THE HAPPIEST PLACE ON EARTH:

A LOOK AT CONSUMER SENTIMENT IN THE US ECONOMY

by

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Table of Contents

1. Introduction

Consumer sentiment is described by Investopedia, as being "a statistical measurement and economic indicator of the overall health of the economy as determined by consumer opinion."[1] Consumer sentiment can reflect people's individual feelings on the economy, their own financial wellbeing, and where they see the economy evolving in the near term. Developed as an economic statistic during the mid-20th century, consumer sentiment has become a barometer whose results influence public policy, economic policy, and stock markets. In this sense, the index could be described as a lagging indicator in the sense that consumer's base their opinion on past events rather than just their predictions of upcoming events. However, the index could also be seen as a leading indicator of upcoming economic events. For example, when consumer sentiment is less positive, markets typically react bearishly, and when consumer sentiment is more positive, we can see upswings in the markets. Causation can run the opposite way also, and markets can influence consumer sentiment. In this paper consumer sentiment's relationship with both the real sector and the financial sector will be examined to determine which way causation applies and how it's related to various economic indicators in both sectors.

For this paper two time-spans will be examined to determine if increased media attention on the economy has played a role. The period of September 2001, which marked the tragic "9-11", will be marked as the start of increased media attention and telecommunications. More on this will be mentioned later on in the analysis.

To start the summary statistics for both consumer sentiment "SENT" and inflation sentiment "NMFINSI" can be seen below.

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[1] "Consumer Sentiment," *Investopedia,* <http://www.investopedia.com/terms/c/consumer-sentiment.asp>.

Chart 1.1: Summary Statistics for SENT

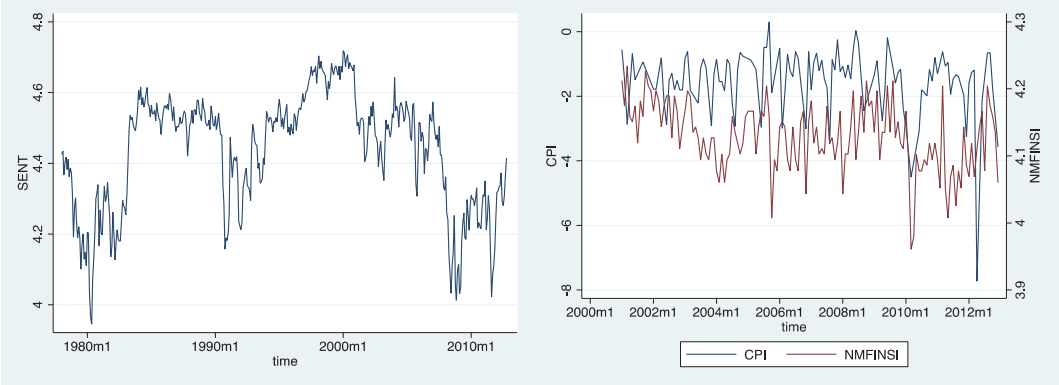
Variable	Obs	Mean	Std. Dev.	Min	Max
SENT	418	4.433878	.1632613	3.945458	4.718499

Chart 1.2: Summary Statistics for NMFINSI

Variable	Obs	Mean	Std. Dev.	Min	Max
NMFINSI	186	4.133228	.0494515	3.960813	4.234107

While the log of SENT and NMFINSI have similar means around 4, the standard deviation for SENT is a bit higher than NMFINSI. The MIN and MAX are also similar for each, with SENT being a larger range from 3.945458 to 4.718499 and NMFINSI having a range between 3.960813 and 4.234107.

Graph 1.1 & 1.2: Logged SENT & NMFINSI with CPI (Inflation)

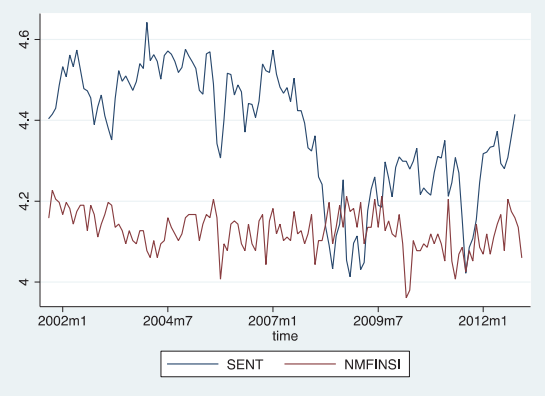


The above graphs show that SENT seems to follow a less stationary path than NMFINSI. NMFINSI looks to be close to white noise with a slight downward trend. SENT, on the other hand, seems to have more upward and downward trends, with an upward trend starting after the recession in the early 1980's, only to decrease during the Dot-Com Bubble in the early 1990's, and then finally a slow decrease starting in the 2000's with a

major decrease during the 2007 recession. Therefore, just looking at the graphs, SENT seems to be affected greatly by GDP and what is happening in the economy.

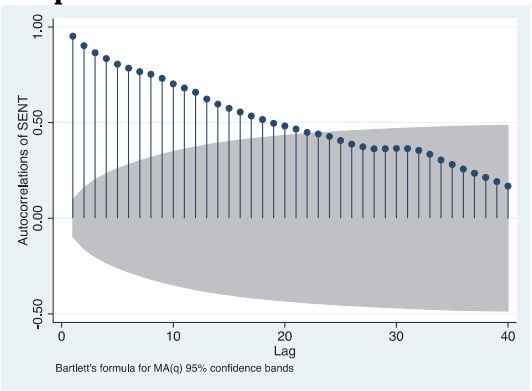
NMFINSI seems to be somewhat correlated with inflation in most cases but not all. NMFINSI also seems to change direction, from increasing to decreasing, as often as inflation, almost quarterly.

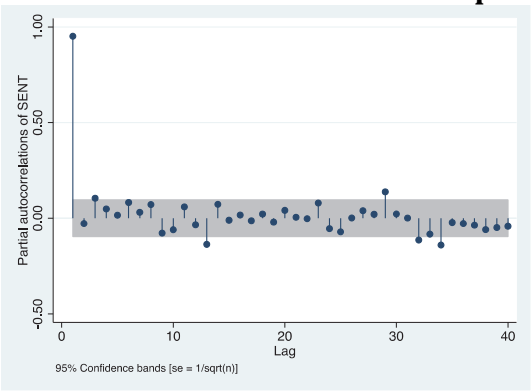
Graph 1.3: Logged SENT & NMFINSI from September 2009 to December 2012



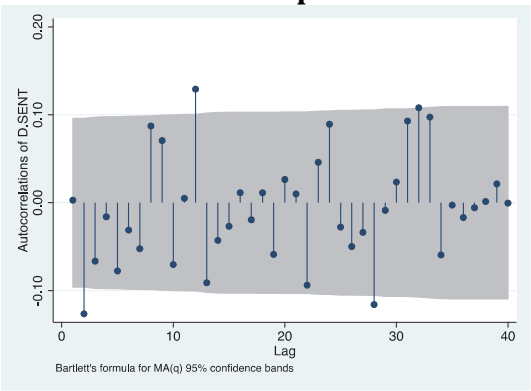
Looking at both variables from the time-span running from September 2001 until December 2012, the two variables seem to be sometimes correlated and sometimes not. Below are the autocorrelation and partial autocorrelation graphs for both SENT and NMFINSI, as well as their first-differenced results.

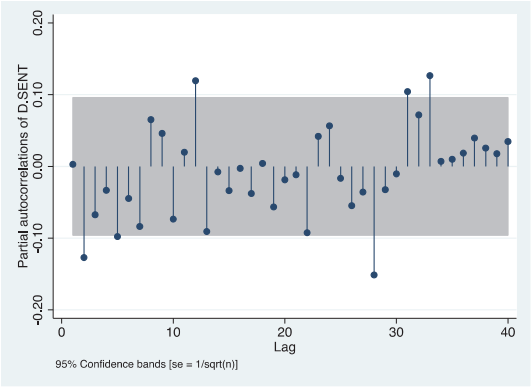
Graphs 1.4 & 1.5: SENT Autocorrelation and Partial Autocorrelation Graphs



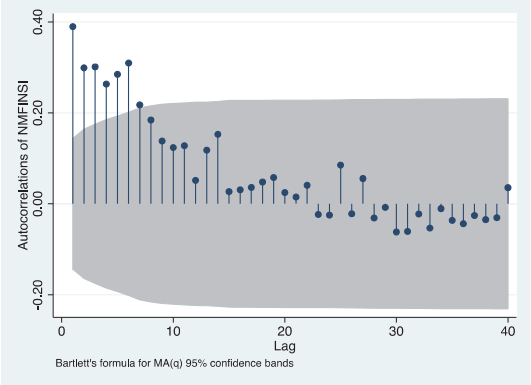


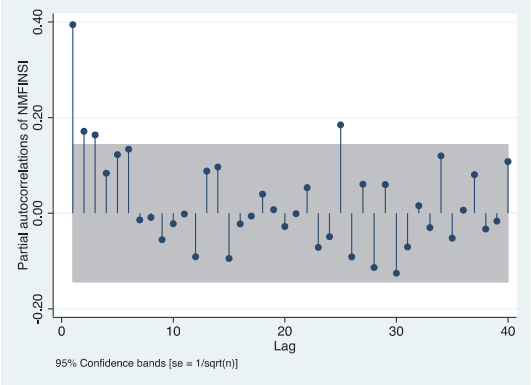
Graphs 1.6 & 1.7: First Differenced SENT Autocorrelation and Partial Autocorrelation Graphs



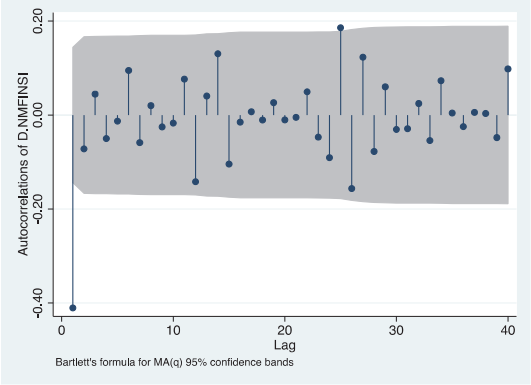


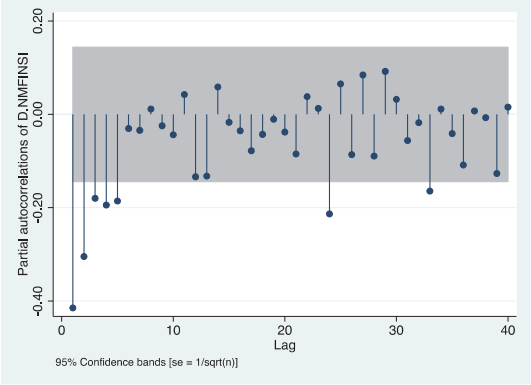
Graphs 1.8 & 1.9: NMFINSI Autocorrelation and Partial Autocorrelation Graphs





Graphs 1.10 & 1.11: First Differenced NMFINSI Autocorrelation and Partial Autocorrelation Graphs





2. Consumer Sentiment Index Background

There are, in fact, two main indices used to describe consumer sentiment. Both the United States' Conference Board and the University of Michigan Survey Research Centre created an index. The Conference Board sends their surveys by mail to approximately five thousand households each month, with an average of three thousand five hundred results. Survey participants are asked to provide qualitative responses to questions regarding various topics such as; current general business conditions in their area, expected business conditions in six months, current job availability in their area, expected job availability six months from now, and expected total family income six months from now. The responses to all questions are then averaged (equally), and turned into one index.[2]

The Michigan Survey is a telephone survey to approximately five hundred households. Participants are asked to provide qualitative responses to various questions regarding; current family conditions, expected financial conditions one year from now, expected general business conditions during the next twelve months, expected business conditions during the next five years, and current buying conditions for large household appliances. The Index of Consumer Sentiment averages the responses to all five of these questions and the Index of Consumer Expectations averages the responses to the three questions regarding expected economic conditions. Then a dozen other questions are asked regarding consumer's attitudes surrounding inflation, housing market conditions,

[2] Fuhrer, J.C., "What Rose Does Consumer Sentiment Play in the U.S. Macroeconomy?" *Federal Reserve of St.Louis,* <http://www.bos.frb.org/economic/neer/neer1993/neer193b.htm>.

automobile market conditions, labour market conditions and more.[3] The index encompasses all of this data, and in general, both the Michigan Survey Index and the Conference Board Index generally agree with each other, being positively correlated. In general, the Michigan Index is examined in this paper, as it is the more popular index to use for empirical work.

As the computations described to calculate the indices both the Michigan and Conference Board's indices take into consideration not only what is happening currently in the economy, but also what is expected by consumers to happen in the near future. These feelings should reflect the way that households and consumers act when making decisions that can affect their economic wellbeing. Therefore, positive it could be possible that consumer sentiment could drive an economy out of recession and back into good health. For the same reasoning, a lack of consumer confidence could perhaps drag the economy into recession. Which way the causation runs is important: large swings in consumer sentiment may provide early warning signals of bad economic times ahead.[4] There are many theories surrounding these questions, and we review them in the next section.

[3] ibid
[4] ibid

2.1 Consumer Sentiment and the Real Sector

Many theories suggest that fluctuations in consumption expenditure can be attributed to current and expected fluctuations in income, wealth, and interest rates. This leaves no role for consumer sentiment, therefore, making the precise role of sentiment in influencing consumers' decision hard to explain. This leads to some confusion over the theory surrounding the consumer sentiment index, and whether it is even important. While some economists see little justification for using the index, they believe that the information contained in consumer sentiment indices are similar to, and contained within, the information and statistics on employment and financial conditions. However, others believe that the consumer sentiment index adds to this information by being "an important influence of consumer spending and saving decisions in determining whether the national economy slips into recession or is propelled toward recovery and growth,"[5] as well as being a good indicator of the timing of consumer expenditure. While most consumers will buy the same goods over their lifetime, depending on economic conditions, their sentiments toward the future economy could change the timing of these purchases, more-so than the decision to purchase at all.[6]

When consumer sentiment is low, and people are generally pessimistic consumers could be seeing, or expecting to see, a fall in their real incomes. This could be due to a number of factors such as inflation or spells of unemployment levels; however, the outcome will be the same. This will lead to consumers cutting back on expenditures, maybe not in the long run, but rather in the short-run or medium term, depending on how long their pessimism exists. The opposite can be seen when consumer sentiment is

[5] ibid
[6] ibid

positive. While an increase in consumer sentiment may be caused by an increase in expected real income, it may manifest itself, in wealth and/or substitution effects occurring. Wealth effect would say that there should be an increase in the consumption expenditure of households and substitution would show an increase in leisure activities. In general, the consumer sentiment tends to have a positive relationship with income, and a negative relationship with inflation rates, unemployment rates, and real interest rates.[7] Therefore, it could be expected that there would be a booming economy during times of consumer optimism, and bust times during consumer pessimism.

The crucial debate is whether or not it is the feelings of the consumers that drive the economy, or if consumers' feelings are subject to, and just merely reflect, what is occurring in the economy currently. However, it has also been said that "measures of consumer sentiment serve as superior forecasters of subsequent economic activity", in other words, "sentiment may not be the proximate cause of the recession or expansion, but it is a reliable forecaster"[8]. It has been stated that "the forecasting record of the Michigan Index implied that consumers who participate in the Michigan survey are particularly adept at preceding and predicting broad trends, anticipating with high probability, changes in unemployment rates by an average of nine months ahead of time, in interest rates by six months, and in inflation by three months"[9]. While consumers may not know exactly the position of the aggregate economy at a point in time, they do know the position of their household and their neighbouring households. For instance, individual responders will notice if prices for their regular purchases have increased, or if

[7] ibid
[8] ibid
[9] ibid

more than a normal level of friends and families are being laid off, etc., which will give them some understanding of the overall economy is at, even if they do not follow GDP, interest rate, or inflation levels.

Empirically it has been shown that "a significant fraction of the movements in the consumer sentiment index can be accounted for by observations of widely disseminated measures such as the latest statistics on GNP growth, the rate of inflation, the rate of unemployment, and interest rates,"[10]. It has been found that nearly seventy percent of sentiment variations are explained by unemployment, inflation, real interest rates, and real income changes. Therefore, it can be argued that either consumer sentiment is just a "good summary measure of well-known economic facts" rather than being its own independent statistic, or rather, that consumer sentiment is therefore playing a large role in these economic factors[11]. Alternatively, it should also be acknowledged, however, that the combined state of financial markets, labour markets, product markets, and policy is not necessarily in the same state at the exact same time across jurisdictions. Therefore, consumer sentiment can act as a reflection or aggregator, taking into consideration the different states of many of these statistics, but may not always be able reliable gauge to the exact state of the aggregate economy.

Various empirical evidence has shown that consumer sentiment plays a small role in explaining subsequent variations in consumption expenditure as independent information, and provides only modest forecasting improvements. This means that consumer sentiment on its own has not been shown empirically to be a major reason for changing economic states. However, evidence has also shown that the consumer

[10] ibid
[11] ibid

sentiments' predictive abilities [on inflation, unemployment, and interest rates] have been statistically significant for over the past thirty years.[12] Overall, consumer sentiment seems to be correlated with current aggregate economic activity, and while it's statistically significant, sentiment seems to play a small role relative to broad macroeconomic aggregates when predicting the economic outlook. It is also estimated that between thirteen and twenty six percent of variations in GDP is related to changes in consumer sentiment.[13]

The question remains then, how exactly does this information help to explain the relationship between consumer sentiment and production? Increased production can require increased investment by investors. "[B]usiness people who are pessimistic about the economic outlook might delay or cancel planned investment,"[14]. With no investment going into businesses to produce goods, this can cause a slowdown in production. As stated earlier, consumption and spending is related to consumer sentiment, and with decreased consumption and spending, manufacturers may also slow down their production in response to decreased demand for their goods.

This relationship between sentiment and production can depend on the type of good being produced, for example, inferior versus normal goods, durable versus perishables, or staple goods. "[L]ow expectations for the future may affect different types of spending in different ways. One would expect, for example, spending on more

[12] ibid
[13] ibid
[14] Kuzmanovic, M., Sanfey, P., "Can consumer confidence data predict real variables?" *European Bank,* <http://www.ebrd.com/downloads/research/economics/workingpapers/wp0151.pdf>.

expensive, durable items to be more sensitive to consumer sentiment, whereas outlays on essential day-to-day goods would fluctuate less in response to expectations,"[15].

Therefore, it is expected that there should be a positive relationship between production, manufacturing and consumer sentiment, for most types of goods. While intuitively this is what is expected, a vector autoregression model will be used to investigate the dynamics, the Granger causation and interactions.

[15] ibid

2.2 Consumer Sentiment and the Financial Sector

While there has been much discussion on consumer sentiment's relationship with aggregate macroeconomic variables, the possible interaction with the financial markets is largely unknown. Despite economic calendars such as Bloomberg and the Wall Street Journal listing the release of this data monthly, and its coverage on financial TV channels, little empirical works exist investigating potential channels. Does consumer sentiment is have an effect on equity prices, or perhaps equity prices are having an effect on consumer sentiment. In the US there has been a great deal of discussion on Main Street versus Wall Street interests, but little talk on establishing any connection empirically. When current income increases, this may increase consumer sentiment. Stock prices are seen as a leading indicator so if stock prices increase then this can be a sign that good economic times are ahead, and therefore, increase consumer sentiment. This relationship explains the latter more direct relationship that explains that when equity prices increase, this causes income to increase, and as stated earlier, this should increase consumer sentiment. This would suggest "households use changes in stock prices as leading indicators of future labour income, but does not rule out the traditional wealth effect,"[16].

There is, however, a more indirect explanation to the relationship between equity prices and consumer sentiment. When consumer sentiment is low, as explained earlier, this can be positively correlated with poor economic states. When this occurs, consumers stop buying goods, and companies may be suffering. Relationships can be circular, for example, laying workers off during bad economic times will cause real income to go

[16] Otoo, M.W., "Consumer Sentiment and the Stock Market" *Federal Reserve of St.Louis* <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=205028>.

down, and lead consumers into not buying as many goods. As companies struggle, their share prices may drop. Therefore, if consumer sentiment were to go down because of a recession, stock prices may also follow. This is a more indirect causation and intuitively this relationship makes sense as this has been seen even recently in the Great Recession of 2008-2009. Therefore, with an increasing consumer sentiment as a leading indicator, one would hypothesize that an increase in the stock market signals good economic times ahead.

Empirical findings relating stock prices and consumer sentiment showed that "sentiment levels of households that owned stock and those that did not responded similarly"[17] suggesting that possibly stock prices are a leading indicator of future income and consumers' attitudes. In fact "expected business conditions was most affected by changes in share prices" while "changes in share prices had little effect on views of current or expected personal finances,"[18]. It was also seen that consumer sentiment and stock prices had a strong "contemporaneous correlation"[19]. The coefficients on current values of stock prices and consumer sentiment were statistically significant and there was a strong relationship between the two. Tests were also conducted for Granger-causality and it was shown that stock prices seem to influence consumer sentiment, but the reverse did not hold true. As well, stock price changes affected changes in consumer sentiment but not lagged changes. Stock prices seemed to explain approximately ten percent of the changes in consumer sentiment.[20]

[17] ibid
[18] ibid
[19] ibid
[20] ibid

This causation theory states stock prices were a leading indicator of the consumer sentiment index. Then it should be seen that when stock prices indicate future income trends, there should be a "response in the level of sentiment to movements in stock prices from households regardless of whether they own stock,"[21]. If sentiment is, in fact, capturing changes in wealth, then it would be unlikely to see a response from a household that does not own stock. In return, households that do own stock, depending on which stock they own, and housing prices (which directly effects household's wealth) would have differing portfolios that may go up or down. Previous empirical analysis on this theory showed that the higher a household's income, the higher the level of consumer sentiment. Overall, both consumer sentiment and stock prices are predicted to have a positive contemporaneous relationship, as an increase in stock prices could lead to an increase in consumer sentiment, and it is more likely that this is due to the fact that stock prices are seen as a leading indicator, and less so directly as a wealth effect.[22]

[21] ibid
[22] ibid

3. Vector Autoregression "VAR" Model Background

In this paper, a vector autoregressive model will be used to analyse the independencies of the various data sets. VAR models are used when there are several endogenous time series and interest is focused on the interactions and the underlying dynamic relationship. The equation for a VAR model can be seen below:

$$y_t = u_t + A_0 y_t + \cdots + A_p y_{t-p} + e_t, \;\; t \in \{1 \ldots T\}$$

where y_t, v and e_t are m× 1 column vectors and A_t are m×m matrices of coefficients. The e_t is a white noise residual vector of the m-element, where $\mathrm{E}\{e_t e_t'\}$ is time invariant and we allow for possible contemporaneous correlation. It is assumed that errors measured at different periods are uncorrelated. Under these assumptions estimation by ordinary least squares is efficient equation by equation.

We will first consider the rationality of our two sentiment variables. This will indicate whether we need to adopt a non-stationary method of inference following Johansen and Phillips or standard VAR inference[23].

[23] Gregory, A., *Econ 853 Notes,* Queen's University, 2013.

3.1 Background on Data Used

Fourteen sets of data were used altogether in the vector auto-regression models. As discussed before, the data that was used to measure consumer sentiment were the Michigan Consumer Sentiment Index and the Michigan Inflation Sentiment Index. These indices were taken from January 1st, 1978 up until December 31, 2012, except for "VIX" which only went back as far as January 2nd, 1990, and "NMFINSI" which went as far back as July 2nd, 1997. These indices were taken from the Federal Reserve of St. Louis, and were recorded monthly. In order to determine their relationship within the economy, first they will be compared with real sector indices, then stock market indices.

Eight variables are used to try and analyse the relationship between consumer sentiment and results in the real sector. These variables are seasonally adjusted Real Gross Domestic Product "GDP", Real Personal Consumption Expenditures "PERINC", Purchasing Managers Composite Index "NAPM", Inflation "CPI", Industrial Production Index "INDPRO", Inventory Sentiment Index "INFINSI", Inventory "INV", and the Civilian Unemployment Rate "UNRATE". All these variables were taken from the Federal Reserve of St. Louis, range from January 1st, 1978 to December 31, 2012, and are for the US.

As an indicator of the economic health of the manufacturing sector, the PMI index "NAPM" is based on five major indicators: new orders, inventory levels, production, supplier deliveries and the employment environment. The conventional interpretation of this index is that if it is above 50% then this indicates an expansion in the manufacturing sector, and below 50% indicates contraction. This data was seasonally adjusted and recorded monthly, excluding business days and weekends. This index is released by the

Institute of Supply Management (ISM), and they release this index on the first business day of every month.[24]

The Industrial Production Index "INDPRO" uses 2007 dollars, and was seasonally adjusted. It was created by the Board of Governors of the Federal Reserve System.[25]

The civilian unemployment rate "UNRATE" is monthly and seasonally adjusted. It represents the number of unemployed as a percentage of the labour force. Labour force data are restricted to people 16 years of age and older, who currently reside in one of the fifty states or the District of Columbia, and does not include people who reside in institutions, and who are not on active duty in the Armed Forces. This data was taken from January 1st, 1978 until December 31st, 2012.[26]

Inflation was used in the model by using the US' CPI. The growth rate of CPI was created, and used for inflation. The data ran monthly from January 1st, 1978 to December 31st, 2012, and the data was from the Federal Reserve of St.Louis.

The Institute for Supply Management also put out an Inventory Sentiment Index "NMFINSI". This index measures the rate of inventories on a feeling of "too high" and "too low". This index is monthly ranging from January 1st, 1978 to December 31st, 2012.[27]

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[24] "PMI" *Investopedia* <http://www.investopedia.com/terms/p/pmi.asp)(http://www.investopedia.com/university/releases/napm.asp>.
[25] "Industrial Production" *Federal Reserve of St.Louis* <http://research.stlouisfed.org/fred2/series/INDPRO>.
[26] "Unemployment Rate" *Federal Reserve of St.Louis* <http://research.stlouisfed.org/fred2/series/UNRATE>.
[27] "Inventory Sentiment" *Institute for Supply Management* <http://www.ism.ws/ISMReport/content.cfm?ItemNumber=10706>.

For interest rates, a US three-month Treasury bill was used, and was collected monthly from the Federal Reserve of St.Louis. This data set ran from January 1978 to December 2012.

Total Business Inventory data "INV" was taken monthly. It should be noted that on June 14th, 2001, data were reconstructed to reflect the switch from the Standard Industrial Classification System "SIC" to the North America Industrial Classification System "NAICS".[28]

Real Personal Consumption Expenditures "PERINC" used 2005 dollars, was seasonally adjusted and created by the US Department of Commerce.[29]

Real, seasonally adjusted, gross domestic product was turned from quarterly data into monthly data by using the quarterly data for each month in the corresponding quarter.

For the stock market, four major stock market indices were used to quantify the state of the market. Included was the Standard & Poor's 500 Index "SNP", Dow Jones Industrial Index "DOW", the National Association of Securities Dealers Automated Quotations System "NASDAQ", and the Exchange Rate Volatility Index "VIX". Because the Sentiment indices are all monthly indices, but the stock market indices are recorded frequently, monthly data was created for each stock market index. In order to create a relevant monthly stock market index, the day that the sentiment index was announced (usually the first day of the month), the corresponding next business day was used for the

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[28] "Total Business Inventory" *Federal Reserve of St.Louis"* <http://research.stlouisfed.org/fred2/series/BUSINV>.
[29] "Real Personal Consumption Expenditures" *Federal Reserve of St.Louis* <http://research.stlouisfed.org/fred2/series/DPCERX1A020NBEA>.

stock market data. Therefore, the result should hopefully show the reaction in the stock markets to the sentiment announcement each month. Of course if markets have an impact on sentiment, then lags of these stock price changes will be relevant. Stock market data was taken from Datastream (S&P 500), Bloomberg (Dow Jones Industrial Index), Yahoo Finance (NASDAQ) (VIX). As explained, all data was extracted daily, and then sampled monthly to obtain the monthly sequence. All data is from January 1st 1978, until December 31st 2012, excluding weekends and business holidays.

When modelling with a VAR model the variables must be stationary. In the Appendix the autocorrelation and partial autocorrelation graphs are shown for all the variables. They showed that the data was non-stationary, but when first differenced became stationary for all variables. An augmented Dickey Fuller test was used to test for a unit root. The null hypothesis is that there is a unit root, meaning if it rejected then there is no unit root. If the unit root is 1 then the process is non-stationary, and if it is less than one than it is stationary[30]. At the 1% confidence interval, the null hypothesis could not be rejected, as the p-values were above 0.05. This was true for all variables except for "NAPM"; however, looking at the graph it seems as though first differencing may be necessary. Therefore, first differences of all variables were found and the Augmented Dickey Fuller test was used again on the all the variables, and it showed that they were all stationary after first differencing. Therefore, from now on the variables listed are actually the first difference of the variables.

[30] "Estimating a Var" *Learneconometrics.com* <http://www.learneconometrics.com/class/5263/notes/Estimating%20a%20VAR.pdf>.

A Johansen test for co-integration was ran for the two sentiment indices. The Michigan Sentiment Index, and the Michigan Inflation Index. The motive behind testing for co-integration is to help set up the econometric model. A Johansen test has two tests, an eigenvalue test and a trace test. The null hypothesis is that there exists an r co-integrating vectors against the alternative of r+1 vectors.[31] The results can be seen below.

Chart 3.1.1: Johansen Test for Co-integration Results

Maximum rank	**parms**	**LL**	**eigenvalue**	**Trace statistic**	**5% critical value**
0	10	485.51341		191.4728	15.41
1	13	544.83473	0.47692	74.8302	3.76
2	14	582.24981	0.34014		

"The body of the table presents test statistics and their critical values of the null hypothesis of no co-integration and one or fewer co-integration equations. The eigenvalue shown on the last line is used to computer the trace statistic in the line above it. Johansen's testing procedure starts with the test for zero co-integrating equations."[32] Therefore, the null hypothesis of no co-integration is strongly rejects, and find that there are two co-integrating relationships.

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[31] Sjo, B, "Testing for Unit Root and Co-integration," *Linkoping University,* < http://www.iei.liu.se/nek/ekonometrisk-teori-7-5-hp-730a07/labbar/1.233753/dfdistab7b.pdf>.

[32] "Vec Intro", *Stata,* <http://www.stata.com/manuals13/tsvecintro.pdf>.

Now to start creating a VAR model, firstly, the relationship with the Michigan Sentiment Index and the Real Sector will be analyzed. To begin, the logged values were taken for the Michigan Consumer Sentiment Index and Michigan Inflation Sentiment Index. Normally, for an ARIMA model, the autocorrelation graphs of the logs of the variables are analyzed to determine stationarity. For VARs it is slightly different. "VARs must obey more restrictive conditions. A VAR is stationary if its first and second moments are independent of t. These conditions imply that each of the elements of y_t is stationary"[33]. Checking for stationarity occurs after the model has been ran by looking at the eigenvalues. A VAR is stationary if all the roots of |A(z)|=0 (from the equations stated in the VAR Background section above) lie outside the unit circle. This is equivalent to all of the eigenvalues lying inside the unit circle. If this is the case then there is stationarity.[34]

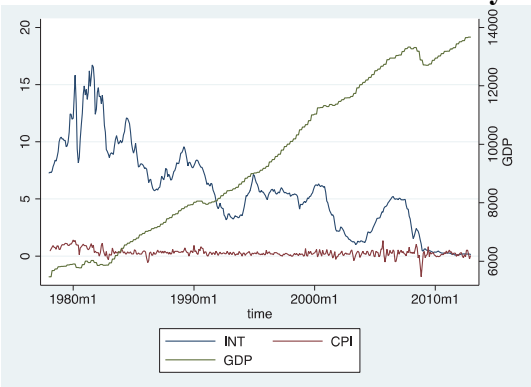
[33] Becketti, S., "Introduction to Time Series using Stata", *Statapress*, 2013.
[34] ibid

3.2 Model Estimation and Testing in the Real Sector

When relating sentiment with the real sector, four VAR models will be used to determine the relationship. The first model will look at three variables: inflation, interest rates, and real gross domestic product. The second model will be a full model with all real sector variables including industrial production, personal income, unemployment rate, inventory, real gross domestic product, PMI, and inflation. The third and fourth models use the same variables, but look at 2001 (post "9-11") to the end of 2012 to try and reveal how more recent media attention on the economy has increased the impact of economic indicators on consumer sentiment.

Below is a depicton of the three variables that will be used in the following VAR model. Here it can be seen that GDP is increasing, while interest rates have mainly decreased, and inflation has stayed relatively constant over time, with some periods of increased change.

Graph 3.2.1: GDP, Interest Rates & Inflation from January 1978 to December 2012



The next step is looking at the relationship between sentiments in the economy and changes in the real sector using a VAR model. Firstly, four criterions were used to determine the number of lags to include in the model. These four criterions included Final Prediction Error "FPE", Akaike Information Criterion "AIC", Schwarz' Bayesian

Information Criterion “SBIC”, and the Hannan and Quinn Information Criterion “HQIC”. The likelihood-ratio results also show up when running a “varsoc” command in Stata. The results can be shown below.

Chart 3.2.1: Criterion Results (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	367.838				1.4e-11	-10.831	-10.7659	-10.6665
1	466.799	197.92	25	0.000	1.5e-12	-13.0388	-12.6481	-12.0516*
2	505.823	78.048	25	0.000	1.0e-12	-13.4574	-12.7412*	-11.6476
3	535.929	60.213	25	0.000	8.9e-13*	-13.6098*	-12.5682	-10.9774
4	560.558	49.258*	25	0.003	9.5e-13	-13.5987	-12.2316	-10.1436

Looking at the starred numbers, to see the recommendation by each criterion, each criterion showed a different result; however, both the FPE and AIC said 3 lags, so that is the recommendation that will be taken for the model.

Viewing the Granger causality test results, it looks as though GDP, and interest rates seem to be playing a role in determining consumer sentiment. This follows the prediction that recessions seem to play a role in consumer sentiment. Interest rates may effect consumers directly if they were looking to invest or take out loans, and therefore, with this direct impact on consumers, interest rates would intuitively also affect their sentiment toward the economy, depending on whether they wanted low or high interest rates.

For the inflation sentiment index, only sentiment seems to be playing a role, but not inflation itself. This is an interesting result that suggests that people’s attitude toward the economy is what leads to their decision on predicting and increased or decreased inflation in comparison to the actual inflation result at the time.

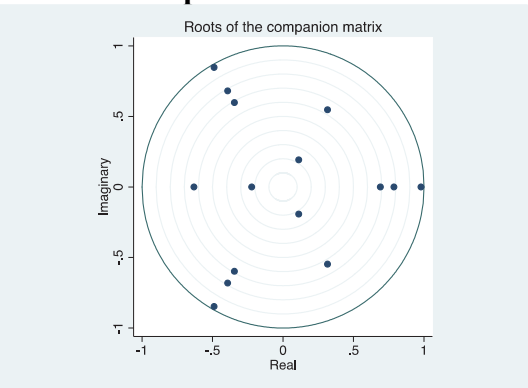
Chart 3.2.2: Granger Causality Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	NMFINSI	1.5369	1	0.215
SENT	CPI	.21982	1	0.639
SENT	GDP	2.9137	1	0.088
SENT	INT	20.61	1	0.000
SENT	ALL	25.35	4	0.000
NMFINSI	SENT	10.181	1	0.001
NMFINSI	CPI	.01432	1	0.905
NMFINSI	GDP	.25	1	0.617
NMFINSI	INT	.05884	1	0.808
NMFINSI	ALL	11.814	4	0.019
CPI	SENT	.37406	1	0.541
CPI	NMFINSI	.46779	1	0.494
CPI	GDP	.15659	1	0.692
CPI	INT	.04775	1	0.827
CPI	ALL	1.0653	4	0.900
GDP	SENT	4.2408	1	0.039
GDP	NMFINSI	.06639	1	0.797
GDP	CPI	.35011	1	0.554
GDP	INT	1.4791	1	0.224
GDP	ALL	5.4457	4	0.245
INT	SENT	1.2507	1	0.263
INT	NMFINSI	1.7567	1	0.185
INT	CPI	.83952	1	0.360
INT	GDP	.04836	1	0.826
INT	ALL	3.4615	4	0.484

Looking at the reverse in causality and how SENT and NMFINSI influence other variables, it looks as though sentiment seems to help determine GDP, therefore, having circular causation. It seems that NMFINSI may be influencing interest rates but this is unlikely. More will be discussed on NMFINSI and GDP in the subsequent models.

To ensure that the above model gives accurate results, the stationarity and stability of the model will be analyzed. In order to determine stationarity, as described earlier, eigenvalues are tested to ensure they all lie inside the unit circle. A “varstable” command was used to ensure that the model is, indeed, stationary, as can be seen in the results below. The results show that all eigenvalues are, in fact, inside the unit circle.

Graph 3.2.2: VAR Model Roots Graph

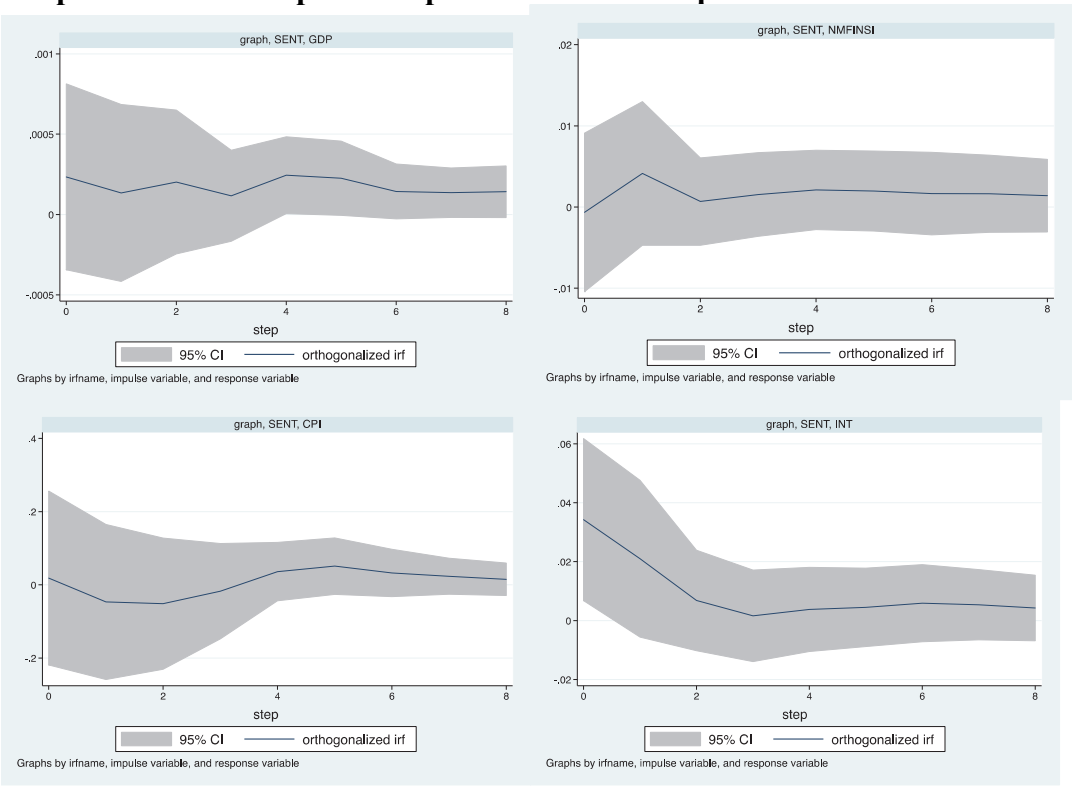


Now that the causation has been examined, the impulse response functions will now be analyzed. "Impulse response functions of a dynamic system is its output when presented with a brief input signal, called an impulse. More generally, an impulse response refers to the reaction of any dynamic system in response to some external change."[35]

Inflation seems to dip in the first quarter, and then has an incline until month 5, until falling back to its starting point by the second quarter. GDP does something similar, but rather than dipping in the first quarter, there is a decrease in the first month, following by an increase and then subsequent decreases and increases until the end of the first quarter, in a zigzag fashion. Inflation sentiment seems to rise in the first month and fall in the second month before reaching original levels again and staying relatively stagnant. Finally, interest rates seem to fall for three months, until gradually settling.

[35] Lu, C., Xin, Z., "Impulse-Response function Analysis: An application to macroeconomy data of China: < http://www.statistics.du.se/essays/D10_Xinzhou_lucao.pdf>.

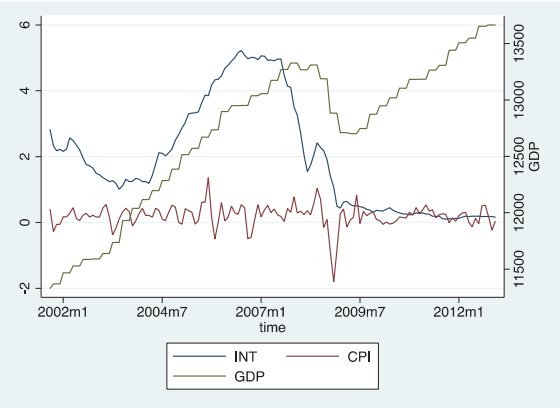
Graph 3.2.3-3.2.6: Impulse Response Function Graphs



Now that a VAR model has been analyzed for the 1978 to 2012 time-span, what may be more interesting is to look at the 2001 to 2012 timeline. Why is this interesting? In 2001 the tragic "9-11" plane crashes occurred. This not only caused the US to increase its security, especially in the skies, but it also increased people's awareness to the news as the US entered a war and the government delivered a colour-coded terrorist activity index to warn Americans if there was heightened terrorist activity risk. As people watched the news more, this led to people watching the economy more too, and increased telecommunications, with high-speed internet, made it that much easier. Therefore, looking at how sentiment plays into the market during a heightened telecommunication era may give a better clue as to whether consumer sentiment plays a more important role nowadays.

Below, the graph of the three indices from September of 2001 until December of 2012 can be seen. As GDP increased, except for the recession in 2007, inflation has stayed constant and interest rates increased first and then decreased for the recession. This graph may give some clues as to the relationship with sentiment.

Graph 3.2.7: Interest Rates, GDP & Inflation from September 2001 to December 2012



Using the four criterion and likelihood-ratio test to determine how many lags should be included in the VAR model, the results shows that 2 significant lags would be used, for the sake of parsimony.

Chart 3.2.3: Criterion Results (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	281.53				1.1e-11	-11.0612	-10.9884	-10.87
1	345.926	128.79	25	0.000	2.2e-12	-12.637	-12.2002	-11.4898*
2	380.687	69.523	25	0.000	1.6e-12*	-13.0275	-12.2266*	-10.9243
3	406.25	51.126	25	0.002	1.7e-12	-13.05	-11.885	-9.99078
4	433.334	54.168*	25	0.001	1.8e-12	-13.1334*	-11.6043	-9.11812

After running the VAR model with 2 lags, a Granger Causality test was ran to see what the impact of both sentiment indices were on the economy, and what economic indicators impacted sentiment. The null hypothesis for the granger causality test is that

the "endogenous variables do not Granger cause the dependent variable."[36] The results can be seen below.

Chart 3.2.4: Granger Causality Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	NMFINSI	2.8e-05	1	0.996
SENT	CPI	.01148	1	0.915
SENT	GDP	.00242	1	0.961
SENT	INT	7.0017	1	0.008
SENT	ALL	7.3249	4	0.120
NMFINSI	SENT	.95897	1	0.327
NMFINSI	CPI	6.9987	1	0.008
NMFINSI	GDP	3.7691	1	0.052
NMFINSI	INT	.81407	1	0.367
NMFINSI	ALL	12.625	4	0.013
CPI	SENT	.43058	1	0.512
CPI	NMFINSI	2.1983	1	0.138
CPI	GDP	1.0451	1	0.307
CPI	INT	.15853	1	0.691
CPI	ALL	5.3517	4	0.253
GDP	SENT	.01203	1	0.913
GDP	NMFINSI	3.5361	1	0.060
GDP	CPI	.02967	1	0.863
GDP	INT	1.51	1	0.219
GDP	ALL	7.2891	4	0.121
INT	SENT	1.6537	1	0.198
INT	NMFINSI	.08917	1	0.765
INT	CPI	.30775	1	0.579
INT	GDP	2.2223	1	0.136
INT	ALL	3.6834	4	0.451

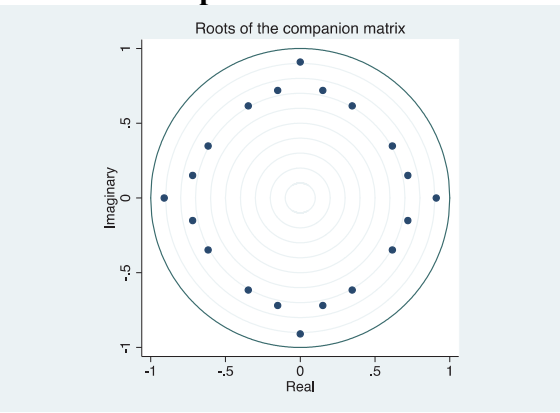
The results show that interest rates impacted sentiment, but not inflation sentiment. Inflation did impact inflation sentiment, but not sentiment. And as well, GDP seemed to impact inflation sentiment, but other than those variables, the rest didn't play a role. Looking at the reverse causation, sentiment seemed to perhaps impact interest rates; however, unlikely, and inflation sentiment seemed to impact GDP, and maybe even inflation itself. The most interesting result seems to be that both inflation and inflation sentiment seem to impact each other, having a circular causation perhaps.

To ensure that the above model gives accurate results, the stationarity and stability of the model will be analyzed. In order to determine stationarity, as described earlier, eigenvalues are tested to ensure they all lie inside the unit circle. A "varstable"

[36] "Interpreting a Granger Causality Test" *Stata,* <http://www.stata.com/statalist/archive/2008-09/msg00192.html>.

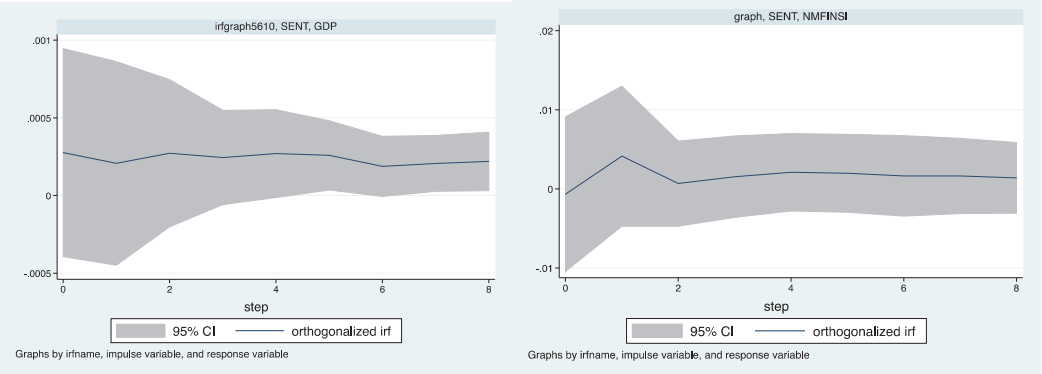
command was used to ensure that the model is, indeed, stationary, as can be seen in the results below. The results show that all eigenvalues are, in fact, inside the unit circle.

Graph 3.2.8: VAR Model Roots Graph



The last step when looking at this VAR model is to look at the impulse response functions. With regards to sentiment, the IRFs can give some insight into how variables respond to changes in sentiment. The results can be seen below.

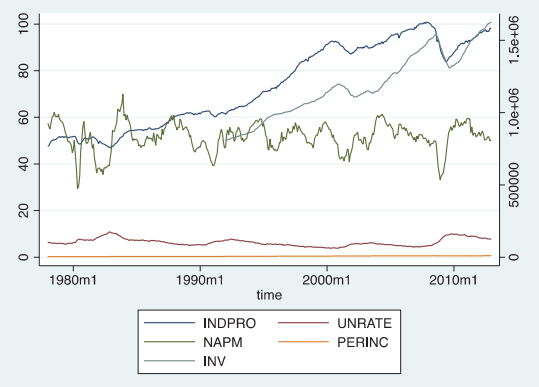
Graphs 3.2.9 to 3.2.12: Impulse Response Function Graphs



Looking at the impulse response functions, when there is a change in sentiment, GDP seems to stay relatively constant, wavering up and down for each subsequent month, but the movements are small. Interest rates also seem to be relatively stable, but only after the second month. For the first two months there is a downward drop before leveling out. Inflation sentiment also only has large movements during the first two months, with an increase in the first month, and decrease in the second month. Inflation itself does the opposite, falling in the first month, before increasing for the next three months before being stable.

Now that the smaller model has been analyzed, the larger model will now be examined. The larger model includes inflation and GDP, but also includes personal income "PERINC", Inventory "INV", Industrial Productions "INDPRO", PMI "NAPM", and the unemployment rate "UNRATE". These variables will first be examined using the entire time span of 1978 through 2012. A graph depicting the new variables to be added to the model can be seen below.

Graph 3.2.13: Industrial Production, Unemployment Rate, PMI, Personal Income and Inventory from January 1978 to December 2012



The four criterion and the likelihood-ratio test will determine the number of lags to be used in the VAR model.

Chart 3.2.5: Criterion Results (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	1409.11				5.7e-30	-41.7944	-41.6772	-41.4982*
1	1559.76	301.29	81	0.000	7.3e-31	-43.8733	-42.7015*	-40.9118
2	1647.38	175.24	81	0.000	6.8e-31	-44.071	-41.8444	-38.4441
3	1742.45	190.14	81	0.000	6.3e-31*	-44.491	-41.2097	-36.1987
4	1842.54	200.18*	81	0.000	7.6e-31	-45.0608*	-40.7248	-34.1032

The numbers in with stars are the lagged values recommended by each criterion. Therefore, looking at the results, 4 lags will be used in the VAR model.

Looking now at the Granger Causality test, a better sense of the relationship between the sentiment indices and each variable can be found.

Chart 3.2.6: Granger Causality Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	NMFINSI	.11908	1	0.730
SENT	CPI	.11544	1	0.734
SENT	GDP	.13762	1	0.711
SENT	INDPRO	1.1322	1	0.287
SENT	UNRATE	.7786	1	0.378
SENT	NAPM	1.2601	1	0.262
SENT	PERINC	.86238	1	0.353
SENT	INV	3.3804	1	0.066
SENT	ALL	11.204	8	0.190
NMFINSI	SENT	14.595	1	0.000
NMFINSI	CPI	4.2327	1	0.040
NMFINSI	GDP	.95965	1	0.327
NMFINSI	INDPRO	.72629	1	0.394
NMFINSI	UNRATE	1.1633	1	0.281
NMFINSI	NAPM	.24873	1	0.618
NMFINSI	PERINC	.4255	1	0.514
NMFINSI	INV	8.185	1	0.004
NMFINSI	ALL	28.201	8	0.000
CPI	SENT	.20762	1	0.649
CPI	NMFINSI	.926	1	0.336
CPI	GDP	1.2883	1	0.256
CPI	INDPRO	.76882	1	0.381
CPI	UNRATE	.28799	1	0.592
CPI	NAPM	1.565	1	0.211
CPI	PERINC	.02186	1	0.882
CPI	INV	.21529	1	0.643
CPI	ALL	8.7918	8	0.360
NAPM	SENT	.05383	1	0.817
NAPM	NMFINSI	2.0343	1	0.154
NAPM	CPI	.14102	1	0.707
NAPM	GDP	.39968	1	0.527
NAPM	INDPRO	1.7644	1	0.184
NAPM	UNRATE	.41509	1	0.519
NAPM	PERINC	4.866	1	0.027
NAPM	INV	6.8406	1	0.009
NAPM	ALL	19.872	8	0.011
PERINC	SENT	5.6566	1	0.017
PERINC	NMFINSI	5.2483	1	0.022
PERINC	CPI	.2084	1	0.648
PERINC	GDP	2.7123	1	0.100
PERINC	INDPRO	.27212	1	0.602
PERINC	UNRATE	.01244	1	0.911
PERINC	NAPM	3.0757	1	0.079
PERINC	INV	2.914	1	0.088
PERINC	ALL	17.374	8	0.026
INV	SENT	.34721	1	0.556
INV	NMFINSI	.0807	1	0.776
INV	CPI	.00136	1	0.971
INV	GDP	.01289	1	0.910
INV	INDPRO	.3379	1	0.561
INV	UNRATE	.08246	1	0.774
INV	NAPM	5.3511	1	0.021
INV	PERINC	.84359	1	0.358
INV	ALL	9.4004	8	0.310
GDP	SENT	.21158	1	0.646
GDP	NMFINSI	3.9865	1	0.046
GDP	CPI	.17104	1	0.679
GDP	INDPRO	.37629	1	0.540
GDP	UNRATE	2.716	1	0.099
GDP	NAPM	2.6177	1	0.106
GDP	PERINC	1.4121	1	0.235
GDP	INV	.51751	1	0.472
GDP	ALL	15.564	8	0.049
INDPRO	SENT	.35368	1	0.552
INDPRO	NMFINSI	.0855	1	0.770
INDPRO	CPI	.01592	1	0.900
INDPRO	GDP	1.8223	1	0.177
INDPRO	UNRATE	.18261	1	0.669
INDPRO	NAPM	3.6278	1	0.057
INDPRO	PERINC	.19974	1	0.655
INDPRO	INV	.05007	1	0.823
INDPRO	ALL	8.9859	8	0.343
UNRATE	SENT	.46806	1	0.494
UNRATE	NMFINSI	.86723	1	0.352
UNRATE	CPI	1.7953	1	0.180
UNRATE	GDP	2.1269	1	0.145
UNRATE	INDPRO	.00132	1	0.971
UNRATE	NAPM	4.0545	1	0.044
UNRATE	PERINC	.48764	1	0.485
UNRATE	INV	6.7841	1	0.009
UNRATE	ALL	13.483	8	0.096

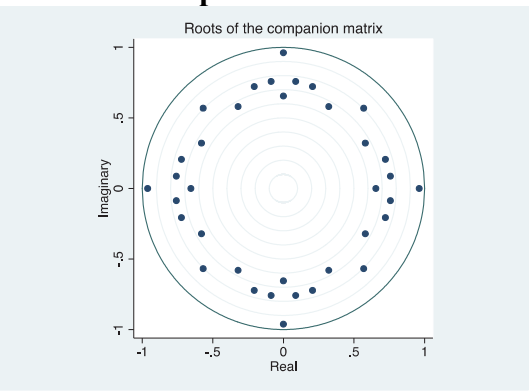
Looking specifically at consumer sentiment, INV is the only variable that seems to play a role in consumer sentiment. INV is a leading indicator, and given the timing, this may make intuitive sense, if sentiment was not a leading indicator. Looking at inflation sentiment, more variables seem to be causing changes. While SENT seems to be helping determine inflation sentiment, as well as inflation and inventory, this may well

make sense since it is supposed to be based on inflation, sentiment, and leading indicators such as inventory.

Now to look at the reverse causation, sentiment seems to be influencing inflation sentiment and personal income. The reason for personal income being effected by sentiment should be fairly straightforward, meaning consumers make decisions on their personal income based on how they feel about the economy. Inflation sentiment shows the same result, with consumers basing decisions of personal income on their predictions for rising prices. Inflation sentiment also seems to be causing changes in GDP; however, inflation does not. The only other variable that seems to be explaining changes in GDP is the unemployment rate. Therefore, more will be discussed on this relationship after looking at the next model's results.

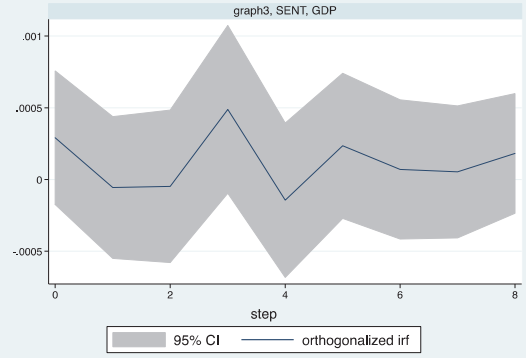
To determine how helpful the above results are, the stationarity and stability of the model will be analyzed. In order to determine stationarity, as described earlier, eigenvalues are tested to ensure they all lie inside the unit circle. A "varstable" command was used to ensure that the model is, indeed, stationary, as can be seen in the results below. The results show that all eigenvalues are, in fact, inside the unit circle.

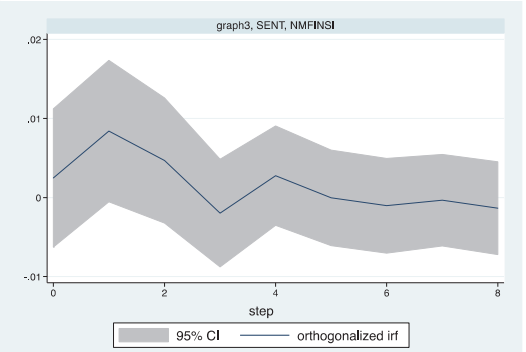
Graph 3.2.14: VAR Model Roots Graph

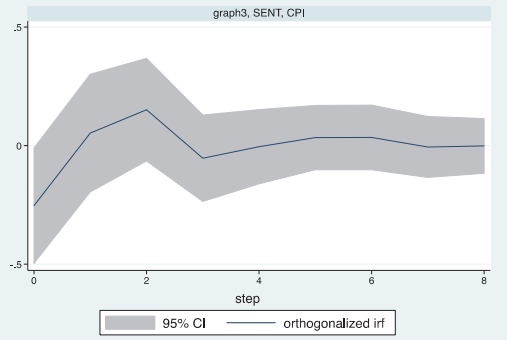


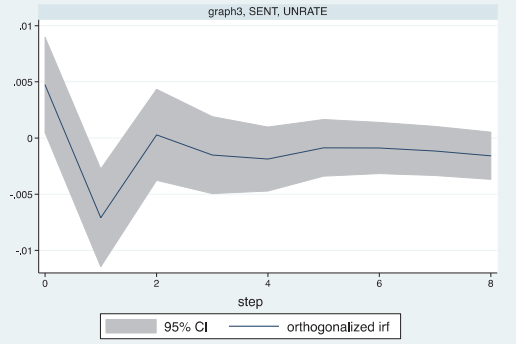
The impulse response functions can give a better idea as to how sentiment affects each variable. With a change in sentiment, GDP has a large shift down in the first month, stabilized in the second month, peaks in the third month before dipping in the fourth month, until finally beginning to stable out by the 6th month. Inflation sentiment peaks in the first month, while dipping in the third, before finally stabling out in the second quarter. Inflation rises for the first two months before falling and stabilizing by the second quarter. Unemployment rate falls drastically in the first month, rising back in the second month before stabling. The PMI index drops and then comes up in the first quarter, with small movements in the second quarter, similarly to personal income. Inventory has an upward shock, then downward movement, before moving up again in the first quarter, which can also be seen in industrial production, while the second quarter shows less movement for both variables.

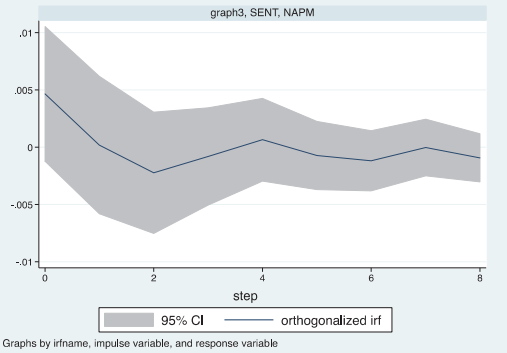
Graphs 3.2.15 to 3.2.22: Impulse Response Functions Graphs

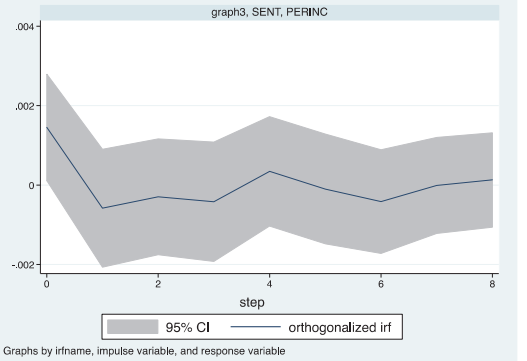


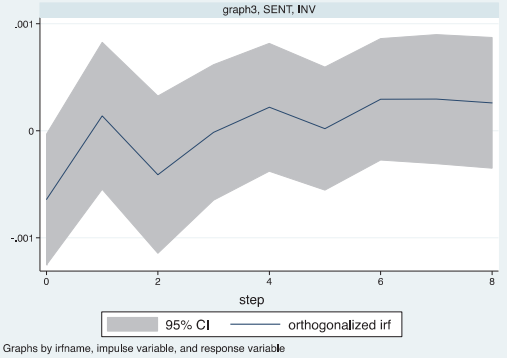


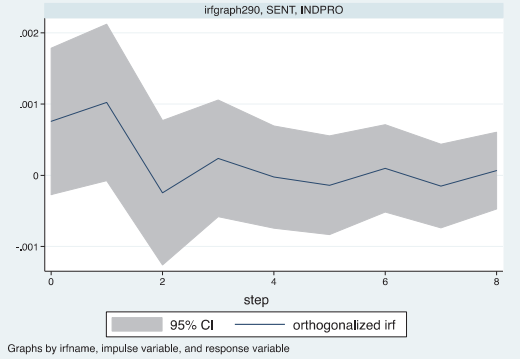






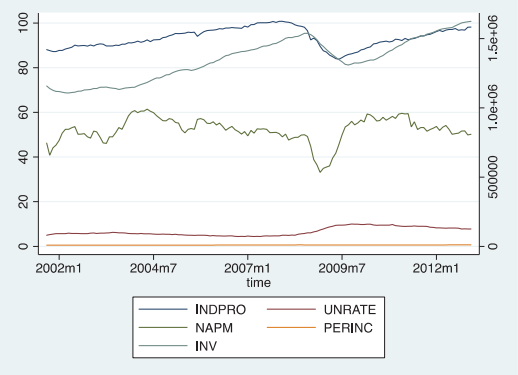






Now that the full time span has been examined, the reduced time span will now be analyzed. The graph below depicts the added variables in the new, shorter, time span. While most of the variables show slight increases from 2001 until 2012, there is not limited change noted, with the exception of the recession starting in 2007.

Graph 3.2.23: Industrial Production, Unemployment Rate, PMI, Personal Income and Inventory from September 2001 to December 2012



Looking at the four criterion and the likelihood-ratio test, the number of lags used in the model will be 4.

Chart 3.2.7: Criterion Results Chart (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	1059.7				4.5e-30	-42.0281	-41.897	-41.6839*
1	1166.64	213.88	81	0.000	1.7e-30	-43.0656	-41.755	-39.624
2	1265.23	197.18	81	0.000	1.1e-30	-43.7691	-41.279	-37.23
3	1365.73	201.01	81	0.000	1.3e-30	-44.5494	-40.8797	-34.9128
4	1550.37	369.26*	81	0.000	2.5e-31*	-48.6946*	-43.8454*	-35.9605

Now to look at the Granger causation results, nothing at the 10% confidence interval seems to be playing a role on sentiment changes. While personal income, unemployment rates, and inventory have the smallest p-values, it is still unlikely they are playing a large role in determining sentiment. For inflation sentiment, it appears that inflation, GDP, sentiment and inventory seem to be playing a role. This result is similar with the larger time-span model. Again, GDP has come up as causing changes, therefore,

while difficult to explain, it seems to be a strong result in both models. The reverse causation also holds true. GDP could be causing inflation sentiment to change since GDP is widely covered by the media. The reverse causation is harder to explain, but perhaps because GDP is quarterly, and was simply turned into a monthly variable by repeating the result each month in the quarter. Therefore, the reason behind inflation sentiment causing changes in GDP could be less to do with economic intuition, and more so to do with the timing of the model and how it was set up. If GDP didn't change before or after a change in inflation sentiment, then perhaps it could be seen as causing and being caused by NMFINSI.

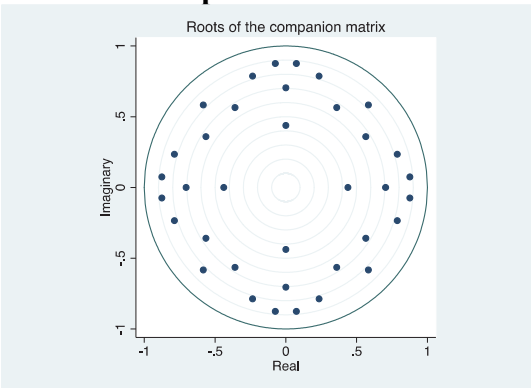
Now to look at the reverse causation for the other variables, sentiment seems to be causing changes in NMFINSI only, and NMFINSI seems to only be causing changes in GDP, which was already explained.

Chart 3.2.8: Granger Causality Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	NMFINSI	.07733	1	0.781
SENT	CPI	.84938	1	0.357
SENT	GDP	.09038	1	0.764
SENT	INDPRO	.4361	1	0.509
SENT	UNRATE	2.1448	1	0.143
SENT	NAPM	1.0959	1	0.295
SENT	PERINC	1.7409	1	0.187
SENT	INV	2.0188	1	0.155
SENT	ALL	9.5584	8	0.297
NMFINSI	SENT	5.3935	1	0.020
NMFINSI	CPI	8.8936	1	0.003
NMFINSI	GDP	5.3446	1	0.021
NMFINSI	INDPRO	1.1156	1	0.291
NMFINSI	UNRATE	2.0702	1	0.150
NMFINSI	NAPM	4.5e-08	1	1.000
NMFINSI	PERINC	.30349	1	0.582
NMFINSI	INV	5.7083	1	0.017
NMFINSI	ALL	26.815	8	0.001
CPI	SENT	.91426	1	0.339
CPI	NMFINSI	1.7848	1	0.182
CPI	GDP	.85311	1	0.356
CPI	INDPRO	3.3443	1	0.067
CPI	UNRATE	.30172	1	0.583
CPI	NAPM	.51049	1	0.475
CPI	PERINC	.52513	1	0.469
CPI	INV	.04461	1	0.833
CPI	ALL	10.466	8	0.234
NAPM	SENT	.78345	1	0.376
NAPM	NMFINSI	2.38	1	0.123
NAPM	CPI	2.9366	1	0.087
NAPM	GDP	.22301	1	0.637
NAPM	INDPRO	.04864	1	0.825
NAPM	UNRATE	9.2e-06	1	0.998
NAPM	PERINC	2.5576	1	0.110
NAPM	INV	6.0392	1	0.014
NAPM	ALL	20.657	8	0.008
PERINC	SENT	2.3384	1	0.126
PERINC	NMFINSI	2.6434	1	0.104
PERINC	CPI	2.6e-05	1	0.996
PERINC	GDP	3.0979	1	0.078
PERINC	INDPRO	.17629	1	0.675
PERINC	UNRATE	.00041	1	0.984
PERINC	NAPM	3.1083	1	0.078
PERINC	INV	2.9486	1	0.086
PERINC	ALL	13.291	8	0.102
INV	SENT	.57522	1	0.448
INV	NMFINSI	.00045	1	0.983
INV	CPI	.32015	1	0.572
INV	GDP	1.1688	1	0.280
INV	INDPRO	.21646	1	0.642
INV	UNRATE	.18777	1	0.665
INV	NAPM	5.6932	1	0.017
INV	PERINC	.32069	1	0.571
INV	ALL	9.0165	8	0.341
GDP	SENT	.17359	1	0.677
GDP	NMFINSI	2.974	1	0.085
GDP	CPI	.3581	1	0.550
GDP	INDPRO	.12906	1	0.719
GDP	UNRATE	3.607	1	0.058
GDP	NAPM	.17027	1	0.680
GDP	PERINC	2.3917	1	0.122
GDP	INV	.3002	1	0.584
GDP	ALL	12.629	8	0.125
INDPRO	SENT	.15075	1	0.698
INDPRO	NMFINSI	.00028	1	0.987
INDPRO	CPI	.2966	1	0.586
INDPRO	GDP	1.0033	1	0.317
INDPRO	UNRATE	.38066	1	0.537
INDPRO	NAPM	2.6913	1	0.101
INDPRO	PERINC	.05782	1	0.810
INDPRO	INV	.00755	1	0.931
INDPRO	ALL	4.2472	8	0.834
UNRATE	SENT	.00841	1	0.927
UNRATE	NMFINSI	.9228	1	0.337
UNRATE	CPI	2.4575	1	0.117
UNRATE	GDP	2.0497	1	0.152
UNRATE	INDPRO	.03906	1	0.843
UNRATE	NAPM	1.1079	1	0.293
UNRATE	PERINC	.32286	1	0.570
UNRATE	INV	2.0151	1	0.156
UNRATE	ALL	8.0855	8	0.425

In order to determine stationarity, as described earlier, eigenvalues are tested to ensure they all lie inside the unit circle. The results show that all eigenvalues are, in fact, inside the unit circle.

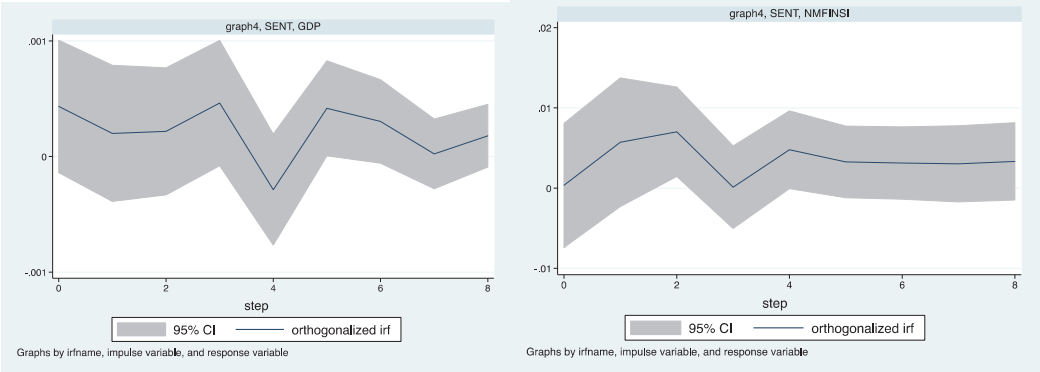
Graph 3.2.24: VAR Model Roots Graph

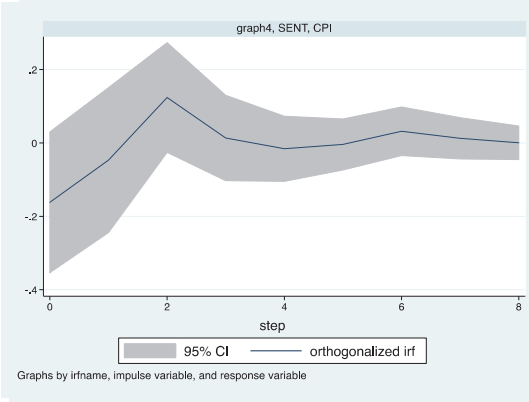


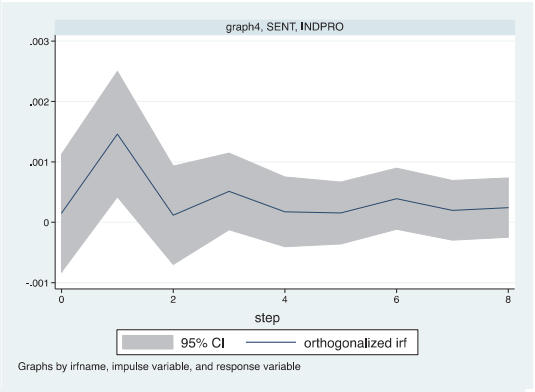
Looking at the impulse response functions graphically again, both unemployment and personal income move down in the first month, up in the second, and down again in the third, before stabling out somewhat in the second quarter. Inflation and Inventory seem to have large increases at the start of the first quarter before stabling out in the second quarter. GDP take a dip in the between the 3rd and 5th months, while inflation sentiment takes a dip between the 2nd and 4th months. PMI falls for the first three months before rising slightly in the fourth and stabling out. And finally, industrial production peaks between months one and two before stabling out.

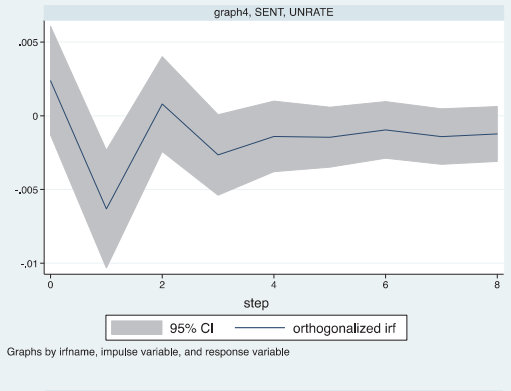
Now that all four real sector models have been examined, the financial sector will now by analyzed.

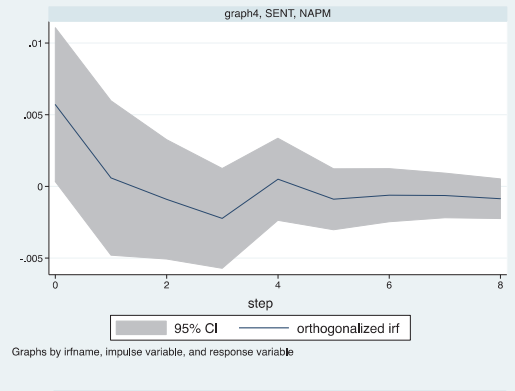
Graphs 3.2.25 to 3.2.32: Impulse Response Function Graphs

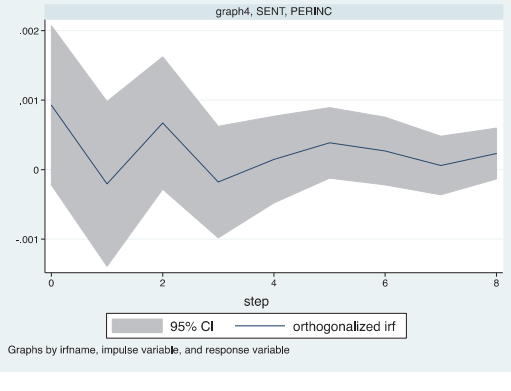


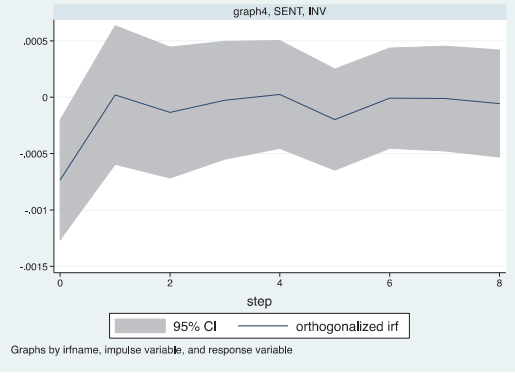








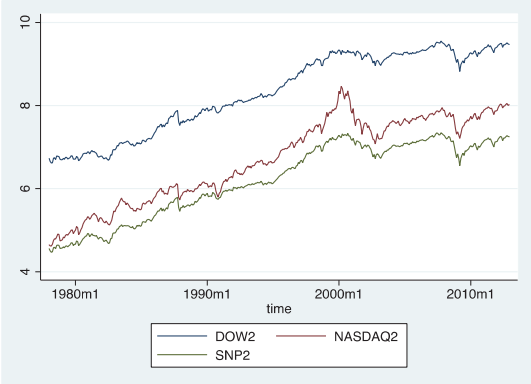




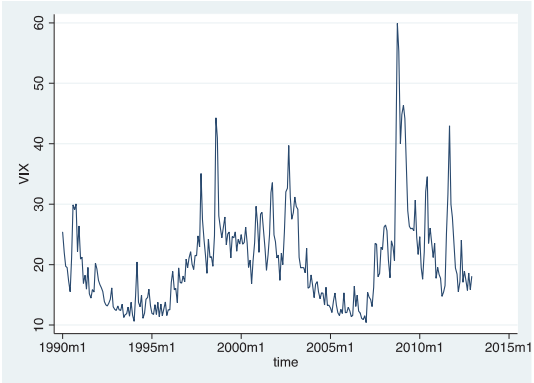
3.3 Model Estimation & Testing in the Financial Market

Only two VAR models will be ran for the financial sector because there are fewer variables to be used in the model. The DOW, SNP, NASDAQ and VIX will all be used to help predict changes in consumer sentiment alone. The two models are two different time spans as previously done for the real sector. The first time-span will be from 1978 through 2012. This is the full dataset. A smaller dataset will then be used, only spanning September 2001 to December 2012. This is to help reflect modern society's media attention on the economy and to help decipher a more modern representation of sentiments influence on the economy. Below is a graph of the three stock indices. It is followed by a graph of the VIX.

Graph 3.3.1: Dow Jones Industrial Index, Standard and Poor 500 Index, NASDAQ Index from January 1978 to December 2012



Graph 3.3.2: Dow Jones Industrial Index, Standard and Poor 500 Index, NASDAQ Index from January 1990 to December 2012



Looking at consumer sentiment and its relationship with the stock market, it would be expected to see either an increase in a stock market index after the announcement of increased sentiment. For the VIX it may be expected to see a decrease in volatility during increased sentiment because consumers will continue to invest, so there would be no expectation of large drops in stock prices. On the other hand, for similar reasoning, the VIX may also increase when sentiment increases, as good news may cause stocks to shoot upwards, therefore increasing volatility.

Now, to look at the four criteria, as well as the likelihood-ratio result, the number of lags to be used in the VAR model can be determined by looking at the following chart.

Chart 3.3.1: Chart 3.1.1: Criterion Results (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	1870				6.5e-13	-13.8662	-13.8394	-13.7994
1	2296.17	852.33	25	0.000	3.3e-14*	-16.8488*	-16.6878*	-16.4479*
2	2311.74	31.145	25	0.184	3.6e-14	-16.7788	-16.4836	-16.0438
3	2333.41	43.34*	25	0.013	3.6e-14	-16.754	-16.3247	-15.6849
4	2346.95	27.085	25	0.352	4.0e-14	-16.6688	-16.1053	-15.2657

Here it is fairly evident that 1 lag should be used for the VAR model. Therefore, from here on a one lag VAR model will be used.

The Wald Granger causality test was ran for the VAR model to determine which variables cause changed in sentiment, and which variables sentiment causes changes in. According to the results, at the 10% confidence interval, the NASDAQ and the VIX seem to be causing SENT changes. In the other causality direction, sentiment seems to be causing changes in the SNP and DOW. The VIX seems to be causing changes in all stock indices, as well as SENT which is interesting, since the VIX is measuring volatility, but not actually predicting volatility. The VIX also doesn't seem to be affected by any of the changes in stock indices. This result seems to be backwards to what would be predicted,

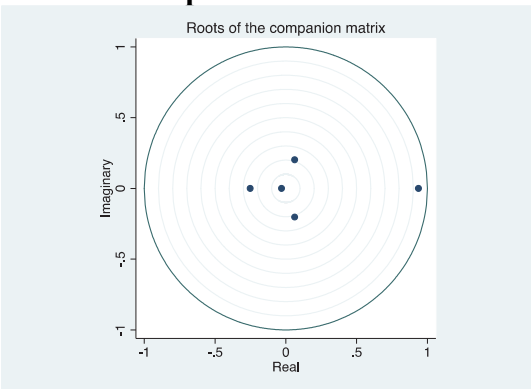
but perhaps this suggests that increased volatility in the stock market is what causes changes in consumer investment behaviours, and therefore, changes in stock prices.

Chart 3.3.2: Granger Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	SNP	.00458	1	0.946
SENT	NASDAQ	5.9362	1	0.015
SENT	DOW	.08559	1	0.770
SENT	VIX	12.237	1	0.000
SENT	ALL	19.56	4	0.001
SNP	SENT	3.1908	1	0.074
SNP	NASDAQ	14.726	1	0.000
SNP	DOW	1.562	1	0.211
SNP	VIX	170.61	1	0.000
SNP	ALL	184.6	4	0.000
NASDAQ	SENT	.03587	1	0.850
NASDAQ	SNP	2.4371	1	0.118
NASDAQ	DOW	1.5953	1	0.207
NASDAQ	VIX	164.48	1	0.000
NASDAQ	ALL	170.1	4	0.000
DOW	SENT	2.7362	1	0.098
DOW	SNP	.05911	1	0.808
DOW	NASDAQ	16.67	1	0.000
DOW	VIX	131.2	1	0.000
DOW	ALL	146.04	4	0.000
VIX	SENT	1.4123	1	0.235
VIX	SNP	.14756	1	0.701
VIX	NASDAQ	1.2519	1	0.263
VIX	DOW	.19305	1	0.660
VIX	ALL	4.6747	4	0.322

In order to determine how helpful the above results are, the stationarity and stability of the model must be considered. As previously explained, if all of the roots lie outside the unit circle, in other words all the eigenvalues lie inside the unit circle, then the model can be deemed stationary. The results can be seen below.

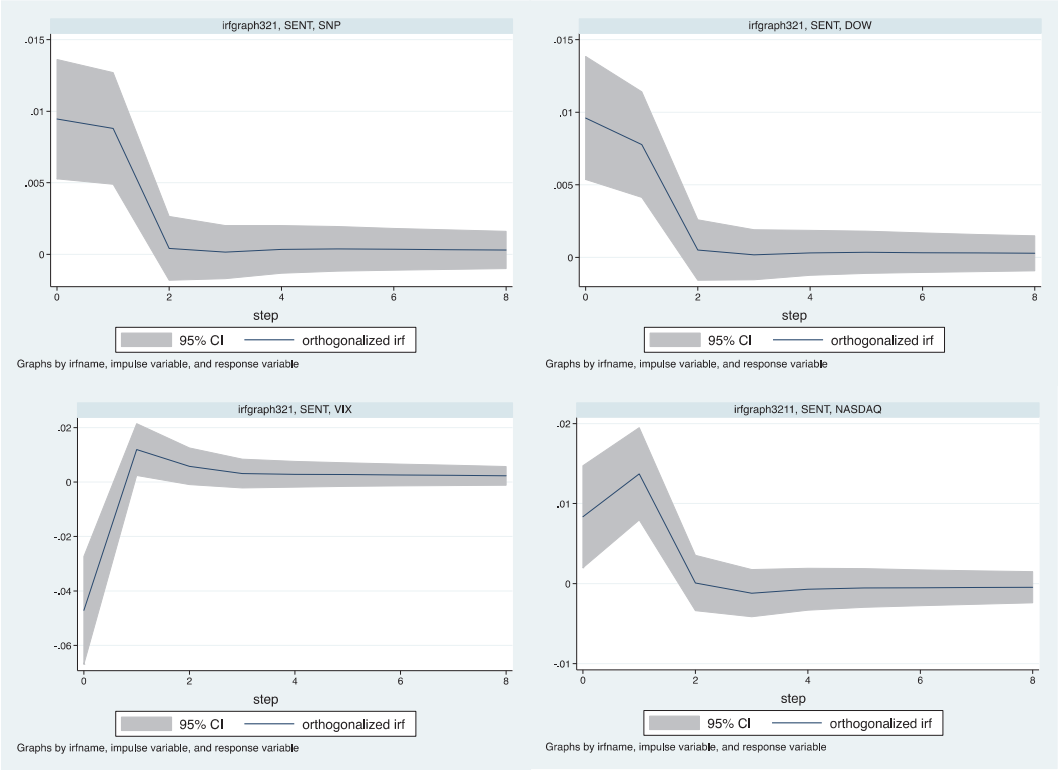
Graph 3.3.3: VAR Model Roots Graph



It can be seen that all the eigenvalues do, indeed, lie inside the unit circle, and therefore, the model is stationary.

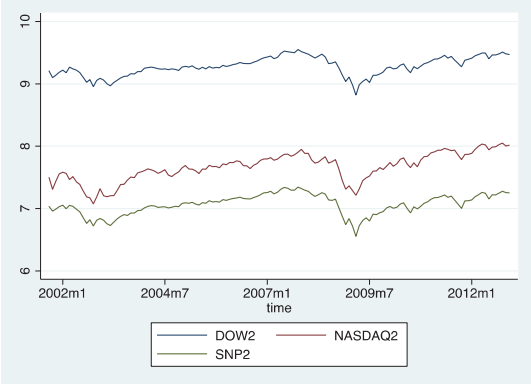
Here the results of the VAR model can be seen in the impulse response functions. Looking at consumer sentiment and SENT's relationship with the other four variables, the IRF can give some insight into the relationship between the variables in the model. Given a change in sentiment, both the SNP and DOW indices seem to fall up until month 2. The NASDAQ on the other hand has a sharp increase in month one, and then falling slightly before plateauing by month 4. The VIX saw an increase in the first month, followed by a fall in the second month, and finally plateauing by month 4.

Graph 3.3.4 to 3.3.7: Impulse Response Function Graphs

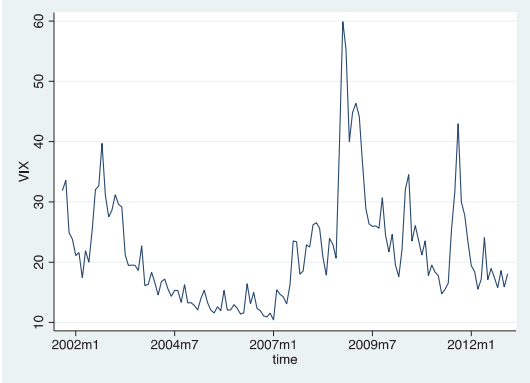


Now that the full model's analysis is complete, the smaller model will be examined to see if similar results occur. The following graph shows the reduced time spans for the stock indices. The second graph shows the reduced time span for the VIX.

Graph 3.3.8: Dow Jones Industrial Index, Standard and Poor 500 Index, NASDAQ Index from September 2001 to December 2012



Graph 3.3.9: VIX from September 2001 to December 2012



Looking now at the four criterion again, and the likelihood-ratio test, the model will be ran with 1 lag.

Chart 3.3.3: Criterion Results (starred)

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	972.368				3.7e-13	-14.4383	-14.3944	-14.3302
1	1188.69	432.64	25	0.000	2.1e-14*	-17.2938*	-17.0302*	-16.6451*
2	1205.08	32.78	25	0.137	2.4e-14	-17.1653	-16.682	-15.9759
3	1220.92	31.681	25	0.167	2.8e-14	-17.0286	-16.3256	-15.2986
4	1245.65	49.474*	25	0.002	2.8e-14	-17.0247	-16.102	-14.754

The Granger causality test shows that in this case sentiment doesn't seem to be influencing any of the variables, but it itself influenced by the VIX. The VIX seems to, again, influence the stock indices, but not vice versa. This may suggest that consumers

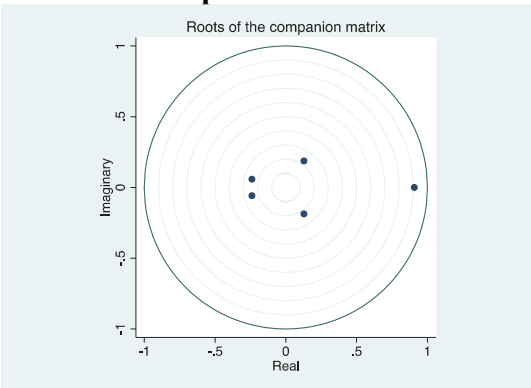
may be responding to higher volatility, and possibly uncertainty, in the stock market rather than to actual stock prices. Therefore, when consumers are deciding on their sentiments toward the economy, they are looking more at the volatility of stocks than the actual price levels, and this could make sense, since large upswings and downswings may reflect an uncertain economy, and this could cause decreased sentiment toward the economy as well.

Chart 3.3.4: Granger Causality Test Results

Equation	Excluded	chi2	df	Prob > chi2
SENT	SNP	.14665	1	0.702
SENT	NASDAQ	1.7961	1	0.180
SENT	DOW	.60229	1	0.438
SENT	VIX	13.921	1	0.000
SENT	ALL	16.123	4	0.003
SNP	SENT	1.2323	1	0.267
SNP	NASDAQ	9.417	1	0.002
SNP	DOW	1.3501	1	0.245
SNP	VIX	115.51	1	0.000
SNP	ALL	124.67	4	0.000
NASDAQ	SENT	.01256	1	0.911
NASDAQ	SNP	8.828	1	0.003
NASDAQ	DOW	6.8071	1	0.009
NASDAQ	VIX	140.48	1	0.000
NASDAQ	ALL	150.48	4	0.000
DOW	SENT	1.4553	1	0.228
DOW	SNP	.00048	1	0.983
DOW	NASDAQ	11.432	1	0.001
DOW	VIX	89.586	1	0.000
DOW	ALL	100.99	4	0.000
VIX	SENT	.48667	1	0.485
VIX	SNP	4.7509	1	0.029
VIX	NASDAQ	1.9861	1	0.159
VIX	DOW	4.703	1	0.030
VIX	ALL	6.8339	4	0.145

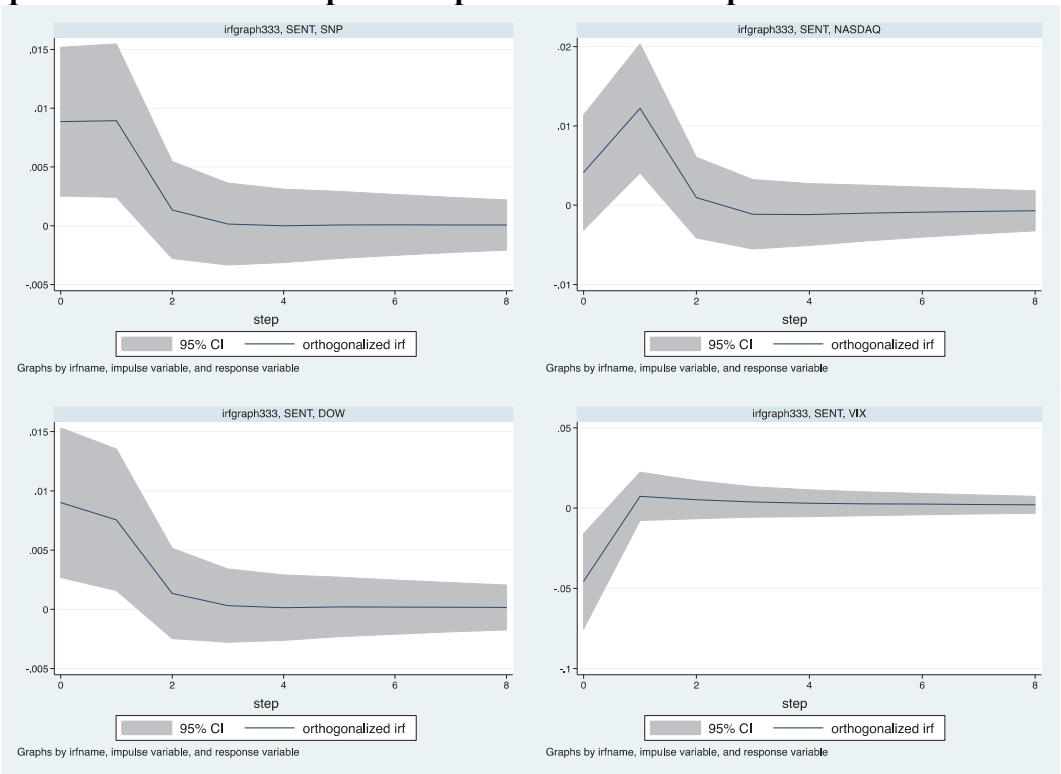
In order to determine stationarity, as described earlier, eigenvalues are tested to ensure they all lie inside the unit circle. The results show that all eigenvalues are, in fact, inside the unit circle.

Graph 3.3.10: VAR Model Roots Graph



Finally, to look at the impulse response functions, for the SNP and DOW indices, there is a slight decrease in the first month, followed by a more dramatic decrease in the second month, plateauing by the 4th month. The NASDAQ shows an increase in the first month followed by a decrease in the second month and then plateauing by the 4th month also. Finally the VIX shows an increase in the first month and being relatively stable afterwards.

Graphs 3.3.11 to 3.3.14: Impulse Response Function Graphs



4. Conclusion

In conclusion, it seems that there is a relationship between consumer sentiment and both the real sector and the financial sector. In the real sector, when examining the smaller model, it was found that interest rates influenced consumer sentiment. This could be because consumers are directly affected by changing interest rates which are changed with an announcement. This announcement may expose the interest rates more than other variables each month, giving it more media attention. In the full time-set model, GDP also seemed to influence consumer sentiment, while in the post "9-11" model, GDP influenced inflation sentiment. Inflation influenced inflation sentiment, but only in the post "9-11" model, while consumer sentiment was the only variable that seemed to influence inflation sentiment in the full time-set model. Therefore, while perhaps before increased media attention on the economy, people's predictions for inflation were driven mainly by their sentiments toward the economy, but now with increased attention on the economy inflation seems to be influencing the inflation sentiment index more.

The larger model shows the importance of inventory on both consumer sentiment and inflation sentiment. With inventory being a leading indicator, this is not such a surprising result. It would also suggest that consumer sentiment may not be a leading indicator, but rather a coincident, or even possibly lagging indicator. The larger model also found that consumer sentiment and inflation both played roles in predicting inflation sentiment in both time-spans. Therefore, when determining the relationship between consumer sentiment and the real sector, it seems as though sentiments, both consumer and inflation, are most likely coincident or lagging indicators. As well, they seem to be relying on interest rates, inflation, GDP and inventory, all of which are variables that

receive a lot of media attention. While other factors receive a lot of news coverage, such as unemployment rates, these lagging indicators help reinforce the idea that only leading and coincident (not lagging) indicators are influencing sentiment, and therefore, sentiment may be a more lagging indicator itself.

Concluding the financial sector results, it seems as though the VIX and NASDAQ are what influence sentiment, while the DOW and SNP do not. The VIX may cause changes in SENT if consumers respond more to increased market volatility than actual price levels. Increased volatility could create uncertainty regarding the economy, and may also increase the media attention on the stock market, causing consumers to take these increased changes more into consideration when deciding on their sentiments toward the economy as a whole. While the NASDAQ is the only stock exchange that seems to effect sentiment, and only in the larger time-span model, this may be because in its earlier form it was a replacement for over-the-counter "OTC" trades, making it different than the DOW and SNP. These over-the-counter trades may have reflected changes in the economy more than stocks on the stock market because OTC trades are done between parties without supervision of an exchange, and therefore making them riskier. Therefore, the NASDAQ may have effected consumer sentiment more if consumers saw other consumers taking increased risk in an OTC market or not. Overall, it was interesting that consumer sentiment seemed to be caused less by actual returns on investment, and more so by consumer's perception of the riskiness, or uncertainty, of the stocks themselves.

In conclusion, it is clear that sentiment and inflation sentiment seem to be related to the economy, but more as a summary statistic than a statistic in its own right.

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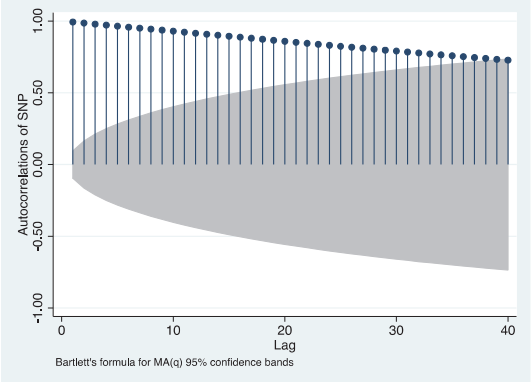
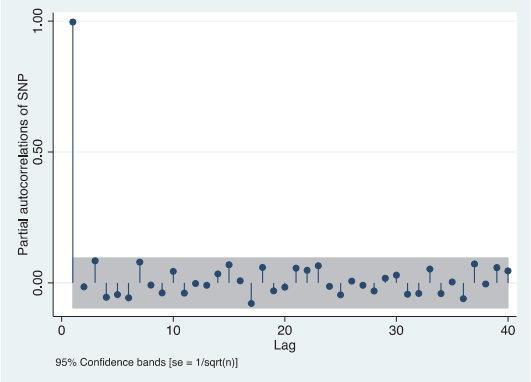
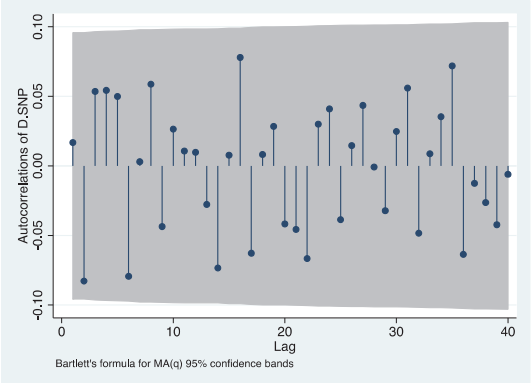
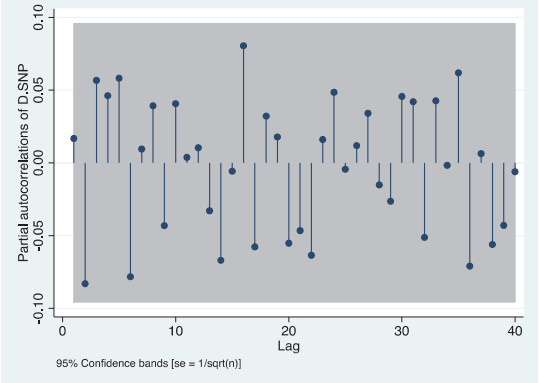
6. Figures

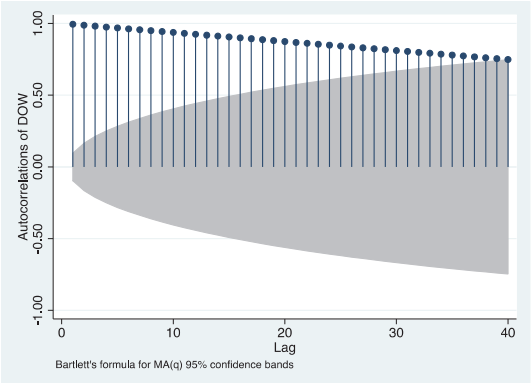
Graphs A.1 to A.44: Autocorrelation Graphs & Partial Autocorrelation Graphs For Each Variable, and the First Difference of Each Variable

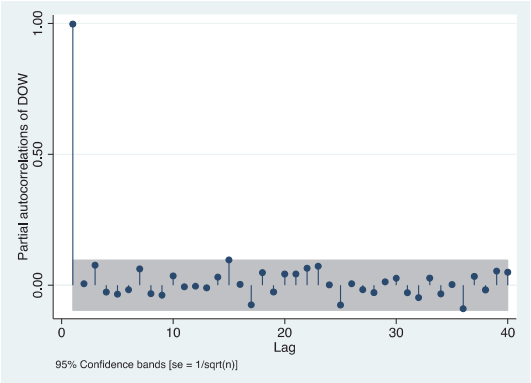


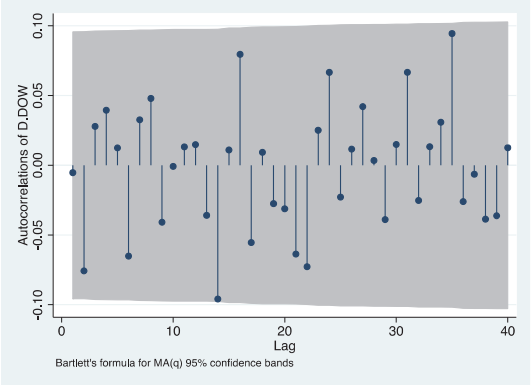


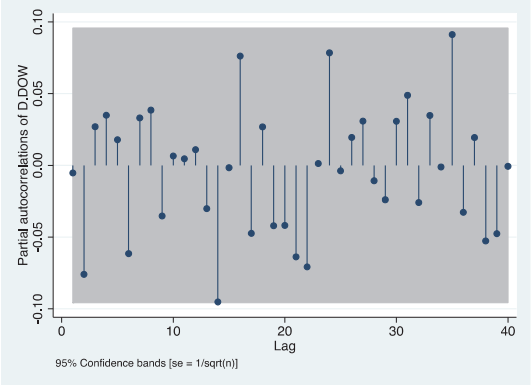


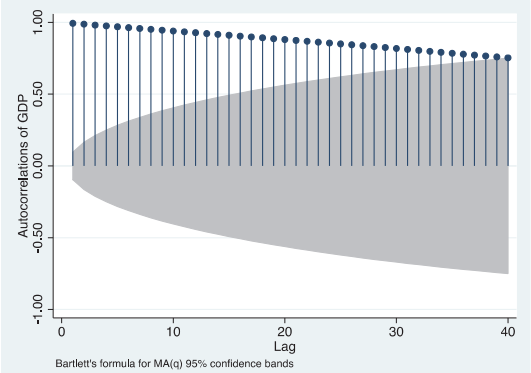







Autocorrelations of D.DOW
-0.10
-0.05
0.00
0.05
0.10
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands


Partial autocorrelations of D.DOW
-0.10
-0.05
0.00
0.05
0.10
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]


Autocorrelations of GDP
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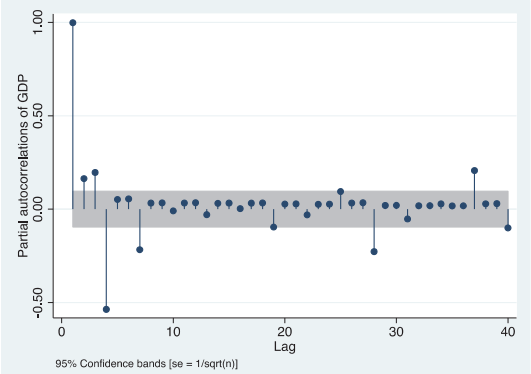
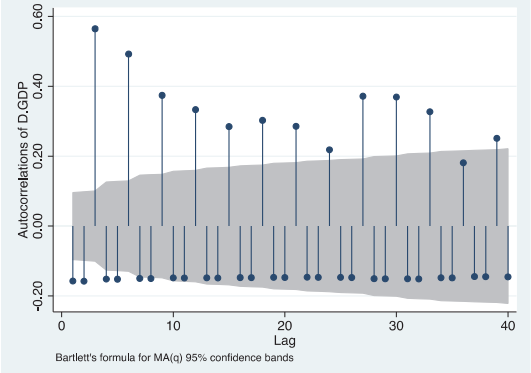
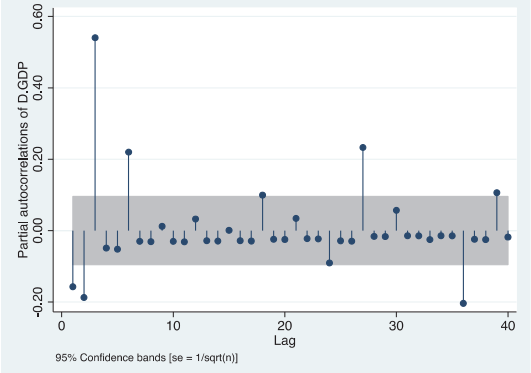
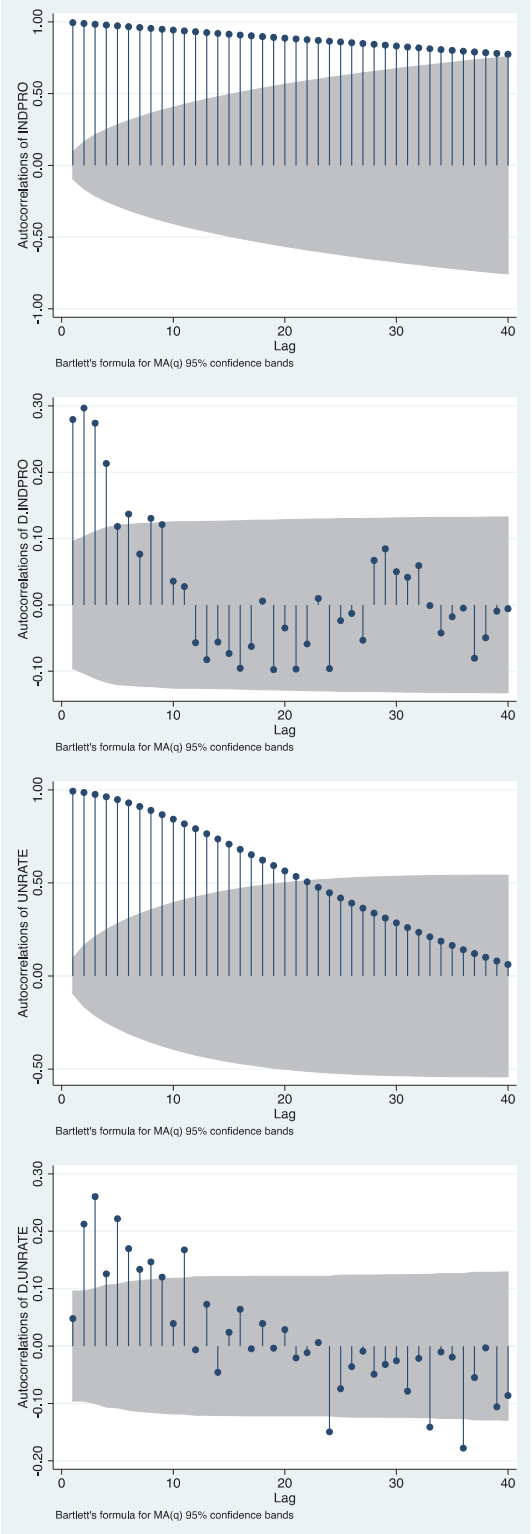
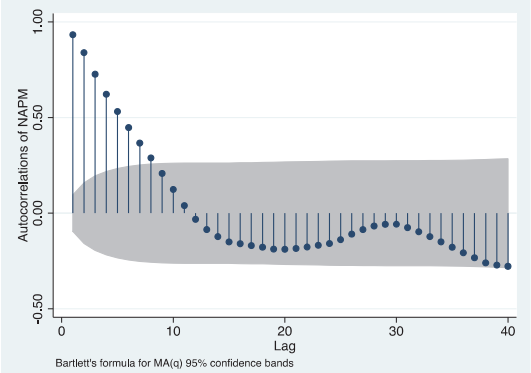
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

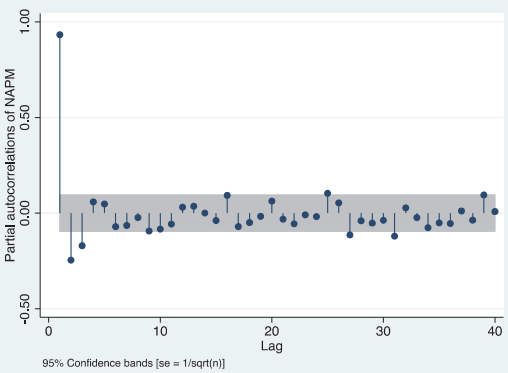

Partial autocorrelations of GDP
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

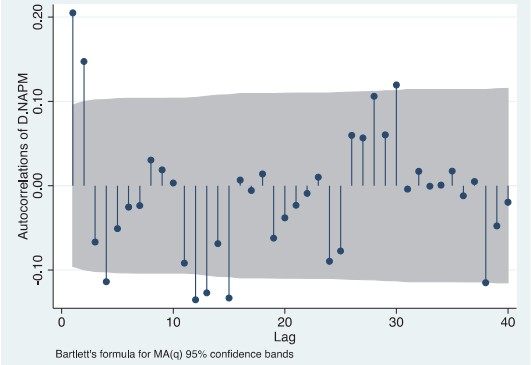

Autocorrelations of D.GDP
-0.20
0.00
0.20
0.40
0.60
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

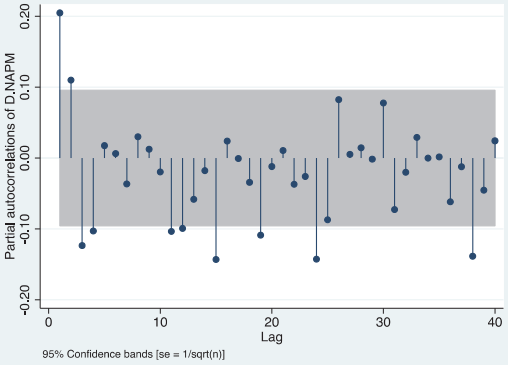

Partial autocorrelations of D.GDP
-0.20
0.00
0.20
0.40
0.60
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

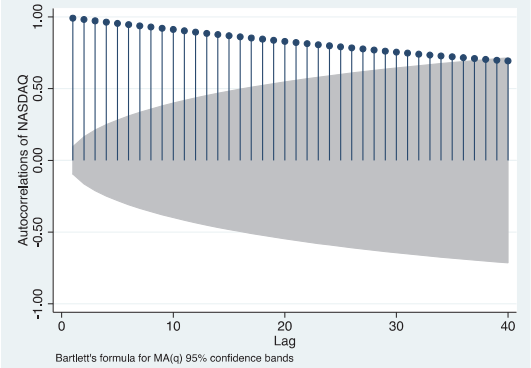

Autocorrelations of INDPRO
Partial autocorrelations of INDPRO
Autocorrelations of D.INDPRO
Partial autocorrelations of D.INDPRO
Autocorrelations of UNRATE
Partial autocorrelations of UNRATE
Autocorrelations of D.UNRATE
Partial autocorrelations of D.UNRATE
Lag
Bartlett's formula for MA(q) 95% confidence bands
95% Confidence bands [se = 1/sqrt(n)]

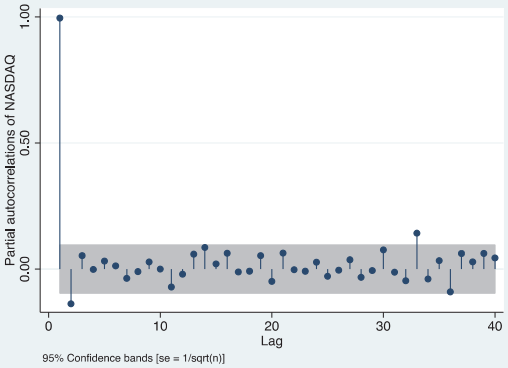

Autocorrelations of NAPM
1.00
0.50
0.00
-0.50
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

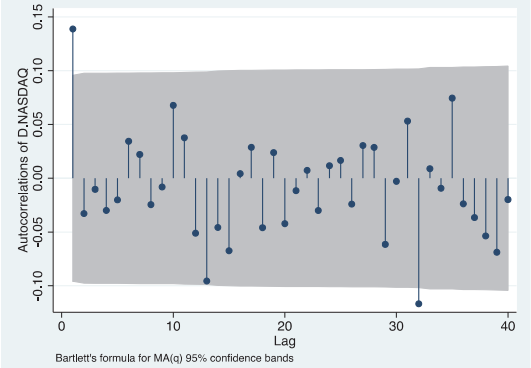

Partial autocorrelations of NAPM
1.00
0.50
0.00
-0.50
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

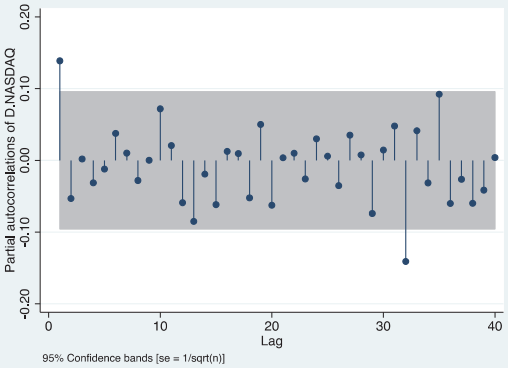

Autocorrelations of D.NAPM
0.20
0.10
0.00
-0.10
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

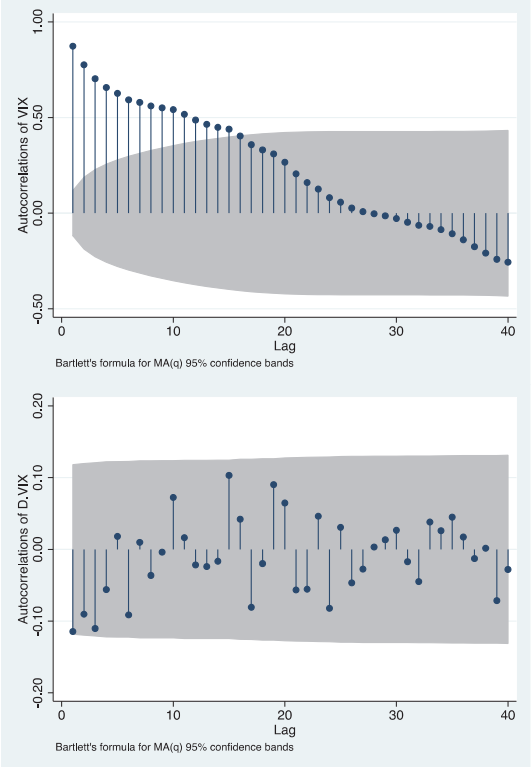

Partial autocorrelations of D.NAPM
0.20
0.10
0.00
-0.10
-0.20
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

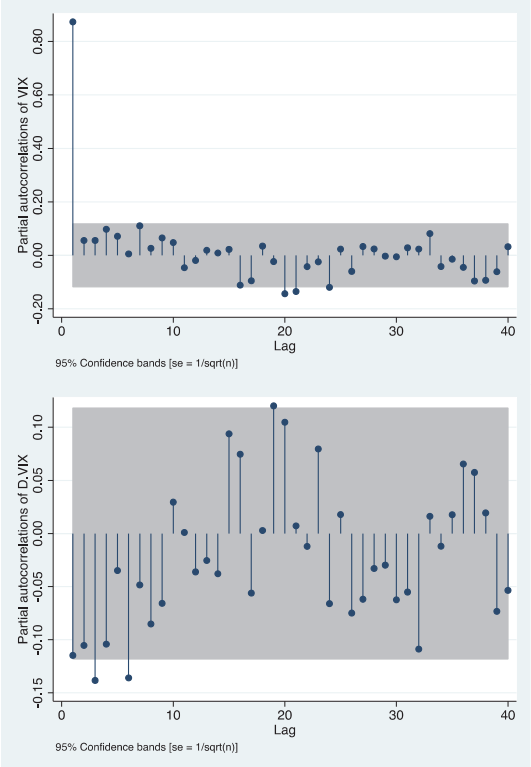

Autocorrelations of NASDAQ
1.00
0.50
0.00
-0.50
-1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

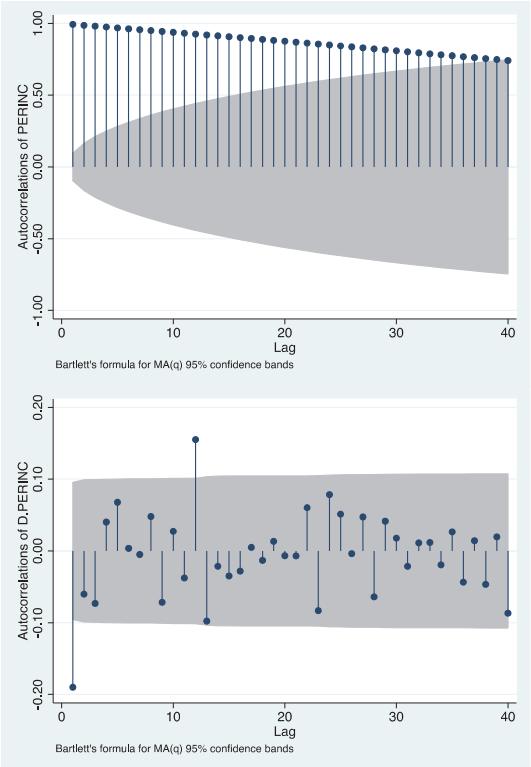

Partial autocorrelations of NASDAQ
1.00
0.50
0.00
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

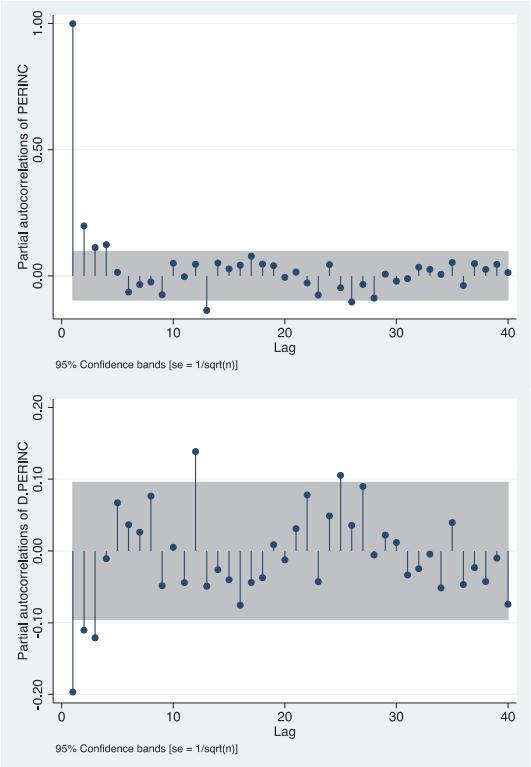

Autocorrelations of D.NASDAQ
0.15
0.10
0.05
0.00
-0.05
-0.10
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

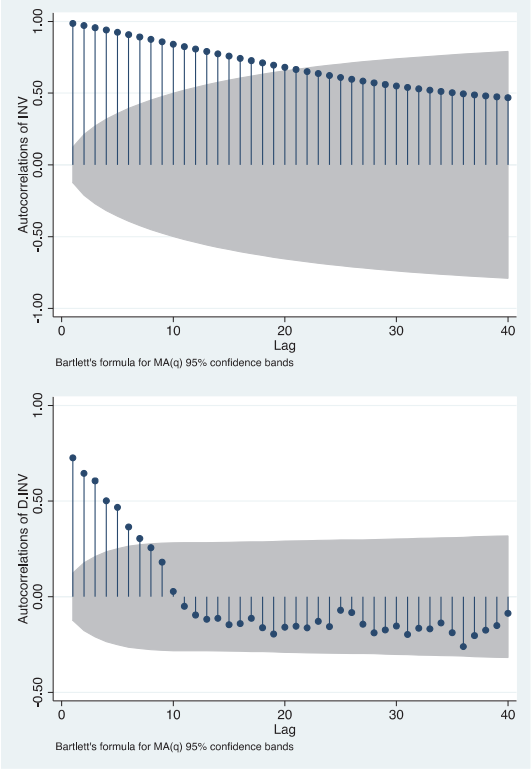

Partial autocorrelations of D.NASDAQ
0.20
0.10
0.00
-0.10
-0.20
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

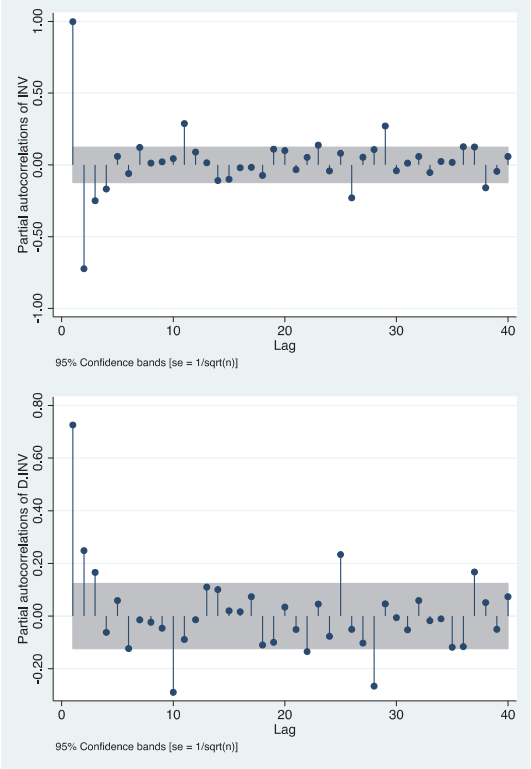

Autocorrelations of VIX
1.00
0.50
0.00
-0.50
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands
Autocorrelations of D.VIX
0.20
0.10
0.00
-0.10
-0.20
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands

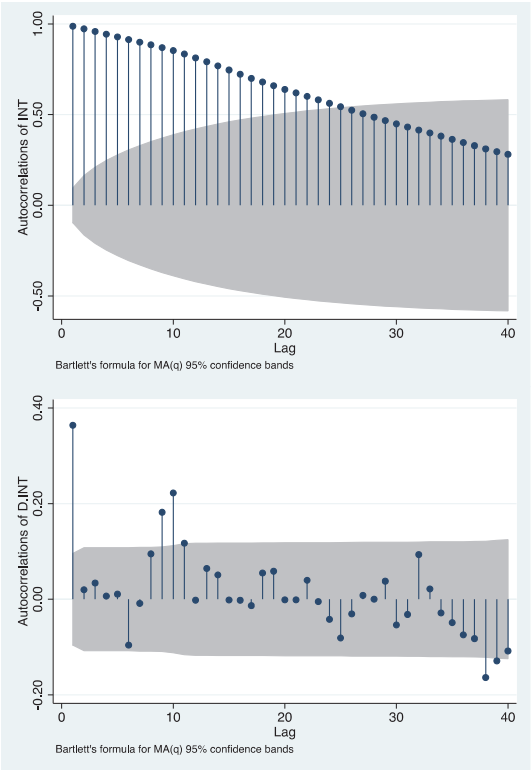

Partial autocorrelations of VIX
0.80
0.60
0.40
0.20
0.00
-0.20
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]
Partial autocorrelations of D.VIX
0.10
0.05
0.00
-0.05
-0.10
-0.15
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

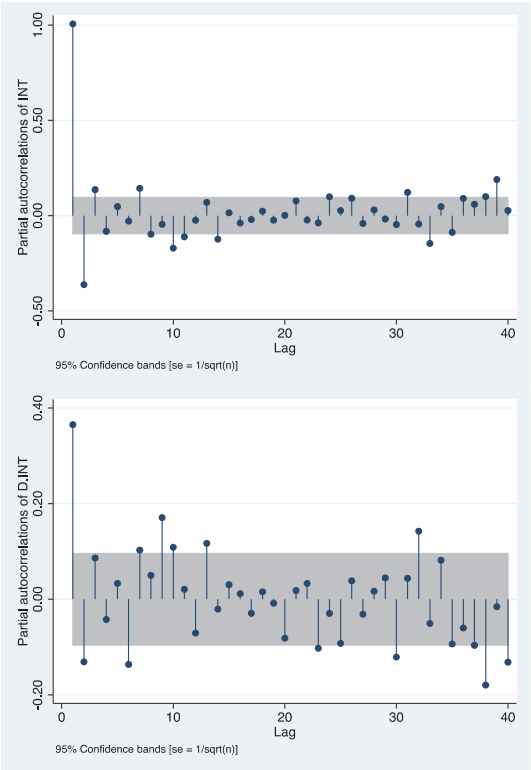

Autocorrelations of PERINC
1.00
0.50
0.00
-0.50
-1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands
Autocorrelations of D.PERINC
0.20
0.10
0.00
-0.10
-0.20
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands


Partial autocorrelations of PERINC
1.00
0.50
0.00
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]
Partial autocorrelations of D.PERINC
0.20
0.10
0.00
-0.10
-0.20
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]


Autocorrelations of INV
-1.00
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands
Autocorrelations of D.INV
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands


Partial autocorrelations of INV
-1.00
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]
Partial autocorrelations of D.INV
-0.20
0.00
0.20
0.40
0.60
0.80
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]


Autocorrelations of INT
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands
Autocorrelations of D.INT
-0.20
0.00
0.20
0.40
0
10
20
30
40
Lag
Bartlett's formula for MA(q) 95% confidence bands


Partial autocorrelations of INT
-0.50
0.00
0.50
1.00
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]
Partial autocorrelations of D.INT
-0.20
0.00
0.20
0.40
0
10
20
30
40
Lag
95% Confidence bands [se = 1/sqrt(n)]

7. Charts

Charts A.1 to A.2: Augmented Dickey Fuller Test Results (Logged Variable and then First-Differenced Log Variable)

Variable	McKinnon P-Value
SENT	0.0841
NMFINSI	0.0131
CPI	0.4423
GDP	0.7750
INDPRO	0.8632
UNRATE	0.3082
NAPM	0.0001
PERINC	0.7507
INV	0.6883
SNP	0.5380
NASDAQ	0.5600
DOW	0.6742
VIX	0.0513

Variable	McKinnon P-Value
CPI	0.0000
GDP	0.0000
INDPRO	0.0000
UNRATE	0.0000
NAPM	0.0000
PERINC	0.0000
INV	0.0099
SNP	0.0000
NASDAQ	0.0000
DOW	0.0000
VIX	0.0000

Charts A.3 to A.6: VAR Results for the Real Sector

VARIABLES	SENT	NMFINSI	CPI	GDP	INT
L3.SENT	0.866***	0.0955***	0.483	0.00411**	0.0880
	(0.0514)	(0.0299)	(0.790)	(0.00200)	(0.0787)
L3.NMFINSI	0.208	0.290***	-1.760	-0.00168	-0.340
	(0.167)	(0.0975)	(2.574)	(0.00651)	(0.256)
L3.CPI	-0.00387	-0.000575	-0.228*	0.000190	-0.0116
	(0.00826)	(0.00481)	(0.127)	(0.000321)	(0.0126)
L3.GDP	3.353*	0.572	11.95	0.494***	-0.661
	(1.964)	(1.144)	(30.19)	(0.0763)	(3.006)
L3.INT	0.365***	-0.0114	-0.270	-0.00380	0.0668
	(0.0804)	(0.0468)	(1.235)	(0.00312)	(0.123)
Constant	-0.285	2.506***	5.035	-0.0110	0.989
	(0.668)	(0.389)	(10.26)	(0.0260)	(1.022)

VARIABLES	SENT	NMFINSI	CPI	GDP	INT
L2.SENT	0.874***	0.0672	1.355	0.00747***	0.0675
	(0.0666)	(0.0412)	(0.982)	(0.00253)	(0.121)
L2.NMFINSI	0.114	0.196	1.250	-0.0150**	-0.434
	(0.199)	(0.124)	(2.943)	(0.00758)	(0.362)
L2.CPI	0.00110	0.00158	-0.122	-0.000558*	0.00375
	(0.00883)	(0.00547)	(0.130)	(0.000336)	(0.0160)
L2.GDP	0.0452	0.708	32.83	-0.188*	6.511
	(2.550)	(1.579)	(37.62)	(0.0969)	(4.623)
L2.INT	0.183**	-0.0756	-4.383***	-0.00140	0.158
	(0.0788)	(0.0488)	(1.163)	(0.00300)	(0.143)
Constant	0.0554	3.007***	-11.34	0.0305	1.461
	(0.813)	(0.504)	(12.00)	(0.0309)	(1.475)

VARIABLES	SENT	NMFINSI	CPI	GDP	INDPRO	UNRATE	NAPM	PERINC	INV
L4.SENT	0.874***	0.119***	0.414	0.00130	-0.00214	-0.0116	-0.00497	0.0118**	-0.00178
	(0.0709)	(0.0311)	(0.910)	(0.00283)	(0.00360)	(0.0169)	(0.0214)	(0.00496)	(0.00303)
L4.NMFINSI	-0.0840	0.0902	3.006	0.0194**	-0.00362	-0.0540	-0.105	-0.0390**	-0.00295
	(0.243)	(0.107)	(3.123)	(0.00971)	(0.0124)	(0.0580)	(0.0735)	(0.0170)	(0.0104)
L4.CPI	-0.00342	-0.00909**	0.193	-0.000166	-6.46e-05	0.00322	0.00114	0.000322	1.59e-05
	(0.0101)	(0.00442)	(0.129)	(0.000402)	(0.000512)	(0.00240)	(0.00304)	(0.000705)	(0.000430)
L4.GDP	1.041	-1.206	-40.89	-0.170	0.193	-0.976	-0.536	-0.323*	0.0136
	(2.807)	(1.231)	(36.02)	(0.112)	(0.143)	(0.669)	(0.848)	(0.196)	(0.120)
L4.INDPRO	2.003	0.704	-21.18	-0.0461	0.0288	-0.0163	-0.755	-0.0687	0.0467
	(1.882)	(0.826)	(24.15)	(0.0751)	(0.0957)	(0.449)	(0.568)	(0.132)	(0.0803)
L4.UNRATE	-0.411	0.220	-3.209	-0.0306*	-0.0101	-0.267**	-0.0907	-0.00364	-0.00571
	(0.466)	(0.204)	(5.979)	(0.0186)	(0.0237)	(0.111)	(0.141)	(0.0326)	(0.0199)
L4.NAPM	0.356	-0.0693	-5.087	-0.0205	0.0307*	-0.152**	-0.0152	0.0389*	0.0313**
	(0.317)	(0.139)	(4.066)	(0.0126)	(0.0161)	(0.0755)	(0.0957)	(0.0222)	(0.0135)
L4.PERINC	-2.241	-0.691	-4.579	-0.114	0.0548	0.402	-1.608**	0.255	0.0946
	(2.413)	(1.059)	(30.97)	(0.0963)	(0.123)	(0.575)	(0.729)	(0.169)	(0.103)
L4.INV	-3.959*	-2.703***	-12.82	-0.0618	-0.0245	-1.337***	-1.701***	0.257*	0.357***
	(2.153)	(0.945)	(27.63)	(0.0859)	(0.109)	(0.513)	(0.650)	(0.151)	(0.0919)
Constant	0.905	3.243***	-14.07	-0.0832**	0.0258	0.282	0.466*	0.109*	0.0224
	(0.902)	(0.396)	(11.58)	(0.0360)	(0.0459)	(0.215)	(0.272)	(0.0631)	(0.0385)

VARIABLES	SENT	NMFINSI	CPI	GDP	INDPRO	UNRATE	NAPM	PERINC	INV
L4.SENT	0.735***	0.0876**	1.127	0.00143	-0.00181	-0.00208	-0.0242	0.0110	0.00280
	(0.0975)	(0.0377)	(1.179)	(0.00343)	(0.00466)	(0.0227)	(0.0273)	(0.00718)	(0.00369)
L4.NMFINSI	-0.0828	0.104	4.810	0.0181*	-0.000238	-0.0667	-0.129	-0.0357	-0.000238
	(0.298)	(0.115)	(3.600)	(0.0105)	(0.0142)	(0.0694)	(0.0834)	(0.0219)	(0.0113)
L4.CPI	-0.0121	-0.0151***	0.299*	-0.000276	-0.000341	0.00479	0.00629*	4.96e-06	-0.000281
	(0.0131)	(0.00507)	(0.159)	(0.000461)	(0.000627)	(0.00306)	(0.00367)	(0.000966)	(0.000497)
L4.GDP	1.418	-4.217**	-52.66	-0.266	0.226	-1.574	-0.623	-0.611*	0.193
	(4.716)	(1.824)	(57.02)	(0.166)	(0.225)	(1.099)	(1.320)	(0.347)	(0.179)
L4.INDPRO	1.752	1.084	-58.66*	-0.0335	-0.125	-0.122	-0.164	-0.0820	-0.0467
	(2.653)	(1.026)	(32.07)	(0.0933)	(0.127)	(0.618)	(0.743)	(0.195)	(0.100)
L4.UNRATE	-0.878	0.334	-3.980	-0.0400*	-0.0177	-0.159	-0.000508	-0.000891	-0.00983
	(0.599)	(0.232)	(7.245)	(0.0211)	(0.0286)	(0.140)	(0.168)	(0.0441)	(0.0227)
L4.NAPM	0.462	-3.63e-05	-3.811	-0.00640	0.0346	-0.108	-0.153	0.0573*	0.0399**
	(0.441)	(0.171)	(5.334)	(0.0155)	(0.0211)	(0.103)	(0.123)	(0.0325)	(0.0167)
L4.PERINC	-3.758	-0.607	-24.95	-0.155	-0.0327	0.377	-1.275	0.244	0.0611
	(2.848)	(1.102)	(34.43)	(0.100)	(0.136)	(0.664)	(0.797)	(0.210)	(0.108)
L4.INV	-3.971	-2.583**	7.136	-0.0538	0.0116	-0.925	-1.922**	0.353*	0.378***
	(2.795)	(1.081)	(33.79)	(0.0983)	(0.134)	(0.651)	(0.782)	(0.206)	(0.106)
Constant	1.503	3.325***	-24.58*	-0.0782*	0.0107	0.291	0.646**	0.0989	-0.00865
	(1.148)	(0.444)	(13.88)	(0.0404)	(0.0549)	(0.268)	(0.321)	(0.0845)	(0.0435)

Chart A.7 to A.8.: VAR Results for the Financial Sector

VARIABLES	SENT	SNP	NASDAQ	DOW	VIX
L.SENT	0.944***	0.0245*	0.00392	0.0230*	0.0774
	(0.0190)	(0.0137)	(0.0207)	(0.0139)	(0.0651)
L.SNP	-0.0172	0.0178	0.430	-0.0451	-0.333
	(0.254)	(0.182)	(0.276)	(0.185)	(0.867)
L.NASDAQ	0.166**	0.188***	0.106	0.204***	0.261
	(0.0683)	(0.0491)	(0.0742)	(0.0499)	(0.233)
L.DOW	-0.0667	-0.205	-0.313	-0.167	0.343
	(0.228)	(0.164)	(0.248)	(0.167)	(0.780)
L.VIX	-0.0617***	-0.166***	-0.246***	-0.148***	-0.122**
	(0.0176)	(0.0127)	(0.0192)	(0.0129)	(0.0603)
Constant	0.248***	-0.104*	-0.0116	-0.0968	-0.347
	(0.0847)	(0.0609)	(0.0920)	(0.0619)	(0.290)

VARIABLES	SENT	SNP	NASDAQ	DOW	VIX
L.SENT	0.944***	0.0245*	0.00392	0.0230*	0.0774
	(0.0190)	(0.0137)	(0.0207)	(0.0139)	(0.0651)
L.SNP	-0.0172	0.0178	0.430	-0.0451	-0.333
	(0.254)	(0.182)	(0.276)	(0.185)	(0.867)
L.NASDAQ	0.166**	0.188***	0.106	0.204***	0.261
	(0.0683)	(0.0491)	(0.0742)	(0.0499)	(0.233)
L.DOW	-0.0667	-0.205	-0.313	-0.167	0.343
	(0.228)	(0.164)	(0.248)	(0.167)	(0.780)
L.VIX	-0.0617***	-0.166***	-0.246***	-0.148***	-0.122**
	(0.0176)	(0.0127)	(0.0192)	(0.0129)	(0.0603)
Constant	0.248***	-0.104*	-0.0116	-0.0968	-0.347
	(0.0847)	(0.0609)	(0.0920)	(0.0619)	(0.290)