How do changes in income and interest rates affect consumer spending over time: Evidence from the US

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Abstract

After the recent economic shocks the debates about how consumption has changed and how it has affected the economy is again on the agenda. This paper uses macroeconomic variables to conduct a time series analysis to study how changes in income and 3-Month Treasury Bill rates affect consumer spending in the US. The findings indicate that a 1% increase in the 3-month Treasury Bill rate is associated with a 0.001% increase in consumption while a 1% increase in income from the previous quarter is associated with a 0.08% increase in consumption. These results are consistent with previous literature, indicating that income and interest rates have a positive impact on consumption.

Introduction

Consumer spending is a crucial component of any economy, accounting for a significant portion of overall economic activity. The recent economic shocks have again raised the question of how consumption has changed and how it has affected the economy is again on the agenda. In 2020 fiscal support, in the form of stimulus checks, boosted household income while household spending was severely restricted by social distancing, so personal income increased while consumption fell[1].

This paper builds on previous research to study the effect of changes in the income and interest rates affect consumer spending (consumption) over time. I use data from the Federal Reserve Economic Data (FRED) database covering the period from the first quarter of 1959 to the first quarter of 2023.

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[1] See Appendix A, Figure 1 for the time series plot for income and consumption.

The relationship between consumption and interest rates has been extensively studied in the literature, with conflicting findings. Some studies have found that consumption is highly sensitive to changes in income, while others have found that interest rates play a more important role. It follows the logic that, on the one hand, higher interest rates increase the cost of borrowing, which in turn reduces the disposable income available for consumption. On the other hand, higher interest rates can also signal a strong economy, which boosts consumer confidence and spending. Furthermore, changes in inflation can affect interest rates and income, which can in turn influence consumption. Therefore, it is essential to take into account the effect of inflation when examining the relationship between income, interest rates, and consumption.

The permanent income hypothesis posits that individuals smooth their consumption over their lifetime by borrowing and saving in response to changes in their income. Under this hypothesis, current consumption should be a function of current and expected future income, rather than current interest rates. One possible explanation for this is the impact of inflation on consumption. Inflation can reduce the purchasing power of consumers, leading to lower consumption levels over time. Choi and Park (2016) found that inflation has a negative effect on consumption in China, while a study suggested that inflation uncertainty can have a negative impact on consumption in the United States.

Previous studies have examined the relationship between consumption, income, and interest rates, but the results have been mixed. Some studies have found that consumption is highly sensitive to changes in income, while others have found that interest rates play a more important role (Campbell & Mankiw, 1989).

In addition, Campbell and Mankiw (1989) argue that income uncertainty and liquidity constraints can lead individuals to deviate from their optimal consumption path. Their study

challenged the conventional view that consumption is highly sensitive to changes in interest rates, finding instead that consumption is more strongly correlated with income changes than with interest rate movements.

The paper is constructed as follows. Section 2 describes the data used in the estimation model. Section 3 discusses the methodology and the estimation model, while section 4 concludes.

Data

The dataset used in this study is from the Federal Reserve Economic Data (FRED) database and consists of quarterly time series data from the first quarter of 1959 to the first quarter 2023. In the estimation model I use CPI to account for inflation, Real Personal Consumption Expenditure per capita, 3-Month Treasury Bill Secondary Market, Rate Real Disposable Personal Income per capita and Real GDP.[2] CPI, T-Bill rates and real disposable personal income were in monthly frequency while GDP and consumption were in quarterly format. Therefore, to have consistency in data I converted the variables in monthly format to quarterly format by taking the three-month averages.

Furthermore, although the data for 3-month T-Bill rates starts from 1934, the rest of the variables' data start from 1959. Hence, I have kept the data for all the variables starting from the first quarter of 1959 to the first quarter of 2023.

Methodology

I use time series estimation ARDL model in first differences to measure the effect of interest rate and income on consumption.

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[2] Please note all the variables are seasonally adjusted.

As the units of the variables are different and there is a non-linear relationship between the variables I have taken the log forms of all the variables. The Figure 1 in Appendix A shows the time-series plot of income and consumption. You can see that both of the variables exhibit an upward trend and there is co-movement between the two variables. As a result of the pandemic in the first quarter of 2020 income increased while consumption plummeted. The rise in income is explained by the provision stimulus that in household's balance sheets looked as income.

I conduct a Dickey-Fuller unit root test to check for stationarity of my variables. As the graphs in Appendix A show most of the variables fluctuate around a linear trend, hence for those variables I use Dickey-Fuller test with a constant and a trend.

The tau statistics for all of the variables are greater than the critical value at 5% level of significance, therefore, the variables are non-stationary. One caution here is that when working with non-stationary variables there is a risk of obtaining biased and inconsistent results, which is also known as spurious regression. Hence, the next step to consider is to check for cointegration among the variables.

After estimating the model and predicting the residuals I conduct the Dicky-Fuller test to check for cointegration. The cointegration test shows that the tau statistic is lower than the critical value, hence I reject the null hypothesis and conclude that there is no cointegration among the variables, therefore, I estimate the ARDL model in its first differences.

Last but not least, to find the model that fits best to my data and research question I use Akaike information criterion (AIC) and measure the relative quality of my statistical models. After changing the model and using different lags, the test shows that the model with the lowest AIC value is

$$ln(cons) \ = \ ln(GDP) \ + \ ln(cpi)_{t-1} \ + \ ln(cpi)_{t-2} + ln(cpi)_{t-3} + ln(cpi)_{t-4} +$$

$$+ \, ln(inc)_{t-1} + ln(inc)_{t-2} + ln(inc)_{t-3} + ln(inc)_{t-4}$$

This implies that according to Akaike information criterion the best fitting model includes the 4-th order lagged value for cpi and income.

Table 1 reports the estimation output. It shows that 1% increase in the 3-Month Treasury Bill rate increases consumption by 0.001%. The reason for this increase can be due to a couple of reasons. Firstly due to the income effect which implies that higher interest rates on safe assets like Treasury bills can increase the return on savings, which can increase the disposable income of households. As a result, households may be more likely to spend more on consumption goods and services now.(Jappelli, & Pistaferri, 2010) It can also be explained through the so-called liquidity effect. When the Treasury bill rates rise, the cost of borrowing for banks and other financial institutions also increases. This can lead to a decrease in the supply of credit, making it harder for households to borrow and spend on big-ticket items like houses and cars. As a result, households may shift their consumption toward smaller purchases like groceries and other everyday items. Finally, this can be due to the "expectation effect" when the interest rates may signal a positive economic outlook, which can boost consumer confidence and encourage more spending. (Attanasio et al., 2009) One can also notice that 1% increase in Treasury bill rate, consumption increases by 0.01%, which is in line with the explained expectation and liquidity effects. Moreover, the results show that 1% increase in inflation from the previous period to the current time would decrease consumption by 0.02%. In addition, 1% increase in income from t-1 to the current time t, consumption increases by 0.08%.

Therefore, we can say that the results are in line with the literature, implying that increase in income and interest rate increases consumption over time.

Table 1: ARDL model estimation

VARIABLES	Difference in Log(Consumption)
Differences in log(GDP)	-4.207*
	(2.225)
Difference in $\ln(\text{CPI})_{t-1}$	-0.020*
	(5.003)
Difference in $\ln(\text{CPI})_{t-2}$	-0.059**
	(5.648)
Difference in $\ln(\text{CPI})_{t-3}$	-0.026*
	(5.713)
Difference in $\ln(\text{CPI})_{t-4}$	-0.007
	(5.114)
Difference in $\ln(\text{Income})_{t-1}$	0.081**
	(1.972)
Difference in $\ln(\text{Income})_{t-2}$	0.079***
	(1.882)
Difference in $\ln(\text{Income})_{t-3}$	0.018***
	(1.874)
Difference in $\ln(\text{Income})_{t-4}$	0.012**
	(1.911)
T-Bill (in %)	0.001***
	(0.040)
Constant	10.40***
	(0.0512)
Observations	251
R-squared	0.178

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

This paper studies the impact of income and interest rate changes on consumption over time. I used an ARDL model to estimate this effect. The findings suggest that income and interest rates are important determinants of consumption behavior. The results indicate that a 1% increase in the 3-month Treasury Bill rate is associated with a 0.001% increase in consumption. This result is consistent with the expectation and liquidity effects of interest rates, which suggest that higher interest rates can increase the return on savings and boost consumer confidence, leading to higher consumption. We also find that a 1% increase in income from the previous quarter is associated with a 0.08% increase in consumption. This result is consistent with the income effect, which suggests that higher income leads to higher consumption. Finally, we find that a 1% increase in inflation from the previous period is associated with a 0.02% decrease in consumption. These results are consistent with previous literature, which suggests that higher income and interest rates lead to higher consumption.

References

Attanasio, O. P., Blow, L., Hamilton, R., & Leicester, A. (2009). Booms and busts: Consumption, house prices and expectations. *Economica*, *76*(301), 20-50.

Choi, H., & Park, Y. (2016). Does inflation have a negative effect on consumption? The case of the United States. Journal of Economic Development, 41(1), 43-61.

Jappelli, T., & Pistaferri, L. (2010). The consumption response to income changes. *Annu. Rev. Econ.*, *2*(1), 479-506.

Appendix A

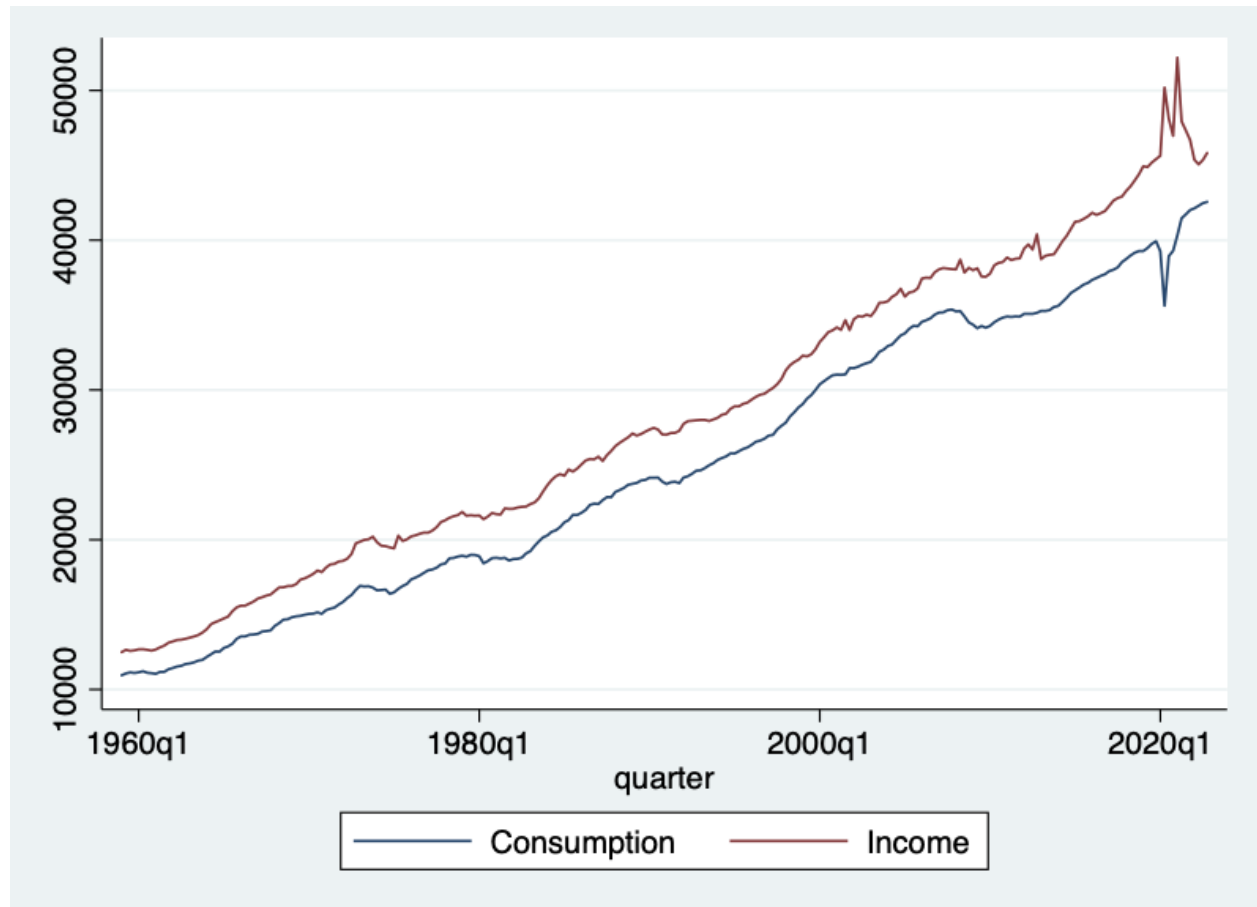*Figure 1: Time Series plot for Real Consumption and Income per capita*

Figure 2: Time Series plot for CPI and 3- Month Treasury Bill rate