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The Impact of Wealth and Sentiment on Consumption: Before and After the Great Recession

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The Impact of Wealth and Sentiment on Consumption: Before and After the Great Recession

by

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Abstract

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I study the impact of consumer sentiment and the wealth effect on aggregate U.S. consumption before and after the Great Recession. First I will introduce a background of the 2008 financial crisis and some major factors leading up to it. I will discuss both the Michigan Consumer Sentiment index as well as the Conference Board's Consumer Confidence index. I will also discuss several measures of net worth relevant for my study. Second, I will discuss the relevant literature and the main findings that correspond to my thesis. Third, I will present the methodology used for my thesis, and the several types of specifications included to adequately test my thesis question. Next, I will present the empirical results found in the various regressions run in both levels and first-difference and their interpretation. Overall, I find no asymmetric response of consumption to changes in wealth and sentiment. Therefore, aggregate consumption tends to respond the same to an equal size increase or decrease in the two main explanatory variables. Additionally, a significant structural shift in aggregate consumption is evident due to the Great Recession. The consumption function on average is estimated to have shifted downward by about $43.791 billion as a result of the near demise of the American economy. After further analysis of the data, another structural shift in aggregate consumption was realized at around 1998. In this case, the consumption function shifted upwards an average $11.557 billion, which can very likely be explained by the repeal of the Glass-Steagall Act allowing loans to be given out to nearly anyone regardless of their financial stability. In sum, consumer sentiment, wealth and disposable income all have a significant impact on aggregate consumption.

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Chapter I

Introduction

The gross domestic product of the United States at the end of 2016 was $16,659.8 billion chained 2009 dollars. Furthermore, real personal consumption expenditure of the United States at the end of 2016 was $11,518.5 billion. Therefore, real aggregate personal consumption made up nearly 70 percent of the entire nation's GDP. Thus, it is crucial to understand the underlying factors that cause changes in aggregate consumption. This not only provides useful information that the average person should know, but it also enables the government to properly take macroeconomic actions, if needed, and/or evaluate the consequences of various policies for consumption, and thus for GDP. Consumption fluctuations were particularly present during the introduction of the Gramm-Leach-Bliley Act of 1999 and during the Great Recession of 2008.

Many experts view the repeal of the Glass-Steagall act in 1999 as a pivotal moment that initiated numerous acquisitions and risky transactions that ultimately led to the Great Recession. Stiglitz (2009) states, "breaking down these barriers, we would wind up with larger financial institutions that would reduce competition, and increase the risk of too big to fail. And so what happened is the commercial banks, which had the security of deposit insurance, the backing of the U.S. government, in effect, dominated." The repeal of the Glass-Steagall, has left a massive burden on the American taxpayers such as when the government decided to spend around $400 billion to bail out AIG and Freddie Mac and Fannie Mae, to name a few, after they went into bankruptcy during the financial crisis. This was the epitome of moral hazard. Before the repeal in 1999, banks were more conservative as they knew they were fully responsible for their actions and the losses they may face. However, after the repeal, banks knew that a substantial part of the risk they were taking would be spread among numerous investors, and losses would not be borne solely by them.

The problem behind repealing Glass-Steagall is that commercial banks and investment banks are fundamentally different. Investment banks run in such a way that they are willing to take greater risks which is necessary to seek higher returns. On the other hand, commercial banks are supposed to provide finance to low risk, smaller enterprises. “It is supposed to be boring; it’s supposed to be conservative; it’s supposed to do the job of assessing risk and making sure capital goes where it’s supposed to go” (Stiglitz, 2009). Allowing commercial banks and investment banks to work so closely, enabling commercial banks to take part in risky transactions, completely goes against the responsibilities these institutions have to the American people. Late Senator Paul Wellstone states that “this is the wrong kind of modernization because it fails to put in place adequate regulatory safeguards for these new financial giants, the failure of which could jeopardize the entire economy” (Crawford, 2011, p. 130). These conglomerates that were “too big to fail” became a huge liability for the American taxpayers and if just one were to collapse, like Lehman Brothers did, it would shake up the entire U.S. economy. Ultimately the housing bubble burst and as foreclosures started to become a regular occurrence, and bank runs were unstoppable, the economy went into the most severe recession since the Great Depression of the 1930’s – The Great Recession. I use two main economic indicators, wealth and sentiment to gain insight on how they affect aggregate consumption. Specifically, I will test to see if there are asymmetric responses of consumption, but more importantly, I test to see the structural change of the consumption function due to the repeal of the Glass-Steagall Act and the Great Recession.

There are two major indices that measure consumer confidence. Each test for a consumer’s view on their present conditions and expectations for future. My thesis utilizes the Michigan

Consumer Sentiment Index and the Conference Board's Consumer Confidence Index. Overall throughout the regression analysis, the Michigan Consumer Sentiment survey tends to have more conclusive and statistically significant results and therefore I use it in the majority of the specifications of the model.

The wealth effect is changes in aggregate demand caused by a change in the value of one's assets such as an individual's home or their stocks and bonds. It is believed that when the market value of any such asset rises, it makes someone feel wealthier and therefore spend more. The opposite is believed to be true as well. Total net wealth is broken down into housing and financial wealth. Housing wealth is simply how much one's place of residence is valued at and financial wealth is the value of an individual's stocks, bonds, money and government securities. My thesis will test to see how all three variations of wealth impact consumption expenditure.

The following chapter will present the relevant literature and the main findings that correspond to my thesis. Chapter three will present the methodology used for my thesis, and the several types of specifications included to adequately test my thesis question. Chapter four will display the empirical results found in the various regressions run in both levels and first-difference and their interpretation. Finally, I will conclude my thesis with the most significant results found throughout my analysis.

Chapter II

Review of Literature

In the following chapter I will discuss the existing literature regarding how wealth and consumer sentiment affect consumption. In addition to reviewing pertinent literature on the determinants of consumption, I will also focus on the effects of real wealth and consumer sentiment on consumption. This is because these factors have played a major role in the 2000-current period. The following section discusses a relevant paper that examines, specifically, the consumption and the Great Recession. In section two, I will discuss the existing literature on how increases and decreases in wealth, both housing wealth and financial wealth, influence one's current and future consumption. In section three, I will provide detail on papers that discuss the effects of consumer sentiment on a household's consumption. Section four will conclude this chapter.

Section I: Consumption and the Great Recession

De Nardi et al (2011) state that the Great Recession was characterized by the most severe year over year decline in consumption since 1945 in which all subcomponents of consumption declined. Moreover, the recovery path of consumption following the crisis has been uncharacteristically weak in comparison to the five preceding recessions. The authors break down their research into two sections, a macro data analysis and a micro data view of total real personal consumption expenditure.

Macro data findings show that the Great Recession caused the most severe and persistent decline in aggregate consumption since World War II. Additionally, all subcomponents of consumption declined, with a significant drop in consumer services relative to most of the previous recessions. In all other recessions, PCE in services grew both before and after its peak, while in the 2008 recession, it stagnated for six quarters following the peak. Non-durable goods had a similar growth path up until its peak compared to the past five recessions; however, it experienced the worst recovery paths following the 2008 crisis. Furthermore, durable goods actually displayed the largest drop five to six quarters after its peak, as it took twelve quarters to get back to the previous peak level. Lastly, the recovery path after the Great Recession has been unusually weak as it took nearly three years for total consumption to return to its level just prior to the recession. This is remarkably long when compared to the second worst rebound after the 1974 recession which lasted just over one year to reach to previous levels.

The micro data evidence utilizes the Michigan Survey of Consumers to document individuals' expected income. The survey asks two questions to determine the magnitude and sign of the income change within the next twelve months. Through the micro data analysis, the authors found that expected nominal income growth experienced its worst decline ever observed in the survey's history, which still had yet to recover to its prerecession levels in 2011. In addition, the decline exists among all age groups, educations levels and income quintiles. However, compared to previous recessions, individuals with higher levels of income and education tend to be more pessimistic than poorer and less educated people. For example, those in the top decile of wealth distribution decreased spending during the Great Recession by 5.4 percent. De Nardi et al (2011) state that the decline in consumption may be due to large negative wealth effects experienced by these household due to the decreased house values and stock market prices. Expectations for real income growth declined as well, however it decreased more significantly when PCE was used instead of actual CPI inflation. In sum, it is clear that the Great Recession had a negative impact on total PCE, as indicated by these findings which show that consumer spending has yet to reach its levels prior to the financial collapse.

Section II: Wealth Effect and Consumption

Wealth is a pivotal factor in determining one's consumption behavior, both in the short-run and in the long-run. There is a lot of literature that examines the significance of one's wealth and how consumption tendencies are impacted by it. The majority of papers regarding wealth and consumption found it necessary to distinguish between different types of wealth: housing wealth, and financial wealth which include assets like stocks and bonds. Ultimately, many papers regarding wealth and consumption came to a similar conclusion, that from a one-dollar increase in housing wealth, holding all else equal, consumption grew by about two cents in the short-run, and nine cents in the long-run. Additionally, the reviewed articles conclude that the housing wealth effects tends to have a substantially larger impact on consumption than financial-wealth effects. Explained by Matteo Iacoviello (2012), housing wealth accounts for nearly two-thirds of total wealth for median households. Cooper and Dynan (2016) state that the marginal propensity to consume out of a one-dollar increase in financial wealth is about six cents while for housing wealth is about nine cents. Each of the articles had several different perspectives on why wealth increased or decreased consumption, and varying types of factors that influence specific groups differently.

Carroll et al (2006) explain that nonstock and stock wealth have different impacts on consumption. The coefficient in the empirical analysis on nonstock wealth is more than twice that of stock wealth, however, nonstock wealth is less precise because it varies considerably less than stock wealth. They find that in the short run, the next quarter effect of a one-dollar change in stock wealth, all else equal, leads to a $0.0157 increase in consumption and a one-dollar change in nonstock wealth causes a $0.0381 rise in consumption. Additionally, in the long-run, a one-dollar increase in stock wealth causes a $0.063 rise in consumption, while a one-dollar increase in non-stock wealth leads to a $0.153 rise in consumption. Therefore, it is clear that nonstock wealth exhibits a greater impact on consumption in both the short and long-run, as it is more than double the effect of stock wealth effects. The authors explain this phenomenon occurs because many consumers tend to believe that house price increases are more reliable and permanent than stock market values and therefore the coefficient is larger.

Iacoviello (2012) finds that the substitution effect and an individual's taste impact consumption. First he claims when housing prices rise, the substitution effect will come into play and households will reduce their demand for housing and free up resources used to consume more thereafter. Since houses are more expensive, as well as the cost of homeownership such as property tax, people will be less inclined to spend money on housing, and instead will use this money towards other non-housing goods. Next he states that one's tastes are important to consider in regards to whether or not someone prefers non-housing goods over housing goods or vice versa. "For instance, individuals might decide that they prefer to live in larger nicer homes rather than going out to a restaurant: under this assumption, it is possible that increases in the price of housing are associated with lower consumption, since the change in house prices is tilting preference away from consumption goods" (Iacoviello, 2012 p. 8). Thus, as the price of houses rise, individuals who prefer to live in larger houses will then have to pay even more on a home, causing them to allocate more money towards house payments, rather than other consumption goods.

The articles reviewed found that liquidity constrained households typically have a higher marginal propensity to consume out of wealth fluctuations compared to wealthier households. Intuitively, this makes sense, especially when considering an affluent homeowner. Generally, affluent households are far less liquidity constrained and have more access to disposable income. Thus, a rich household will not be affected nearly as much if at all if their disposable income increased by say, one-hundred dollars. On the other hand, a household that has to live on a more day-by-day basis, will tend to feel much more capable to consume if their liquidity or disposable income increases by one-hundred dollars. As home prices increase, liquidity constrained individuals have more collateral against which they can borrow to finance their purchases, thus constrained homeowners are likely to increase spending when home prices increase as long as home equity loans are readily available. Therefore, net worth distribution matters when considering the relationship between wealth and consumption, as Cooper and Dynan (2016) explain.

In addition to net worth distribution, Cooper and Dynan (2016) find that house price increases may actually negatively impact those who rent homes. If the price increases pass through to the renters, then they must reduce their consumption on non-housing goods due to the higher cost of shelter. On the other hand, “like renters, homeowners will face higher future housing costs, but they also experience a capital gain; accordingly, if housing costs do not increase one-for-one with home price appreciation (because, for example, the homeowner plans to downsize in the near future), then homeowners could be better off when house prices rise and increase their consumption accordingly” (Cooper et al, 2016 p. 44). In this case, if their home price increased, it does not mean the costs of homeownership necessarily rise as well and thus consumption may increase. Renters may face higher monthly bills because they have to compensate the homeowner for their increased bills.

This study emphasizes the importance of breaking down the data rather than analyzing at it as a whole. Therefore, Cooper and Dynan (2016) are concerned about disaggregated data rather than aggregated data because it can serve as a much better means of understanding the relationship between wealth and its effect on consumption. The authors explain that disaggregated data is important because “time-varying dispersion of asset price shocks may lead to incorrect conclusions when using aggregate net worth because different locations tend to have different demographic characteristics that may affect response of consumption to net worth fluctuations” (Cooper et al, 2016 p. 41). For example, younger households tend to be more credit constrained, and therefore usually have a higher marginal propensity to consume as a result of wealth fluctuations, than older households. They state that since the share of housing wealth in total wealth is higher for lower-income homeowners, the aggregate MPC out of housing wealth tends to be higher. These results suggest disaggregate data is important because it can help show the differences among demographics.

Simo-Kengne et al (2014) analyze their data by applying a time-varying parameter vector autoregressive approach rather than looking at disaggregate data. Using 120 years’ worth of data from 1890 to 2012, the authors include the Great Depression and the Great Recession. They were able to find that “per capita consumption growth volatility peaks at the beginning of the sample followed by a downward trend thereafter. The volatility stabilized at a low level in the early 1970s, and during the Great Moderation of the mid-1980s. Towards the end of the sample, the stochastic volatility of the consumption growth remains low, reflecting the Great Moderation” (Simo-Kengne et al, 2014, p. 346) The authors found that the volatility of housing returns followed that of consumption where it too peaked at the beginning of the sample and stabilized in the 50s. In addition to housing returns, they noticed that the stochastic volatility of stock returns and stock market booms have no resemblance to housing market booms. In sum, the authors found that in general real housing returns exhibit a positive effect much more frequently than the impact of real stock return, which usually exhibits a negative effect over different horizons and over time. They explain that besides a negative consumption effect due to the decline in real stock return that, “stakeholders draw on their wealth during stock market booms to increase their financial investment and, hence, reduce their consumption. At longer-term horizon, this negative effect dies out, possibly indicating that the positive wealth effect offsets the negative substitution effect in the long run.”

Carroll and Zhou (2010 and 2012) utilize disaggregated national state-level data. The researchers constructed enhanced state-level consumption data and used state-level stock wealth, after-tax income and housing wealth in real per capita terms. The authors believe that studies using aggregate data are subject to “endogeneity and aggregation problems.” To construct consumption data by state, the authors divide the state general sales tax revenue by general sales tax rate since personal consumption expenditure data by state is not available in the United States. In their conclusion, the authors find similar results to those papers that use aggregate data. They find that with a two-year lag, income changes have a fairly big impact on consumption. Thus, there is a sluggish income effect in addition to lagging wealth effects.

Despite their differences, each article reviewed comes to nearly the same conclusion: that housing wealth effects on consumption are more substantial than financial wealth effects. The main differences are the approach in which the authors broke down the data, and discussed different causations of the change in consumption as a result of a change in wealth.

Section III: Consumer Sentiment and Consumption

Consumer confidence, is often referred by the Federal Reserve as having a direct impact on household consumption and future economic activity. It is important to gain a better understanding on how exactly consumer sentiment affects consumption in the short- and long-run as it enhances the ability of policymakers to better gauge what should or should not be implemented in order to improve the economy. Ludvigson (2004) and Lahiri et al (2015), share a lot of similar ideas.

Both reviewed articles use the University of Michigan's Consumer Sentiment Index as well as the Conference Board's Consumer Confidence Index. Each of the surveys contain a present component and an expectations component. For example, the Conference Board's survey looks at business conditions so it gives a better gauge on labor market conditions. Michigan's asks questions on expected business conditions, over the course of the next year and next five years as well as expected changes in the respondent's financial situation.

The articles analyze how consumer sentiment affects various types of consumption expenditures. Ludvigson (2004) looks at five categories of household consumption expenditure: total expenditure, motor vehicle expenditure, expenditure on all goods (excluding motor vehicles), expenditure on services and expenditure on durable goods excluding motor vehicles. Lahiri et al (2015) use durable goods, non-durable goods, services and the total of them all. Additionally, both papers look at regressions to obtain a baseline forecast measure of consumption growth to investigate whether sentiment measures contain unique information that is not available in other aggregate measures of economic activity.

Ludvigson states that "measures of consumer confidence – taken alone – have important predictive power for quarterly consumer expenditure growth" (Ludvigson, 2004, p. 39). Therefore, he determines whether these consumer sentiment measures include predictive information that is not contained in a "standard set of baseline economic indicators." He uses labor income growth, the log first difference of the real quarterly average stock prices of the S&P 500 and the first difference of the three-month Treasury bill rate. Similarly, Lahiri et al look at the rate of return to S&P 500 index, the 3-month Treasury Bill rate, and labor income growth which is wages and salaries plus transfers minus personal contributions for social insurance. Both articles implement four lags of consumer confidence in order to see how the previous sentiment surveys affect the future consumption. Therefore, the authors find that consumer sentiment surveys have more powerful predictive abilities on future consumption than they do on current consumption.

Ultimately, both reviewed papers find that adding consumer confidence surveys increase the predictability accuracy of consumption to an extent. Ludvigson states that the results for consumer attitudes for future spending is more mixed; whereas Lahiri et al find that consumer confidence in general makes a notable and positive contribution to forecasting personal consumption expenditure.

Ludvigson (2004) explains two possible economic interpretations as to why consumer confidence surveys explain the predictive power of consumer attitudes: that consumer sentiment surveys simply reflect precautionary saving motives or that they encompass household expectations of future income or wealth. “If higher consumer confidence levels capture reduced uncertainty about the future and therefore diminish the precautionary motive for saving, then higher consumer confidence should be associated with a higher level of consumption today, relative to tomorrow” (Ludvigson, 2004 p. 44). Lahiri et al on the other hand, oppose that confidence surveys reflect precautionary savings motives and say that because of methodological reasons, there is no strong evidence supporting this claim. Secondly, Ludvigson writes that consumer sentiment indices may be capturing individuals’ expectations of future income or wealth. Lahiri more or less agrees with this claim and states that, “using household data from CAB during 1978 to 2014, they show that sentiment captures predominantly household-specific perceptions and expectations of their own economic conditions as well as the condition and outlook of the economy” (Lahiri et al, 2015 p. 20).

Nguyen et al (2013), was a much different article as it focused on the reaction of heterogeneous consumers to news in Australia to see how individuals respond asymmetrically to changes in sentiment using positive and negative news. The consumers were disaggregated by age, gender, household income, and voting intentions. Additionally, the authors used the Westpac-Melbourne Institute Consumer Sentiment index which is constructed from a monthly survey of 1200 Australian households which is in between the volume of surveys taken for the two main American indexes. The two key contributions of the paper are that it finds households react asymmetrically to good and bad news which supports the presence of negativity bias. Secondly, it finds that households with different characteristics react differently to news. This article also stresses the importance of looking at disaggregate consumer sentiment to news by ages, home ownership, voting intentions, gender and income because households with different backgrounds and demographics tend to always react differently to positive and negative news.

In summary Nguyen et al (2013) have several main findings from their empirical investigation. First asymmetry is present in the response of consumers to all four news items with respondents only reacting to bad news, *not* positive news, and this negativity bias remained across all consumer groups. Therefore, it concluded that falls in consumer sentiment have negative effects on consumption but rises have no effect. Next, contrary to expectations, target bank rate declines are seen by consumers as bad rather than good news. The authors believe this is explained by the fact that “consumers may view loosening in monetary policy as signals of weakness in economic activity ahead leading to decline in sentiment” (Nguyen et al, 2013 p. 433). Also, gender, home ownership and age do not seem to be important in consumer reactions, however voting intentions are unexpectedly important. People tend to be more optimistic if the political party they support is elected and vice versa. Ultimately, falls in consumer sentiment are associated with declines in real household consumption while no relationship seems to be present between rises in consumer sentiment and consumption.

Garrett et al (2004) take a different approach to the data and analyzes how consumer sentiment predicts retail spending at the state-level. This paper concludes that there is indeed a strong correlation between consumer sentiment measures and retail sales growth in numerous states, however consumer confidence only shows relatively weak predictive power for future retail spending.

The authors note the importance of looking at the data at a state-level rather than national aggregate level. They state that “state-level business cycles are not necessarily synchronous with national cycles. Thus, it is of interest to determine whether and to what extent consumer sentiment reflects idiosyncratic regional activity versus aggregate conditions” (Garrett et al, 2004 p. 124). Having greater knowledge of consumer sentiment and consumption at the state-level allows policymakers to gain insight about regional economic conditions and therefore give them better judgment on policies to enact.

Similar to the articles reviewed that use aggregate data, Garrett et al (2004) include lagged values of real-estate level personal income growth and retail sales growth as their explanatory variables to account for any autocorrelation. Having baseline variables allow the researchers to accurately determine the effects of consumer sentiment on retail consumption.

The authors conclude that the empirical results only serve as modest predictors of state-level retail sales growth. They find that on average, “consumer sentiment forecasts retail sales growth for at least 27 percent of the 44 states analyzed. In those states having a significant sentiment/spending relationship, the explanatory power averages about four percent." Therefore, it proves to show that it is more useful and predictive to analyze the data at a national level.

Reverse causality is critical to take into account, and therefore Jeffrey Guo (2016) studies the effect that consumption and employment have on consumer confidence by region in the United States. I will focus specifically on the consumption aspect of the literature.

Guo makes it clear that regions around the United States are affected differently from economic events. The Great Recession hit some states harder than others. For example, South Dakota's employment contracted by only 1.86 percent whereas Nevada dropped nearly 13 percent in the same period. Moreover, in terms of household consumption, New England's spending did not shrink nearly as much as the consumption did in the West. Additionally, the Great Recession not only affected varying regions differently, but it also caused individuals to change spending on various types of goods in various ways. For example, people cut back on buying durable goods more than what people spent on services. Thus, the different categories of consumption are not affected the same.

Guo finds that the analysis suggests that regional differences do exist in the relationship between consumption and consumer confidence. His empirical analysis shows that the Middle Atlantic division has a significant coefficient on nondurable consumption expenditure, whereas the same variable in the Pacific division was statistically insignificant. This could imply that "a New Yorker's consumption of nondurables affects his confidence in the economy more than a Californian's nondurables consumption would affect her confidence" (Guo, 2006 p. 19). Ultimately, Guo's study exhibits a significant regional difference among consumption and its effects on future consumer confidence.

Prospect theory is a behavioral economic model that explains the way people choose between different prospects with stated probabilities and monetary outcomes. Kahneman et al (1979) critique the traditional expected utility theory as a descriptive model of decision under risk, and therefore create the prospect theory. The expected utility theory states that if specific conditions are satisfied, the value associated with an individual's risky action is the value of the final outcome that specific individual places on it. However, Kahneman et al counter this and claim that people make decisions based on the potential value of losses and gains, not based on the final outcome.

The authors "first show that people overweight outcomes that are considered certain, relative to outcomes which are merely probable – a phenomenon which they label the certainty effect" (Kahneman et al, 1979). This effect is in essence when a prospect is initially thought of as certain and becomes less probable, it tends to have a greater effect than when the prospect was merely probable before the probability was reduced by the same amount. For example, a sure gain that is reduced to an 80 percent gain has a greater psychological impact on choice than a prospect that goes from a probability of a 60 percent gain to a 40 percent gain. Therefore, the authors go on to say that this situation violates the independence axiom of the expected utility theory, and thus it is not a reliable method to understand choice.

Next, the authors discuss the reflection effect. This is when you change the signs of some of the outcomes from positive to negative, in which preference between negative prospects is the mirror image of the preference between positive prospects. Thus, the reflection of prospects around zero reverses the preference. This "implies that risk aversion in the positive domain is accompanied by risk seeking in the negative domain" (Kahneman et al, 1979). For example, the majority of respondents in their test were willing to accept the risk of 80 percent to lose $4,000, in preference to a sure loss of $3,000. On the other hand, people were risk averse when the prospects were in the positive domain, for example, people preferred a sure win of $500 then an 80 percent chance of gaining $1000.

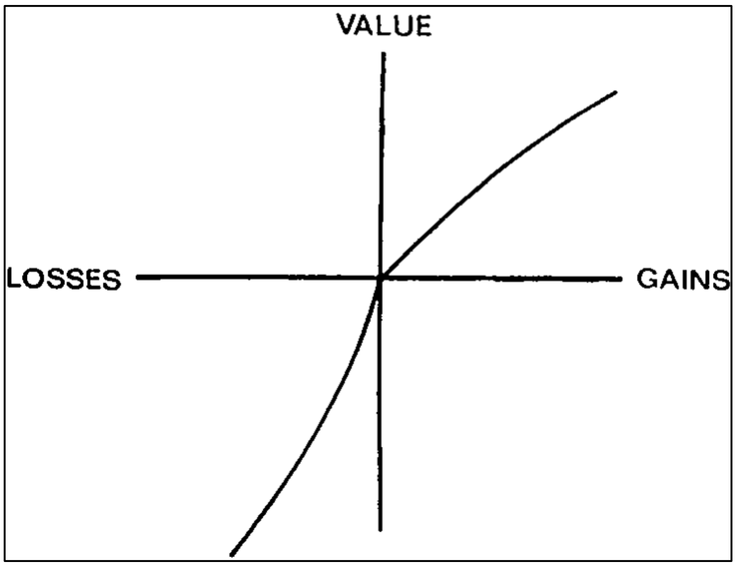
Therefore, the authors found several empirical effects which invalidate the expected utility theory as a descriptive model and thus formulate the prospect theory. The prospect theory is composed of two separate phases, the editing phase and the evaluation stage.

The editing phase is essentially an analysis of the given prospects which then is put into a simpler representation of the choices. There are several main operations in this phase. First is coding in which people perceive gains and losses defined around some neutral reference point. In other words, they determine what is a gain or a loss depending on their current asset position. Next is the combination stage in which the various prospects are simplified by combining probabilities with the same outcomes. After this, some prospects that are extremely unlikely to happen are simply discarded and not considered. Ultimately, this stage consists of individuals deciding which prospects are equivalent, they set a reference point to which gains and losses will be measured, and in the end look at lesser outcomes as losses and greater ones as gains.

The subsequent evaluation phase is when the subject assesses each of the edited prospects and chooses which one has the highest value to them, keeping in mind their individual reference points. The value of the edited prospect is expressed in terms of two scales. The first scale puts a decision weight on each probability, which shows the effect of the probability on the overall value of the prospect. These weights measure how the prospect impacts the individual, not just the likelihood of the events happening. The second scale assigns a number which represents the subjective value of the particular outcome. Therefore, this value is essentially the gains or losses a person experiences relative to their reference point.

Similar to Nguyen et al (2013), the authors find that people respond more significantly to losses more than they do gains, and therefore, as seen in figure one below, the slope of the losses is steeper.

Figure I: Hypothetical Value Function



Source: Kahneman et al, (1979)

Thus, the prospect theory shows that people tend to be more significantly affected by a loss of a sum of money than they are positively affected by an increase in a sum of money. Similar to Nguyen et al (2013), people tend to react more substantially when they hear bad news, versus when they hear good news.

Ultimately, prospect theory states that individuals make choices based on the deviations (gains or losses) from their reference point. However, the decision maker using the utility theory simply bases their choice on the final value of the outcome, not on if the change is a gain or a loss. Kahneman et al (1979), find many drawbacks in the utility theory, and therefore created this alternative, the prospect theory.

Section IV: Concluding Remarks

What emerges from the relevant reviewed literature is that both the wealth effect and consumer sentiment have a significant effect on consumption expenditure. Additionally, each of the variables being tested have shown to have more predictive power of future consumption rather than predicting contemporaneous consumption. In light of these findings, more research is pertinent to examining the impact of the combination of both the wealth effect and consumer sentiment on consumption as well as taking into account the asymmetric effects of wealth and sentiment. The existing literature serves as a launching pad for the next chapter where I will continue with my own analysis of the data. I will consider both financial and housing wealth, as well as both the University of Michigan's Consumer Sentiment Index and the Conference Board's Consumer Confidence Index. I will build a general consumption function and continue to modify it to fit my thesis and test for asymmetrical responses and structural changes.

Chapter III

Methodology

The purpose of this chapter is to set up a model to test the effects of consumer sentiment and wealth on consumption before and after the Great Recession. Prior to introducing the actual model, it is important to discuss the difference between aggregate and disaggregate data. Thus, section one explains the reasoning behind using aggregate data. Next, section two will discuss potential econometric or technical issues that may arise in this type of model and how I will address them. Following that, section three will present a generic consumption function and subsequent modifications made to it to provide analysis for my thesis question and to address the issues raised.

Section I: Aggregate Vs. Disaggregate Data

Disaggregate data, also known as micro data, would allow me to directly follow an individual and how their sentiment and wealth affect their personal consumption. Therefore, micro data would be advantageous to understand more specifically how people spend and save their income. It would potentially shed light to different demographics around the country and other external factors that may influence an individual's consumption. Unfortunately, however, disaggregate data is much more difficult to obtain and, therefore, my thesis utilizes aggregate data, also known as macro data. Using aggregate data will enable me to examine economic interactions of an individual at a macro level. In addition, traditional macroeconomic policy uses aggregate data which has been successful in properly understanding the economy, and subsequently implementing proper policies to address macroeconomic problems. Stoker (2010) states that, "the econometrics of aggregation refers to modelling with the individual-aggregate connection in mind, creating a framework where information on individual behavior together with co-movements of aggregates can be used to estimate a consistent econometric model." Thus, although micro data would be beneficial, aggregate data provides information useful for macroeconomic policies which correspond to individual behavior.

Section II: Potential Econometric Issues and Remedies

In this type of model, some issues may arise that distort the results. These problems include: autocorrelation or serial correlation, reverse causality, multicollinearity, and spurious correlation.

The first issue that could be problematic to the results is autocorrelation or serial correlation. There are a number of likely causes behind it. One may be the omission of key predictor variables. Another may be the misspecification of the functional form in which a variable is being tested in. Perhaps using a linear form does not as adequately estimate the model and instead it would be more accurate to be in a quadratic form. For example, disposable income may face diminishing marginal utility meaning that someone who goes from an income of $50,000 to $100,000, may be more compelled to consume, whereas someone who starts at an income of $200,000 and increases to $250,000 may not be as inclined to consume as much. Therefore, the variable should not be estimated in a linear form, rather potentially in a non-linear form.

To determine if the model exhibits autocorrelation, I will be using the Durbin-Watson statistic. If indeed serial correlation is present, there a few remedies to combat this issue. One important method is to incorporate the necessary variables that may have been omitted, and are pertinent to the accuracy of the model. Next, I can implement the Cochrane-Orcutt procedure which is represented as AR(n) in the estimation where *n* is the number of previous quarters. This usually helps fix the issue because it modifies the original equation in such a way so that the actual equation estimated would tend to be free of autocorrelation. Another method is to determine if the model is in the proper functional form whether it be linear, logarithmic, quadratic, or other any other type of form. To test for this, I can run a regression with the linear form of the variables, as well as those same variables in a non-linear form. Therefore, if for example a quadratic form of a variable is statistically significant, then there is non-linearity, and thereafter, the quadratic form will be used instead, after checking to see if the serial correlation has been remedied.

Reverse causality is another issue that must be addressed. The Granger causality test can be used to determine in which direction causality actually occurs. Does *x* cause *y* or instead does *y* cause *x*? Lagged variables are important from both economic and econometric perspectives to determine causality. Economically, for example, it may be important to lag the disposable income variable because there could be a realization period. Thus, it is reasonable to think that an individual may not change their current consumption if their current disposable income changed simultaneously, rather, a person may experience a change in their disposable income, and therefore, alter their consumption the following quarter(s). Econometrically, using lagged variables can address the problem of reverse causality or not. For example, if I run a regression with lagged disposable income to see how it affects consumption, and the result is statistically significant, that means that a change in last quarter’s disposable income causes current consumption to change. Therefore, it is impossible to say there is still an issue of reverse causality because you cannot say that today’s current consumption caused last quarters disposable income to change.

Multicollinearity is another econometric issue that may arise throughout the regressions. For example, financial wealth and housing wealth may be highly correlated, and therefore, must be run in separate regressions. In addition, the Michigan Consumer Confidence Index and the

Conference Board Consumer Sentiment Index have a high probability of being strongly correlated and therefore cannot be used together in the same regression. To test to see if this issue is present, I will calculate correlation matrices of the variables and therefore those with a high degree of correlation, will be noted and used separately in proceeding regressions to avoid multicollinearity.

Lastly, spurious correlation is an issue that must be addressed because it will cause misleading results between non-stationary variables. To check if a given variable it non-stationary and therefore may cause a spurious correlation, I will run unit root tests for each variable. For those predictor variables that show a high probability of being non-stationary, I will convert the values in levels into first-differences which generally fixes the issue.

Section III: The Model

A generic consumption function must first be formulated to get a basic understanding of the main explanatory variables that influence consumer spending. This initial consumption function serves as a simple baseline model because it does not take into consideration structural changes before and after the 2008 Great Recession, as well as the potential asymmetrical effects of the main explanatory variables, wealth and sentiment on consumption. The general consumption function that is used to estimate a household's tendency to consume takes the following functional form:

$$C_t = \beta_0 + \beta_1 NW_t + \beta_2 S_t + \beta_3 X_t + \varepsilon_t \tag{1}$$

where C_t is consumption, NW_t is some measure of wealth, either total net wealth, financial wealth or housing wealth, S_t is some measure of consumer sentiment, either from the University of

Michigan's consumer sentiment index or the Conference Board's consumer confidence index, and X_t serves as a vector variable to represent other factors besides the main variables that might have additional explanatory power, such as the value of the S&P 500's index, 3-month Treasury Bill rate, and disposable income.

Equation one however is not sufficient enough to allow for adequate regression analysis of the relationship between the explanatory variables and consumption. Although it gives a good basic understanding of the main variables, it does not include lagged variables nor does it take into consideration a lagged dependent variable representing habit persistence. The following equation implements these lagged independent variables as well as a lagged dependent and takes the form:

$$C_t = \beta_0 + \beta_1 NW_{t-n} + \beta_2 S_{t-n} + \beta_3 X_{t-n} + \beta_4 C_{t-n} + \varepsilon_t \qquad (2)$$

where *t-n* stands for some quarter *t*, lagged by *n* number of quarters. It should be understood that *n* could take the value of zero to show that the given variable is not being lagged. The use of the lagged variables is to gain an understanding of how past quarter values of the explanatory variables impact and predict current consumption. Furthermore, C_{t-n} is the habit persistence variable. It is important to include this variable to gauge how past consumption tendencies influence current consumption as well as what steady-state estimates are.

Two major economic theories explain the theoretical basis behind why it is important to include habit persistence, or in other words, a lagged dependent variable: Milton Friedman's permanent income hypothesis and Franco Modigliani's theory of the life-cycle model.

The permanent income hypothesis describes that people spread their consumption over their lifetime. Consumption is not determined just by one's current income but also by their expected long-term average income, known as their permanent income. Therefore, since changes in permanent income last for many periods, they have a larger effect on consumption than temporary changes in income. Thus, temporary income changes would typically be saved, whereas changes in permanent income would be consumed. Since there is no way to gauge expected future income, there tends to be what is called consumption smoothing in which people spread out their changes in income over time. The habit persistence variable allows for econometric analysis of this hypothesis as it gives an understanding of how prior consumption may have impacted current consumption, taking into account net wealth, to see if this phenomenon of consumption smoothing truly does exist.

The life-cycle model has two significant aspects. First, the average worker experiences consistent increases in real income, with peak earnings generally between the ages of fifty and sixty. Following retirement however, income drops significantly. Second, the lifetime pattern of consumption is much smoother than the pattern of income over time. Overall, saving is minimal and sometimes even negative during early working years when income is low. Additionally, saving is at its maximum when income is at its highest, in one's fifties to sixties. Lastly, consumption, or "dissaving" occurs during retirement as people take from their wealth to meet living expenses. Ultimately, the life-cycle model concludes that the average propensity to consume is greater in both young and aging individuals, since they borrow against future income or use their savings. Middle-aged people, the working class, tend to save more, because they have a higher income and they are typically saving for retirement. Therefore, the life-cycle hypothesis supports the need for a habit persistence variable to understand consumption-smoothing and how prior spending tendencies impact current consumption.

To address the specific questions posed in this thesis there must be two modifications. The first modification that must be made is to test for structural changes to understand whether the 2008 crisis led to a change in the structure of consumption. In other words, a modification must be made to the first equation to see how the explanatory variables may affect the dependent variable differently before and after the Great Recession. The second modification needed is to add a dummy variable that will test for asymmetrical responses. Therefore, I will be able to determine whether consumption experiences the same response to a one unit increase in wealth as it does with a one unit decrease in wealth, or if in fact consumption reacts asymmetrically. I will test this for both wealth and consumer sentiment.

In order to test for structural changes, a dummy variable must be implemented into the model. One main question to the thesis is to understand if the Great Recession shifted the way people consumed, or if it just caused people to simply decrease their consumption temporarily, and then they continued to consume per usual after some time. The following equation incorporates a dummy variable to test for this structural change:

$$C_t = \beta_0 + \beta_1 NW_{t-n} + \beta_2 S_{t-n} + \beta_3 X_{t-n} + \beta_4 C_{t-n} + \beta_5 (D07Q2) + \varepsilon_t \tag{3}$$

where *D07Q2* is the dummy variable set to test for structural changes before and after quarter two of 2007. The dummy variable is set during this time because it is when the United States was experiencing the start of the collapse. If for example, β_5 equals negative two and β_0 equals five, then it would indicate a downward shift in the consumption function after quarter two of 2007 from \$5 billion to \$3 billion. If, however, β_5 is insignificant, then it could stand to reason that the other variables within the model may have been the contributors to the decrease in consumption, and therefore, structural changes are not present in the regressed model. Thus, the consumption function is robust enough to withstand a major event like the Great Recession. Another regression will be run with a dummy variable to test for a structural change due to the repeal of the Glass-Steagall Act in 1999, with the variable represented as *D97Q4.*

Symmetricity is another question that needs to be answered. It is important to understand if people react the same to an increase and decrease in one of the main explanatory variables or if they respond asymmetrically. Various dummy variables will be used to test asymmetry. The following equation implements these dummy variables:

$$C_t = \beta_0 + \beta_1 NW_{t-n} + \beta_2 (dnw1) NW_{t-n} + \beta_3 (dnw2) NW_{t-n} + \beta_4 S_{t-n} + \beta_5 (dmcs1) S_{t-n} + \beta_6 (dmcs2) S_{t-n} + \beta_7 X_{t-n} + \beta_8 C_{t-n} + \varepsilon_t \qquad (4)$$

where *dnw1* accounts for an increase in net wealth, *dnw2* stands for a decrease in net wealth, *dmcs1* is for an increase in the Michigan Sentiment index, and *dmcs2* stands for a decrease in the index. Another regression will be run using the Conference Board Consumer Confidence index instead of the Michigan Sentiment index, where the dummy variables are defined as: *dcbi1* for increases in the Conference Board index and *dcbi2* will be for decreases. In addition, other regressions will be run using dummy variables for financial and housing wealth.

The following chapter will utilize the models previously discussed and in light of the results, apply any necessary modifications.

Chapter IV

Empirical Analysis

The purpose of this chapter is to estimate the models discussed in the previous chapter and in light of the results obtained, make any necessary modifications. In section one, I will present the data and sources. Section two will consist of the empirical regression analysis. Section three will discuss the results found in section two. Section four will conclude the chapter.

Section I: Data and Sources

The data are collected from the *Fair Model: The US Model – Appendix A* last updated on January 30, 2016. This is a compilation of thousands of macroeconomic variables. In addition, some data are from the Federal Reserve Bank of St. Louis, the University of Michigan, and the Conference Board. I select several, defined below, that are directly connected to my thesis question.

Table I: Data Description

Code	Definition & Sample Size	Description
cbi	Conference Board Consumer Sentiment Index (1977Q2 - 2016Q3)	Indicator to measure consumer confidence, which is the degree of optimism on the state of the economy that consumers are expressing through their activities of savings and spending. Based on 5,000 households and is benchmarked to 1985=100. Opinions on current conditions make up 40% of the index, with expectations of future conditions comprising the remaining 60%.

Code	Definition & Sample Size	Description
co	Total Household Consumption Expenditure, B2009$ (1947Q1 - 2016Q2)	Transaction of the national account's use of income account representing consumer spending. Consists of the expenditure incurred by resident households on individual consumption goods and services, including those sold at prices that are not economically significant.
d07Q2	Dummy Variable for before and after 2007 Q2	Used to test for structural changes in consumption at the period 2007Q2
d97Q4	Dummy Variable for before and after 1997 Q4	Used to test for structural changes in consumption at the period 1997Q4
dcbi1	Dummy Variable for Increases in CBI (1977Q3 - 2016Q3)	If the change in CBI is positive, the dummy variable will be 1. If the change in CBI is negative, the dummy variable will be 0. This will test for asymmetrical responses of consumption.
dcbi2	Dummy Variable for Decreases in CBI (1977Q3 - 2016Q3)	If the change in CBI is positive, the dummy variable will be 0. If the change in CBI is negative, the dummy variable will be 1. This will test for asymmetrical responses of consumption.
dmcs1	Dummy Variable for Increases in MCS (1978Q2 - 2016Q2)	If the change in MCS is positive, the dummy variable will be 1. If the change in MCS is negative, the dummy variable will be 0. This will test for asymmetrical responses of consumption.
dmcs2	Dummy Variable for Decreases in MCS (1978Q2 - 2016Q2)	If the change in MCS is positive, the dummy variable will be 0. If the change in MCS is negative, the dummy variable will be 1. This will test for asymmetrical responses of consumption.
dnw1	Dummy Variable for Increases in NW (1952Q1 - 2015Q4)	Used to test for asymmetrical responses for NW
dnw2	Dummy Variable for Decreases in NW (1952Q1 - 2015Q4)	Used to test for asymmetrical responses for NW
dnwfin1	Dummy Variable for Increases in net financial wealth	Used to test for asymmetrical responses for NWFIN
dnwfin2	Dummy variable for decreases in net financial wealth	Used to test for asymmetrical responses for NWFIN

Code	Definition & Sample Size	Description
dnwh1	Dummy variable for increases in net housing wealth	Used to test for asymmetrical responses for NWH
dnwh2	dummy variable for decreases in net housing wealth	Used to test for asymmetrical responses for NWH
mcs	The University of Michigan Consumer Confidence Index (1978Q1 - 2016Q2)	Consumer confidence index published monthly by the University of Michigan. The index is normalized to have a value of 100 in December 1964. Each month uses at least 500 telephone interviews. Used to assess near-time consumer attitudes to the business climate, personal finance and spending. As well as to promote an understanding of, and to forecast changes in the national economy.
nw	Total Net Wealth, B2009$ (1952Q1 - 2015Q4)	The total assets minus total outside liabilities of an individual.
nwfin	Total Net Financial Wealth, B2009$ (1952Q2 - 2016Q1)	Total value of an individual's financial holdings such as shares in stocks, or bonds.
nwh	Total Net Housing Wealth, B2009$ (1952Q2 - 2016Q1)	The total value of an individual's home.
rs	Three-month Treasury Bill Rate, Percentage Points (1952Q2 - 2016Q1)	A short-term debt obligation backed by the U.S. government with a maturity of less than one year, sold in denominations of $1,000 up to a maximum purchase of $5 million. Investors do not receive regular payments, but a T-Bill pays an interest rate.
sp500	S&P 500 Closing Prices, (1950Q1 - 2016Q2)	An index of 500 stocks seen as a leading indicator of U.S. equities and a reflection of the performance of the large cap universe, made up of companies selected by economists.
ypd	Disposable Income in Billions of Chained 2009 Dollars (1947Q1 - 2016Q2)	Income remaining after deduction of taxes and other mandatory charges, available to be spent or saved as one wishes.

Below are the questions asked for each of the consumer sentiment surveys.

Michigan Consumer Sentiment Survey:

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

Among the Michigan questions, numbers one and five are concerned with present conditions of the household and the other questions survey for expected economic conditions. "For each of the five questions, a respondent can choose among three responses: favorable (e.g. situation getting better), neutral (e.g. situation is the same as before), and unfavorable (e.g. situation getting worse)" (Lahiri et al, 2015).

Conference Board Consumer Confidence Survey:

1. How would you rate present general business conditions in your area? [good/normal/bad]
2. What would you say about available jobs in your area right now? [plentiful/not so many/ hard to get]
3. Six months from now, do you think business conditions in your area will be [better/same/worse]?
4. Six months from now, do you think there will be [more/same/fewer] jobs available in your area?
5. How would you guess your total family income to be six months from now? [higher/ same/lower]

The questions from the Conference Board are received from Ludvigson (2004). The first two questions test for present economic conditions and the final three survey for expectations.

In the following section, regarding the empirical regression analysis, variables with a (-1) denote the previous quarter's observation(s). In addition, variables that are represented as d(X), denote that the first difference was taken.

Section II: Empirical Regression Analysis

This section will present a summary of the results from the various specifications of the model. The empirical results are in both levels and first-differences. However, prior to presenting findings, it is important to understand the issue of multicollinearity, thus the use of a correlation matrix, seen below indicates which variables are highly correlated and should not be run together.

Table II: Correlation Matrix

Correlation Matrix												
	CBI	CD	CN	CO	CS	MCS	NW	NWFIN	NWH	RS	SP500	YPD
CBI	1	-0.148	-0.127	-0.129	-0.126	0.853	-0.033	-0.022	-0.055	0.245	0.079	-0.149
CD	-0.148	1	0.986	0.985	0.974	-0.041	0.981	0.973	0.927	-0.825	0.944	0.985
CN	-0.127	0.986	1	1.000	0.997	0.001	0.982	0.969	0.938	-0.852	0.943	0.998
CO	-0.129	0.985	1.000	1	0.998	0.003	0.981	0.969	0.935	-0.860	0.943	0.999
CS	-0.126	0.974	0.997	0.998	1	0.016	0.975	0.964	0.929	-0.868	0.939	0.997
MCS	0.853	-0.041	0.001	0.003	0.016	1	0.075	0.084	0.033	-0.016	0.161	-0.012
NW	-0.033	0.981	0.982	0.981	0.975	0.075	1	0.986	0.947	-0.804	0.970	0.977
NWFIN	-0.022	0.973	0.969	0.969	0.964	0.084	0.986	1	0.889	-0.799	0.988	0.968
NWH	-0.055	0.927	0.938	0.935	0.929	0.033	0.947	0.889	1	-0.741	0.871	0.925
RS	0.245	-0.825	-0.852	-0.860	-0.868	-0.016	-0.804	-0.799	-0.741	1	-0.757	-0.864
SP500	0.079	0.944	0.943	0.943	0.939	0.161	0.970	0.988	0.871	-0.757	1	0.939
YPD	-0.149	0.985	0.998	0.999	0.997	-0.012	0.977	0.968	0.925	-0.864	0.939	1

Correlation matrices are useful to understand which explanatory variables are highly correlated with each other. Therefore, the higher the correlation is, meaning the closer it is to one or negative one, the more likely a regression run with those two or more variables will face issues caused by multicollinearity. To rid of this issue, subsequent regressions will only use one of the two or more variables. For example, no regression will contain all three wealth variables. Rather, each wealth variable will be run separately which will estimate more accurate results. However, it is important to note that there are some special cases in which two or more highly correlated variables must be used in the same regression. For example, as seen in the correlation matrix, net wealth and disposable income have a correlation of 0.977, meaning there is likely a high chance of multicollinearity. Since both YPD and wealth are robust with respect to a variety of specifications, and indeed both variables belong to the equation based on a priori reasoning, it is appropriate to dismiss the problem of multicollinearity.

I conduct two types of regressions: a set in levels and first-difference. Levels have a more straightforward meaning. A one unit increase from last quarter in a given variable, *ceteris paibus*, leads to a change in consumption, equal to the size of the given variable's estimated coefficient. The relevant interpretation in the case of first-differences is slightly different. It states that there is an incremental change in consumption in response to an incremental change in a given variable. For example, if a result is 0.18d(YPD), then it would mean that an incremental change disposable income results into an 18 cent incremental change in consumption. Note that all variables with a dollar amount measure are expressed in terms of 2009 dollars and are thus in real terms.

Table III: Summary of Regressions in Levels

		Regression Number									
Coefficient		1	2	3	4	5	6	7	8	9	10
ar(1)					0.174***	0.211***		0.156	0.179***		
ar(2)						0.238***					
ar(3)						0.142					
co(-1)		0.849***	0.808***	0.87***	0.898***	0.866***	0.887***	0.871***	0.886***	0.814***	0.861***
d07q2		-29.925***	-57.792***	-48.709***	-40.78***					-41.747***	
d97q4								28.125***			39.372***
dcbi1										0.454***	
dcbi2										0.435***	
dmcs1			0.320								0.483***
dmcs2			0.307								0.465***
dnw1		0.0038***	0.005***							0.006***	0.007***
dnw2		0.0037***	0.005***							0.006***	0.007***
dnwfin1				0.004***	0.004***						
dnwfin2				0.004***	0.004***						
dnwh1									0.005***		
dnwh2									0.004***		
mcs		1.2598***		1.069***	1.293***	1.73***	1.878***	1.791***	1.576***		
nwh(-1)						0.008***					
nwh							0.004***	0.005***			
rs(-1)							-3.267***	-4.539***	-3.385**	-6.382***	-8.506***
sp500(-1)										-0.007	
ypd(-1)					0.089***						
ypd		0.127***	0.164***	0.117***		0.105***	0.097***	0.105***	0.096***	0.145***	0.074***
R^2		0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
D-W		1.843	1.666	1.776	1.997	1.949	1.637	2.034	2.036	1.906	1.722
Steady-State	ypd	0.841	0.854	0.9	0.873	0.784	0.858	0.814	0.842	0.779	0.532
	nw	0.0252	0.026							0.032	0.05
	nwfin			0.031	0.039				0.049		
	nwh					0.0597	0.035	0.039			

Note: The estimation uses the least squares method. Numbers with *** denote estimates at the 1% significance level. Numbers with ** denote estimates at the 5% significance level. Numbers with * denote estimates at the 10% significance level. Numbers with no * denote estimates with no significance. Steady-state numbers do not require significance level. R^2 is the adjusted R^2.

Table IV: Regressions in First-Difference

	Regression Number						
Coefficient	1	2	3	4	5	6	7
ar(1)					0.132***		
ar(2)					0.237***		
ar(3)					0.302		
cbi					0.715***		0.494***
d(co(-1))							0.209***
d07q2			-14.324**	-4.24			
d97q4	13.551***	10.736**					10.348***
d(mcs)	1.483***	1.499***	1.404***	0.976		1.296***	
d(nw)	0.01***		0.01***			0.009***	
d(nwfin)					0.01***		0.013***
d(nwh(-1))		0.068***					
d(nwh)				0.061***			
rs(-1)						-1.876***	
d(ypd)	0.107***	0.08***	0.116***	0.107***	0.055***	0.111***	0.075***
R^2	0.181	0.329	0.175	0.271	0.382	0.18	0.373
Durbin-Watson	1.586	1.672	1.606	1.672	1.978	1.56	2.216

Note: The estimation uses the least squares method. Numbers with *** denote estimates at the 1% significance level. Numbers with ** denote estimates at the 5% significance level. Numbers with * denote estimates at the 10% significance level. Numbers with no * denote estimates with no significance. R^2 is the adjusted R^2.

There are several important aspects of the regression analysis that must be discussed. First, the Cochrane-Orchutt procedure was implemented to address the condition of serial correlation. This is generally incorporated when the Durbin-Watson statistic is significantly far away from two (that is, close to zero or four). Therefore, residual tests are run, and I include the appropriate number of corrections depending on how many quarters the autocorrelation occurs in.

Next is the use of the several different kinds of dummy variables. One set of dummy variables tests for asymmetrical responses of consumption to the main explanatory variables, consumer sentiment and wealth. The dummy variables ending in the number one, tests from increases in the given variables, whereas the dummy variables ending in two test for decreases. There is some indication in the literature that consumer response to increases in certain variables might be different from decreases in those same variables. So, it seemed appropriate to test for this.

Two dummy variables were created to test for structural changes in consumption. The first dummy variable, denoted d07q2 is used to answer one of the main questions of the thesis. That is, did the Great Recession cause a dramatic change in consumption habits.

The other dummy variable, denoted d97q4, was implemented after observing the structure of a graph of the wealth variables. As seen below in figure two, during around 1997, all forms of wealth began to experience a lot of fluctuations which led me to believe that there was some sort of structural change that occurred around this time. Therefore, I constructed a dummy variable to test for changes in the consumption function during quarter four of 1997.

Figure II: Normalized Representation of Net Wealth

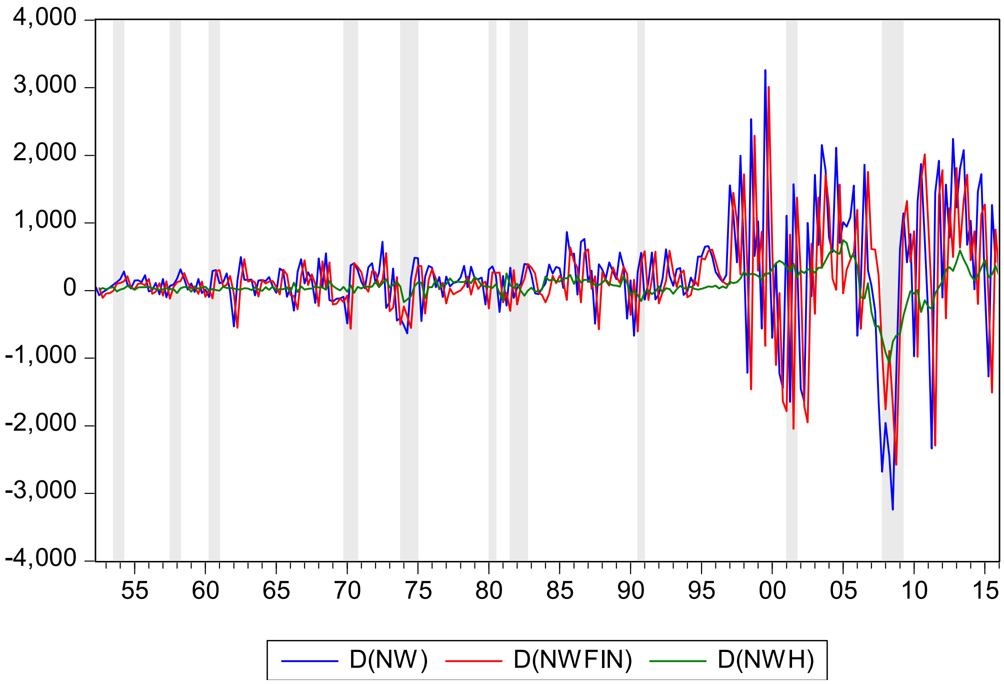


Figure two displays the structural changes in both 1997 and 2007. There is a visible increase and then decrease in net wealth, respectively.

Section III: Discussion of Results in Regression Analysis

Throughout the different specifications of the model, the results have shed light on the various questions my thesis analyzed, as well as presented unexpected information that originally was not being tested for. This section will discuss the results pertaining to each explanatory variable and what their general outcome is. It will be broken into two subsections: one to explain the results in levels and another to describe them in the first difference.

Section III-A: Discussion of Results in Levels

In general, there is no evidence of asymmetrical responses of consumption to changes in wealth and sentiment. In nearly every regression run, the dummy variables for increases and decreases were almost equal. Therefore, people's consumption habits tend to respond symmetrically to a one-unit increase or decrease of the given variable, all else equal. This opposes what Nguyen et al (2013) and Kahneman et al (1979) discovered. Both authors found that people tend to respond more dramatically to decreases in given variables than they did to increases. Nguyen et al (2013) results show only a response to bad news not good news. They explain this to be a phenomenon of negativity bias in which people tend to significantly respond to bad things that happen to them. Kahneman et al (1979) explain this through the hypothetical value function in which they state that people tend to be more negatively affected by a loss of a sum of money than they are positively affected by an increase in a sum of money.

Throughout the various specifications of the model, the Michigan Consumer Sentiment Index displayed stronger correlations with consumption, and thus was used the majority of the time. On average, all else equal, a unit increase in the index of the Michigan Consumer Sentiment will lead to between a $1.07 and $1.88 billion real increase in total consumption. Thus, as people see positive prospects in the future in terms of their financial stability and economic outlook, they will tend to increase their spending.

Similarly, as Cooper et al (2014) and Iacoviello (2010) do in their papers, net wealth is broken into three different variables: total net wealth, financial wealth, and housing wealth. In terms of total net wealth, aggregate consumption tends to increase in the range of $0.004 and $0.008 when wealth increases by one-dollar. It is important to understand that although $0.006 is a very small number, in respect to say a one-billion-dollar increase in total aggregate net wealth, aggregate consumption will approximately increase by $6,000,000.

Total net financial wealth is similar. In general, the various models estimate that with all else equal, a one-dollar increase in financial wealth causes aggregate consumption to rise by about $0.004. Housing wealth tends to have a wider range of influence on consumption. In general, with a one-dollar increase from the previous quarter's housing wealth, the aggregate will tend to consume $0.0045 more. However, if housing wealth in the previous quarter increases by one-dollar, then the aggregate will be inclined to spend $0.008 more. Therefore, if the value of the aggregate house price rises, people will tend to consume more because they feel more financial stability. Iacoviello (2010) explains that a substitution effect may play a role in this increase in consumption. He states that when house prices rise, the substitution effect will cause households to reduce demand for housing and free up resources used to consume more. Thus, the increase in consumption may not only be because aggregate housing wealth increased, but instead it is due to people lowering their demand for housing goods and increasing it for non-housing commodities.

Next, disposable income remained to be one of the most robust variables throughout all specifications of the model. On average with a one-dollar increase in YPD from last quarter, the aggregate tends to consume between $0.097 and $0.164 more. This makes logical and economic sense because if the aggregate after tax income rises, then people can use this left over cash to consume more goods and services.

As expected, short-term interest rates, specifically an increase from the previous quarter have a substantial negative effect on consumption. When the previous quarter's interest rates rise by one percentage point, people will be inclined to reduce their spending in the range of $3.27 and $8.51 billion. Debt is often taken out for many durable goods since they tend to be fairly costly, therefore people will generally decrease their spending on these goods when interest rates rise because it becomes more expensive to borrow money.

Milton Friedman's permanent income hypothesis and Franco Modigliani's theory of the life-cycle model are both, in effect, captured in the functions containing a lagged dependent variable, CO(-1), known as habit persistence. Including this variable explains how one's last quarter's consumption impacts their current consumption and helps us understand how consumption smoothing actually exists. Therefore, the estimations on average show that aggregate consumption rises by around $0.808 to $0.898 when consumption from the previous quarter rises by one-dollar. Overall, the impact of all of the explanatory variables diminish the more we go into the distant past. That is to say, disposable income from say 20 quarters ago will in essence be negligible. For example, in equation five of table three, the coefficient of CO(-1) is 0.866 and 0.105 for disposable income. That means that the effect of disposable income last quarter is 0.86 multiplied by 0.105 and the effect of disposable income two quarters ago on current consumption is 0.86^2 multiplied by 0.105 and so on. Therefore, the farther you go in the past, the smaller the effect each variable has on current consumption. To put the example of disposable income from 20 quarters into perspective, the coefficient would be estimated at 0.005 which is nearly 21 times smaller than 0.105.

Some of the most interesting results came from the two dummy variables set to test for structural changes in 1997 and 2007. First, as expected after some research, the dummy variable, d97q4 demonstrates a large positive shift in the consumption function. Aggregate consumption, throughout several specifications of the model, increased between $28.13 and $39.37 billion. This can all be explained by the repeal of the Glass-Steagall Act in 1999. It should be noted that although the Gramm-Leach-Bliley Act was implemented in 1999, some economic and financial processes that led to its official enactment were already very much in play, and therefore the dummy variable is set for the fourth quarter of 1997 to capture the prior changes happening.

In late 1933, during a five-day bank holiday, the Glass-Steagall Act was passed by Congress prohibiting commercial banks from engaging in the investment business. It was enacted as an emergency response to the failure of nearly 5,000 banks during the Great Depression. "It gave tighter regulation of national banks to the Federal Reserve System; prohibited bank sales of securities; and created the Federal Deposit Insurance Corporation (FDIC), which insures bank deposits with a pool of money appropriated from banks" (Amer. Law and Legal Info, n.d.). The act needed to be implemented as it restored public confidence in the banking sector and helped take control of the bank runs that were occurring. The Gramm-Leach-Bliley Act of 1999 also known as the Financial Services Modernization Act of 1999 was enacted removing barriers in the market among banking companies, securities companies and insurance companies that prohibited any one institution from acting as any combination of an investment bank, a commercial bank, and an insurance company. Many believe this was one of the primary causes that led to the Great Recession. This repeal allowed banks to hand out loans to anyone who had a pulse and therefore, investment in housing skyrocketed, and net wealth as a whole soared as well. Thus, consumption increased because people felt extremely financially stable and able to afford anything, since they thought their housing wealth was so robust and reliable.

However, as perfectly displayed by the other dummy variable, d07q2, put in place to test for structural changes during the Great Recession, the near demise of the American economy caused consumption to drastically decrease. Throughout many specifications of the model, there appears to be a large range in which the consumption function was estimated to have shifted down. The aggregate consumption decreased between $29.925 and $57.792 billon. This is economically sound because once the housing market crashed, and prices fell drastically, people became extremely cautious on what they spent their money on and thereafter, mainly allocated their money only towards necessities.

Finally, the long-run steady-state response of consumption to changes in personal disposable income at the aggregate level and wealth is much different than what is presented in table three. In the steady-state, CO = CO(-1) and therefore, the coefficients of these variables will be much greater. In general, the long-run MPC out of disposable income is between $0.78 and $0.90. MPC out of net wealth is much lower, but still significant when the change in steady-state wealth is large. On average, the MPC out of total net wealth is between $0.026 and $0.05. Thus, as wealth increase by one dollar, then the aggregate will consume around $0.038 more in the long-run.

Section III-B: Discussion of Results in First-Difference

It is helpful to analyze the data in different forms as they present different findings as well as combat some underlying econometric issues that may be corrupting the data such as non-stationarity which can cause spurious correlation. Therefore, similarly to Ludvigson's (2004) paper, I took the first difference of many of the variables. This allows me to understand a more incremental change within the data that the regressions in levels does not display. This means that I can estimate how a change in the growth of some explanatory variable causes a change in the growth of my dependent variable. It must be noted that in situations of first-difference, it is normal for the adjusted R^2 to drop considerably, however what is most important to look at in this case are to see if the signs of the coefficients make logical and economic sense, and if their t-statistic indicates that the result is statistically significant.

Habit persistence as expected is robust and plays a role in first-differences. The results estimate that an incremental change in the previous quarter's consumption causes an incremental change in current consumption of about $0.209. Therefore, people tend to be affected by how they previously consumed throughout the year.

Furthermore, just as Ludvigson (2004) implements a dummy variable for the recession of 1990-1991, the two dummy variables d97q4 and d07q2 were included to test for structural changes in consumption within my model. The results show that due to the repeal of the Glass-Steagall act in 1999 and sudden explosion of mortgage-backed securities followed by appreciation of the housing market, there was a subsequent positive shift in the consumption function in 1997 quarter four, between $10.736 to $13.551 billion. Therefore, as housing wealth grew, and the ability to borrow money became easier, consumption inevitably skyrocketed.

The repeal of the Gramm-Leach-Bliley Act needless to say miserably failed when the housing bubble became far too large to handle, and the market collapsed, as depicted by the results of the d07q2 dummy variable. It is estimated that the consumption function drastically shifted downward by about $14.324 billion. People witnessed their wealth almost completely diminish, and therefore aggregate spending cut back tremendously. Although this coefficient is statistically insignificant in regression number four, it actually provides an explanation as to what is going on in the economy. Unlike regression three, housing wealth is included in regression four. Therefore, the insignificance makes sense because housing wealth falls so dramatically, and is also statistically significant in regression four, so it in essence takes into account what the dummy variable would do.

The coefficient of the Michigan Consumer Sentiment Index is fairly large compared to other variables. On average the incremental change in consumption in response to an incremental change in the MCS index is between $1.404 and $1.499 billion. Therefore, as people see positive prospects, they tend to increase their spending.

Unlike the regressions in levels, the wealth variables demonstrated similar results to all of the reviewed literature regarding the wealth effect on consumption. Each article discussed in chapter two explain that housing wealth had a much more substantial impact on consumption than financial wealth. As presented in my results, on average an incremental change in consumption in response to an incremental change in housing wealth is between $0.061 and $0.068 whereas as financial wealth is only about $0.01. Therefore, my results are in agreement with previous literature which helps confirm my results.

Disposable income again is a very robust variable in the first-difference, and its coefficient is statistically significant in all specifications of the model. In general, a marginal change in disposable income leads to an incremental change in consumption between $0.075 and $0.111. Therefore, as after tax income rises, consumption on all other goods increases.

Section IV: Conclusion

In summary, consumption exhibits a fairly symmetrical response to increases and decreases of the same magnitude in consumer sentiment and wealth. In addition, the results for structural changes in the consumption function due to the Great Recession are as expected. The aggregate consumption function shifted downward substantially due to the financial crash. Through further research, another structural change was discovered during the period leading to the repeal of the Glass-Steagall Act in 1999. As regulations were removed and weakened between commercial and investment banks, investment in housing and in turn the value of the housing market began to rise significantly. With increased housing wealth, people felt richer and more financially stable, and thus the aggregate consumption function shifted upward dramatically at the end of 1997. Disposable income remained a very robust variable throughout all specifications of the model and the results in levels and first-difference were fairly similar. Lastly, the lagged dependent variable representing habit persistence as explained by the life-cycle model and the permanent income hypothesis, was statistically significant in all versions of the model. People always tend to be affected by consumption in the previous quarter. In sum, it is evident that there are many factors that impact total aggregate consumption, especially the collapse of the American economy in 2008.

Chapter V

Conclusion

My thesis examines the impact of wealth and consumer sentiment on consumption before and after the Great Recession. The sample size varies among the different specifications of the model; however, it generally ranges from the second quarter in 1978 to the first quarter of 2016. My original model is a basic consumption function slightly adapted from the model Lahiri et al (2015) use. Subsequently, I performed various modifications of the consumption function in order to adequately test for my thesis question. In particular, I added a lagged dependent variable to account for habit persistence, dummy variables to test for an asymmetrical response of consumption from wealth and sentiment, as well as two dummy variables to test for structural changes in both quarter four of 1997 and quarter two of 2007. The first structural dummy variable is used to test for a shift in the consumption function due to changes in the financial sector that led to the Gramm-Leach-Bliley Act of 1999, and the second is used to test for a shift during the financial crisis of 2008. In addition, I use a similar technique to Ludvigson (2004) and take the first-difference of several variables to address the possibility of non-stationarity and potential spurious correlation.

The two main explanatory variables I use in this thesis are consumer sentiment and wealth. Sentiment is obtained from both the University of Michigan Consumer Sentiment Index and the Conference Board’s Consumer Confidence Index, however the Michigan index tends to have more explanatory power and thus I use it more frequently. Wealth is broken down into total net wealth, net housing wealth and net financial wealth. Additionally, a vector variable is included to account for economic indicators that have an obvious effect on consumption. It includes disposable income, closing prices of the S&P 500 and the three-month treasury rates.

The data are a compilation from several different widely used sources that provide macroeconomic data. These sources include *Fair Model: The US Model – Appendix* A last updated on January 30, 2016, the Federal Reserve Bank of St. Louis, the University of Michigan, and the Conference Board.

There are several key findings that the empirical regression analysis provides. First, I find that disposable income and the lagged-dependent variables are highly robust throughout all specifications of the model. On average, in levels, a one-dollar increase in disposable income from the previous quarter results in a $0.12 rise in aggregate consumption. Therefore, people tend to expand their consumption expenditure when their after-tax income rises. In general, in first-difference, the incremental change in consumption in response to an incremental change in disposable income is $0.09. Including the lagged dependent variable captures and confirms Milton Friedman's permanent income hypothesis and Franco Modigliani's theory of the life-cycle model. The empirical analysis concludes that, in the steady state, on average a one-dollar increase in the previous quarter's consumption leads to a $0.86 rise in current consumption.

Consumption responds symmetrically to wealth and sentiment. Therefore, an increase or decrease of the same magnitude in both variables lead to the same size rise or fall of consumption. Thus, as wealth rises (or falls) by one-dollar, consumption increases (or decreases) by $0.004, and as sentiment rises (or falls) by one index unit, aggregate consumption tends rise (fall) by about $1.52 billion.

The repeal of the Glass-Steagall Act in 1999 caused a big structural change in the consumption function and on average caused it to shift upward by about $11.557 billion. However, a more significant shift in the consumption function was caused by the Great Recession in which aggregate consumption plummeted an average $43.791 billion. Therefore, the nation saw what they thought were immense gains in their wealth as a result to the Gramm-Leach-Bliley Act of 1999 as mortgages and loans were virtually at everyone and anyone's disposal. Yet, once the housing bubble burst, people experienced a drastic decline in their wealth and thus significantly reduced their consumption expenditure, over and above what is captured by the wealth and sentiment variables. Overall the results suggest a strong relationship between wealth, sentiment and consumption.

There are some limitations in, and potential improvements that can be made to my study. First of all, similar to Guo (2016) and Garrett et al (2004), the data could have been broken down regionally. This can improve the results because the data for the main explanatory variables may be significantly different in the Northeast than they are in the Midwest. Another method would be to use disaggregate data similar to what Carroll et al (2010) do in which they look at consumption changes by state. A person living in New York City will generally have different amounts of wealth, consumption and outlook on the economy as an individual would in say Montana. Thus, it would be helpful to see if there are state-specificities at play, and therefore not only would it be easier for federal macroeconomic policies to be properly put in place, but each state would have an idea of what types of policies they should implement themselves.

In light of my study, further research can be conducted to better understand what impacts consumption. Further research can look at different types of events that may cause the relationship between consumption and some of the explanatory variables to change. Additionally, if data are available, future research can look into other countries and compare how consumption reacts differently from the way it does in the United States.

Appendix

Regressions in Levels

Regression 1:

Dependent Variable: CO
Method: Least Squares
Date: 02/09/17 Time: 15:10
Sample (adjusted): 1978Q1 2015Q4
Included observations: 152 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-127.5364	23.81523	-5.355244	0.0000
YPD	0.127034	0.029160	4.356413	0.0000
D07Q2	-29.92534	12.40963	-2.411461	0.0171
CO(-1)	0.848923	0.031569	26.89090	0.0000
MCS	1.259894	0.254794	4.944751	0.0000
DNW1*NW	0.003822	0.000947	4.034130	0.0001
DNW2*NW	0.003749	0.000996	3.764098	0.0002

R-squared	0.999853	Mean dependent var	7261.452
Adjusted R-squared	0.999847	S.D. dependent var	2362.869
S.E. of regression	29.23588	Akaike info criterion	9.633629
Sum squared resid	123936.8	Schwarz criterion	9.772887
Log likelihood	-725.1558	Hannan-Quinn criter.	9.690200
F-statistic	164364.8	Durbin-Watson stat	1.842866
Prob(F-statistic)	0.000000		

Regression 2:

Dependent Variable: CO
Method: Least Squares
Date: 02/09/17 Time: 15:10
Sample (adjusted): 1978Q2 2015Q4
Included observations: 151 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-75.55417	24.65863	-3.064005	0.0026
YPD	0.163844	0.030767	5.325322	0.0000
D07Q2	-57.79201	11.90228	-4.855542	0.0000
CO(-1)	0.808301	0.033248	24.31093	0.0000
DNW1*NW	0.004663	0.001024	4.553048	0.0000
DNW2*NW	0.004611	0.001079	4.272684	0.0000
DMCS1*MCS	0.320272	0.192778	1.661349	0.0988
DMCS2*MCS	0.307105	0.197712	1.553299	0.1226

R-squared	0.999829	Mean dependent var	7284.152
Adjusted R-squared	0.999821	S.D. dependent var	2354.045
S.E. of regression	31.52150	Akaike info criterion	9.790742
Sum squared resid	142085.6	Schwarz criterion	9.950598
Log likelihood	-731.2010	Hannan-Quinn criter.	9.855684
F-statistic	119490.8	Durbin-Watson stat	1.665930
Prob(F-statistic)	0.000000		

Regression 3:

Dependent Variable: CO
Method: Least Squares
Date: 02/09/17 Time: 15:10
Sample (adjusted): 1978Q1 2016Q1
Included observations: 153 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-123.5372	25.36722	-4.869954	0.0000
YPD	0.117015	0.029152	4.013955	0.0001
D07Q2	-48.70958	13.45995	-3.618853	0.0004
CO(-1)	0.869717	0.030572	28.44857	0.0000
DNWFIN1*NWFIN	0.003788	0.001125	3.366341	0.0010
DNWFIN2*NWFIN	0.003599	0.001170	3.076424	0.0025
MCS	1.069052	0.284095	3.763006	0.0002

R-squared	0.999849	Mean dependent var	7288.274
Adjusted R-squared	0.999843	S.D. dependent var	2378.337
S.E. of regression	29.78827	Akaike info criterion	9.670779
Sum squared resid	129551.8	Schwarz criterion	9.809426
Log likelihood	-732.8146	Hannan-Quinn criter.	9.727100
F-statistic	161466.7	Durbin-Watson stat	1.776080
Prob(F-statistic)	0.000000		

Regression 4:

Dependent Variable: CO
Method: Least Squares
Date: 02/12/17 Time: 17:48
Sample (adjusted): 1978Q2 2016Q1
Included observations: 152 after adjustments
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-121.3717	32.08573	-3.782731	0.0002
MCS	1.293130	0.326878	3.956005	0.0001
DNWFIN1*NWFIN	0.004032	0.001374	2.935229	0.0039
DNWFIN2*NWFIN	0.003908	0.001425	2.743206	0.0069
YPD(-1)	0.088655	0.033142	2.674960	0.0083
CO(-1)	0.897961	0.034883	25.74241	0.0000
D07Q2	-40.78013	15.75336	-2.588663	0.0106
AR(1)	0.173755	0.084487	2.056600	0.0415

R-squared	0.999841	Mean dependent var	7311.001
Adjusted R-squared	0.999833	S.D. dependent var	2369.472
S.E. of regression	30.57575	Akaike info criterion	9.729488
Sum squared resid	134622.3	Schwarz criterion	9.888639
Log likelihood	-731.4411	Hannan-Quinn criter.	9.794141
F-statistic	129526.6	Durbin-Watson stat	1.997207
Prob(F-statistic)	0.000000		

Inverted AR Roots	.17

Regression 5:

Dependent Variable: CO
Method: Least Squares
Date: 02/14/17 Time: 15:26
Sample (adjusted): 1978Q4 2016Q1
Included observations: 150 after adjustments
Convergence achieved after 12 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-50.85410	57.37687	-0.886317	0.3770
CO(-1)	0.866385	0.037822	22.90697	0.0000
NWH(-1)	0.007838	0.003231	2.426140	0.0165
RS(-1)	-6.483058	2.352560	-2.755746	0.0066
MCS	1.730332	0.342828	5.047225	0.0000
YPD	0.104899	0.033007	3.178046	0.0018
AR(3)	0.211476	0.083869	2.521494	0.0128
AR(2)	0.238243	0.083196	2.863627	0.0048
AR(1)	0.142169	0.085259	1.667508	0.0976

R-squared	0.999853	Mean dependent var	7356.163
Adjusted R-squared	0.999845	S.D. dependent var	2352.383
S.E. of regression	29.27906	Akaike info criterion	9.649747
Sum squared resid	120874.2	Schwarz criterion	9.830385
Log likelihood	-714.7310	Hannan-Quinn criter.	9.723135
F-statistic	120208.2	Durbin-Watson stat	1.948679
Prob(F-statistic)	0.000000		

Inverted AR Roots	.79	-.32+.41i	-.32-.41i

Regression 6:

Dependent Variable: CO
Method: Least Squares
Date: 02/14/17 Time: 17:20
Sample (adjusted): 1978Q1 2016Q1
Included observations: 153 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-116.9644	33.09263	-3.534455	0.0005
CO(-1)	0.886679	0.033921	26.13927	0.0000
MCS	1.878279	0.202883	9.257944	0.0000
NWH	0.004493	0.001792	2.506990	0.0133
YPD	0.096833	0.029969	3.231097	0.0015
RS(-1)	-3.267037	1.429153	-2.285995	0.0237

R-squared	0.999838	Mean dependent var	7288.274
Adjusted R-squared	0.999832	S.D. dependent var	2378.337
S.E. of regression	30.81106	Akaike info criterion	9.732050
Sum squared resid	139550.2	Schwarz criterion	9.850891
Log likelihood	-738.5019	Hannan-Quinn criter.	9.780326
F-statistic	181107.6	Durbin-Watson stat	1.637218
Prob(F-statistic)	0.000000		

Regression 7:

Dependent Variable: CO
Method: Least Squares
Date: 02/15/17 Time: 13:26
Sample (adjusted): 1978Q2 2016Q1
Included observations: 152 after adjustments
Convergence achieved after 5 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-67.45314	42.79098	-1.576340	0.1171
CO(-1)	0.870407	0.036489	23.85416	0.0000
MCS	1.790956	0.234221	7.646435	0.0000
NWH	0.004693	0.002033	2.308390	0.0224
YPD	0.104995	0.031937	3.287599	0.0013
RS(-1)	-4.538584	1.704931	-2.662034	0.0087
D97Q4	28.12496	13.82288	2.034667	0.0437
AR(1)	0.155593	0.084525	1.840800	0.0677

R-squared	0.999845	Mean dependent var	7311.001
Adjusted R-squared	0.999838	S.D. dependent var	2369.472
S.E. of regression	30.16531	Akaike info criterion	9.702458
Sum squared resid	131032.2	Schwarz criterion	9.861610
Log likelihood	-729.3868	Hannan-Quinn criter.	9.767111
F-statistic	133075.9	Durbin-Watson stat	2.033772
Prob(F-statistic)	0.000000		

Inverted AR Roots	.16

Regression 8:

Dependent Variable: CO
Method: Least Squares
Date: 02/14/17 Time: 18:02
Sample (adjusted): 1978Q2 2016Q1
Included observations: 152 after adjustments
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-89.76845	39.35620	-2.280922	0.0240
CO(-1)	0.886372	0.036728	24.13354	0.0000
MCS	1.575526	0.261732	6.019610	0.0000
DNWH1*NWH	0.005409	0.002083	2.596860	0.0104
DNWH2*NWH	0.004282	0.002100	2.038458	0.0433
YPD	0.095995	0.032340	2.968334	0.0035
RS(-1)	-3.385362	1.705000	-1.985549	0.0490
AR(1)	0.178973	0.084991	2.105775	0.0370

R-squared	0.999847	Mean dependent var	7311.001
Adjusted R-squared	0.999839	S.D. dependent var	2369.472
S.E. of regression	30.03284	Akaike info criterion	9.693656
Sum squared resid	129883.9	Schwarz criterion	9.852808
Log likelihood	-728.7179	Hannan-Quinn criter.	9.758309
F-statistic	134252.6	Durbin-Watson stat	2.035504
Prob(F-statistic)	0.000000		

Inverted AR Roots	.18

Regression 9:

Dependent Variable: CO
Method: Least Squares
Date: 02/15/17 Time: 16:17
Sample (adjusted): 1977Q3 2015Q4
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.85163	37.87967	0.444873	0.6571
CO(-1)	0.814176	0.029590	27.51568	0.0000
DCBI1*CBI	0.454216	0.151762	2.992947	0.0033
DCBI2*CBI	0.435393	0.162712	2.675860	0.0083
YPD	0.144505	0.027633	5.229526	0.0000
DNW1*NW	0.005676	0.001238	4.586426	0.0000
DNW2*NW	0.005763	0.001318	4.374035	0.0000
D07Q2	-41.74653	11.48761	-3.634049	0.0004
RS(-1)	-6.382114	1.344883	-4.745479	0.0000
SP500(-1)	-0.007102	0.020268	-0.350384	0.7266

R-squared	0.999866	Mean dependent var	7216.284
Adjusted R-squared	0.999857	S.D. dependent var	2380.387
S.E. of regression	28.43020	Akaike info criterion	9.595512
Sum squared resid	116391.8	Schwarz criterion	9.792717
Log likelihood	-728.8544	Hannan-Quinn criter.	9.675616
F-statistic	119158.7	Durbin-Watson stat	1.905748
Prob(F-statistic)	0.000000		

Regression 10:

Dependent Variable: CO
Method: Least Squares
Date: 02/15/17 Time: 16:37
Sample (adjusted): 1978Q2 2015Q4
Included observations: 151 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	162.1196	40.25617	4.027199	0.0001
CO(-1)	0.860718	0.029499	29.17803	0.0000
D97Q4	39.37217	12.19197	3.229352	0.0015
DMCS1*MCS	0.483157	0.177424	2.723175	0.0073
DMCS2*MCS	0.464855	0.181501	2.561167	0.0115
YPD	0.074025	0.026060	2.840599	0.0052
DNW1*NW	0.007404	0.001072	6.907086	0.0000
DNW2*NW	0.007469	0.001140	6.551542	0.0000
RS(-1)	-8.505822	1.561748	-5.446348	0.0000

R-squared	0.999840	Mean dependent var	7284.152
Adjusted R-squared	0.999831	S.D. dependent var	2354.045
S.E. of regression	30.61735	Akaike info criterion	9.738763
Sum squared resid	133113.9	Schwarz criterion	9.918601
Log likelihood	-726.2766	Hannan-Quinn criter.	9.811823
F-statistic	110822.0	Durbin-Watson stat	1.721900
Prob(F-statistic)	0.000000		

Regressions in First-Difference

Regression 11:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/14/17 Time: 17:44
Sample (adjusted): 1978Q2 2015Q4
Included observations: 151 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.96676	4.525757	7.505209	0.0000
D(YPD)	0.107115	0.038350	2.793093	0.0059
D(NW)	0.010131	0.003071	3.299071	0.0012
D(MCS)	1.483060	0.608861	2.435794	0.0161
D97Q4	13.55159	6.077624	2.229752	0.0273

R-squared	0.202462	Mean dependent var	49.57285
Adjusted R-squared	0.180611	S.D. dependent var	40.73187
S.E. of regression	36.87052	Akaike info criterion	10.08525
Sum squared resid	198477.6	Schwarz criterion	10.18516
Log likelihood	-756.4367	Hannan-Quinn criter.	10.12584
F-statistic	9.265827	Durbin-Watson stat	1.586194
Prob(F-statistic)	0.000001		

Regression 12:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/14/17 Time: 17:41
Sample (adjusted): 1978Q2 2016Q1
Included observations: 152 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.31293	4.054625	8.216031	0.0000
D(YPD)	0.079703	0.034910	2.283134	0.0239
D(NWH(-1))	0.067566	0.009957	6.786068	0.0000
D(MCS)	1.498532	0.549014	2.729497	0.0071
D97Q4	10.73559	5.481005	1.958689	0.0520

R-squared	0.346959	Mean dependent var	49.54868
Adjusted R-squared	0.329190	S.D. dependent var	40.59786
S.E. of regression	33.25088	Akaike info criterion	9.878381
Sum squared resid	162526.3	Schwarz criterion	9.977851
Log likelihood	-745.7569	Hannan-Quinn criter.	9.918789
F-statistic	19.52521	Durbin-Watson stat	1.671912
Prob(F-statistic)	0.000000		

Regression 13:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/14/17 Time: 18:24
Sample (adjusted): 1978Q2 2015Q4
Included observations: 151 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	42.96824	4.082123	10.52595	0.0000
D(YPD)	0.116385	0.038179	3.048419	0.0027
D(NW)	0.010434	0.003078	3.390071	0.0009
D(MCS)	1.403602	0.609573	2.302597	0.0227
D07Q2	-14.32436	7.290689	-1.964747	0.0513

R-squared	0.196546	Mean dependent var	49.57285
Adjusted R-squared	0.174534	S.D. dependent var	40.73187
S.E. of regression	37.00701	Akaike info criterion	10.09264
Sum squared resid	199949.8	Schwarz criterion	10.19255
Log likelihood	-756.9946	Hannan-Quinn criter.	10.13323
F-statistic	8.928866	Durbin-Watson stat	1.606141
Prob(F-statistic)	0.000002		

Regression 14:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/14/17 Time: 18:25
Sample (adjusted): 1978Q2 2016Q1
Included observations: 152 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	38.61919	3.947744	9.782598	0.0000
D(YPD)	0.106626	0.035818	2.976928	0.0034
D(NWH)	0.061042	0.010695	5.707730	0.0000
D(MCS)	0.976381	0.576292	1.694248	0.0923
D07Q2	-4.239935	6.981048	-0.607349	0.5446

R-squared	0.290458	Mean dependent var	49.54868
Adjusted R-squared	0.271151	S.D. dependent var	40.59786
S.E. of regression	34.65947	Akaike info criterion	9.961361
Sum squared resid	176588.0	Schwarz criterion	10.06083
Log likelihood	-752.0634	Hannan-Quinn criter.	10.00177
F-statistic	15.04400	Durbin-Watson stat	1.672203
Prob(F-statistic)	0.000000		

Regression 15:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/15/17 Time: 13:08
Sample (adjusted): 1977Q3 2016Q1
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	39.69990	3.640501	10.90506	0.0000
D(CBI)	0.785813	0.369346	2.127579	0.0350
D(YPD)	0.123282	0.037601	3.278640	0.0013
D(NWFIN)	0.013568	0.003496	3.881357	0.0002

R-squared	0.218876	Mean dependent var	49.32581
Adjusted R-squared	0.203357	S.D. dependent var	40.28103
S.E. of regression	35.95278	Akaike info criterion	10.02776
Sum squared resid	195182.9	Schwarz criterion	10.10630
Log likelihood	-773.1512	Hannan-Quinn criter.	10.05966
F-statistic	14.10374	Durbin-Watson stat	1.584403
Prob(F-statistic)	0.000000		

Regression 16:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/15/17 Time: 13:08
Sample (adjusted): 1978Q2 2015Q4
Included observations: 151 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	49.51638	5.767557	8.585329	0.0000
D(MCS)	1.295879	0.608612	2.129235	0.0349
D(NW)	0.009415	0.003105	3.031648	0.0029
D(YPD)	0.110922	0.038172	2.905878	0.0042
RS(-1)	-1.876380	0.844336	-2.222315	0.0278

R-squared	0.202287	Mean dependent var	49.57285
Adjusted R-squared	0.180432	S.D. dependent var	40.73187
S.E. of regression	36.87457	Akaike info criterion	10.08547
Sum squared resid	198521.1	Schwarz criterion	10.18538
Log likelihood	-756.4532	Hannan-Quinn criter.	10.12606
F-statistic	9.255789	Durbin-Watson stat	1.560422
Prob(F-statistic)	0.000001		

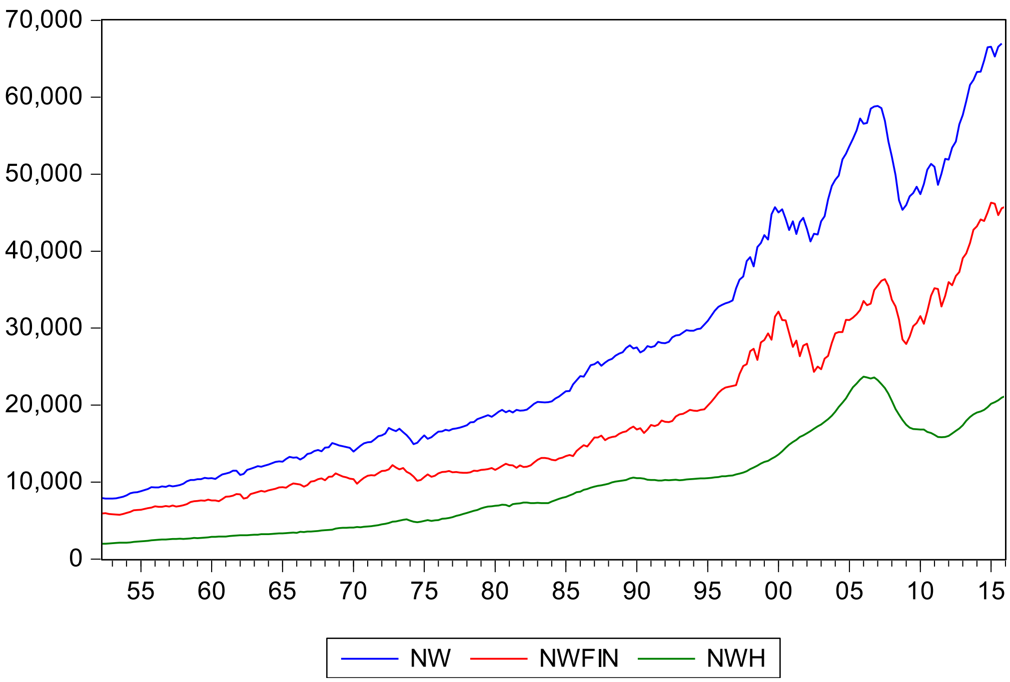
Regression 17:

Dependent Variable: D(CO)
Method: Least Squares
Date: 02/15/17 Time: 16:22
Sample (adjusted): 1977Q2 2016Q1
Included observations: 156 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-18.20712	10.97490	-1.658978	0.0992
D(CO(-1))	0.209832	0.078959	2.657496	0.0087
D97Q4	10.34818	5.323903	1.943721	0.0538
D(NWFIN)	0.013458	0.003027	4.445978	0.0000
D(YPD)	0.074843	0.033640	2.224852	0.0276
CBI	0.494347	0.128778	3.838741	0.0002

R-squared	0.393769	Mean dependent var	49.14038
Adjusted R-squared	0.373561	S.D. dependent var	40.21762
S.E. of regression	31.83139	Akaike info criterion	9.796485
Sum squared resid	151985.6	Schwarz criterion	9.913788
Log likelihood	-758.1259	Hannan-Quinn criter.	9.844129
F-statistic	19.48609	Durbin-Watson stat	2.216431
Prob(F-statistic)	0.000000		

Graph of Wealth Variables:



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