Here, *Variable 12m change*( $t$ ) represents the 12-month absolute change of a given variable at time  $t$ . *Variable*( $t$ ) is the value of the variable at the current time period, and *Variable*( $t-12$ ) is the value of the same variable 12 months prior.

This approach allows us to investigate the lead-lag relationships and the dynamic interactions between these economic indicators and consumer sentiment over the analysed period 1985-2023. The transformed variables are all stationary.

The order of variables in a VAR model can significantly influence the results, especially when it comes to the interpretation of impulse response functions. The specific order of variables EPU, IPI, CPI, Unemployment rate, and consumer sentiment is chosen to reflect the dynamics of the economic system under study. In this research, EPU is considered to be the most exogenous variable due to its influence on other economic factors as discussed in chapter 3. Thus, it is placed first as it influences the rest of the variables. From the remaining variables IPI is found to be the second exogenous variable due to its influence on employment and price levels. CPI, which in this formula reflects how changes in IPI and EPU translate into price levels is third. Last of the independent variables is the unemployment rate, which is influenced by the three variables. According to Lütkepohl & Krätzig, (2004), the ordering should reflect theoretical considerations and the nature of the data.

$$y_t = [EPU, IPI, CPI, Unrate, ICS] \quad (2)$$

VAR models are well-suited for forecasting purposes due to their characteristics. They provide a framework where the present values of variables are influenced by their past values. Through analytical methods such as impulse response, forecast error variance decompositions, and scenario analysis, the relationships among variables within VAR models can be examined. In this thesis, the impulse response method is applied.

Var model can be defined as:

$$ICS_t = \alpha + \sum_{k=1}^{12} (\beta_{1k} EPU_{t-k} + \beta_{2k} IPI_{t-k} + \beta_{3k} CPI_{t-k} + \beta_{4k} Unrate_{t-k} + \beta_{5k} ICS_{t-k}) + \epsilon_t \quad (3)$$

In the formula above  $ICS_t$  is the dependent variable at time period  $t$ ,  $\alpha$  is the constant term,  $\sum_{k=1}^{12}$  indicates a specific time period in the past and 12 stands for 12 lags. Thus, means that the last 12 lagged values of each variable are summed together.  $\beta_{1k}$  is the coefficient and  $Variable_{t-k}$  represents the specific variable  $k$  periods ago.  $\epsilon_t$  is the constant term.

Like any other model, it has its pros and cons in empirical analysis. The VAR model is more flexible as it is capable of capturing relationships between multiple variables at the same time. Each variable is regressed by its own lagged values and in addition with lagged values of other variables in the model. Thus, data regarding how one variable can affect the behaviour of another variable is captured. To come up with prominent results the variables must be in the correct form in addition to having the right number of lags and a reasonable number of variables. Too many variables can cause results to be weak (Verbeek, 2004).

To choose the optimal number of lags for each analysis the Akaike information criteria (AIC) is used. This is a widely used method. In addition to being used in many other studies, it has a few characteristics that make it the most usable. It offers a more comprehensive approach. It evaluates the goodness of fit of different time series models while simultaneously considering their complexity, thereby keeping a balance between model accuracy and simplicity. By taking into account model complexity or the number of parameters and goodness or the ability to explain the data AIC provides a robust framework for selecting the optimal number of lags in a time series model (Akaike, 1974; Yang, 2005).

The use of 12 lags in a VAR model is particularly relevant in capturing the seasonal and cyclical patterns in economic data. For example, in economic research, using 12 lags allows the model to account for annual cycles and seasonal variations, which are essential in this specific research. This approach is beneficial in this master's thesis because it enables a more detailed and accurate analysis of how the discussed independent variables affect the dependent variables. According to my understanding, 12 lags help to capture the delayed effects and interdependencies that might not be apparent with fewer lags. Using too many lags in VAR models can lead to overfitting, where the model captures noise rather than the true underlying relationships. Overfitting reduces the model's predictive power and generalizability. For instance, Verbeek, (2004) highlights that

excessive lags result in inefficient estimates and inflated standard errors, weakening the robustness and interpretation of the model. Similarly, Lütkepohl & Krätzig, (2004) discuss how selecting an optimal number of lags is crucial for balancing the capture of relevant information while maintaining model efficiency. Therefore, selecting an optimal number of lags, like 12 in this study, helps balance capturing relevant information and maintaining model efficiency, ensuring that the results are both robust and interpretable. In addition, the study from Ozcicek & McMillin, (1999) highlights that an excessive number of lags can inflate the parameter space unnecessarily and reduce the model's predictive power. This can be particularly harmful in small sample sizes, where the number of observations is insufficient to reliably estimate many parameters.

Impulse response analysis is a critical technique for interpreting VAR model estimates. To put it simply, impulse response describes the dynamic way in which a system responds to outside changes. When applied to VAR models, the impulse response function demonstrates the dynamic effects following an impulse to the system. In practical terms, these responses are derived from estimated VAR coefficients, and confidence intervals are constructed using the bootstrap method to account for estimation uncertainty. Additionally, alternative bootstrap approaches can be explored to refine the analysis (Verbeek, 2004).

In addition to the impulse response test, the variance decomposition method can be implemented to discover the weights of each variable within a shock to another variable. This method helps to determine the amount of the forecast error variance of each of the variables that is explained by exogenous shocks to the other variables. Appendix 3, Table 1 holds the results for the weights of a shock in a consumer sentiment age subgroup variable (Lütkepohl & Krätzig, 2004).

The test to determine how one variable precedes another is called the Granger causality test. Even though its basic concept is to find if one variable affects another it has its limitations. Before conducting analysis, it is important to have the optimal lag length and stationary variables to get ideal results. It is also important to remember that the test does not suggest if there is a causal mechanism between two variables but rather only suggests if one variable can be used to forecast the effects on another variable. In case some of the conditions are not met alternative methods such as the Engle-Granger or Johansen tests become necessary (Granger, 1969).

For Granger Causality Bivariate system is used as the idea is to test if variable  $x$  Granger causes variable  $y$ . The model can be defined as:

$$x_t = \sum_{i=1}^{12} \alpha_i y_{t-i} + \sum_{i=1}^{12} \beta_i x_{t-i} + \epsilon_{x,t} \quad (4)$$

$$y_t = \sum_{i=1}^{12} \lambda_i y_{t-i} + \sum_{i=1}^{12} \sigma_i x_{t-i} + \epsilon_{y,t} \quad (5)$$

In the model  $x_t$  and  $y_t$  present the time series.  $\alpha_i, \beta_i, \lambda_i$  and  $\sigma_i$  are the lagged coefficients of variables. 12 is the number of lags used in this study and  $\epsilon_{x,t}$  and

$\epsilon_{y,t}$  are the error terms. Thus, formulas (4) and (5) construct a bivariate VAR model that both include 12 lags. In both formulas past values of  $y$  influence  $x$ . Through this formula the null hypothesis ( $H_0$ ),  $x_t$  does not Granger cause  $y_t$ , can be tested or an alternative hypothesis ( $H_1$ ),  $x_t$  Granger cause  $y_t$ . Jansen & Nahuis (2003) conduct the Granger causality test in a similar method to test the relationship between stock market development and consumer confidence.



## 5 RESULTS AND ANALYSIS

### 5.1 VAR results

In this section, the results of the Vector Autoregression (VAR) analysis are presented. The VAR model is used to explore the relationships between consumer sentiment and the chosen economic variables, including EPU, the IPI, the Consumer Price Index CPI, and the unemployment rate. Each age subgroup is presented in its subchapter: 5.1.1 for the 18-34 age group, 5.1.2 for the 35-54 age group, and 5.1.3 for the 55+ age group.

The VAR analysis is particularly useful in addressing the third investigative question: "How significant are the effects of other variables on age group sentiments compared to the influence of EPU?" By examining the coefficients and p-values of each variable, the VAR model provides insights into the relative significance and impact of each economic variable on consumer sentiment across different age groups.

The decision to use 12 lags in the VAR models was based on the Akaike Information Criterion (AIC) and selection criteria from previous research, such as Stock & Watson (2001), which suggest that 12 months or one year is an appropriate lag length to capture the dynamics of economic variables and their impact on consumer sentiment. In their study, they used quarterly data and 4 lags. This approach ensures that the analysis considers the full effect of historical data, providing a comprehensive view of the lead-lag relationships and highlighting the importance of each variable over time.

By presenting the results for each age subgroup separately, the analysis allows for a detailed comparison of how economic variables influence consumer sentiment across different age groups. This helps answer the first investigative question about how the results change between different age groups and the second question about identifying lead-lag relationships.

#### 5.1.1 VAR Results for the age group 18-34

The table 5 presents the VAR results for the youngest age group. Variables like EPU and CPI show immediate effects as they are significant at early lags, while others like the unemployment rate demonstrate delayed impacts. This highlights the varying speeds at which different economic factors influence consumer sentiment. The significant positive effect of IPI and the negative impact of CPI and EPU suggest that economic stability and clear policy directions are crucial for maintaining consumer confidence among young adults.

Table 5 VAR Results for the age group 18-34

Variable	Estimate	p-value (Significance)
EPU.11	-0.037	6.36e-06 ***
IPI.11	1.565	0.001 **
CPI.11	-3.071	0.004 **
Age 18-34.11	0.332	2.91e-10 ***
IPI.12	-2.240	0.0003 ***
Age 18-34.12	0.241	1.03e-05 ***
IPI.13	1.392	0.031 *
IPI.17	-1.913	0.003 **
CPI.17	-3.903	0.04 *
Unemployment rate.17	-2.761	0.005 **
CPI.18	5.603	0.003 **
Unemployment rate.110	2.344	0.014 *
Unemployment rate.112	-2.606	0.002 **
Age 18-34.112	-0.337	3.52e-11 ***
const	2.659	0.004 **

The first lag of EPU is highly significant with a negative estimate (-0.037, p-value 6.36e-06). This indicates that an increase in economic policy uncertainty from the previous month significantly decreases current consumer sentiment among young adults. EPU's influence is primarily significant at the first lag. The lack of significance in later lags suggests that the impact of policy uncertainty is immediate and diminishes over time. This is consistent with studies such as Baker et al. (2016), which highlight that economic policy uncertainty can cause immediate shifts in consumer behaviour and confidence.

IPI is significant at several lags (e.g., lags 1, 2, 3, and 7), indicating that industrial production has a persistent effect on consumer sentiment over multiple periods. For example, the first lag of IPI has a positive estimate (1.57, p-value 0.001), suggesting that increased industrial production boosts consumer confidence. The repeated significance across various lags, especially in the first few months, reflects the ongoing influence of industrial production on the economic outlook and job market, which are critical for young adults. The effects diminish after the initial months but can still resurface, as seen in the significance at lag 7.

CPI shows significant negative effects at several lags (e.g., lags 1, 7 and 8), with the first lag having a substantial negative estimate (-3.07, p-value 0.004). This implies that rising consumer prices from previous months negatively affect current consumer sentiment. The negative impact of CPI is notable in the short term for the first few months and again at later lags. This pattern aligns with the understanding that inflation can have both immediate and delayed effects on purchasing power and cost of living, as discussed by Souleles (2004).

The unemployment rate is significant at lags 7, 10 and 12. The seventh lag shows a significant negative impact (-2.76, p-value 0.005), while the tenth lag indicates a significant positive effect (2.34, p-value 0.014). The significance of these specific lags suggests that changes in the unemployment rate take several months to influence consumer sentiment. The delayed response could be due to the time it takes for unemployment changes to affect household income, job security perceptions, and overall economic stability for young adults.

Lagged consumer sentiment is highly significant across multiple lags. The first lag has a strong positive estimate (0.33, p-value  $2.91e-10$ ), indicating that past sentiment strongly influences current sentiment. The persistence of significantly lagged sentiment values underscores the importance of momentum in consumer confidence. If young adults were optimistic or pessimistic in the past, this sentiment is likely to continue, reflecting a carryover effect from month to month.

### **5.1.2 Var results for the age group 35-54**

Table 6 presents the significant VAR results for the age group 35-54. The results across multiple lags for different variables suggest that the age group 35-54 responds dynamically to economic changes. This demographic is likely influenced by immediate economic conditions (as seen with IPI and EPU) and shows delayed reactions to changes in inflation and unemployment rates. This behaviour aligns with the life-cycle hypothesis, where middle-aged consumers are balancing savings and expenditures, making them particularly sensitive to economic fluctuations (Deaton et al., 2000)

Table 6 Var results for the age group 35-54

Variable	Estimate	p-value (Significance)
EPU.l1	-0.03011	9.67e-05 ***
IPI.l1	1.302	0.003 **
CPI.l1	-3.483	0.0003 ***
Age 35-54.l1	0.569	< 2e-16 ***
CPI.l2	4.473	0.006 **
CPI.l3	-4.739	0.007 **
Unemployment rate.l3	-3.115	0.0007 ***
Age 35-54.l4	-0.147	0.016 *
CPI.l6	3.722	0.036 *
Age 35-54.l6	0.143	0.021 *
unemployment rate.l7	-2.546	0.006 **
IPI.l9	1.407	0.014 *
CPI.l9	4.709	0.008 **
EPU.l10	-0.018	0.038 *
CPI.l10	-4.132	0.022 *
CPI.l11	3.537	0.039 *
Unemployment rate.l11	2.556	0.003 **
IPI.l12	-0.972	0.021 *
Unemployment rate.l12	-3.418	7.01e-06 ***
Age 35-54.l12	-0.246	5.72e-06 ***
const	2.601	0.004 **

The first lag of EPU has a significant negative effect on consumer sentiment (Estimate = -0.03, p-value = 9.67e-05 \*\*\*). As mentioned, this aligns with a by Baker et al. (2016), who found that increased economic policy uncertainty tends to negatively impact economic activity and consumer sentiment. The immediate response to policy uncertainty likely reflects the sensitivity of this age group to economic policy changes, which can affect job security, investment decisions, and overall economic stability.

The first lag of IPI shows a significant positive impact on consumer sentiment (Estimate = 1.30, p-value = 0.003 \*\*). This suggests that industrial production, a proxy for economic activity, positively influences consumer confidence, as noted by Stock and Watson (1989). The significant impact at the first lag indicates that immediate changes in industrial production are quickly felt by consumers within this age group, who may be more attuned to economic conditions due to their position in the labour market and economic life cycle.

The CPI has multiple lags that significantly impact consumer sentiment, these are the first, second, and the third lag. In addition, lags 6, 9, 10 and 11 are also significant but with slightly decreasing significance level. These results suggest that inflation's effect on consumer sentiment is complex and can vary over

time. This complexity is consistent with Souleles (2004), who found that consumer responses to inflation can be immediate and varied, reflecting concerns about purchasing power and economic stability.

The third lag of the unemployment rate significantly affects consumer sentiment negatively (Estimate = -3.12, p-value = 0.0007 \*\*\*), as does the seventh lag (Estimate = -2.55, p-value = 0.006 \*\*), and the eleventh lag (Estimate = 2.56, p-value = 0.003 \*\*). This suggests that changes in the unemployment rate impact consumer sentiment, but the effects may be delayed, reflecting the time it takes for labour market conditions to influence consumer perceptions and behaviour.

### 5.1.3 Var results the age group 55+

The first lag of EPU shows a significant negative impact on consumer sentiment (Estimate: -0.03, p-value: 0.0002 \*\*\*). This suggests that an increase in economic policy uncertainty leads to a decrease in consumer sentiment among the 55+ age group in the following period.

Table 7 Var results the age group 55+

Variable	Estimate	p-value (Significance)
EPU.l1	-0.027	0.0002 ***
IPI.l1	1.002	0.019 *
CPI.l1	-2.165	0.0201 *
Age 55+.l1	0.534	< 2e-16 ***
CPI.l5	2.926	0.078 .
EPU.l6	0.0186	0.025 *
CPI.l6	-3.058	0.068 .
age 55+.l6	0.127	0.028 *
IPI.l10	1.234	0.026 *
CPI.l10	-3.102	0.072 .
Unemployment rate.l11	1.368	0.098 .
Unemployment rate.l12	-1.679	0.020 *
age 55+.l12	-0.325	6.85e-10 ***
const	2.012	0.014 *

The first lag of IPI has a significant positive effect on consumer sentiment (Estimate: 1.002, p-value: 0.02 \*). This indicates that improvements in industrial production positively influence consumer confidence. This finding is consistent with Stock and Watson (1989), who demonstrated the link between industrial output and economic perceptions. The tenth lag of IPI shows a significant positive impact (Estimate: 1.23, p-value: 0.026 \*). This delayed effect might indicate a longer-term adjustment in sentiment to changes in industrial production, reflecting the time it takes for economic conditions to influence consumer perceptions.

The first lag of CPI shows a significant negative impact (Estimate: -2.165, p-value: 0.02 \*), indicating that increases in inflation lead to lower consumer sentiment in the short term. This finding is supported by research from Souleles (2004), which shows that inflation can negatively affect consumer confidence. The lags 5, 6 and 10 are not significant, though close to the significance level. Thus, some delayed effects can be noticed but the results are not robust.

The eleventh and twelfth lag of the unemployment rate show mixed results as the eleventh lag is not significant, but the twelfth lag is. A significant negative impact on consumer sentiment (Estimate: -1.679, p-value: 0.020 \*). This suggests that high unemployment rates, even with a lag, significantly reduce consumer confidence, which is consistent with findings by Blanchflower & Oswald (2004) who noted the psychological effects of unemployment on broader economic sentiment. The results also suggest a prolonged adverse effect of unemployment on sentiment among older adults.

## 5.2 Results for the VAR impulse response

To get a better understanding of how variables affect each other impulse response test has been used. It allows the reader to easily understand the effect of the independent variable on the dependent variable. All the results are listed in Appendix 2. The impulse response from EPU shows the effect of a one standard deviation shock to EPU on the consumer sentiment of different age groups. The results, as depicted in Appendix 2, indicate that for the age group 18-34, the sentiment initially decreases and then gradually increases over time. This suggests that young adults are initially negatively impacted by economic policy uncertainty but adapt over time. This finding is consistent with Baker et al. (2016), who found significant negative effects of policy uncertainty on economic activity. The age group 35-54 shows a similar pattern, with an initial decrease followed by a recovery. This demographic is sensitive to policy changes. For the age group 55+, the sentiment exhibits a more prolonged negative response, reflecting their dependency on fixed incomes and investments, as discussed by Ludvigson (2004). The impulse response of each age subgroup variable to a shock in the economic policy uncertainty in the US is presented in figure 7.

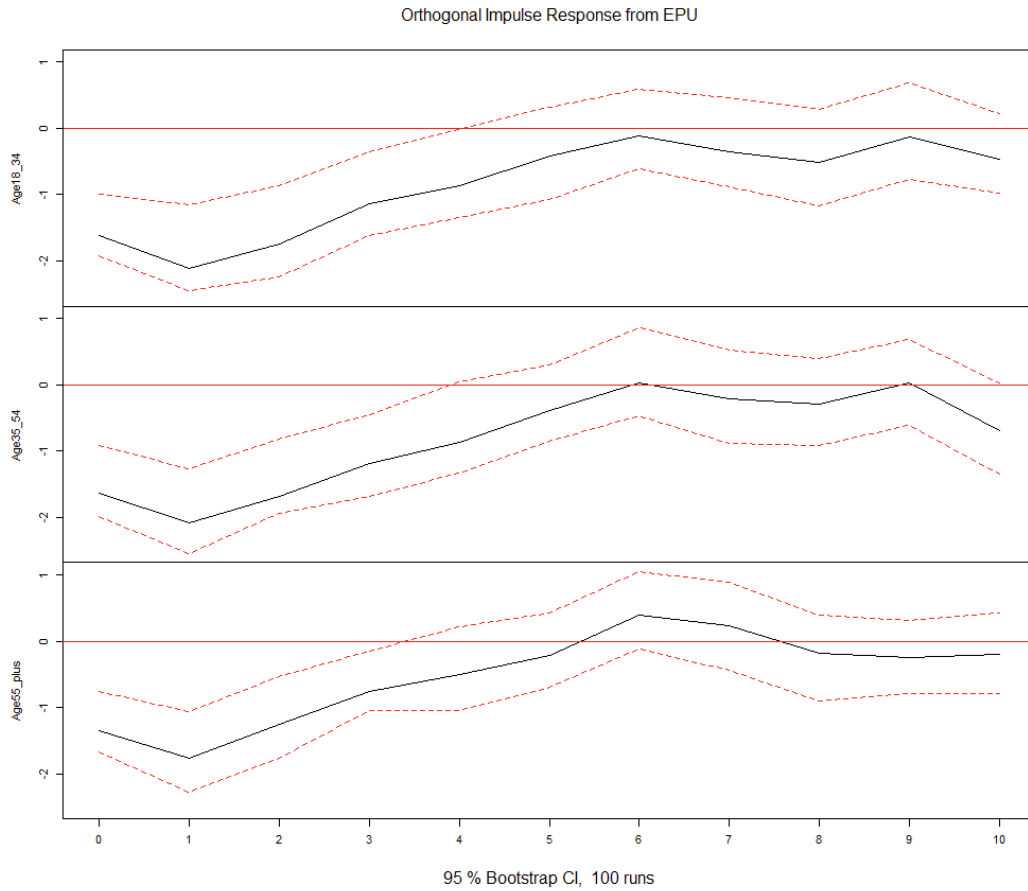


Figure 7 Impulse responses of age subgroup variables to a shock in the economic policy uncertainty in the US.

The response to a CPI shock reveals interesting dynamics. For the age group 18-34, the sentiment decreases following a CPI shock, suggesting young adults are adversely affected by inflation. This aligns with Souleles (2004), who provided results that consumers are more responsive to price changes. The age group 35-54 shows a similar but less pronounced negative response. Their sentiment recovers faster compared to younger adults, indicating a moderate sensitivity to inflation. The oldest age group also experiences a negative impact, but the response is muted compared to younger age groups.

Shocks to the unemployment rate produce varied effects. For the age group 18-34, the sentiment initially increases, suggesting a complex relationship where changes in the unemployment rate might signal different economic conditions to young adults. The age group 35-54 shows a more pronounced and negative response to unemployment rate shocks, indicating higher sensitivity to job market conditions. The response for the age group 55+ is less clear, with initial

fluctuations that stabilize over time, reflecting possibly diverse financial security situations within this age group.

The impact of industrial production changes is significant across all age groups. For the age group 18-34, there is a positive response, indicating that improvements in industrial production boost the confidence of young adults. The age group 35-54 also shows a positive response, suggesting that industrial production is an important determinant of sentiment, echoing findings by Stock & Watson (1989). The response for the age group 55+ is positive but less pronounced, indicating that while older adults are influenced by industrial production, the effect is somewhat muted compared to younger groups.

The impulse response analysis effectively addresses investigative questions. It shows how economic variables impact consumer sentiment differently across age groups, thus answering the first question about varying results between demographics. By illustrating the lead-lag relationships between shocks to economic variables and changes in consumer sentiment, the analysis addresses the second question. Lastly, the varying significance of other variables compared to EPU helps in understanding their relative influence on age group sentiments, thus addressing the third question.

### 5.3 Results for the forecast error variance decomposition

The results for the forecast error variance decomposition are presented in Appendix 2. In general, it presents the amount of the forecast error variance of ICS that can be attributed to shocks in the used variables across different age groups. The tables highlight the significance of each variable in explaining the variations in ICS over time.

For the youngest group, the variance decomposition shows that the contribution of EPU to the forecast error variance of ICS increases over time, starting at 6.12% at lag 1 and peaking at 15.71% by lag 4. This indicates that economic policy uncertainty has a growing influence on the consumer sentiment of younger adults over time. The impact of IPI starts relatively low at 2.08% at lag 1 but increases steadily to 17.50% by lag 9. This suggests that industrial production becomes increasingly important in explaining variations in consumer sentiment for this age group. The contribution of CPI is initially high at 7.25% and continues to increase, reaching 23.53% by lag 12. This consistent rise indicates that inflation significantly impacts the consumer sentiment of younger adults. The impact of the unemployment rate is minimal initially 0.00% at lag 1 but increases to 2.77% by lag 12, suggesting a delayed but growing effect on consumer sentiment.

For the middle-aged group, the influence of EPU on ICS is substantial from the beginning, starting at 10.48% at lag 1 and peaking at 18.78% by lag 3. This indicates a strong initial sensitivity to economic policy uncertainty. The contribution of IPI begins at 2.78% at lag 1 and rises to 15.13% by lag 10, showing the increasing importance of industrial production over time in explaining consumer



sentiment. The CPI's contribution starts at 3.24% and reaches 24.16% by lag 12, indicating a significant and growing impact of inflation on consumer sentiment for this age group. The unemployment rate has a relatively small but increasing effect, starting at 0.55% at lag 1 and reaching 2.77% by lag 12, indicating a delayed impact on consumer sentiment.

Among older adults, the influence of EPU on ICS starts at 7.93% at lag 1 and peaks at 14.96% by lag 3. This suggests that while economic policy uncertainty is initially less influential compared to younger age groups, its impact grows over time. The contribution of IPI starts very low at 0.13% at lag 1 but increases to 10.33% by lag 12, indicating a delayed but eventually significant effect on consumer sentiment. The CPI's impact begins at 4.95% at lag 1 and increases to 21.01% by lag 12, showing that inflation continues to be an important factor influencing consumer sentiment. The effect of the unemployment rate is again relatively small compared to other variables as it starts at 0.79% at lag 1 and peaks by lag 12 at 2.14% indicating its effect increases over time.

#### **5.4 Granger Causality test**

In this section, the results of the Granger causality tests are presented. It is used to explore the relationships between dependent and independent variables. The results help to answer investigative questions. In addition, the Granger causality tests provide insights into lead-lag relationships, investigative question two, by revealing whether changes in economic variables precede changes in consumer sentiment. This helps identify which variables have leading effects on consumer sentiment.

Using 12 lags in the analysis ensures an examination of how past variables impact current consumer sentiment. This method gives a clear view of the lead-lag relationships, highlighting each variable over time. Using these lags enables to capturing of the full effect of historical economic data on present consumer sentiments, making findings more robust. This method is the most appropriate to use in VAR analysis to answer the research question.

Table 8 Granger Causality test results

Consumer sentiment for age group 18-34		
Variable	F-test	p-value
EPU (Economic Policy Uncertainty)	2.92	0.0006
CPI (Consumer Price Index)	1.64	0.077
IPI (Industrial Production Index)	2.70	0.001
Unemployment Rate (unrate)	1.40	0.162
Consumer sentiment for age group 35-54		
Variable	F-test	p-value
EPU (Economic Policy Uncertainty)	2.29	0.007
CPI (Consumer Price Index)	3.11	0.0003
IPI (Industrial Production Index)	0.89	0.553
Unemployment Rate (unrate)	1.97	0.024
Consumer sentiment for age group 55+		
Variable	F-test	p-value
EPU (Economic Policy Uncertainty)	2.75	0.001
CPI (Consumer Price Index)	1.65	0.074
IPI (Industrial Production Index)	1.85	0.037
Unemployment Rate (unrate)	1.35	0.183

#### 5.4.1 Granger Causality test 18-34

The table above shows the results of the F-test and p-value for Granger causality test when using 12 lags. The Granger causality test results reveal that EPU significantly influences consumer sentiment in the 18-34 age group. This finding is consistent with the existing literature, as the work by Baker et al. (2016) which emphasizes the impact of economic policy uncertainty on economic sentiments. The sensitivity of young adults to EPU can be attributed to their higher levels of economic uncertainty and greater dependence on future economic prospects, making them more responsive to policy changes.

The CPI does not significantly Granger-cause consumer sentiment in the 18-34 age group. Although inflation is a critical economic indicator, its direct influence on young adults' sentiment appears less pronounced. Blanchflower & Oswald, (2004) suggest that younger consumers might prioritize factors such as job security and economic stability over inflation when forming their economic outlook.

IPI significantly impacts consumer sentiment among the 18-34 age group, indicating that industrial production, reflecting broader economic activity, is an important determinant for young adults. Studies like Blanchard & Watson (1986) highlight those changes in industrial production signal economic health, which influences job prospects and economic stability, factors that are particularly relevant for younger demographics. The unemployment rate does not significantly Granger-cause changes in consumer sentiment for the 18-34 age group. This result aligns with findings from Clark & Summers (1982) who notes that young

adults often experience greater employment volatility, and their sentiment might be more influenced by other economic indicators rather than the unemployment rate alone.

#### **5.4.2 Granger Causality test 35-54**

For the age group 35-54 the results are different compared to the younger age group. The Granger causality test results for EPU indicate a significant influence on the consumer sentiment of the 35-54 age group. The F-test value is 2.29 with a p-value of 0.007, suggesting that changes in EPU do Granger-cause changes in consumer sentiment for this age group. Similarly to the youngest age group this aligns with findings from the research by Baker et al. (2016). This effect is particularly pronounced for the 35-54 age group, likely due to their active participation in the workforce and heightened sensitivity to economic policy changes affecting job security and investment decisions.

The CPI, which measures inflation, also shows a significant causal relationship with consumer sentiment in this age group. The F-test value of 3.11 and a p-value of 0.0003 indicate that inflationary pressures significantly affect the confidence levels of consumers aged 35-54. Previous research, including that by Carroll et al. (1994), has documented how inflation expectations can alter consumer behaviour. The 35-54 age group, often in their peak earning years and with significant financial responsibilities, is particularly attuned to changes in inflation, which can erode purchasing power and affect consumption patterns.

For the IPI, the Granger causality test results show an F-test value of 0.89 and a p-value of 0.55, indicating that changes in industrial production do not Granger-cause changes in consumer sentiment for the 35-54 age group. This result is somewhat surprising given the general assumption that industrial production, as a proxy for overall economic activity, should influence consumer confidence. However, it is possible that the direct impact of IPI on sentiment is overshadowed by more immediate factors such as employment and inflation.

The unemployment rate shows a significant Granger causality effect with an F-test value of 1.97 and a p-value of 0.02. This result suggests that changes in unemployment significantly affect consumer sentiment among the 35-54 age group. The importance of employment status for this age group cannot be overstated, as job security and income stability are crucial determinants of confidence. This finding is consistent with the work of Blanchflower & Oswald, (2004) who noted the strong linkage between unemployment and well-being.

#### **5.4.3 Granger Causality test 55+**

The results indicate a significant Granger causality from EPU to consumer sentiment in the 55+ age group, with an F-test value of 2.75 and a p-value of 0.001. This finding suggests that fluctuations in economic policy uncertainty considerably affect the confidence levels of older consumers. This age group, often reliant on fixed incomes and sensitive to policy changes affecting retirement benefits and

healthcare, is likely to react strongly to changes in economic policy uncertainty. As discussed the research by Baker et al. (2016) emphasize how policy uncertainty can lead to decreased consumer spending, particularly among those with higher risk aversion, such as older adults.

The CPI's influence on consumer sentiment for the 55+ age group shows an F-test value of 1.65 and a p-value of 0.07, suggesting a weaker but still notable relationship. Inflation can erode the purchasing power of fixed incomes, which is a significant concern for this age group. The somewhat marginal p-value indicates that while inflation's impact on sentiment is present, it is less pronounced compared to younger age groups. Research by Carroll et al. (1994) has shown that inflation expectations can significantly influence consumer behaviour, which is particularly relevant for older adults managing limited resources.

The IPI shows a significant causal relationship with consumer sentiment in the 55+ age group, with an F-test value of 1.8504 and a p-value of 0.04. This indicates that changes in industrial production, a proxy for economic activity, do influence the confidence levels of older consumers. This finding aligns with the broader economic literature suggesting that overall economic health, as reflected by industrial production, impacts consumer sentiment. However, the relationship is not as strong as that observed for EPU, highlighting the relative importance of direct policy impacts over general economic conditions for this age group.

The Granger causality test results for the unemployment rate reveal an F-test value of 1.35 and a p-value of 0.18, indicating that changes in unemployment do not significantly Granger-cause changes in consumer sentiment for the 55+ age group. This is somewhat expected, as the direct impact of unemployment is likely less relevant for retirees compared to younger, working-age individuals. Blanchflower & Oswald, (2004) discuss the strong linkage between unemployment and well-being, but this linkage appears weaker for older adults, who are less directly affected by changes in employment conditions.

#### **5.4.4 Comparative analysis of the Granger causality results**

For the 18-34 age group, the significant impact of EPU on consumer sentiment F-test = 2.9184, p-value = 0.0006 is consistent with findings from Baker et al. (2016), who noted the profound effect of policy uncertainty on economic activity. The influence of the IPI F-test = 2.70, p-value = 0.001 aligns with Stock & Watson, (1989) highlighting the correlation between industrial production and economic fluctuations. Though the CPI shows a moderate influence F-test = 1.64, p-value = 0.08, it aligns with Souleles (2004) in how younger consumers respond to price changes.

The 35-54 age group displays significant Granger causality from both EPU F-test = 2.29, p-value = 0.007 and CPI F-test = 3.11, p-value = 0.0003. The lack of significance from IPI F-test = 0.90, p-value = 0.55 suggests that this demographic might prioritize job stability and financial health over industrial output, as discussed by Deaton, (2002).

For the 55+ age group, EPU F-test = 2.75, p-value = 0.001 and IPI F-test = 1.85, p-value = 0.04 significantly affect consumer sentiment. This observation is in line with Ludvigson, (2004) who noted that older consumers are highly sensitive to broader economic conditions due to dependency on fixed incomes and investments. CPI's smaller impact F-test = 1.65, p-value = 0.07 reflects findings from the Bureau of Labor Statistics study on the Experimental Consumer Price Index for Elderly (CPI-E), indicating older individuals' stable expenses and lesser responsiveness to short-term price fluctuations (Stewart, 2008).

## 6 DISCUSSION

The results indicate that EPU significantly impacts consumer sentiment across all age groups, with younger adults (18-34) being the most sensitive to changes. The CPI also has a notable effect, particularly on the youngest and oldest age groups. Industrial production positively influences sentiment across all demographics, whereas the unemployment rate's impact varies, with middle-aged adults (35-54) showing the most pronounced sensitivity.

EPU's impact on consumer sentiment is significant across all age groups, with the most substantial immediate effect on the 18-34 age group. This aligns with Baker et al. (2016), who found that economic policy uncertainty negatively influences economic activity and consumer confidence. The sensitivity of younger adults to EPU could be due to their more precarious economic positions and greater exposure to policy-driven job market fluctuations.

The CPI's effect varies among age groups. Younger adults (18-34) show a significant negative response to inflation, which supports findings by Souleles (2004), indicating that younger consumers are more responsive to price changes. The middle-aged group (35-54) also experiences a negative impact, though less pronounced and with quicker recovery, suggesting moderate sensitivity to inflation. For the oldest age group (55+), the response is muted, reflecting their more stable expenses and smaller responsiveness to short-term price fluctuations, consistent with the findings of Stewart (2008) on the CPI-E.

IPI positively influences consumer sentiment across all age groups, with significant effects noted particularly in the youngest (18-34) and middle-aged (35-54) cohorts. This is consistent with Stock & Watson (1989), who highlighted the importance of industrial production as a key economic indicator. The positive response suggests that improvements in industrial production boost economic confidence and perceptions of job security.

The unemployment rate shows varied impacts across age groups. The middle-aged group (35-54) is the most affected, with significant negative responses indicating higher sensitivity to job market conditions. This aligns with findings by Blanchflower & Oswald (2004), who noted the effects of unemployment on economic sentiment. The delayed impact on the oldest age group suggests that changes in unemployment rates take longer to influence their sentiment, possibly due to more stable income sources like pensions.

The key issue with the study was that the VAR model results did not pass the serial correlation tests and heteroscedasticity tests, indicating potential issues with the model. A maximum of 12 lags were used, which AIC lag selection method also suggested. This was based on previous research and the fact that 12 lags are enough to capture short-term and long-term effects. With more lags, the results could have passed the serial correlation and heteroscedasticity tests, but the results would not have been robust as the amount of lags would have been too high. However, by also conducting the Granger causality test the results were

more fulfilling. Most importantly, the results were consistent with existing literature. When findings are consistent with previous studies, it indicates that the observed relationships are likely reflective of true economic dynamics rather than model-specific issues. Thus, adding credibility to the results.

The economic significance of results comes from how individual age groups react to different macroeconomic variables. More precisely based on the results comprehensive policies addressing unemployment, inflation, and industrial production are essential for maintaining stable consumer sentiment, which is important for economic growth. For example, a positive link between industrial production and consumer sentiment highlights the need for good industrial policies to boost consumer confidence.

All in all, the results align with previous literature which creates credibility. According to my knowledge, there have not been many if any studies specifically focusing on the age groups used in this study. However, there have been various studies about similar topics or variables as discussed which is beneficial as the results were not fully robust. However, as the results align with previous studies, they can be considered correct but not necessarily fully accurate. This is mainly due to the large time period and the usage of multiple variables.

## 7 CONCLUSIONS

This research investigated the relationship between EPU, IPI, CPI, unemployment rate, and consumer sentiment across different age demographics in the United States, employing VAR model and Granger causality tests. The focus was between EPU and different consumer sentiment groups, but other variables are also investigated for more comprehensive results. The analysis spanned from 1985 to 2023.

The findings from VAR model revealed that EPU significantly influences consumer sentiment across all age groups, with the magnitude and persistence of the impact varying notably between demographics. Young adults (18-34) exhibited immediate and pronounced decreases in sentiment following increases in EPU, aligning with existing literature that highlights the sensitivity of this group to economic uncertainties due to their relatively higher economic vulnerability and future dependence. Middle-aged consumers (35-54), who are typically in their peak earning years, also showed significant sensitivity to EPU, reflecting their concerns over job security and investment returns during periods of policy uncertainty. In contrast, older adults (55+) displayed a more muted yet prolonged response, indicating that while EPU affects their sentiment, their more established financial positions provide some buffer against immediate shocks.

The impulse response analysis further confirms these findings, showing reactions to shocks in other economic variables such as CPI, IPI, and the unemployment rate. Younger adults were most responsive to CPI changes, suggesting a high sensitivity to inflationary pressures which directly affect their purchasing power and cost of living. The IPI had a positive impact across all age groups, particularly boosting the confidence of younger and middle-aged adults by signaling economic stability and job security. Interestingly, the unemployment rate had a complex effect, particularly on the youngest age group, where an initial increase in sentiment was observed, possibly reflecting varying interpretations of economic signals by different demographic groups.

The results confirm the significant role of EPU in shaping consumer sentiment, confirming the theoretical frameworks of Prospect Theory and the Life Cycle Hypothesis. The behavioral responses observed align with Prospect Theory, indicating that individuals prioritize loss avoidance, leading to decreased consumer confidence during periods of heightened policy uncertainty. The Life Cycle Hypothesis also provides a compelling explanation for the observed variations across age groups, emphasizing the influence of lifecycle stages on economic behavior and sentiment. Moreover, the Granger causality tests reinforced findings, establishing that changes in EPU precede shifts in consumer sentiment across different age groups, with young and middle-aged adults showing the most significant responses. This highlights the predictive power of EPU and its usefulness as a leading indicator for policymakers and economists aiming to anticipate and mitigate economic impacts.



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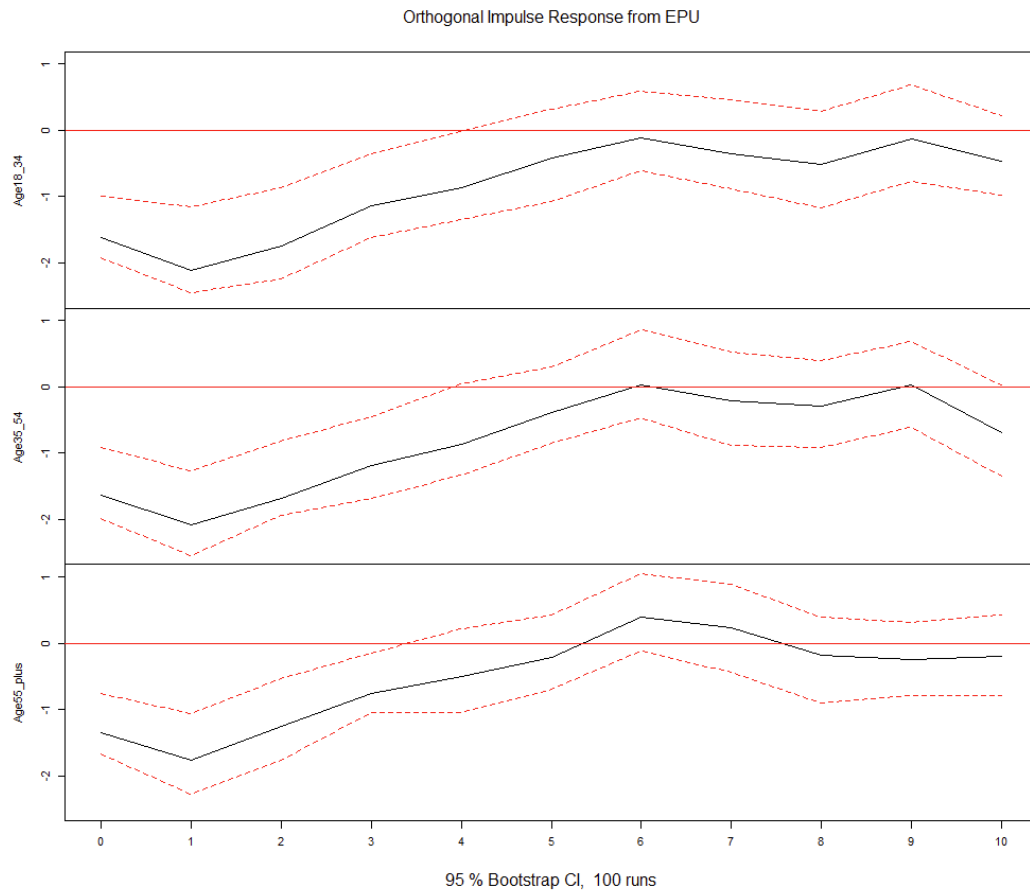
Yang, Y. (2005) Can the Strengths of AIC and BIC Be Shared? A Conflict between Model Identification and Regression Estimation, *Biometrika*, 92(4), pp. 937–950.

## APPENDIX 1      Query

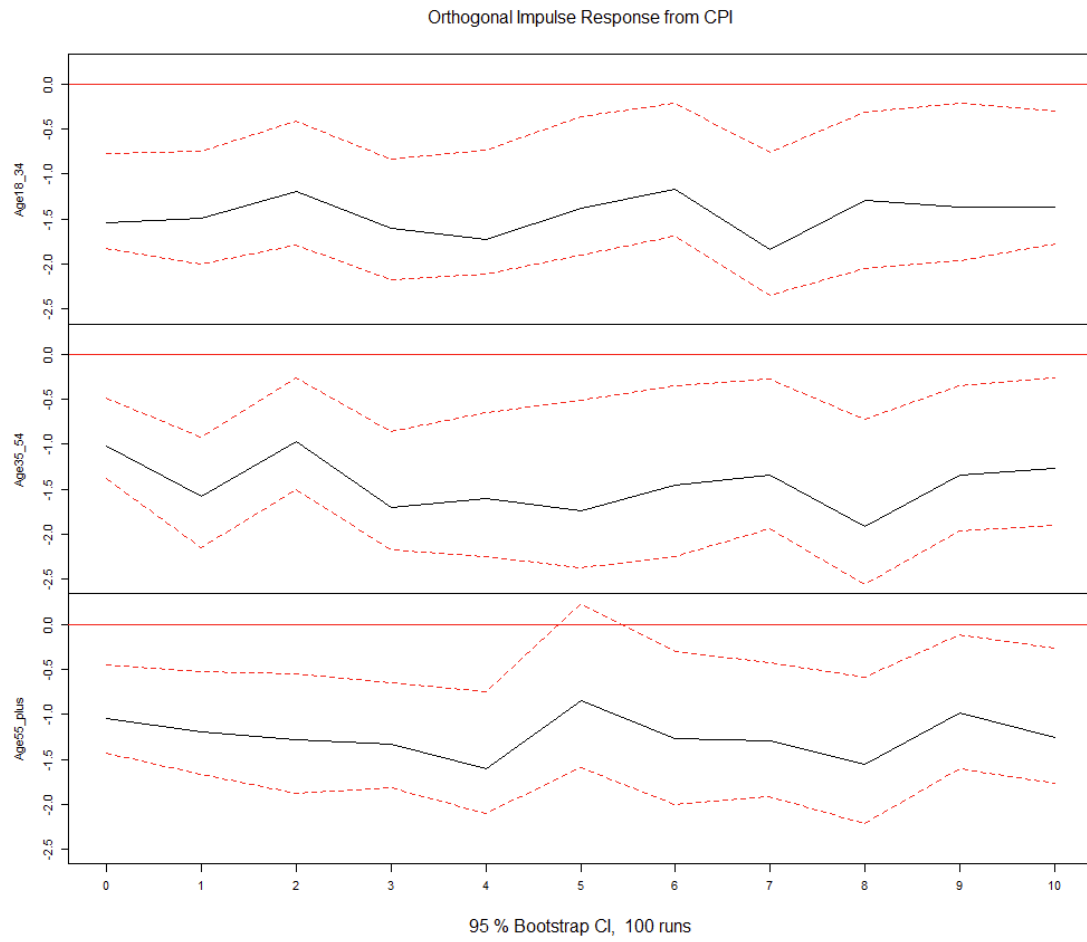
There are five questions asked by the interviewees which are;

1. "We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?"
2. "Now looking ahead--do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?"
3. "Now turning to business conditions in the country as a whole--do you think that during the next twelve months we'll have good times financially, or bad times, or what?"
4. "Looking ahead, which would you say is more likely--that in the country as a whole we'll have continuous good times during the next five years or so, or that we will have periods of widespread unemployment or depression, or what?"
5. "About the big things people buy for their homes--such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or bad time for people to buy major household items?"

## APPENDIX 2 VAR impulse response Figures and Forecast error variance decompositions table

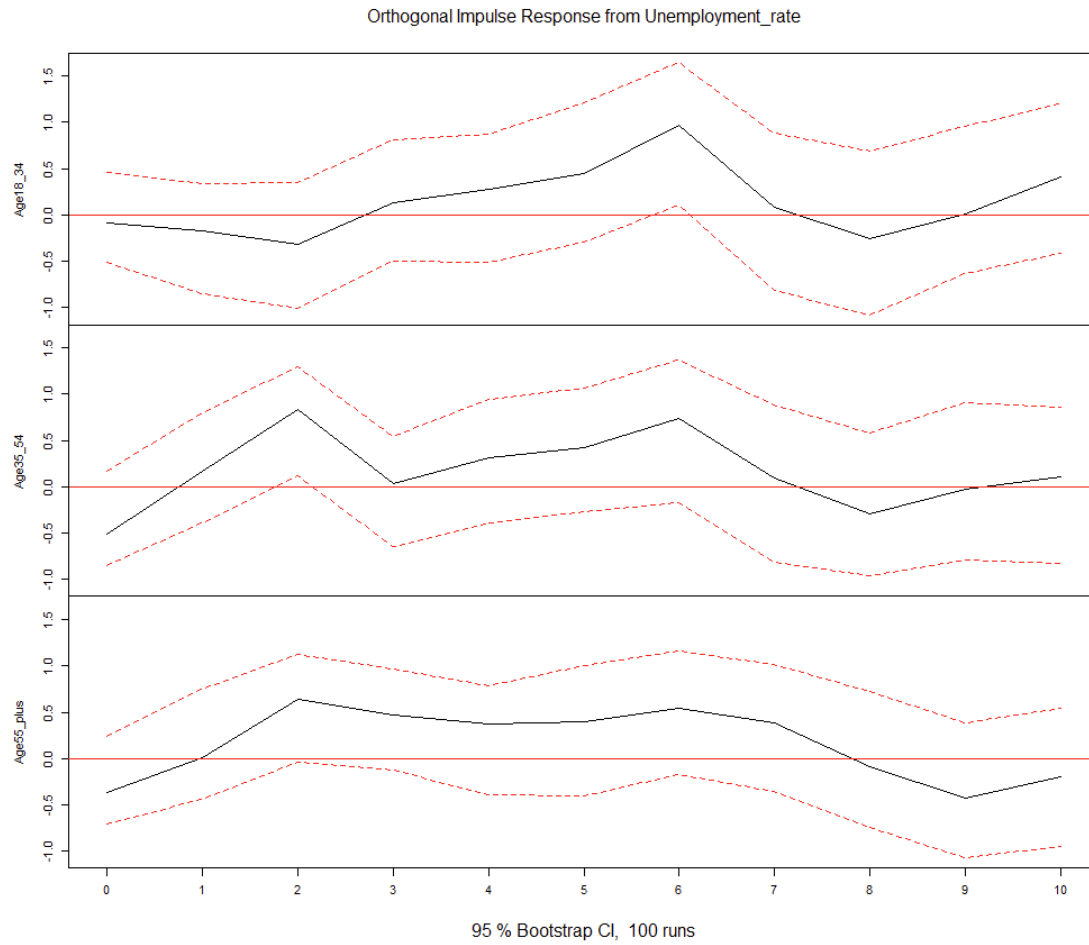


Appendix 2, Figure 1 Impulse responses of age subgroup variables to a shock in the economic policy uncertainty in the US.

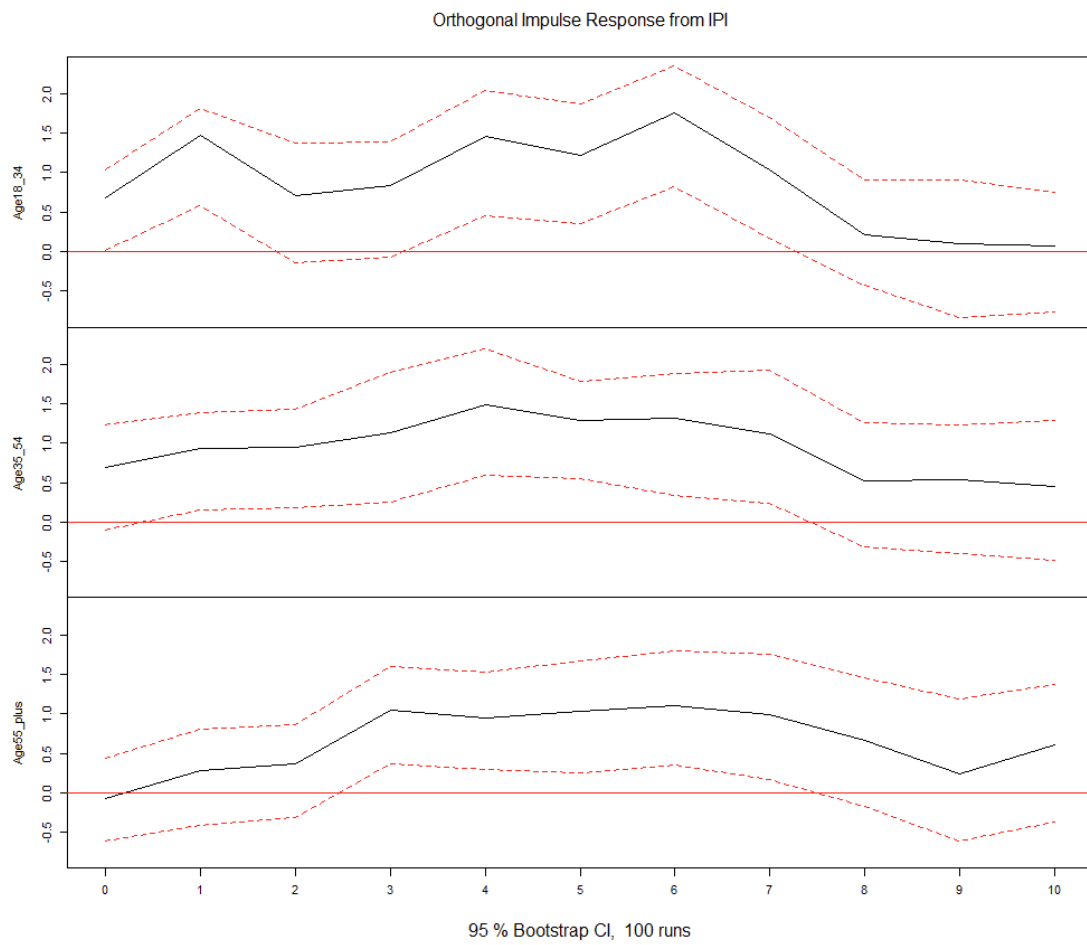


Appendix 2, Figure 2 Impulse responses of age subgroup variables to a shock in the consumer price index in the US.





Appendix 2, Figure 3 Impulse responses of age subgroup variables to a shock in the unemployment rate in the US.



Appendix 2, Figure 4 Impulse responses of age subgroup variables to a shock in the industrial production index in the US.

Appendix 2, Table 1 Forecast error variance decomposition to VAR models in percentage  
(Age 18-34)

Lags	EPU	IPI	CPI	UR	ICS 18-34
1	6.12%	2.08%	7.25%	0.00%	84.55%
2	12.91%	7.34%	9.78%	0.02%	69.95%
3	15.25%	7.74%	10.49%	0.22%	66.30%
4	15.71%	9.11%	12.11%	0.22%	62.85%
5	14.95%	11.81%	14.20%	0.32%	58.72%
6	14.21%	13.69%	15.55%	0.68%	55.87%
7	13.03%	17.06%	15.94%	1.65%	52.32%
8	12.38%	17.68%	18.67%	1.58%	49.69%
9	12.23%	17.50%	19.53%	1.59%	49.14%
10	11.90%	17.12%	21.06%	1.55%	48.37%
11	11.72%	16.76%	22.34%	1.88%	47.30%
12	11.41%	16.26%	23.53%	2.77%	46.02%

Appendix 2, Table 2 Forecast error variance decomposition to VAR models in percentage  
(Age 35-54)

Lags	EPU	IPI	CPI	UR	ICS 35-54
1	10.48%	2.78%	3.24%	0.55%	82.94%
2	16.48%	4.66%	7.64%	0.43%	70.78%
3	18.78%	6.82%	7.74%	1.26%	65.05%
4	18.26%	8.74%	9.87%	1.40%	61.66%
5	17.88%	11.51%	11.87%	1.53%	57.21%
6	16.94%	12.89%	15.10%	1.76%	53.36%
7	15.85%	14.24%	16.73%	2.02%	51.15%
8	15.26%	13.13%	17.95%	1.95%	51.62%
9	14.74%	14.86%	20.73%	2.04%	47.62%
10	14.35%	15.13%	21.80%	2.03%	46.69%
11	14.30%	15.01%	22.91%	1.95%	45.38%
12	13.89%	14.62%	24.16%	2.77%	44.49%

Appendix 2, Table 3 Forecast error variance decomposition to VAR models in percentage  
(Age 55+)

Lags	EPU	IPI	CPI	UR	ICS 55+
1	7.93%	0.13%	4.95%	0.79%	86.20%
2	13.71%	1.14%	7.56%	0.55%	77.03%
3	14.96%	1.90%	9.78%	0.99%	72.37%
4	14.45%	4.41%	11.14%	1.17%	68.83%
5	13.62%	5.62%	13.34%	1.47%	65.95%
6	12.95%	6.96%	13.78%	1.68%	64.64%
7	11.89%	8.44%	14.97%	1.78%	62.91%
8	11.24%	9.75%	16.43%	1.77%	60.81%
9	10.73%	10.12%	18.43%	1.79%	58.94%
10	10.47%	10.09%	19.04%	1.94%	58.46%
11	10.17%	10.52%	20.22%	1.88%	57.20%
12	9.84%	10.33%	21.01%	2.14%	56.68%

### **Appendix 3      Use of AI Based Tools**

In this master's thesis I have used the help of artificial intelligence (AI) through ChatGPT. AI has been used to assist with code and data issues in R. Also, it has been used to give guidance on how to format or present findings. After asking how ChatGPT had assisted me with this master's thesis it gave the following answer. "It offered guidance on using statistical software, troubleshooting analysis issues, and ensuring smooth research progression. ChatGPT also helped in formatting findings coherently and structuring your thesis effectively. Additionally, it saved time by automating table and graph creation and provided immediate feedback.