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The Impact Of Interest Rates Vs. Economic Growth On The Performance Of Commercial Banks - An Empirical Analysis Of Commercial Banks In The U.s.

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THE IMPACT OF INTEREST RATES VS. ECONOMIC GROWTH ON THE PERFORMANCE OF COMMERCIAL BANKS – AN EMPIRICAL ANALYSIS OF COMMERCIAL BANKS IN THE U.S.

by

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This thesis, submitted by Justin Pavek in partial fulfillment of the requirements for the Degree of Master of Science in Applied Economics from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

Dr. Grant McGimpsey
Dean of the School of Graduate Studies

April 27, 2017

Date

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Justin Pavek
March 21, 2017

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ABSTRACT

As the Economy continues to recover from the 'Great Recession', the Fed is taking a very cautious approach to increasing interest rates; which have been at historical lows the past several years. If interest rates are increased too quickly, or by the wrong amount, there may be negative ramifications on economic activity. With the slow recovery following the 'Great Recession', commercial banks in the U.S. have struggled to return bank performance to pre-recession levels, as the low interest rate environment has had a negative impact on profitability and overall bank performance (as have changes in regulation). It cannot be argued that commercial banks will receive a higher return on investment when interest rates are high; however, interest rates and economic activity are negatively correlated. So, which is more beneficial to maximizing bank performance in the current market environment: increasing interest rates or stable economic growth? As shown with my econometric model, commercial banks in the U.S. have historically benefited greater from economic growth, in the current market environment, as opposed to an increase in interest rates. I use time series data on all commercial banks in the U.S. (consolidated), and an ARIMA model with additional independent variables, to support my conclusions. I also ran separate regressions based on bank size, and it is found that the performance of 'large' commercial banks (>$1B in total assets) benefits greater from economic activity (growth), when compared to smaller more regionalized banks. To truly maximize bank performance in the long run, interest rates should be determined based on a supply/demand equilibrium; which in theory should support stable economic activity.

CHAPTER I

INTRODUCTION

The years 2007-2009 will likely go down in history as the most consequential financial crises the U.S., and global economy, experienced since the 'Great Depression'; this event is known as the 'Great Recession'. To mitigate the impacts of the 'Great Recession', the U.S. government implemented the Troubled Asset Relief Program (TARP) to help stabilize the financial system; in total $475B in funds were injected into the financial system to restart growth, and prevent foreclosure when avoidable. Additionally, the Fed used monetary easing to help improve conditions in the credit market through Large-Scale Asset Purchases (LSAP's) whereby treasury securities were purchased to manage the supply of bank reserves in an effort to maintain market conditions consistent with the fed funds target rate (which is the interest rate depository institutions charge to lend reserves to other depository institutions); to support increased economic activity, the fed funds target rate was reduced to historical lows, causing interest rates to fall significantly.

Since the 'Great Recession', the U.S. Economy has experienced relatively adequate economic growth, which has improved and stabilized in recent periods; causing the Fed to begin changing its stance on monetary policy. My thesis takes an empirical approach to analyzing the difference between the impact interest rates and economic activity have on the current performance of commercial banks (in the U.S.); specifically, I am able to show that the performance of commercial banks in the U.S. has historically benefited greater from economic growth, as opposed to an increase in interest rates. The existing literature lacks discussion around the difference between the impact interest rates and economic activity (negatively correlated over time) have on the performance of commercial banks, specifically in the U.S. Furthermore, updated research on estimating financial performance with an economic model is limited following the 'Great Recession' which captures a significant event within the data. My empirical research focuses on three hypotheses (with variation expected based on commercial bank 'Size'):

H1 – Banks should not be so eager to accept an increase in interest rates from the Fed as the impact on economic activity has historically negatively impacted future bank performance; this does not suggest that banks should not increase rates consistent with the Fed, rather banks should be more concerned about stable economic activity as opposed seeing the Fed increase rates.

H2 – Economic performance plays a more significant role in the current performance of commercial banks, when compared to increasing interest rate levels – Re-affirmation of conclusion made by Glen and Mondragon-Velez (2011) for banks in developing countries.

H3 – Based on historical data one could develop an equilibrium between interest rates and economic activity to maximize bank profitability; this could be done in applying 'The Natural Rate of Interest Theory' (discussed below) whereby economic activity would be stabilized.

The results of my empirical research allow me to conclude the following:

1. There is clearly a negative correlation between interest rates and economic activity. As intended by monetary policy, interest rates are increased to keep inflation in check; and if rates go up too fast or at the wrong time, economic activity will slow/contract. The data shows that there is a negative correlation between increasing the fed funds rate and future economic activity (GDP growth).

2. Bank performance (as measured by ROA) benefits greater from consistent economic growth, as opposed to increasing interest rates. I do not suggest that higher interest rates do not provide a higher return; rather I show that current bank performance is more likely to benefit from consistent economic growth going forward, as a change in interest rates at the wrong time or by the wrong amount could send economic activity in the opposite direction.

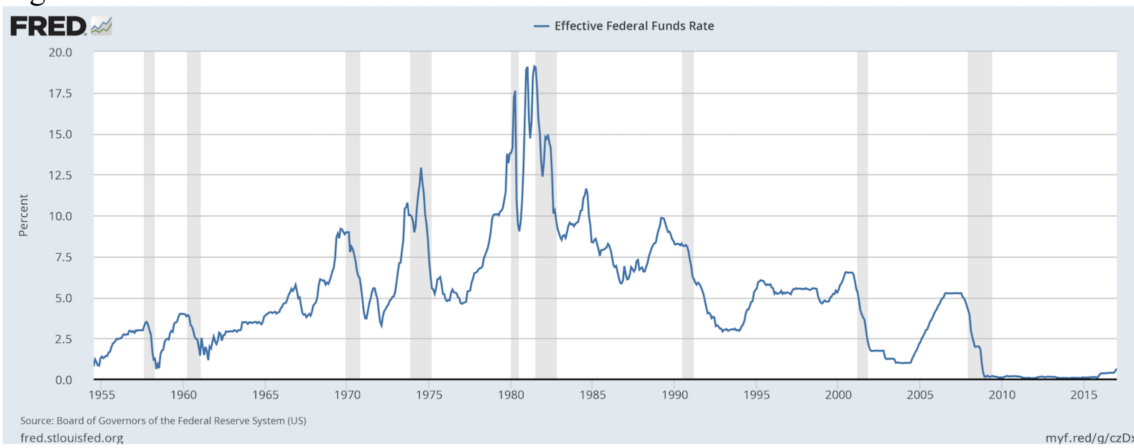
3. In order to maximize bank profitability, we first need to stabilize economic activity; reducing the impact changing interest rates has on economic activity. If this could be done, an equilibrium interest rate could prove to maximize bank profitability in the long run. I suggest that the use of a 'Natural Interest Rate' could be this equilibrium rate.

Background:

The fed funds target rate was reduced to a historical low of 0-25 basis points (bps), where 100 bps is equal to 1%, on December 16, 2008. This target rate was maintained until December 16, 2015, when the Fed made the decision to increase the target rate to 25-50 bps; one year later, on December 14, 2016, the target rate was again increased by 25 bps, to 50-75bps. In a press release from the Federal Reserve, dated February 1, 2017, it was communicated that the fed funds target rate would be maintained at the current level (50-75bps); the Federal Open Market Committee (FOMC) noted that while there has been improvement in the sentiment of consumers and businesses, household spending remained moderate and business fixed investments were 'soft'.

To put the volatility and past levels into perspective, the graph below shows the historical fed funds target rate. It should be clarified that the target rate was changed to a target range during the 'Great Recession'; it should also be noted that periods shaded in gray indicate a recession. In almost all instances where the fed funds rate is on an increasing trend, it reaches a peak and is followed by a drop in the target rate and subsequently a recession. This would explain why the FOMC is taking such a cautious approach to increasing the rate now; the goal is to maintain inflation of 2% with consistent economic growth, however, achieving this is not as simple as it sounds.

Figure 1: Historical Fed Funds Rate with Recession Indications



This could lead one to ask: 'Why does this all matter? These are historical points and we need to focus on the future.' While this is true, we also need to focus on the mistakes made in the past, to try and avoid repeating history. While the Fed is not all to blame when a recession occurs, as there are many different factors that go into each instance, changes to monetary policy have adverse implications for the health of the economy as the general purpose of monetary policy in the first place is to control inflation and keep economic growth in check. It cannot be argued that interest rates can only go up from here, as we are still sitting at historically low levels (unless one were to believe in a negative interest rate environment); what can be argued is the timing of these increases to ensure we do not repeat history over and over again.

The FOMC meets eight times throughout the year, and there is speculation by many that there will be additional increases to the target rate through the remainder of FY '17 (one of which is anticipated, by the markets, to occur within days of me writing this statement). Commercial banks have been eagerly awaiting increases in the fed fund target rate, as this directly impacts interest banks charge to customers; by increasing interest rates, banks can capture a larger profit on their depository funded debt (among other things) thus improving financial performance. However, the purpose of controlling the target rate is to support economic stability, as increasing the rate too quickly or at the wrong time can send the economy in the other direction (as we have seen in the past). Specifically, the Fed will implement monetary easing by reducing interest rates and/or increasing the money supply, to encourage economic growth; which was done in response to the 'Great Recession'. Conversely, the Fed will tighten monetary policy by increasing interest rates and/or reducing the money supply to slow economic growth and control inflation. As such, by increasing the target rate it would appear the Fed is changing its stance on monetary policy, to maintain a stable economy. However, if rates are increased too quickly or at the wrong time this could lead to a slowdown in economic growth as the result of monetary tightening.

While the performance of commercial banks is directly impacted by interest rate levels, economic activity also materially impacts profitability, and as discussed in the literature (Glen and Mondragon-Velez (2011)) has a more significant impact to bank performance; economic growth leads to increased investment which leads to increased financing needs, thus allowing banks to grow their lending portfolios, leading to stronger performance. However, if economic growth slows there will be a decline in investment and the lending portfolios of banks will contract, negatively impacting performance. So, the question is, which is more beneficial to the performance of a commercial bank? Higher interest rates, or higher (stable) economic growth? Obviously the two cannot be maintained at a consistent 'high' level when applying monetary policy, but from the view of a commercial bank which should be more appealing? This is the question I intend to answer through my empirical research. Specifically, I developed a model to estimate bank performance, using internal and external factors, providing insight to the debate around current interest rate levels from the viewpoint of commercial banks.

As supported by existing literature (Glen and Mondragon-Velez (2011)), the performance of financial institutions (commercial banks) tends to follow a pattern like a business cycle. During periods of economic growth (low interest rates) bank performance is strong, however as the economy begins to slow (interest rates increase) the performance of financial institutions begins to decline; this is the result of both a contraction in lending portfolios and increased credit risk, among other things. Furthermore, during periods of economic growth, banks tend to make riskier investments to capture additional profit; however, as the economy moves in the other direction these risky investments can lead to losses for banks as debtors experience financial struggles in a weakening economy, limiting their ability to repay debt (increasing defaults).

An article written for the February 9, 2017 issue of the Wall Street Journal, titled 'Companies Race to Refinance Debt' notes that the anticipation of a continued increase in interest rates is fueling perhaps the largest corporate refinance boom in many years. Specifically, businesses refinanced ~$100B in loans during the month of January '17, which per the article is the largest monthly total in nearly a decade; this follows just one month after the Fed announced its decision to increase the fed funds target rate to 50-75bps. This is being done by businesses to save on interest expense, as rates are expected to continue increasing. If businesses are making the decision to refinance debt, it could also be assumed that they will likely be cutting back on future investments thus reducing future lending needs.

Natural Rate of Interest:

An equilibrium interest rate to maximize bank performance is centralized around 'The Natural Rate of Interest' originated by Knut Wicksell, a Swedish Economist. The following discussion is based on an article written by Rosen and Ravier (2014) titled the 'Natural Rate of Interest Rule'. While 'The Natural Rate of Interest Theory' is used to support an alternative method to monetary policy, to ensure economic stability, based on my empirical results a similar method would also maximize bank performance in the long run.

The Federal Reserve was created on December 23, 1913 as a response to financial instability; their ultimate objective, to utilize monetary policy to maximize employment, abate inflation and control long-term interest rates. As an alternative to monetary policy, Wicksell's monetary equilibrium doctrine (Wicksell, 1898) would theoretically result in inflation-free economic stability allowing for sustained growth; something the Federal Reserve has not been able to do successfully since their inception. In following Wicksell's theory, interest rates for loanable funds would be determined based on a 'Natural Interest Rate'; in applying such a method the money supply, in theory, would be in equilibrium, whereby supply and demand are equal.

‘The Natural Rate of Interest’ is defined by Wicksell as an interest rate that is ‘Commodity-Price-Neutral’; rather than being determined by financial markets, the interest rate is set by means of a supply/demand equilibrium. Thus, long term prices would be stabilized and savings would be equal to investment; i.e. money supply would be equal to money demand. To validate this theory, the authors discuss historical data which pre-dates central banking, and supports the idea of ‘free banking’; however, a truly ‘free banking’ environment never really existed in the U.S. prior to the inception of the Federal Reserve. Nonetheless, as evidenced by the decisions made by the Federal Reserve in the early 2000’s, the use of monetary policy can be truly toxic to the stability of our economy at the national level, and even on a global scale. Rather than drastically dropping interest rates in the early 2000’s in response to a recession, it is argued that using a ‘Natural Rate of Interest’ would have reduced the impact resulting from the ‘Housing Bubble’ (Rosen and Ravier (2014)); as we would not have experienced the run up in home loans, which led to a significant increase in home values and further financing beyond true values, thus creating a bubble.

To be clear, the purpose of my research is not to come up with a ‘Natural Rate of Interest’, rather I use this theory to show that decisions made by the Federal Reserve are proven to create instability in the financial system, and there are possibly alternative theories that could be implemented to create economic stability. Furthermore, this theory suggests that interest rates could be determined by a supply/demand equilibrium to reduce volatility in economic activity; thus, eliminating one of the factors that materially impacts bank performance. As discussed in my review of the literature, Glen and Mondragon-

Velez (2011) find that economic growth is the primary driver of loan portfolio performance, while interest rates have second-order effects. As such if interest rates were determined based on an equilibrium (natural method), resulting in economic stability, the impacts found in the existing data from volatility in economic activity could be greatly reduced.

The remainder of this paper is organized as follows: first, I provide a review of the existing literature, which also discusses how my research adds additional value (*Literature Review*); second, the variable selection process is explained including stylized facts and a description of the data considered in my analysis (*Stylized Facts – Data Summary*); third, the econometric methodology used to empirically analyze my topic is discussed and justified (*Methodology*); this is subsequently followed by a detailed discussion around the results (*Results*); lastly, this paper concludes by revisiting my hypotheses and providing closing comments to support my conclusions, which includes guidance to further expand on my work.

Chapter II

LITERATURE REVIEW

In the wake of the ‘Great Recession’ economists have had the opportunity to conduct new empirical research, testing existing theories and prior research, around the impact the state of the economy has on the performance of financial institutions; or conversely, how financial institutions can impact the state of the economy. As one would suspect, the state of the economy plays a crucial role in the performance of financial institutions; however as evidenced by the ‘Great Recession’, decisions made by financial institutions can also impact the state of the economy (which would intensify the impact on financial institution performance). This allows one to conclude that there is circular causality (two-way) between the performance of financial institutions and the state of the economy; i.e. variable X causes variable Y, and Y causes X, which causes more Y.

Simply put, the timeline of the ‘Great Recession’ would support this theory. While the economy was doing well, financial institutions could grow their portfolios through multiple channels; and as financial portfolios grew, other sectors of the economy benefited (e.g. the housing market). However, much of this growth included risky behavior which led to the collapse of the financial industry on a global scale, and drove the economy into a recession. As the economy collapsed, financial institutions suffered significant losses; and without bailouts from the United States government, we could still be stuck in a deep recession (or depression) today. Whether this was the right call or not is beyond the scope of this paper, and warrants much more debate.

As previously discussed, my research takes an empirical approach to analyzing and interpreting the role interest rates and economic activity play in the performance of commercial banks; specifically, in the U.S. I developed a model to empirically describe commercial bank performance (at the aggregate level), with my independent variables including an interest rate variable as well as an economic activity variable (as described in the *Stylized Facts – Data Summary*); the purpose of my research is to correlate the state of the economy (measured by economic activity and interest rate levels) and the performance of commercial banks (acknowledging the fact that there is circular causality). The existing literature on this topic varies widely in scope, and includes both new and old research.

As the macro economy goes through business cycles (i.e. booms and busts), the decisions made by commercial banks, and ultimately their performance, typically follows a similar pattern. Glen and Mondragon-Velez (2011) studied the effects of business cycles on the performance of commercial banks in developing countries during the period 1996-2008. They found that economic growth is the primary driver of loan portfolio performance, while interest rates have second-order effects; the relationship between credit quality (loan loss provisioning) and economic growth is also found to be non-linear under extreme situations; such as a recession or economic boom. The authors also make the same notion that the relationship between business cycles and bank performance implies a series of two-way causality; as I had previously mentioned.

Bucher, Dietrich and Hauck (2013) take a different approach and study the impact business cycles have on internal and external funding sources of banks; concluding that macroeconomic policy plays a crucial role in the access to funding and stability of the financial system. Their research includes discussion of the financial instability hypothesis of Minsky (1986), which states that during periods of economic growth (prosperity), speculation and increased borrowing may push the economy to the edge; leading to a financial crisis (such as the 'Great Recession'). Bolt et al. (2012) examines bank profitability in 17 countries during the period 1979-2007 and concludes that bank profits behave in a pro-cyclical pattern, especially during deep recessions. Bolt et al. (2012) point out in their research that past lending practices should also be taken into consideration when analyzing the profitability of a loan portfolio (Net Interest Income); i.e. long term interest rates in prior years are found to be important determinants of bank performance, implying that there is a lagged effect.

As indicated by the existing literature, it is conceivable that the state of the economy plays a crucial role in the performance of commercial banks. The same can be said about interest rates, however as noted above this has been found to have second-order effects to economic activity. Stepping aside from bank performance for a moment, the research conducted by Dotsey (1998) analyzes the predictive power of the yield curve for economic activity; concluding that the spread between different indexes includes useful predictive power and that this can be considered a leading indicator of economic activity. This would support my comments around the fact that interest rates are negatively correlated with economic activity. The study conducted by Dotsey (1998) was an expansion on a much larger empirical analysis completed by Stock and Watson (1989) which attempted to predict future economic activity based on a large series of macro-economic indicators, one of which was the spread between the ten year and one year US Treasury Bond.

Taking yet another approach, Delis and Kouretas (2011) studied the Euro Banking industry during the period 2001-2008 to expand on existing literature that viewed the low interest rate environment during the early 2000's as a leading factor that caused banks to partake in more risky behavior in search for a higher return. They conclude that low interest rates do in fact increase bank risk taking; this research is an expansion on that conducted by Keeley (1990) and Dell' Ariccia and Marquez (2006) which supported the fact that 'certain exogenous shocks that lead to lower informational asymmetries, trigger intensified competition and credit expansion, and create incentives for banks to search for higher yields in more risky projects' (Delis and Kouretas 2011).

One thing that came out of the 'Great Recession' was the Dodd Frank Act, which greatly changed the regulation of the banking industry. It was expected that this tightening in bank regulation would limit commercial banks' ability to take more risky positions during periods of low interest rates; which would limit bank performance. Gropper, Jahera Jr. and Park (2015) study the impact political power, economic freedom and Congress have on the performance of banks. They conclude that bank performance and economic freedom (which factors in bank regulation) are positively related; less regulation means more economic freedom. The authors also re-confirm prior research conducted by Gropper et al. (2013), concluding that political connections and bank performance are positively correlated; however, this correlation is found to be less significant when there is more economic freedom.

In addition to regulatory control, the government can also impact bank profitability through monetary policy. Mamatzakis and Bermpei (2016) studied the relationship between unconventional monetary policy (UMP) and the performance of U.S commercial banks; concluding that UMP has a negative relationship with bank performance. However, this negative relationship is mitigated for banks in the sample that had high levels of asset diversification and low deposit funding. The impact UMP has on the performance of commercial banks is explained in existing literature through two channels: 'Portfolio Balance' and 'Signaling'. The 'Portfolio Balance' channel (Gagnon et al., 2011; Joyce et al., 2012) uses the notion that the Fed's large scale asset purchases (monetary policy method) affect long term interest rates as the amount of long term assets held by the private sector are reduced. While the 'Signaling' channel assumes that monetary policy may signal to the market that the Fed has changed its stance on policy, which would impact investors' expectations on short term interest rates. This in turn would affect long term bond yields through the expected short term rate, which is a function of long term interest rates (Bauer and Rudebusch, 2013). This volatility in interest rates impacts a bank's net interest income, and overall performance.

Jimenez, et al. (2012) took a different approach and looked at the impact monetary policy has on credit supply, for banks in Spain; more specifically they ask the question 'does the stance of monetary policy and business cycle fluctuations affect credit supply?'

They conclude that higher short term interest rates (lower GDP growth) result in reduced loan granting, and this impact is stronger for banks with low levels of capital and liquidity. This further supports my comments that increasing interest rates (reduced economic growth) would result in a contraction to loan portfolios, negatively impacting future bank performance. Flannery (1981) further supports this by disproving the assumption that banks may borrow short and lend long which would negatively impact bank performance in an increasing rate environment. It is found that the general practice of most commercial banks is to 'match fund' their loans, or utilize derivative financial instruments, to reduce overall interest rate risk; i.e. banks hedge themselves against interest rate volatility through 'match funding' or the use of synthetic securities (financial derivatives).

Up to this point, I have discussed existing literature that covers a wide spectrum of avenues to analyzing the performance of commercial banks, as well as how different variables that can explain bank performance interact with each other. A recent MSAE graduate from the University of North Dakota completed their thesis on a similar topic, titled 'Bank Efficiency Ratios – Can they be used to reliably predict future bank performance?' (Loebach, 2015). In his review of the literature, Loebach sites several of the same studies I have discussed herein; the selection of variables for my model to explain bank profitability uses a similar approach to Loebach (2015) (see *Stylized Facts – Data Summary)* however the intent of our research differs greatly. Loebach concludes that while the efficiency ratio is a statistically significant predictor of bank performance, a better indicator is a bank's current return on average assets (ROAA). As such rather than focusing on expense reductions to improve the efficiency ratio, it is suggested that banks should instead focus on revenue enhancement.

Existing literature most closely related to my topic is that completed by Athanasoglou, Brissmiss and Delis (2008). The purpose of their study was to analyze bank-specific, industry-specific, and macro-economic determinants of bank profitability; for a panel of Greek banks during the period of 1985-2001. Their research incorporates the traditional structure-conduct-performance (SCP) hypothesis, which states that increased market power (economies of scale) leads to monopoly type profits; however, no evidence is found to support this theory. All the bank-specific variables used, with the exception of bank size, are found to be statistically significant in the model; as such my variable selection is largely based upon their research (see *Stylized Facts – Data Summary*). The authors are also able to conclude that business cycles have a positive effect on bank performance, however, this effect is found to be asymmetric and only significant at the extreme points in a business cycle (peak or trough).

In contrast to Athanasoglou et al. (2008), Smirlock (1985) and Pasiouras and Kosmidou (2007) can show that size is statistically significant (and positive) when trying to explain bank profitability. As such to incorporate size into my empirical research I have broken the banking industry down by size (three sub-groups), as detailed below in the *Methodology* section.

While there is an abundance of supplementary literature for this topic, this literature review has provided a solid foundation for what has been completed thus far; and is inclusive of those articles that most closely relate to the purpose of my research. To build on this, I am adding to the existing literature in the following ways: First, I will be focusing on banks in the U.S. pre, during and post 'Great Recession'; I was not able to find any existing literature that had taken this approach, to date. Second, my empirical research takes a close look at the comparison of how interest rates and economic activity impact bank performance; I was not able to find a study focusing on this comparison with current U.S. data. Third, my study on bank performance is focused on the aggregate level, which provides guidance to the commercial banking industry; since we cannot change economic activity or interest rates for each individual bank. Lastly, in adding to the literature I will be attempting to support the fact that we could potentially set an equilibrium interest rate to maximize bank profitability; this would be an expansion on the 'Natural Rate of Interest Theory', through an empirical approach.

CHAPTER III

STYLIZED FACTS - DATA SUMMARY

The time-series dataset used for my econometric analysis is compiled from various sources. Specifically, U.S. commercial bank data was gathered from Call Reports through the FDIC website; every commercial bank in the U.S. that is insured by the FDIC is required to submit quarterly Call Reports under their regulation requirements. The sample includes all commercial banks (on a consolidated basis) in the U.S., that are regulated by the FDIC, for the period 1992-2016; it should be noted that the dataset only includes annual data (fourth quarter) up until 2001. By measuring on a quarterly basis, as opposed to YTD, I can effectively capture the variance in bank performance from quarter to quarter, whereas YTD would not work appropriately as it would be a compilation of performance throughout the year.

In choosing to stick with consolidated bank data my results show the impact interest rates and economic growth have on the entire commercial banking system in the U.S., which is the intent of my research; I am not trying to show the impact on an individual basis. The macro-economic data was gathered from the Federal Reserve Economic Data (FRED) – St. Louis website, for the same periods noted above. Lastly, the Economic Freedom Summary Index is from freetheworld.com; this same index was used in prior research conducted by Gropper, Jahera Jr. and Park (2015). As previously noted, the selection of the dependent and independent variables is based primarily on prior research that attempted to explain bank performance. The most influential paper on the selection of variables used in my model is Athanasoglou et al. (2008).

Table 1: Variable List

Variable	Description	Expected Coefficient Sign
Dependent Variables:		
Return on Assets (ROA)	*Return on Avg. Earning Assets measured in bps*	
Return on Equity (ROE)	*Return on Equity measured in bps*	
Net Interest Margin (NIM)	*Net Interest Margin measured in bps*	
Independent Variables:		
Bank Specific Variables		
Capital Ratio (Cap)	*Equity to Total Assets Ratio measured in bps*	?
Credit Risk Ratio (Cred)	*Loss Allowance to Total Loans measured in bps*	Depends
Efficiency Ratio (Effic)	*Bank Efficiency Ratio measured in bps*	-
Liquidity Ratio (Liq)	*Bank liquidity Risk measured in bps*	?
Loan Deposit Ratio (LDR)	*Total Loans to Total Deposits measured in bps*	+
Macro Economic Variables		
GDP Growth Quarterly (GDP)	*Quarterly GDP Growth measured in bps*	+
Inflation Quarterly (Inf)	*Quarterly Inflation measured in bps*	?
Effective Fed Funds Rate (FFR)	*Effective Fed Funds Rate measured in bps*	+
1 Mo. LIBOR (LIBOR)	*1 Mo. London InterBank Offered Rate measured in bps*	+
Prime Rate (PR)	*Fed Prime Rate measured in bps*	+
Unemployment Rate (Unemp)	*National Unemployment Rate (Seasonally Adj.) measured in bps*	-
Dummy Variables		
Recession Indicator (RecDum)	*= 1 recession, = 0 no recession*	-
Senate (Sen)	*= 1 Republican Control, = 0 Democrat Control*	+
House (Hou)	*= 1 Republican Control, = 0 Democrat Control*	+
President (Pres)	*= 1 Republican Control, = 0 Democrat Control*	+
Other		
Economic Freedom Index (EFI)	*Index measuring Economic Freedom, factoring in Regulation*	+

*Notations are in Parenthesis

Table 1 above includes the primary variables (dependent and independent) considered in my econometric model. It should be noted that not every variable is included in every regression due to issues with multi-collinearity; nor are my final model results discussed below all-inclusive of the variables noted above. Specifically, I found that some of the independent variables were statistically insignificant, and by removing them it did not materially change my overall results. To provide consistent measurement of my coefficient estimates, all ratios and percentages have been converted into basis points (bps); where 100 bps is equal to 1%. In the banking world one would not typically report an efficiency ratio, for example, in bps format however for the purposes of my analysis it is necessary for consistent measurement across my bank specific and macro-economic variables. Table 1 above also shows the expected coefficient sign for each of my independent variables, which I further detail below.

Dependent Variables:

Consistent with the research of Athanasoglou et al. (2008), return on assets (ROA = Net Profits/Average Earning Assets) is used as my key dependent variable of interest, to measure bank performance; while I also considered return on equity (ROE = Net Profits/Equity) and net interest margin (NIM = Net Interest Income/Average Earning Assets) as these are common measures of bank performance. However, as noted by Athanasoglou et al. (2008) ROE is a measure of financial leverage, thus, banks that hold a higher leverage position tend to report a higher ROA but lower ROE. Additionally, banks are required to maintain certain levels of capital by their regulators, which has varied over the years as regulations change. Because ROE does not capture the risk of higher leverage, and the ratio can be impacted by changes in bank regulation I have decided to follow the same approach as Athanasoglou et al. (2008) and use ROA as my key dependent variable to measure bank performance.

The rationale behind including NIM to measure bank performance is supported by the fact that this ratio is heavily influenced by interest rate levels; however, I found the independent variables in my model to be less statistically significant when using NIM as the dependent variable; as a result, my error was much larger. Thus, ROA remains the primary dependent variable of interest to measure bank performance.

In using financial ratios instead of a bottom line income number one can measure performance consistently over time and compare to prior years on a level playing field, as these three ratios adjust for changes in assets and equity over time; whereas a bottom line income number would not be a consistent measurement over time (i.e. does not adjust for size). Table 2 below lists the sample summary statistics for the dependent variables considered in my research (all U.S. commercial banks consolidated): ROA has a mean of 0.98% ranging between -0.96% and 1.42% and a standard deviation of 0.46%; ROE has a mean of 9.86% ranging between -10.15% and 15.53% and a standard deviation of 5.02%; and NIM has a mean of 3.60% ranging between 2.99% and 4.55% and a standard deviation of 0.38%.

Table 2: Dependent Variables Summary Statistics

Dependent Variables	**Mean**	**Std. Dev.**	**Min**	**Max**
Return on Assets (ROA)	97.58	45.91	-96	142
Return on Equity (ROE)	986.22	502.49	-1015	1553
Net Interest Margin (NIM)	360.35	38.22	299	455

* Recall, Table 2 reports the ratios in bps format and as such one simply divides by 100 to get the percentage, as traditionally reported.

Independent Variables:

The independent variables used in my analysis are based primarily on the work of Athanasoglou et al. (2008); the sample period for all variables of interest is 1992-2016. As discussed in my Literature Review, the research conducted by Athanasoglou et al. (2008) took an empirical approach to measuring bank profitability (performance) using bank-specific, industry specific and macro-economic determinants. However, our research differs in a few ways: first, I am looking at commercial banks in the U.S. on a consolidated basis; second, I am trying to differentiate between the impact interest rates and economic activity have on bank performance; and lastly, I use my results to support an equilibrium interest rate based on 'The Natural Rate of Interest' theory. I have also added a few additional independent variables, consistent with prior research, to try and avoid omitted variable bias.

The bank specific variables selected are a combination of five ratios that are intended to capture the primary drivers of bank performance, internally; while the macro-economic variables capture my primary independent variables of interest (economic activity and interest rates); as well as the unemployment rate. It is recognized that multi-collinearity exists between some of these variables and as such when running my actual regressions, I try not to include redundant variables (i.e. one of the three interest rates is used in the final model). Table 3 below includes the sample summary statistics for my independent variables considered (all U.S. commercial banks consolidated); it should be noted that the actual regressions include lags and differences to account for delayed effects and the tendency of some variables to persist over time (see *Methodology* section).

Table 3: Independent Variables Summary Statistics

Independent Variables	Mean	Std. Dev.	Min	Max
Bank Specific Variables				
Capital Ratio (Cap)	1013.49	107.63	751.00	1134.00
Credit Risk Ratio (Cred)	194.86	66.12	115.00	369.00
Efficiency Ratio (Effic)	5911.28	311.37	5268.00	6662.00
Liquidity Ratio (Liq)	3075.67	635.02	2355.07	4087.83
Loan Deposit Ratio (LDR)	7985.91	806.86	6817.00	8992.00
Macro Economic Variables				
GDP Growth Quarterly (GDP)	86.76	125.52	-211.52	480.52
Inflation Quarterly (Inf)	0.78	0.92	-2.29	3.41
Effective Fed Funds Rate (FFR)	183.32	203.31	7.00	581.00
1 Mo. LIBOR (LIBOR)	199.40	205.45	15.15	605.75
Prime Rate (PR)	489.54	198.17	325.00	883.00
Unemployment Rate (Unemp)	629.71	169.51	400.00	990.00
Dummy Variables				
Recession Indicator (RecDum)	0.12	0.32	0	1
Senate (Sen)	0.43	0.50	0	1
House (Hou)	0.72	0.45	0	1
President (Pres)	0.43	0.50	0	1
Other				
Economic Freedom Index (EFI)	8.08	0.31	7.68	8.65

*Recall, Table 3 reports the ratios in bps format and as such one simply divides by 100 to get the percentage, as traditionally reported for each of the ratios above; interest rates are commonly reported as bps.

Bank Specific Variables:

The capital ratio is a measure of total equity to total assets for a specific period (quarterly). This is a measure of bank capitalization or conversely bank leverage; e.g. a higher ratio would indicate higher capitalization whereas a lower ratio would indicate higher leverage. By including a capital measure, I can capture bank leverage which has been known to be a key factor in bank performance. However, the expected sign of this co-efficient is inconclusive without additional analysis, since excessive levels of owner equity could indicate that capital is not being used at its full capacity which would result in lower profits, or higher leverage would result in increased costs which would also reduce bank profitability; thus there is likely a balance of leverage and capitalization that is most ideal and the coefficient estimate will be dependent on how close actual levels are to this balance. As previously noted, capital levels are also influenced by bank regulators, and as such holding excess capital above regulatory requirements is at the discretion of each individual commercial bank; my measure of capital shows the capitalization for all commercial banks in the U.S., consolidated. The mean capital ratio for my sample is 10.14% with a range of 7.51% to 11.34% and a standard deviation of 1.08%.

Credit risk is a measure of anticipated losses based on the existing loan portfolio and current economic conditions. This ratio is measured as the bank's allowance for loans and lease losses (ALLL) divided by total loans. A bank that uses effective risk management uses a series of algorithms and risk ratings to predict the probability of default and loss given default for each specific loan. Based on the results, a provision (income statement expense) for loan losses is made to the ALLL account (contra-asset account on the balance sheet netted against total loans) to help mitigate any risk for potential losses in the portfolio. A higher ratio would indicate higher credit risk, while a lower ratio would indicate lower credit risk. Credit risk and provisions to the ALLL account directly impact the income statement and balance sheet, and thus overall bank performance. As such the expected sign of this coefficient is negative for ROA and ROE, however higher credit risk should imply higher return (higher interest rates) to compensate for the additional risk and thus the coefficient estimate for the NIM model is expected to be positive. The mean credit risk ratio for my sample is 1.95% with a range of 1.15% to 3.69% and a standard deviation of 0.66%.

As concluded by the work of Loebach (2015), a banks efficiency ratio is found to be a useful indicator of bank performance; specifically, future bank performance. As such I have included the efficiency ratio in my list of independent variables. This ratio effectively captures the non-interest expenses (overhead expenses) of a bank in relation to total revenue (interest income plus non-interest income); thus, it is a measure of how much it costs the bank (overhead expense) to generate \$1.00 in revenue. It is the goal of every bank to maintain a low efficiency ratio; as a rule of thumb, it is considered adequate if the efficiency ratio is below 50% (i.e. for every \$0.50 of overhead, the bank generates \$1.00 in revenue). By including the efficiency ratio in my independent variables, I can capture the cost side of bank performance as well as business efficiency; the coefficient estimate for the efficiency ratio is expected to be negative. The mean efficiency ratio for my sample is 59.11% with a range of 52.68% to 66.62% and a standard deviation of 3.11%.

An additional measure that has been found to be an important determinant of bank performance is the liquidity ratio. This is a measurement of the banks liquid assets (net cash, net securities, and net fed funds sold and reverse purchases) divided by total liabilities. The rationale in including a liquidity measure is based on the fact that banks with low liquidity are at a higher risk for adverse bank performance, especially in an economic downturn; however, like the capital position as discussed above, banks could also hold excessive liquidity resulting in the potential of lost profits. Thus, the expected sign of this coefficient is inconclusive without additional analysis. The mean liquidity ratio for my sample is 30.76% with a range of 23.55% to 40.88% and a standard deviation of 6.35%.

The last of the bank-specific independent variables to be discussed is the loans to deposits ratio; this is a measure of total loans divided by total deposits. Because a bank generates the most interest income on its deposit funded loans, as they can capture a larger spread, it is expected that a higher ratio would result in better bank performance; as such the coefficient estimate is expected to be positive. This ratio was selected as an alternative measure for liquidity, however it was found that the liquidity ratio was more statistically significant in the model; I did not include both in the final model as these two variables are highly positively correlated with one another. The mean loans to deposits ratio for my sample is 79.86% with a range of 68.17% to 89.92% and a standard deviation of 8.07%.

Macro-Economic Variables:

As a measure of economic activity, I use the quarterly change in real gross domestic product (seasonally adjusted); this variable is labeled GDP growth. Not only is GDP a key variable used in other bank performance research, it is also one of the key measures used by economists when discussing the health of the economy and current economic activity. A positive change in GDP would mean economic growth, which is expected to positively impact bank performance. The mean GDP growth rate for my sample is 0.87% with a range of -2.12% to 4.81% and a standard deviation of 1.26%. Table 3 also includes an inflation variable; however, this was not found to be as statistically significant in the models, and GDP growth was more closely correlated with bank performance.

The next macro-economic variable is a measure of interest rates. As shown in Table 3 I have included three different interest rates: Effective Fed Funds Rate; 1 Mo. LIBOR; and Prime Rate. It is only necessary to include one in the final model, and I have decided to stick with the Effective Fed Funds Rate. While prior literature includes the use of different interest rates, including the Effective Fed Funds Rate, I find this interest rate to be most relevant for the purposes of my analysis as this is the rate that is controlled by monetary policy; the other interest rate indexes are highly correlated with changes in the Effective Fed Funds Rate (Table 4), however there is typically a lag period between changes in the other indexes. By including the Effective Fed Funds Rate in my model, I can capture the initial decision of the Fed to change interest rates. The mean Effective Fed Funds Rate for my sample is 1.83% with a range of 0.07% to 5.81% and a standard deviation of 2.03%.

Table 4: Correlation between Interest Rates

	Effective Fed Funds Rate	Prime Rate
Effective Fed Funds Rate	-	
Prime Rate	0.9992	-
1 Mo. LIBOR	0.9943	0.996

In addition to my two key macro-economic variables of interest I also include the national unemployment rate, seasonally adjusted. This is to capture additional variance in the data due to changes in the macro-economy. While GDP growth, interest rates and unemployment are all correlated in some way, by including the unemployment rate I can explain more of the variance in the data; the coefficient estimate for this variable is expected to be negative as a higher unemployment rate typically implies weakness in the macro-economy. The average unemployment rate during my sample period was 6.29% with a range of 4.00% to 9.90%, and a standard deviation of 1.70%.

Dummy/Other Variables:

To capture the effect of business cycles on bank performance I use a dummy variable to indicate periods of a recession. As confirmed by the research of others (discussed above) business cycles are found to have a significant impact on bank performance. Specifically, during periods of economic growth, banks can grow their loan portfolio and invest in riskier assets, however as the economy turns in the other direction loan portfolios tend to contract and credit risk increases, resulting in weaker bank performance. As with many of the variables included there is likely a lag in the effect a recession has on bank performance; this is factored into my model as discussed in the *Methodology* section below. On average, the U.S. was in a recession 12% of the time during my sample period.

As confirmed by Gropper, Jahera Jr. and Park (2015) politics can also play a factor in bank performance; specifically, politicians with a Republican agenda are more likely to loosen regulation and promote economic freedom, while democrats tend to follow an agenda in opposition to these views. Thus, it would be expected that in a Republican controlled government (majority Republican), bank performance would improve; assuming there would be changes in bank regulation and the freedom of businesses. When setting up the model I only found House control to be statistically significant; as such the other two political variables are not included in the final model. Lastly, I also include the Economic Freedom Index used by Gropper, Jahera Jr. and Park (2015) to measure changes in economic freedom over time; this includes regulation, among other things. In interpreting the index, a higher number implies looser business policy and less regulation (i.e. more economic freedom).

In this section I have discussed my data sample for all commercial banks in the U.S., that are insured by the FDIC; in addition to the rationale behind my variable selection. As noted in the *Methodology* section below, my regression analysis also breaks up the commercial banking industry by size (Total Assets). In doing so I can show how the coefficient estimates for my independent variables differ based on bank size. It is anticipated that bank size will make a difference, however the overall conclusions are expected to remain consistent.

CHAPRTER IV

METHODOLOGY

As noted, I have compiled a time series dataset which includes both seasonal and non-seasonal factors; there are also time dependent disturbances in the data that would not be captured with a standard regression model. Prior literature (Athanasoglou et al. (2008)) indicates that when panel data are used for the purposes of measuring bank performance, it is appropriate to include time fixed effects. While my data is strictly time-series, there are still time dependent disturbances in the data, thus, I have chosen to use an Autoregressive Integrated Moving Average (ARIMA) model; which includes the use of additional independent variables beyond my dependent variable of interest (ROA to measure bank performance). Traditional ARIMA models are used to fit a univariate model with time dependent disturbances; however, I also want to provide coefficient estimates for additional independent variables important to my analysis, as detailed in the *Stylized Fact – Data Summary*. While this is outside the norm for a traditional ARIMA model, it is still common practice to fit an ARIMA model with additional independent variables.

To develop my model, I started by determining the appropriate auto-regressive and moving average orders. In doing so I looked at the auto-correlation and partial auto-correlation of my dependent variable (ROA for the purposes of this discussion). The results suggested that the auto-regressive order should be set with three lags, and the moving average order should be set with four lags, as these periods are all outside of the 95 percent confidence band of no correlation; my model is AR (1/3) MA (1/4) (see Appendix A - Auto-Correlation and Partial Auto-Correlation). As such my model integrates ROA into the independent variables by auto-regressing lags one through three and applying a moving average of periods one through four.

The next step in developing my model was to identify the variables that were non-stationary over time (dickey-fuller test), and adjust using the first difference method. All bank independent variables were converted to first differences, to ensure they were stationary over time; thus, my model estimates for the bank independent variables measures the effects of the variance in changes over time. My economic activity variable of interest, GDP growth, is already considered to be a first difference as it is the change in real GDP from one period to the next; thus, I am able reject the null hypothesis and conclude that this variable is stationary over time.

With my interest rate variable, the Fed Funds Rate, I am unable to reject the null indicating that the variable is non-stationary over time; this can be explained by the fact that interest rates have been very volatile over my sample time-period and have been at historical lows the past several years. However, for the purposes of this analysis I want to capture actual interest rate levels, not just changes in interest rates and as such I acknowledge the fact that my interest rate variable is non-stationary and make no further adjustment. To support my overall conclusion, I did run a separate model to include the first difference of the Fed Funds Rate as an independent variable and my final results hold true; however, to explain the results with respect to my overall research intent, it makes more sense when I include the actual Fed Funds Rate. The other independent variables included in my final model (unemployment rate, Economic Freedom Index) as well as my dummy/indicator variables (House control and recession) do not warrant further adjustment as it was confirmed that these variables are in fact stationary over time; i.e. I can reject the null hypothesis that a unit-root exists.

With my data adjusted as appropriate for an ARIMA model, my final step was to determine the lags, if necessary, for each of my independent variables. In doing so I started with models limited to only bank data, bank data and GDP growth, bank data and the Fed Funds Rate, and then integrated my additional variables of interest. To further determine the appropriate lags for my GDP growth and Fed Funds Rate variables, I looked at the correlation between these two variables, with ROA, to determine the set-up of my model. As shown in Table 5a below, ROA has a positive correlation with the Fed Funds Rate up to the 4th lag, however the correlation becomes increasingly more negative beginning with the 5th lag. On the other hand, GDP growth has a positive correlation with ROA that is diminishing over-time; nonetheless remains strong (compared to the correlation between the Fed Funds Rate and ROA) through the 6th period. Thus, stable and recurring economic growth should provide banks with consistently improving bank profitability; however, regarding interest rates, the impact is positive in the beginning but the data would suggest that this effect becomes negative over time; likely due to the impact increasing interest rates have on GDP growth (as detailed in Table 5b).

Table 5a: Correlation with ROA (All Commercial Banks)

Correlation: ROA			
Fed Funds Rate		GDP Growth	
--.	0.3868	--.	0.4489
L1.	0.3116	L1.	0.4568
L2.	0.2244	L2.	0.4355
L3.	0.1553	L3.	0.4121
L4.	0.0559	L4.	0.4689
L5.	-0.0498	L5.	0.4082
L6.	-0.1498	L6.	0.4031

Table 5b: Correlation (GDP Growth and Fed Funds Rate)

Correlation			
GDP Growth		Fed Funds Rate	
Fed Funds Rate		GDP Growth	
--.	0.2881	--.	0.1531
L1.	0.2058	L1.	0.2812
L2.	0.1522	L2.	0.2839
L3.	0.0824	L3.	0.2757
L4.	0.0058	L4.	0.2718
L5.	-0.0236	L5.	0.2173
L6.	-0.1158	L6.	0.2381

Based on these results I included the 1st lag (*t-1*) and 6th lag (*t-6*) for both GDP growth and the Fed Funds Rate in my models; in doing so I capture the initial positive impact of both, and then the diminishing impact for GDP growth and negative impact for the Fed Funds Rate in prior periods. I also include the square of GDP growth and the Fed Funds Rate, with the same respective lags, to show that the model is in fact non-linear; i.e. diminishing marginal return or loss. The following models were found to provide the most consistent results with the lowest margin of error based on a one step ahead forecast. I used the robust standard errors option to account for the risk of heteroscedasticity.

Model 1 - GDP Model:

$$Y_t = c + \beta_{cap}X_{t-1} + \beta_{cred}X_t + \beta_{effic}X_{t-1} + \beta_{liq}X_{t-1} + \beta_{GDP}X_{t-1} + \beta_{GDP}X_{t-6} + \beta_{GDP^2}X_{t-1} + \beta_{GDP^2}X_{t-6} + \sum_{t}^{l} \beta_l X_{t-1}^{l} + \varepsilon_t$$

Model 2 - Interest Rate Model:

$$Y_t = c + \beta_{cap}X_{t-1} + \beta_{cred}X_t + \beta_{effic}X_{t-1} + \beta_{liq}X_{t-1} + \beta_{FFR}X_{t-1} + \beta_{FFR}X_{t-6} + \beta_{FFR^2}X_{t-1} + \beta_{FFR^2}X_{t-6} + \sum_{t}^{l} \beta_l X_{t-1}^{l} + \varepsilon_t$$

Model 3 - Combined Model:

$$Y_t = c + \beta_{cap}X_{t-1} + \beta_{cred}X_t + \beta_{effic}X_{t-1} + \beta_{liq}X_{t-1} + \beta_{GDP}X_{t-1} + \beta_{GDP}X_{t-6} + \beta_{GDP^2}X_{t-1} + \beta_{GDP^2}X_{t-6} + \beta_{FFR}X_{t-1} + \beta_{FFR}X_{t-6} + \beta_{FFR^2}X_{t-1} + \beta_{FFR^2}X_{t-6} + \sum_{t}^{l} \beta_l X_{t-1}^{l} + \varepsilon_t$$

The bank independent variables of interest are the change in the capital ratio (*cap*) lagged one period (*t-1*), the change in credit risk (*cred*) for the current period (*t*), the change in the efficiency ratio (*effic*) lagged one period (*t-1*) and the change in the liquidity ratio (*liq*) lagged one period (*t-1*). Model 1 only integrates GDP growth (*GDP*) for periods *t-1* and *t-6*, while excluding the Fed Funds Rate (*FFR*); conversely Model 2 integrates the Fed Funds Rate for periods *t-1* and *t-6* while excluding GDP growth. Then I tie everything together and include both independent variables of interest in Model 3. Recall, GDP^2 and FFR^2 are included in the models to show that my independent variables of interest are non-linear in the model. The remaining independent variables (*l*) included in my models are the first period lag (*t-1*) of the recession dummy variable, unemployment rate, House control indicator variable and Economic Freedom Index.

In addition to running these Models on my full data set (i.e. all commercial banks in the U.S.), I break commercial banks down by size (generating separate data sets) and re-run my Models. Specifically, I use total assets and break the data into three sub-groups: Commercial Banks >$1B; Commercial Banks $100MM - $1B; and Commercial Banks <$100MM. In doing so I can show how bank size plays a factor in the overall results; this is explained in further detail below.

CHAPTER V

RESULTS

The results of my ARIMA Models for all commercial banks in the U.S. are detailed in Table 6 below. With regards to Model 1, where only GDP growth was factored into the model, it is shown that both lagged periods (*t-1* and *t-6*) included are statistically significant at the 1% confidence level; the same holds for the square of these variables supporting the fact that GDP growth has diminishing marginal returns (i.e. the relationship is non-linear) with respect to bank performance. The results of Model 1 would suggest that GDP growth of 25bps or 0.25% in the prior period (t-1) would support increased ROA of 4bps or 0.04%; however, this effect becomes negative in the sixth period suggesting that GDP growth of 25bps or 0.25% in period *t-6* would result in a 2bps or 0.02% decline in ROA. This is likely attributed to that fact that volatility in GDP growth has occurred throughout the time-period selected; which includes two (one very significant) recessions. Although the GDP growth in period *t-6* would indicate a slight decline in ROA, the results would suggest that stable and consistent GDP growth over-time would result in consistently increasing ROA.

Switching the analysis over to interest rates, Model 2 integrates the Fed Funds Rate as an independent variable; and excludes GDP growth. As detailed in Table 6, it is shown that the Fed Funds Rate for period t-1 is statistically significant at the 5% confidence level, while period t-6 is statistically significant at the 1% confidence level; the Fed Funds Rate squared for these respective periods is statistically significant at the 5% confidence level (supporting a non-linear relationship). Based on the output, a 25bps or 0.25% increase in the Fed Funds Rate in period *t-1* would support a 6.53bps or 0.063% increase in ROA; which is stronger than the impact GDP growth had on ROA for the prior period (as previously discussed). However, when a 25bps or 0.25% increase in the Fed Funds Rate is factored into period *t-6*, the returns in period *t-1* are almost completely offset (and the negative impact in period *t-6* is more statistically significant in the model). Furthermore, it is possible to have consistent GDP growth over time (if stable), however consistent increases in the Fed Funds Rate over time would negatively impact GDP growth and likely lead to a recession; which would materially impact ROA in a negative way.

Model 3 integrates both GDP growth and the Fed Funds Rate, with the same respective lags and squared versions of the variables. The results detailed in Table 6 indicate that GDP growth and GDP growth squared are statistically significant at the 1% level for both periods *t-1* and *t-6*; however, the Fed Funds Rate and Fed Funds Rate squared variables become non-statistically significant, as the coefficient estimates are greatly reduced when factoring in GDP growth. Specifically, based on the results from Model 3 it is shown that 25bps or 0.25% GDP growth in period *t-1* would support a 3.88bps or 0.0388% increase in ROA; while the same level of GDP growth in period *t-6* would lead to a 1.81bps or 0.0181% decline in ROA. Conversely the coefficient estimates for the Fed Funds Rate would indicate that the overall impact to ROA from changes in interest rates are rather marginal; and not statistically significant.

Table 6: ROA Model Results - All Commercial Banks

Dependent Variable:	Model 1		Model 2		Model 3	
ROAbps	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)
Capital Difference						
L1.	0.0024	0.0903	0.2256	0.1925	0.0357	0.0883
Credit Risk Difference	-1.8190	0.1437 **	-1.0091	0.5824 *	-1.7200	0.1344 ***
Efficiency Ratio Difference						
L1.	0.0096	0.0066	0.0259	0.0073 ***	0.0075	0.0069
Liqudidty Ratio Difference						
L1.	0.0225	0.0305	0.0060	0.0334	0.0272	0.0293
GDP Growth bps						
L1.	0.1621	0.0345 ***			0.1553	0.0273 ***
L6.	-0.0831	0.0223 ***			-0.0722	0.0190 ***
GDP Growth bps sq.						
L1.	-0.0005	0.0001 ***			-0.0005	0.0001 ***
L6.	0.0002	0.0000 ***			0.0002	0.0000 ***
Fed Funds Rate bps						
L1.			0.2612	0.1078 **	0.0382	0.0413
L6.			-0.2048	0.0769 ***	-0.0611	0.0421
Fed Funds Rate bps sq						
L1.			-0.0004	0.0001 **	0.0000	0.0001
L6.			0.0003	0.0001 **	0.0001	0.0001 *
Recession (Dummy)						
L1.	-16.8920	4.5648 ***	-30.5475	12.8483 **	-20.9104	4.9208 ***
Unemployment bps						
L1.	-0.0947	0.0151 ***	-0.0405	0.0234 *	-0.0756	0.0150 ***
House Control						
L1.	21.9456	3.9034 ***	30.8942	11.6177 ***	24.2775	4.4355 ***
Economic Freedom						
L1	49.3227	6.2114 ***	34.3718	19.0598 *	48.7676	8.0394 ***
Constant	-257.4029	54.1961 ***	-179.2658	140.8911	-267.6946	61.4145 ***
ARMA						
ar						
L1.	-1.0112	0.1149 ***	-0.6448	0.2287 ***	-1.0278	0.1115 ***
L2.	-0.8810	0.1394 ***	-0.3953	0.3418	-0.9118	0.1258 ***
L3.	-0.7734	0.1287 ***	-0.5256	0.1605 ***	-0.7867	0.1222 ***
ma						
L1.	0.7777	0.2189 ***	1.1537	0.1156 ***	0.6993	0.2321 ***
L2.	0.8735	0.0842 ***	0.6410	0.3554 *	0.8558	0.0984 ***
L3.	1.0241	0.1544 ***	1.1537	0.1156 ***	0.9746	0.1840 ***
L4.	0.5004	0.1828 ***	1.0000	0.0000 ***	0.4371	0.1842 **
/sigma	9.1361	0.7342 ***	11.8434	1.3717 ***	8.6243	0.6223 ***

*1% Significance Level **5% Significance Level ***10% Significance Level

Model 3 results are generally consistent to Model 1 results, with regards to GDP growth; however, Model 3 and Model 2, when comparing the effect of changes in the Fed Funds Rate, vary greatly. These results are consistent to my overall hypothesis in that bank performance (ROA) benefits more from consistent GDP growth when compared to increasing interest rates (based on historical data).

While my hypotheses are supported using a data set with all commercial banks, it is found that the results vary based on bank size. As noted in the *Methodology* section, I gathered additional time-series data sets for different sub-groups of commercial banks in the U.S. based on bank asset size (these results are found in Tables 7-9 in *Appendix B*). I first look at what I define as 'large' banks; banks with >$1B in assets. This is purely a subjective definition of 'large' banks as there is significant variation between asset size for banks in this sub-group; nonetheless I can support my conclusions using this benchmark for 'large' banks. The sub-group for 'medium' sized banks is defined as banks with assets between $100MM and $1B; and the sub-group for 'small' banks is defined as assets <$100MM.

As detailed in Table 7 (*Appendix B*) the results for the 'large' bank sub-group are generally consistent with my overall results, previously discussed. However, it is found that the Fed Funds Rate is not statistically significant to either Model 2 nor Model 3; while the coefficient estimates are comparable. Thus, my conclusions hold for 'large' banks; conversely, with respect to the 'medium' and 'small' banks, the coefficient estimates are materially different, and the statistical significance of my independent variables of interest is diminished. This would be expected for smaller, more regionalized banks. Specifically, economic activity at the national level would be expected to impact ‘large’ commercial banks that have a wider geographical footprint. While smaller more regionalized banks would be impacted by local economic activity, which can vary compared to economic activity at the national level. Furthermore, competition from ‘large’ commercial banks has a material impact on ROA for smaller banks; while large banks can provide favorable rates/deals and still generate adequate return through economies of scale, it is more difficult for smaller banks to do the same; the number of ‘large’ banks has been consistently increasing over time.

Using a one step ahead forecast, I generated a predicted value for ROA and took the difference from my predicted ROA and actual ROA to generate my model error. The graphs below show the error results for Models 1, 2 and 3, respectively for all commercial banks (All); the errors for each of the three subgroups were generally consistent. As suggested by these graphs, the largest prediction error occurs during the ‘Great Recession’; with so many other factors impacting bank performance during this period it becomes more difficult to predict ROA. Nonetheless my one step ahead forecast is within 20bps or 0.2%. The error for each model has an approximate mean of 0 and a standard deviation of 10bps or 0.1%; and all three are approximately normally distributed. Additionally, the errors for each respective model were verified as white-noise (white-noise test).

Figure 2: Model 1 Error (All)

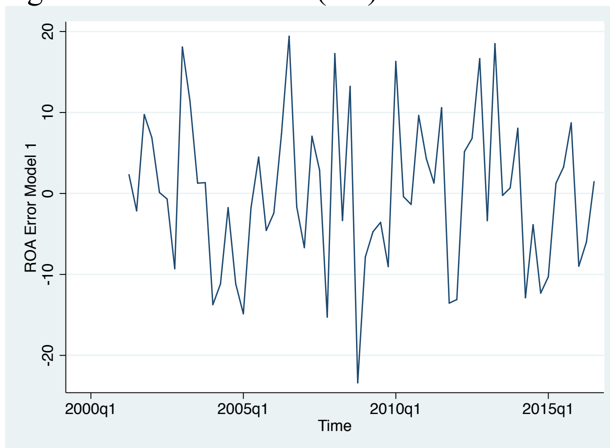


Figure 3: Model 2 Error (All)

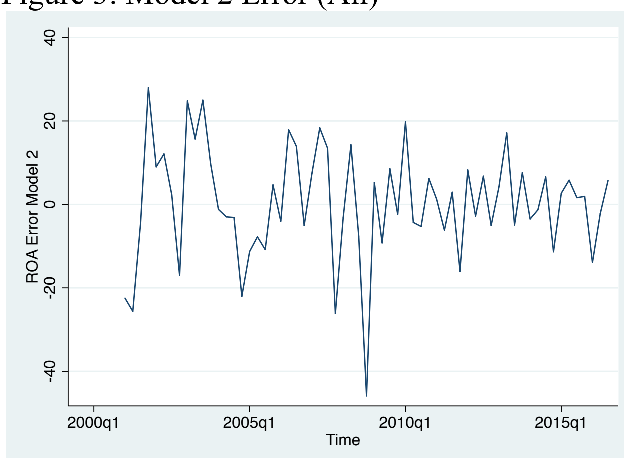
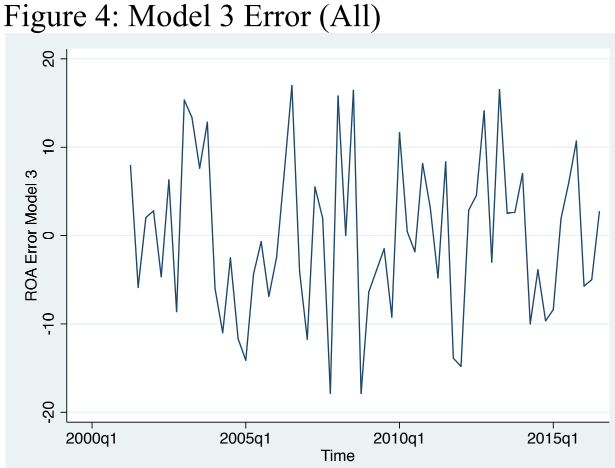


Figure 4: Model 3 Error (All)



Going one step further, I re-ran all three models against the data set of all commercial banks and included my error terms in each respective regression. It was found that the co-efficient estimates for my independent variables of interest remained consistent with the initial models; and my new error was greatly reduced. This alternative approach to estimating my models further confirms that my results hold true.

CHAPTER VI

CONCLUSION

As confirmed by my econometric model results, commercial banks (specifically those with assets >$1B) should be more concerned about economic activity and growth, as opposed to increasing interest rates, with respect to improving bank performance in the current market (as measured by ROA for the purposes of this paper). To be clear, I am not arguing the case that interest rates need to go up, as they are at historic lows and keeping them at these low levels could result in inflation above the target rate; nor am I suggesting that higher interest rates do not provide higher returns. What I am suggesting is that the current performance of commercial banks benefits more from stable and consistent economic growth as opposed to changes in interest rates, based on historical data. This is largely due to the fact that increasing (or decreasing) interest rates at the wrong time or by the wrong amount can lead to drastic shifts in economic activity. While increasing rates will allow banks to capture a higher return on bank owned assets, the negative impact on economic activity is likely to offset these returns and reduce bank performance, over time.

So, the question remains, how does one go about setting an equilibrium between interest rates and economic activity to maximize bank profitability in the long run? I would suggest that using an approach like the 'Natural Rate of Interest Theory' would allow banks to maximize profitability in the long run, while also providing the economy with stable and consistent growth over time. By reducing the impact mechanically changing interest rates has on economic activity, using a natural approach and letting a supply/demand equilibrium determine interest rates would in theory stabilize economic activity and allow banks to continue growing their loan portfolios in a stable environment. Using this approach would not eliminate the risk of a recession, as there would still be business cycles like we see today. However, the significance of recessions, or swings in economic activity would be greatly reduced, according to this theory. At the very least it warrants additional consideration, as the Fed has been unable to show that monetary policy can be used to control economic activity effectively.

To conclude, I have shown that economic activity as measured by GDP growth is more beneficial to improving the current performance of commercial banks, as opposed to increasing interest rates. As noted I am not suggesting that higher interest rates do not improve bank performance, nor am I suggesting that banks can maximize profitability in a low rate environment; rather I point out that over time economic growth has shown to be more beneficial to improving bank performance. If one could find a way to stabilize economic growth by setting the appropriate interest rate level, banks could essentially maximize profitability over the long run. The Fed has proven that this task is extremely difficult, as there are so many different factors that play a role in the decisions they make. So perhaps it is time to try a new approach to setting interest rates; in which the basic economic concept of equilibrium is used to determine a "Natural Interest Rate".

While I have been able to support my conclusions regarding bank performance, further research is warranted to dig deeper into this complex topic. The U.S. has spent the past century trying to create a stable economic environment through the use of monetary policy; however, time and time again this has proven unsuccessful. Maybe this is the correct approach and someone is close to figuring it out; or perhaps it is impossible to control such shifts in the economy; or maybe it is time to try something new. I would suggest that more research needs to go into the idea of a 'Natural Interest Rate', but for now commercial banks should be satisfied with consistent economic growth; as making the wrong decision with regards to interest rates could send us back in the other direction.

APPENDICES

Appendix A:
Auto-Correlation and Partial Auto-Correlation (ROA All Commercial Banks)

Figure 5: ROA Auto-Correlation to determine Moving Average

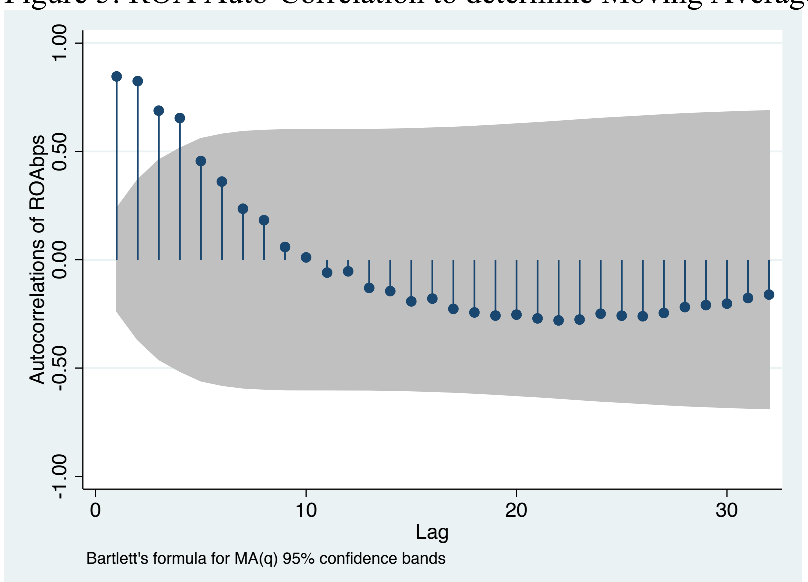
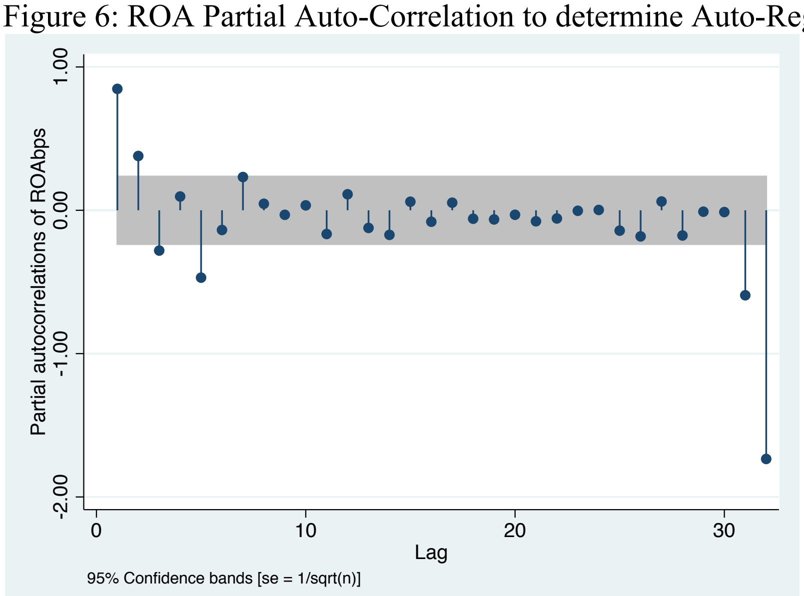


Figure 6: ROA Partial Auto-Correlation to determine Auto-Regression



Appendix B:
Model Results by Bank Size

Table 7: ROA Model Results - Assets >$1B

Dependent Variable:	Model 1		Model 2		Model 3	
ROAbps	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)
Capital Difference						
L1.	-0.0113	0.0987	0.0519	0.0584	0.0212	0.0882
Credit Risk Difference	-1.6457	0.1444 ***	-0.1000	0.3265	-1.5716	0.1426 ***
Efficiency Ratio Difference						
L1.	0.0060	0.0072	0.0321	0.0020 ***	0.0039	0.0076
Liqudidty Ratio Difference						
L1.	0.0264	0.0318	-0.0568	0.0157 ***	0.0261	0.0281
GDP Growth bps						
L1.	0.1820	0.0380 ***			0.1738	0.0307 ***
L6.	-0.0699	0.0254 ***			-0.0642	0.0228 ***
GDP Growth bps sq.						
L1.	-0.0005	0.0001 ***			-0.0005	0.0001 ***
L6.	0.0002	0.0000 ***			0.0001	0.0000 ***
Fed Funds Rate bps						
L1.			0.3150	0.2094	0.0423	0.0486
L6.			-0.1303	0.0923	-0.0501	0.0451
Fed Funds Rate bps sq						
L1.			-0.0005	0.0003	0.0000	0.0001
L6.			0.0001	0.0002	0.0001	0.0001
Recession (Dummy)						
L1.	-21.6625	5.5094 ***	-50.6213	10.7600 ***	-26.0466	5.9747 ***
Unemployment bps						
L1.	-0.0910	0.0169 ***	-0.0265	0.0343	-0.0706	0.0158 ***
House Control						
L1.	19.8578	4.6340 ***	27.9914	12.8171 **	23.2131	5.0680 ***
Economic Freedom						
L1	49.3235	6.4645 ***	23.1098	30.1826	47.0001	9.0553 ***
Constant	-258.0015	57.8489 ***	-94.3970	234.2161	-256.4400	69.7771 ***
ARMA						
ar						
L1.	-0.9646	0.1213 ***	0.5985	0.7300	-0.9758	0.1170 ***
L2.	-0.8589	0.1558 ***	-0.7745	0.3302 **	-0.8875	0.1303 ***
L3.	-0.7827	0.1372 ***	0.3129	0.6360	-0.7947	0.1253 ***
ma						
L1.	0.7056	0.2267 ***	0.2615	0.6980	0.6321	0.2358 ***
L2.	0.8797	0.0929 ***	0.2331	0.1533	0.8763	0.1190 ***
L3.	0.9755	0.1796 ***	1.0083	0.1593 ***	0.9190	0.2121 ***
L4.	0.4025	0.1914 **	0.0367	0.7110	0.3445	0.1803 ***
/sigma	10.1069	0.7455 ***	13.0793	1.2252 ***	9.6656	0.6828 ***

*1% Significance Level **5% Significance Level ***10% Significance Level

Table 8: ROA Model Results - Assets $100MM - $1B

Dependent Variable:	Model 1		Model 2		Model 3	
ROAbps	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)
Capital Difference						
L1.	0.0659	0.0657	-0.0181	0.0457	0.0421	0.0755
Credit Risk Difference	-4.1545	0.5430 ***	-3.0923	0.9609 ***	-3.3695	0.6021 ***
Efficiency Ratio Difference						
L1.	0.0181	0.0110 *	0.0274	0.0108 **	0.0183	0.0105 *
Liqudidty Ratio Difference						
L1.	0.0570	0.0204 ***	0.1008	0.0216 ***	0.0764	0.0276 ***
GDP Growth bps						
L1.	0.0318	0.0197			0.0066	0.0197
L6.	0.0300	0.0298			0.0051	0.0248
GDP Growth bps sq.						
L1.	-0.0003	0.0000 ***			-0.0002	0.0001 ***
L6.	0.0000	0.0001			0.0000	0.0000
Fed Funds Rate bps						
L1.			0.1015	0.0366 ***	0.0017	0.0375
L6.			-0.0942	0.0586	-0.1152	0.0519 **
Fed Funds Rate bps sq						
L1.			-0.0002	0.0001 **	0.0000	0.0001
L6.			0.0001	0.0001 **	0.0002	0.0001 **
Recession (Dummy)						
L1.	-27.1543	4.7382 ***	-34.6748	5.8132 ***	-29.8833	3.8919 ***
Unemployment bps						
L1.	-0.1267	0.0063 ***	-0.1396	0.0081 ***	-0.1312	0.0104 ***
House Control						
L1.	16.1757	4.4983 ***	24.3305	6.3337 ***	21.9662	5.0929 ***
Economic Freedom						
L1	43.1287	3.2555 ***	37.5376	9.0857 ***	57.2727	9.0291 ***
Constant	-187.6542	25.4600 ***	-137.4350	69.5436 **	-293.2430	64.8776 ***
ARMA						
ar						
L1.	-1.0624	0.3398 ***	-0.9732	0.3208 ***	-0.9864	0.1942 ***
L2.	-0.7610	0.1899 ***	-0.5874	0.3406 *	-0.6978	0.1795 ***
L3.	-0.6428	0.1511 ***	-0.5509	0.1342 ***	-0.6412	0.1176 ***
ma						
L1.	0.6764	0.5228	0.9170	0.1509 ***	0.6978	0.2532 ***
L2.	0.0251	0.0678	-0.0405	0.0322	0.0093	0.0350
L3.	-0.8956	0.1635 ***	-1.1235	0.0448 ***	-0.9746	0.1024 ***
L4.	-0.8059	0.5548	-0.7530	0.1547 ***	-0.7325	0.2537 ***
/sigma	8.1229	0.7958 ***	8.9150	0.6480 ***	7.5617	0.5488 ***

*1% Significance Level **5% Significance Level ***10% Significance Level

Table 9: ROA Model Results - Assets <$100MM

Dependent Variable:	Model 1		Model 2		Model 3	
ROAbps	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)	Coefficient Estimate	Std Error (Robust)
Capital Difference						
L1.	-0.0305	0.0849	-0.0099	0.0463	-0.0322	0.0869
Credit Risk Difference	-4.6224	0.6799 ***	-4.3237	0.5875 ***	-3.6851	0.4762 ***
Efficiency Ratio Difference						
L1.	-0.0102	0.0062	-0.0130	0.0051 **	-0.0097	0.0065
Liqudidty Ratio Difference						
L1.	0.0676	0.0231 ***	0.0651	0.0143 ***	0.0888	0.0165 ***
GDP Growth bps						
L1.	0.0137	0.0250			0.0112	0.0252
L6.	0.0262	0.0240			0.0488	0.0260 *
GDP Growth bps sq.						
L1.	-0.0002	0.0001 ***			-0.0002	0.0000 ***
L6.	0.0000	0.0001			0.0000	0.0000
Fed Funds Rate bps						
L1.			0.0654	0.0655	0.0216	0.0313
L6.			-0.0292	0.0427	-0.1622	0.0331 ***
Fed Funds Rate bps sq						
L1.			-0.0001	0.0001	0.0000	0.0001
L6.			0.0000	0.0001	0.0002	0.0000 ***
Recession (Dummy)						
L1.	-18.0456	6.6800 ***	-1.2154	9.8721	-21.0014	5.1393 ***
Unemployment bps						
L1.	-0.0672	0.0121 ***	-0.0606	0.0330 *	-0.0664	0.0060 **
House Control						
L1.	14.6416	4.3002 ***			11.3612	5.0196 ***
Economic Freedom						
L1	29.4509	4.6117 ***			48.5561	8.8726 ***
Constant	-131.1136	42.1582 ***	110.2519	23.9985 ***	-273.7980	62.7595 ***
ARMA						
ar						
L1.	-1.1093	0.0921 ***	-0.1988	0.2567	-1.2362	0.0896 ***
L2.	-1.1072	0.0978 ***	0.8292	0.0970 ***	-1.0729	0.1346 ***
L3.	-0.9683	0.0237 ***	0.0484	0.2157	-0.8216	0.0941 ***
ma						
L1.	0.9944	0.1453 ***	0.2343	0.2449	0.4131	0.1787 **
L2.	1.3116	0.1968 ***	-0.2686	0.1412 *	-0.0810	0.1197
L3.	0.9893	0.1524 ***	0.6729	0.1316 ***	-0.6881	0.1506 ***
L4.	0.3044	0.1613 *	0.6560	0.1882 ***	-0.6439	0.1301 ***
/sigma	8.0143	1.0453 ***	8.8600	0.8133 ***	5.8638	0.4341 ***

*1% Significance Level **5% Significance Level ***10% Significance Level

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