Econometrics Project 1:

Motor Vehicle Assemblies and Consumer Confidence

# Introduction, Background

From behavioral economics to game theory, analyzing how individuals and entities make decisions is a critical aspect to studying economics. One possible source for these decisions is the idea of consumer confidence. The idea that consumer sentiment partially drives the values of different macro-economic indicators is not a new one, with references dating back to a classic piece of economic literature known as *The General Theory of Employment, Money, and Interest,* published by John Maynard Keynes in 1936. Within, the author speaks to the idea of “animal spirits”; difficult to manage and measure, but vital to the decision-making process of any individual or firm. The term speaks to ideas that these entities hold as core beliefs or perspectives that influence their choices (Keynes, 1936).

In his speech *Sentiment and the Real Economy*, President of the Federal Reserve bank of Richmond Tom Barkin lays out a common scenario that encapsulates the phenomena of animal spirits. In his business experience, Barkin often found that firms use their beliefs about the future of the economy to drive decision-making. In cases where the firm was confident of a positive future economic climate, forecasts were more aggressive for future metrics. When the script flipped to times of uncertainty for the future economy, organizations were more likely to be cautious in their assumptions and predictions (Barkins, 2019). These scenarios point to a correlation between firms’ beliefs about their economic environment and their actions, assuming the changes in forecasts resulted in similar changes in their firms’ decisions.

The effect of making decisions correlated to economic statistics or sentiment is not limited to businesses. In a research paper *Consumer Confidence and Consumer Spending,* Sydney Ludvigson used two consumer sentiment indexes to measure the effect of consumer optimism on personal expenditure growth. She found that “measures of consumer attitudes on their own have… significant predictive power for quarterly consumption growth”, with 15% of the next quarter’s variation of total personal consumption expenditure growth was explained by the values of the current quarter’s consumer sentiment surveys (Ludvigson, 2004).

# Methodology

This brings me to the ultimate purpose of this paper: does weak consumer sentiment imply that car sales will drop in this quarter? To answer this question, we will estimate regressions between consumer optimism as given by the University of Michigan Consumer Sentiment index and the total number of vehicles assembled in the united states, with separate iterations using either expansion or recession data. We will also conduct a regression including a lagged variable to incorporate the last quarter sentiment value’s effect on the number of assemblies this quarter. Then, we will use those regressions to forecast this quarter’s and next quarter’s number of assemblies based on consumer sentiment reaching 80. Theoretically, we will use a quarter’s total number of vehicle assemblies to be an indicator of the equilibrium quantity for the vehicular manufacturing market in that quarter. Thus, a higher total assembly implies a strong demand for said production, while drops in the statistic will be interpreted as decreases in demand.

# Results

For our first regression, we used only data points from recessive years. The following is the information about the first iteration. The following Regression will be known as Regression 1:

Regression 1: Consumer Sentiment vs Motor Vehicle Assemblies (US), Recessive Years

|  |  |  |
| --- | --- | --- |
| Centered R^2 | 0.4938426 | |
| Durban Watson | 0.9172 | |
| Variable | Coefficient | Significance |
| Constant | -1.964283462 | 0.48584737 |
| Consumer Sentiment | 0.141786817 | 0.00347949 |

Regression 1’s R^2 figure is displaying that 51% of the difference in Motor Vehicle Assemblies in a given quarter is explained by variations in consumer sentiment in the same quarter. With a significance level of less than .00001%, it is extremely likely that there is a causal relationship between the two factors. Figure 1 shows a graph of the recession data used and the regression line of our first iteration.



Figure 1: Regression 1 shows the relationship between consumer sentiment and total assemblies during recession years exclusively

Visually the relationship appears to be a positive correlation between consumer optimism and motor vehicle assemblies. This makes sense, as periods when consumer sentiment is low imply periods of time when economic activity is low, in turn hinting that the propensity for consuming goods is lower relative to other years in the business cycle. If consumers are less likely to purchase goods and services, then it is not necessarily unreasonable to assume that they are also less likely to purchase motor vehicles. This lesser demand contrasts with periods of the recession years where sentiment is still high, possibly either at the beginning of the recession where sentiment has not reacted yet or at the end, when economic activity begins to recover. In these 2 data entries, the high consumer sentiment in fact did translate to higher total vehicle assemblies.

For our next regression, we will use expansion data to estimate the same relationship. This iteration will be referred to as Regression 2.

Regression 2: Consumer Sentiment vs Motor Vehicle Assemblies (US), Expansive Years

|  |  |  |
| --- | --- | --- |
| Centered R^2 | 0.3592387 | |
| Durban Watson | 0.3967 | |
| Variable | Coefficient | Significance |
| Constant | 4.1278124945 | 0.00000011 |
| Consumer Sentiment | 0.0756877025 | 0.00000000 |



Figure 2: Graphed regression 2 shows the relationship between consumer sentiment and total vehicle assemblies in the same quarter.

There are some interesting differences to note between the two regression versions. First, note that the R^2 statistic has decreased from .51 in the regression 1 to .36 in regression 2. Also, the consumer sentiment coefficient fell by 25%, meaning the impact of an increase in consumer sentiment on total assemblies dropped by ¼ as well. For a visual comparison, we look to figure 3:



Figure 3: Regressions 1 and 2 plotted on the same graph. Regression 1 (recession years) is blue, regression 2 (expansion years) is green

Notice the difference in slopes between the 2 regressions. The impact of optimism appears to be larger during recession years than expansion periods. As such, we can expect fluctuations in consumer sentiment to have a larger impact during recession years than expansion years.

The experimentation will conclude with a forecast of consumer sentiment dropping to 80. During expansion years, the regression estimates a demand of 9.379 million units, with a 95% confidence interval from 5.268 million to 13.48983124 million units. For the expansion data, the predicted value when consumer sentiment fell is 10.183 million units, with the 95% confidence interval between 7.54722391 million to 12.818 million units. Notice that the confidence interval for the recession years is wider than that for expansions. This points to a more volatile figure for assemblies during those recessive years, meaning that its riskier to operate at a consumer sentiment level of 80 if the economy is in a recession.

# Conclusion

While consumer sentiment is an important aspect to understanding today’s vehicular assembly market, it is important to consider other factors as well. Depending on how the decreases in demand are distributed, it is possible that a company will lose large portions of its business or be completely unaffected. Also, the distinction between whether we are currently in a recession or expansion determines the volatility of the assembly market.

To your point on whether falling consumer confidence can result in a recession, its absolutely possible. Barkin himself speaks to it, saying that recessions can become “self-fulfilling prophecies”, where uncertainty of the future leads firms and consumers alike to decrease purchases and reduce economic activity in general. It’s also important to consider the contextual influences of the source of uncertainty. In this case, the rumors of a possible terrorist attack.

To analyze this specific threat, we can look back to the 9/11 attacks for historical data. According to the St. Loius Federal Reserve, some of the immediate effects on the economy were an “temporary inability to clear checks caused by the suspension of flights,” the temporary closing of financial markets, mass withdrawals, and businesses investing in more liquid assets. In this case, the increased difficulty of travel especially can slow down business, making it more costly to import and export both final and intermediate products.

While the threat of economic damage is substantial, I would be careful about deciding immediately. It is important to understand the Federal Reserve’s possible responses. In looking at how the Fed reacted to the 9/11 attacks, we can understand that the central bank has several tools in place to be able to manipulate consumer sentiment and different economic factors. In response to the 9/11 attacks, the Federal Reserve provided extra liquidity to firms and individuals throughout several markets. This move increased consumer confidence, and after 3 weeks the liquidity of the markets and the involvement of the government were back to pre-attack levels, meaning that the effect of 9/11 was very quickly neutralized by the central bank.

To the choice of whether to shut down production, I would wait to see the Fed’s response. While the sudden drop of consumer confidence is something to consider, it is not the only factor in this exchange alone, even disregarding how our firm is positioned within the vehicle assembly market. I would argue the central banks could prevent a recession; in which case it is less risky to continue operating. However, if the decision must be made right now, I would argue that there is evidence that the lower consumer confidence may result in a decrease in market demand for vehicle assemblies, which may in turn warrant shutting down production.

Sources:

“Sentiment and the Real Economy - Speech, Tom Barkin, May 15, 2019.” Federal Reserve Bank of Richmond. Accessed January 25, 2020. https://www.richmondfed.org/press\_room/speeches/thomas\_i\_barkin/2019/barkin\_speech\_20190515.

Keynes, John Maynard. *The General Theory of , Interest, and Money*. London: Macmillan and Co., 1936.

Ludvigson, Sydney C. “Consumer Confidence and Consumer Spending.” *Journal of Economic Perspectives* 18, no. 2 (2004): 29–50. <https://doi.org/10.1257/0895330041371222>.

Neely, Christopher J. “The Federal Reserve's Response to the Sept. 11 Attacks: St. Louis Fed.” The Federal Reserve's Response to the Sept. 11 Attacks | St. Louis Fed. Federal Reserve Bank of St. Louis, November 30, 2017. https://www.stlouisfed.org/publications/regional-economist/january-2002/the-federal-reserves-response-to-the-sept-11-attacks.

RATS Code

\*\*\* Intro code \*\*\*

cal(q) 1900:1

all 2025:4

data(format=fred) \* \* MVAAUTLTTS UMCSENT USREC

table(picture="\*.##")

\*\*\* Rename Variables \*\*\*

set Assemblies = MVAAUTLTTS

set Consumer = UMCSENT

\*Graph the data to understand it

GRAPH(STYLE=LINE,HEADER="Motor Vehicle Assemblies, Autos and Light Truck Assemblies",VLABEL="Millions of Units",HLABEL="Year") 1

# Assemblies \* \*

GRAPH(STYLE=LINE,HEADER="Consumer Sentiment",VLABEL="Consumer Sentiment",HLABEL="Year") 1

# consumer \* \*

\* Assemblies= B0 + B1 Consumersentiment

\*Now we want to do a regression only taking recession data

set SREC = %if(USREC<1,0,1)

linreg(smpl=SREC) Assemblies \* \* resids

# constant consumer

prj fitted1

scatter(smpl=SREC,style=dots,header="Assemblies as a Function of Consumer Sentiment, Recession Data (Regression 1)",VLABEL="Motor Vehicle Assemblies (Millions of Units, US)",HLABEL="Consumer Sentiment (University of Michigan Consumer Sentiment index)", $

overlay=line, ovsame, ovcount=1) 2

# Consumer Assemblies \* \*

# Consumer fitted1 \* \*

\*Now we want to do a regression only taking expansion data

set SEXP = %if(USREC>0,0,1)

linreg(smpl= SEXP) Assemblies \* \* resids

# constant consumer

prj fitted2

scatter(smpl=SEXP,style=dots,header="Assemblies as a Function of Consumer Sentiment, Expansion Data (Regression 2)",VLABEL="Total Motor Vehicle Assemblies (Millions of Units, US)",HLABEL="Consumer Sentiment", $

overlay=line, ovsame, ovcount=1) 2

# Consumer Assemblies \* \*

# Consumer fitted2 \* \*

\*Now for a plot with both regression lines to compare

scatter(style=dots,header="Assemblies as a Function of Consumer Sentiment, All Data (Regressions 1 and 2)",VLABEL="Total Motor Vehicle Assemblies (Millions of Units, US)",HLABEL="Consumer Sentiment", $

overlay=line, ovsame, ovcount=2) 3

# Consumer Assemblies \* \*

# Consumer fitted1 \* \*

# Consumer fitted2 \* \*