MONETARY HAWKS AND DOVES: UTILIZING INDIVIDUALIZED TAYLOR RULE RESPONSES TO CHARACTERIZE FOMC MEMBERS

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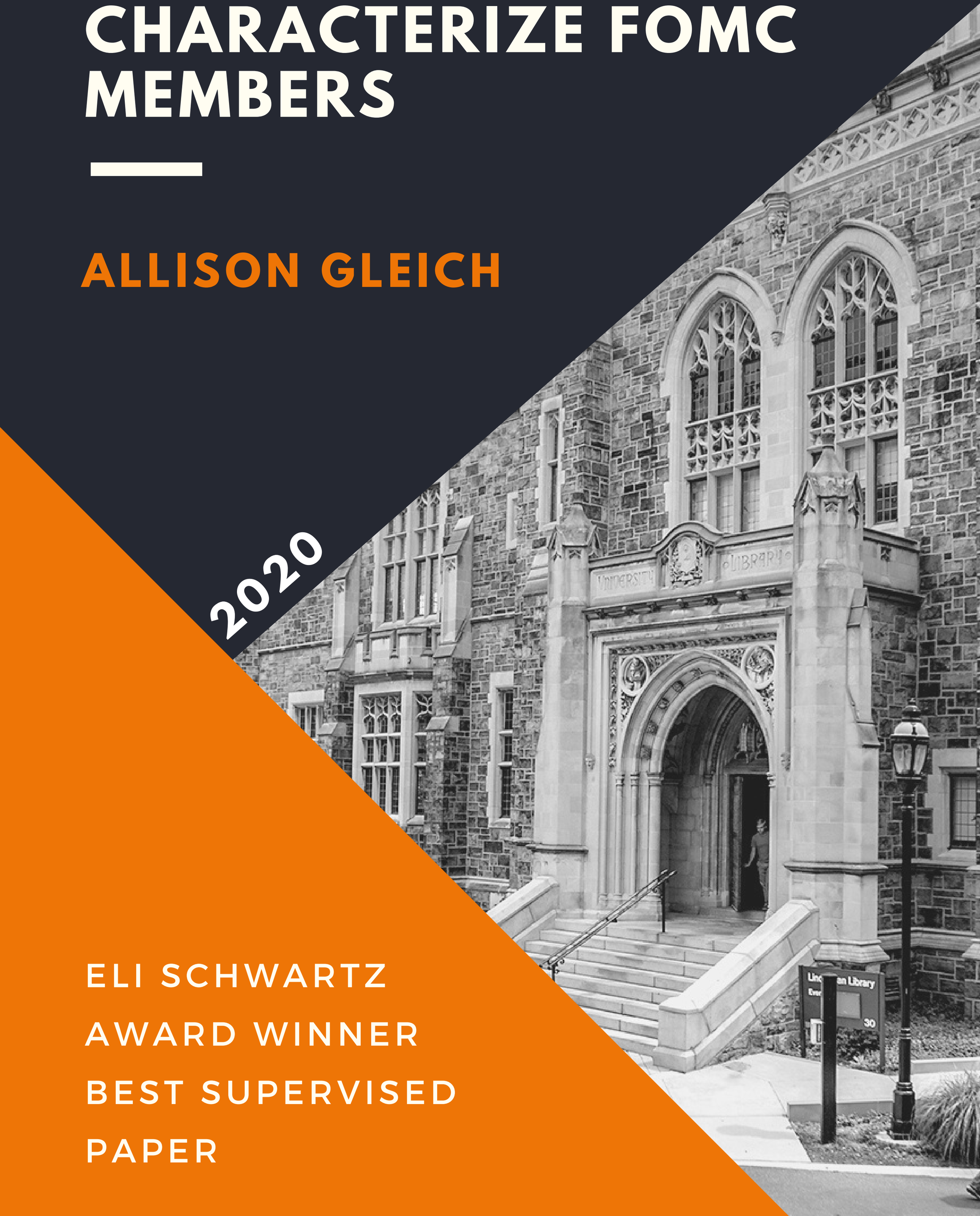

ELI SCHWARTZ AWARD WINNER BEST SUPERVISED PAPER

Monetary Hawks and Doves: Utilizing Individualized Taylor Rule Responses to Categorize Federal Open Market Committee Members

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In order to categorize Federal Open Market Committee members as monetary hawks or doves, I propose a new methodology where I calculate each member's Taylor Rule responses by utilizing their voting histories. Monetary hawks emphasize the importance of keeping inflation low and consistent, regardless of any other economic factors. Doves are mainly concerned with keeping output growth high and steady. By running Ordinary Least Squares regressions for each member and regressing their desired Federal Funds Rate on the inflation and output gap at each meeting, I was able to determine each member's unique interest rate reaction function coefficients for inflation and output. Through this methodology I then determined whether each member swayed more towards hawk-like or dove-like behaviors. Previous research has been performed to label each member, however, this is the first methodology that is solely quantitative in nature. The results yielded 8 hawks, 13 doves, and 8 members that were neither.

1 Introduction and Background

After it's official formation in 1933, the Federal Open Market Committee (FOMC) had a wide array of duties related to stabilizing the economy. It was not until 1987 when the FOMC's primary duty became voting on the target Federal Funds Rate (FFR) eight times each year. The FOMC is composed of seven members from the Board of Governors, four of the 12 Reserve Bank Presidents on a rotating basis, and the New York Federal Reserve President. The committee votes on the target FFR roughly two times each quarter.

In order to decide on the target FFR, the Federal Reserve has many interest rate reaction functions that they have utilized over the years. One particular function that has become widely used in recent years is the Taylor Rule. The Taylor Rule is an unofficial policy tool that was developed by John Taylor in 1993 that has been shown to be effective. Many FOMC members use the Taylor Rule to arrive at an optimal target FFR and guide their voting decisions. The rule suggests what the target FFR should be based on the inflationary gap and output gap. In the classical Taylor Rule, the target FFR should be equal to the sum of the current FFR, the inflation rate, half of the output gap, and half of the inflationary gap. While the classical version of the rule uses one half to account for the output and inflationary gaps, there are many other versions that assign different coefficients to both gaps.

Although the Federal Reserve tends to be a data-driven entity and often utilizes policy tools, such as the Taylor Rule, each FOMC member has a slightly different perception on how to define an optimal and healthy economy. Based on their personal preferences, FOMC members can be labeled as either monetary hawks or doves. These labels are simply speculations of FOMC member's ideologies. The Federal Reserve is an independent, nonpartisan entity where the members typically do not explicity reveal their preferences or personal opinions. Due to the insulation of the Fed's personal opinions, there is no accurate way to label FOMC members without an in depth analysis. Through my methodology, I am able to extract the member's policy preferences from their voting records and label them as hawks and doves. While hawks emphasize the importance of keeping inflation low and consistent, regardless of any other economic factors, doves are mainly concerned with keeping output growth high and steady, or, alternatively, keeping unemployment low. By categorizing members into these two ideological camps, it becomes easier to explain why certain members vote in certain ways. Additionally, it can help economists predict how current and future FOMC members will vote based on the economic conditions and their categorization as a hawk or a dove. Finally, we can compare the economic performance during hawk and dove-dominated eras to see which ideology guides the economy better.

Research on past FOMC members and their hawkish or dove-like voting patterns has already been conducted using various methodologies. The continuation of this research is necessary to find a more efficient and simple means of categorization. Additionally, the results yielded by these different methodologies can be compared against one another to draw greater supported conclusions.

I began my research by collecting macroeconomic data from August 2001 to September 2019. I then utilized the Federal Reserve Minutes to consolidate each FOMC member's voting history overtime into one column. I combined the voting histories with the macroeconomic data to run a regression for each member. Next, I recorded the coefficients for inflationary gap and output gap that make up the individual member's unique Taylor Rule. By comparing the two coefficients to each other, I was then able to categorize each member as a hawk or a dove and compare the results to other similar studies. The results yielded 8 hawks, 13 doves, and 8 members that were neither. By comparing my results to the Misery Index, I have been able to conclude that the economy is typically healthier under a dove-dominated FOMC.

In the next section I will be discussing various papers that have also researched FOMC member categorization. Following the literature review in section 2, I will be describing my unique methodology of categorization in section 3. In section 4, I will be explaining how I obtained my data and how I arrived at my results. In section 5, I will be analyzing my results and comparing them back to past studies. Lastly, in section 6, I will formulate my final remarks.

2 Literature Review

There are many studies that focus on FOMC members and their policy preferences. While there are many driving factors that motivate members to arrive at their policy decisions, a common factor is inflation. Overtime, many members have shown to prioritize steady inflation in their voting decisions, making them a "hawk". Conversely, many members have shown to ignore inflation, making them more "dove-like".

In one study that explored a new methodology of categorizing FOMC members as hawks and doves, Klodiana Istrefi (2017) at the Bank of France utilized qualitative descriptions found in over 20,000 articles and journals. Istrefi searched for articles on each individual FOMC member and noted all of the articles that mentioned their policy preferences. She divided the policy preferences into four categories; Expected Hawk, Hawk, Expected Dove, Dove. "Expected" is placed in front of the categorization if the evidence stems from inferences based on their background and public statements. A member is labeled strictly as a hawk or a dove if the evidence stems from their votes and decisions made while a voting member on the FOMC.

The study concluded that from the 1960s to 2015, 39% of FOMC members were hawks, 30% were doves, and 24% were inconclusive (2018). The research goes a step further and recognizes correlations between a member's categorization and other factors, such as educational background, ideologies, chairman during their term, among others. Due to the qualitative nature of her study, I believe my quantitative methodology has the potential to yield more accurate and efficient results.

Another study on FOMC member's hawkish or dove-like behavior tests the theory that their categorization is due to their lifetime inflation experiences. Malmendier (2018) tests this by utilizing the Taylor Rule and assigning a variable, *j*, to represent the members personal inflation experiences. He looks into their voting history, as well as their age and inflationary events throughout their lifetime. After careful analysis and computation, Malmendier concludes that there is a significant effect of lifetime inflation experiences on an FOMC member's votes, official remarks, and forecasts. This means that FOMC members who are similar in age are more likely to vote the same way and fit into the same ideological categorization. While Malmendier's study uses quantitative data, there is no way to accurately quantify lifetime inflation experiences. Therefore, his results are not obtained from a strictly quantitative source.

A study that set out to rank past Federal Reserve chairs from most dove-like to least was conducted by Wilson (2019) utilizing the Taylor (1993) Rule. He had originally predicted that Yellen would appear to be a strong dove, due to her background as a labor economist and language utilized in many speeches about the importance of low unemployment. The method Wilson used to arrive at his conclusions involved comparing the target FFR according to the Taylor Rule to the FFR that was voted on by the FOMC. He then goes one step further and compares the average FFR during each chairman's term to the average inflation during that time. Through this method, he concludes that Yellen is the most dove-like chair, while Greenspan is the most hawk-like chair. While Bernacke leans more towards the hawkish end of the spectrum, he is the most moderate.

Despite all of these studies that have been conducted on the categorization of FOMC members, a major concern surrounding the topic is the scarcity of data. In his research on the structure of the Federal Reserve, Peter Conti-Brown (2016) argues that there are too few data points in an FOMC member's voting history to accurately categorize them into hawks or doves. Additionally, there seems to be a bias in the votes of FOMC members as they attempt to maintain credibility by voting close to unanimously. By employing a quantitative method to categorize members and then comparing my results back to the work performed by Istrefi and others, the similarities or differences in the results will reveal whether or not these reservations are true. If my conclusions close to mirror past results, then the shortage of data does not affect the accuracy of the study.

3 Methodology

As evident in past studies, a lot of varying research has been done in attempts to categorize FOMC members as either hawks or doves to better understand how the Federal Reserve arrives at their policy decisions. This research also has the potential to reveal how well or poorly the economy performs under each ideology. The categorization of FOMC members does not currently have a standardized method, which can cause the data to vary from study to study. In the research I have conducted, I proposed and performed a new methodology for the categorization of FOMC members to better understand FOMC members behavioral patterns and their impacts on the health of the economy.

While there are many variations of the Taylor Rule, the most widely accepted version, and the one that I have used in my research, is as seen below:

$$i = r^* + \pi + \beta_\pi (\pi - \pi^*) + \beta_y (y - y^*)$$

In the classical Taylor Rule, both betas are the same and equal to 0.5. However, most policymakers do not follow the Taylor Rule to an exact degree. The betas vary among FOMC members, which is what I have seen through their voting histories. If the β_π is higher than the β_y, the economist is an inflationary hawk. If the β_y is higher, the economist is a dove. I aim to estimate the betas for each FOMC member and test the null hypothesis that β_π and β_y are statistically the same. If they are not, I can reject the null hypothesis and continue with my categorization of the FOMC members in my sample.

The current methodologies to categorize FOMC members rely heavily on qualitative research and are extremely time consuming. By quantifying these two schools of thought, past and present FOMC members can be more effectively categorized by utilizing a quantitative method. Furthermore, the data can then be compared to prior research to observe how closely the results align with one another, despite the different approaches. This will provide a deeper understanding of monetary hawks and doves and their voting decisions.

4 Data

The voting history data necessary for this approach is available on the FOMC Minutes, where each member's voting record is recorded after each meeting. By aggregating the member's votes for the time they served on the board with the inflation and output gap at the time of their votes, their specific Taylor Rule ratio can be estimated. For my research, I utilized

the FOMC minutes released immediately after each FOMC meeting from August 21, 2001 to September 19, 2019.

Beginning with the August 21st, 2001 FOMC meeting, I recorded each voting member of the FOMC and their policy decisions. The members were listed in columns, where the FOMC meeting dates were listed in rows. In each column a "0" was placed in the cell corresponding to the meeting date, if the voting member agreed with the final policy decision. If the president dissented, I indicated that in the data. An "inc" denoted if the member wanted a rate increase beyond what was voted on. A "dec" denoted if the member wanted a rate decrease beyond what was voted on. A "keep" indicated that the voting member wanted to keep the current rate when the majority did not. I manually collected the data from the FOMC minutes up until September 19th, 2019, totaling 115 FOMC meetings with 56 different FOMC voting members.

The next dataset I collected was the macroeconomic data. I began with the shadow Federal Funds Rate, which can be obtained from the Federal Reserve Bank of Atlanta. The shadow rate accounts for other vital economic factors that the FOMC would be conscientious of when making policy decisions. Due to quantitative easing in 2009 and other unconventional policy tools employed by the Federal Reserve during the financial crisis, the traditional FFR does not accurately represent the interest rate desired by the Central Bank. The shadow rate does not have a zero-lower bound, which allows for negative interest rates that can more accurately describe the condition of the economy at that time (Wu, Xia 2016). Once the shadow FFR returns to above zero, the short-term FFR is equivalent to the shadow rate. The shadow rate has been equal to the regular FFR since November 2015, after the economy's complete recovery from the financial crisis.

To obtain data on the output gap I utilized the Philadelphia Federal Reserve real time data database to look into the recorded GDP. By using real time data, I was able to utilize the same data that the FOMC members would have used when deciding on their votes at each meeting. I detrended the data with the quadratic detrending method in order to remove the time trend from the time series data (Nikolsko-Rzhevskyy 2011). By doing this, I ended up with the real changes in output each quarter, while ignoring the time trend. The method of quadratic detrending required utilizing the vintages of data to find the residuals of the output gap.

Next, to obtain the data on inflation I also utilized the database from the Philadelphia Federal Reserve. I then aggregated all of the macroeconomic data into a spreadsheet that was broken down into quarters. The FOMC meets twice each quarter, which required me to split the data into eighths in order to have accurate data for each meeting date. To split the quarters into eighths, I took the average of the data from the quarter before and the quarter after to obtain eight

sets of macroeconomic data for each year. By breaking down my data, I was then able to align the FOMC meeting dates with the corresponding eighth.

In order to run a regression for each individual FOMC member, I had to seperate each member into their own spreadsheet of time series data, where I merged their individual voting history with the coinciding macroeconomic data. Each time an FOMC member dissented and their vote was not listed as a "0", I changed the federal funds rate to represent the member's desired rate. In many cases, the FOMC minutes are extremely detailed and explicitly state by exactly how many basis points the member wanted to raise or lower the FFR by. In those instances, I added or subtracted the proper amount of basis points from the FFR for that specific meeting date. In the few cases where it was not explicit, I increased or decreased the FFR by 50 basis points, to account for the strong desire for the rate change. In the examples where the member dissented and wanted to keep the FFR where it was, I would either add or subtract 50 basis points from the FFR at the proceeding meeting to represent the members ideal FFR.

Before running the regression, I ensured that all OLS violations were accounted for to make sure my results were not biased or inefficient. The data is free from homoscedasticity, autocorrelation, multicollinearity, and endogeneity. Once each member's data was updated and accurate, I ran a simple Ordinary Least Squares (OLS) regression for each FOMC member. I regressed the FFR on the inflation and output gap and was able to obtain an estimation of β_π and β_y to arrive at the member's unique Taylor Rule response. If an FOMC member followed the Taylor Rule exactly, the coefficient yielded for output gap would be statistically the same to the coefficient yielded for inflation minus one. After I ran the regression, I performed an equality test, testing to see if β_π minus one was equal to β_y . This yielded a p-value that showed whether or not there was a significant difference between inflation minus one and the output gap. If there was no statistical difference between the coefficients, it was evidence that the FOMC member showed no strong hawk-like or dove-like voting tendencies. However, for the member's with a p-value below 0.05, I was able to reject the null hypothesis that inflation and output gap response are the same, and therefore I was able to label the members as hawks and doves accordingly.

In order to yield the most accurate results, I obtained as much of the FOMC member's voting histories as possible. This data was extremely finite, due to the strict meeting schedule, with only eight meetings each year. There were 29 FOMC members in the dataset with 20 or more voting records, where I felt as though I could confidently run an accurate regression. There were 26 FOMC members in the dataset with 19 or less voting records, where I did not have enough data to run the regression and therefore, I could not draw any conclusions.

5 Results

The results yielded 8 hawks, 13 doves, and 8 members that could not be concluded as either a hawk or a dove, due to a p-value that was too high (above 0.05). This translates into 27.5% hawks, 45% doves, and 27.5% neither.

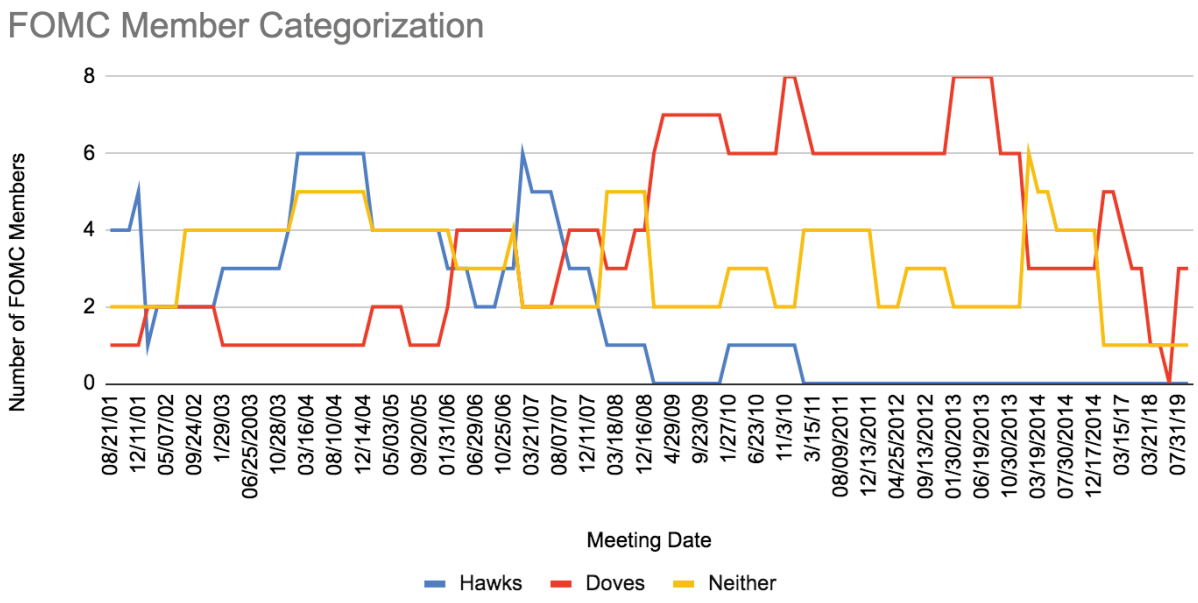
The results are organized into the table below:

FOMC Member	INFL	INFL minus	INFL SE	GAP	GAP SE	p-value	Categorization
Greenspan	1.32	0.32	0.256	0.091	0.201	0.588	neither
Bernacke	1.263	0.263	0.202	0.422	0.038	0.479	neither
Bies	2.158	1.158	0.204	-0.389	0.238	0	hawk
Ferguson	1.366	0.366	0.25	0.087	0.191	0.495	neither
Gramlich	0.507	-0.493	0.257	0.348	0.164	0.039	dove
Kohn	1.664	0.664	0.215	0.206	0.057	0.074	hawk
Olson	1.511	0.511	0.251	-0.042	0.232	0.217	hawk
Moskow	3.296	2.296	0.349	-0.69	0.216	0	hawk
Stern	0.854	-0.146	0.212	0.614	0.13	0.007	dove
Geithner	3.042	2.042	0.306	-0.041	0.172	0	hawk
Hoenig	3.167	2.167	0.4	-0.185	0.087	0	hawk
Minehan	3.575	2.575	0.532	-0.955	0.402	0	hawk
Pianalto	1.265	0.265	0.325	0.377	0.071	0.769	neither
Poole	3.263	2.263	0.39	-0.673	0.226	0	hawk
Fisher	1.684	0.684	0.552	0.489	0.087	0.757	neither
Lacker	-0.306	-1.306	0.38	0.801	0.077	0	dove
Yellen	0.725	-0.275	0.374	0.651	0.083	0.041	dove
Kroszner	-1.051	-2.051	0.89	1.572	0.271	0.004	dove
Warsh	-0.275	-1.275	0.41	0.782	0.101	0	dove
Rosengren	-0.239	-1.239	0.437	0.956	0.117	0	dove
Evans	0.204	-0.796	0.39	0.715	0.085	0.002	dove
Plosser	1.572	0.572	0.608	0.432	0.126	0.843	neither
Duke	-0.341	-1.341	0.13	0.409	0.052	0	dove
Dudley	-0.034	-1.034	0.311	0.508	0.139	0	dove
Kocherlakota	-1.412	-2.412	0.653	-1.496	0.33	0.061	neither
Raskin	-0.345	-1.345	0.165	0.136	0.165	0	dove
Tarullo	-0.31	-1.31	0.305	0.144	0.181	0	dove
Powell	1.863	0.863	0.753	1.027	0.206	0.846	neither
Bullard	-0.415	-1.415	0.341	1.166	0.172	0	dove

In the table of results, the FOMC Members are listed in chronological order from when they joined the Federal Open Market Committee. Most members have taken breaks during their tenure on the board, but it is apparent that FOMC members that are serving around the same time

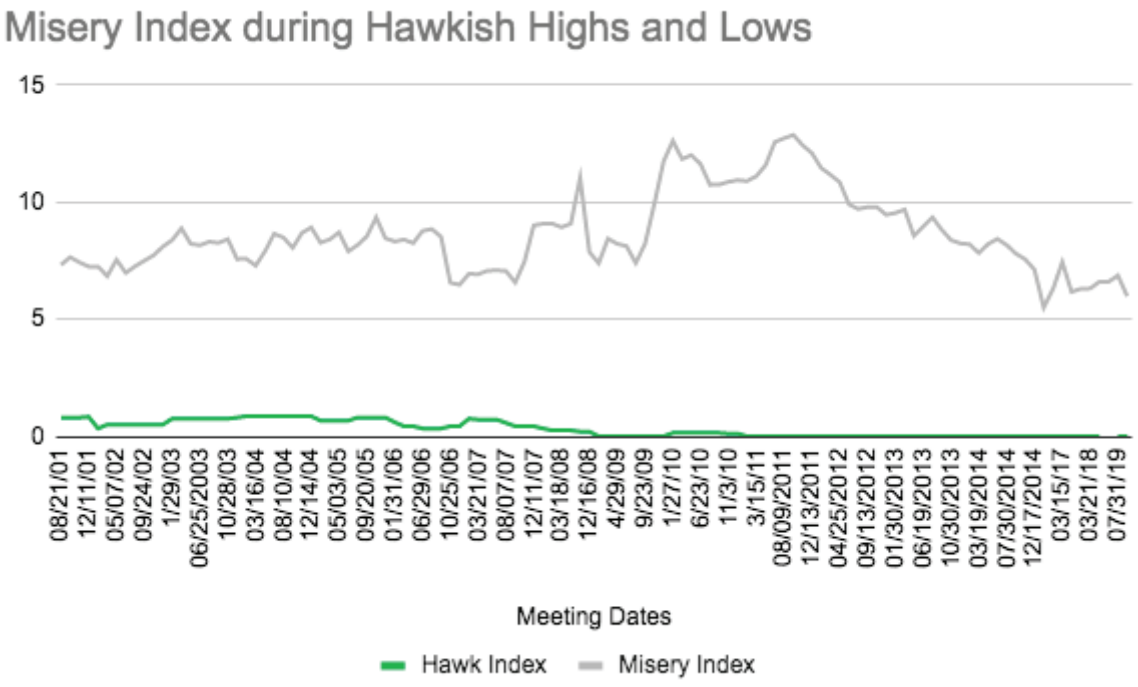
are more likely to have the same categorization. For example, during the Yellen FOMC the vast majority of committee members followed her dove-ish ideologies.

Once I obtained the results, I was able to calculate the number of hawks, doves, and "neithers" at each FOMC meeting. This allowed me to see the time periods in which the committee was dominated by hawks. Due to the finite nature of the data, the results I obtained do not total to all 12 members of the FOMC for each meeting. Many members did not have a vast enough voting history to be categorized, which is why not all 12 members can be accounted for. The graph below shows the number of hawks, doves, and "neithers" on the committee over time.



It is apparent that there is a strong hawk presence up until 2008. Between August 2001 and March 2008, the committee majority was mostly hawks, but fluctuated periodically. From 2009 onward doves dominated the FOMC. The graph shows that since 2011, there have been no hawkish members on the FOMC. This means that the policies and rate changes that have been passed recently tend to be more dove-like. Due to the overwhelming dove-like majority of the FOMC, it can be inferred that in the past eight years inflation has not been the main concern of the FOMC. The FOMC seemed to be much more concerned with keeping output high and unemployment low in their policy decisions.

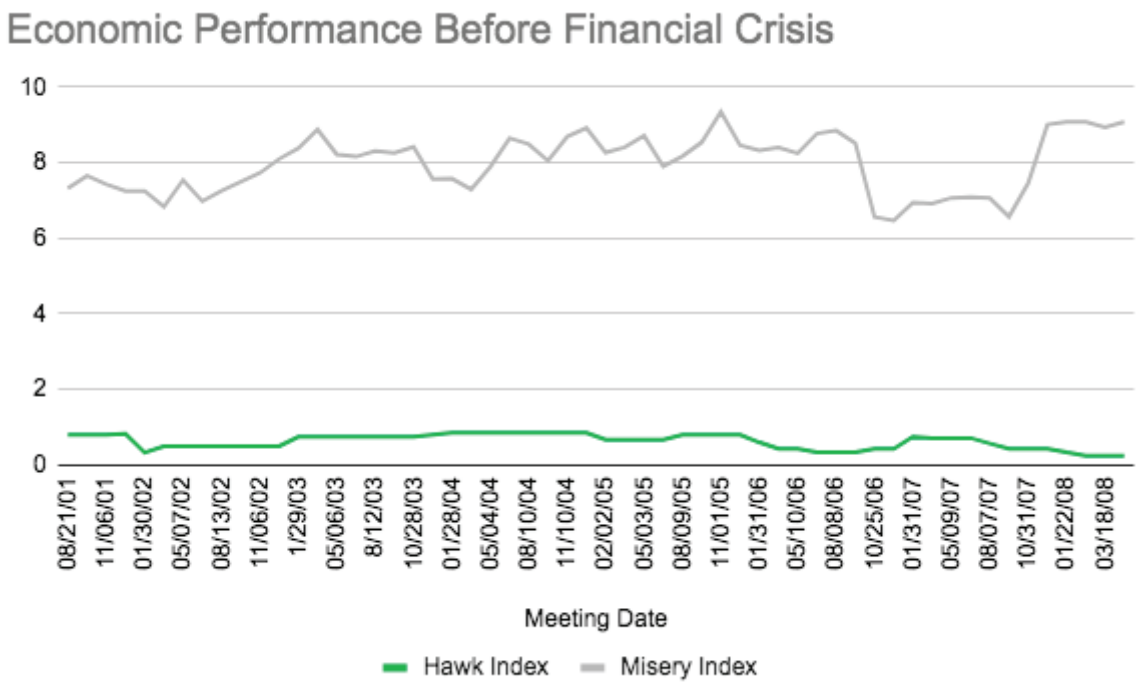
The graph below shows the percentage of hawks overtime, listed as the “Hawk Index”, compared to the Misery Index, to represent economic performance overtime.



The Misery Index is an economic indicator of how healthy the economy is. It is calculated by summing the unemployment rate with the inflation rate. The higher the Misery Index is for a given quarter, the worse the economy is doing. A low Misery Index usually indicates a productive and healthy economy (Hanke 2019). By placing the Misery Index over the Hawk Index, I was able to see whether the economy performed better under a hawkish or dove-ish FOMC.

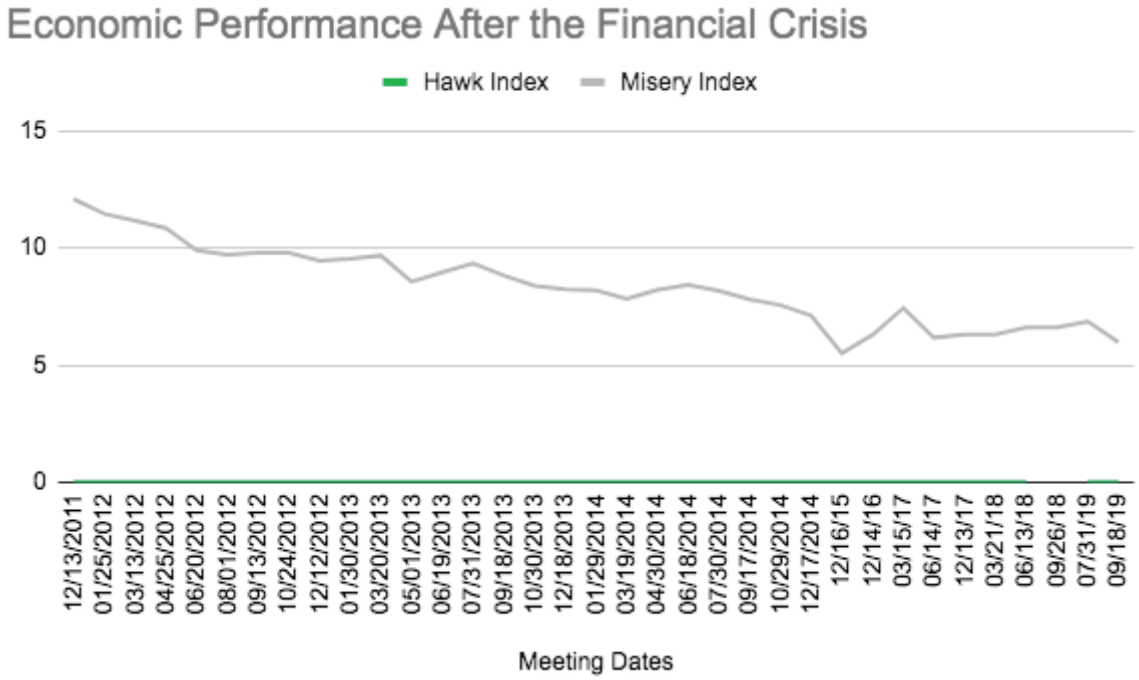
Before drawing conclusions, it must be noted that the 2008 financial crisis (which began in September of 2008 and greatly affected the economy until mid-2011) had tremendous effects on the health of the economy that was beyond the FOMC’s control. Therefore, the Misery Index is the highest, as seen above, at the end of 2008. It does not return to a normal level until early 2012. During that time, the FOMC was dominated by dove-ish members. Because of the extreme nature of the financial crisis, the recession is enough evidence to draw conclusions about doves impact on the health of the economy. In order to properly analyze the data, while regarding the financial crisis as an outlier, I seperated the graphs into pre and post financial crisis time periods.

The graph below shows the same data as above for FOMC meetings before the 2008 financial crisis.



When the Misery Index is at its highest points, there are typically more hawks than doves serving on the FOMC. Leading up to the financial crisis (on the far right side of the graph) the Misery Index is high and the number of hawks is greater than the number of doves. However, the hawk index shows that in this period from 2001-2008, the number of hawks serving on the FOMC stays fairly consistent. This makes it difficult to draw any conclusions about economic performance during hawk highs and lows.

I went a step further and pulled the data from after the financial crisis and the recovery period to see if there was a correlation between the Misery Index and a hawk-ish FOMC in more recent years. The graph below shows the economic performance after the economy reverted back to normalcy at the end of 2011.



Due to the lack of hawks serving on the FOMC post-financial crisis, I cannot make any conclusions about the success or failure that hawk-ish FOMCs have recently had on the economy. However, beginning in 2017, the Misery Index reached its lowest point in my dataset. During these times (from December 2017 to September 2019), the FOMC was dominated by doves. This provides some evidence that a dove-dominated FOMC tends to be most successful. While there could be other factors at play, there is strong reason to believe that dove-like policies have a more positive effect on the health of the economy.

After my initial analysis, I began to compare my results to prior studies on FOMC categorization. When comparing my results with Istrefi's, I see some similarities and some key differences. Istrefi found Yellen to be a strong dove, which my data agrees with. Additionally Istrefi found about a quarter of the FOMC members to be neither hawks or doves, which is also found in my data. However, Istrefi labeled Plosser, Fisher, Bernake, and Greenspan as hawks, which my data disagrees with. Those four perceived hawks in Isterfi's findings are actually labeled as "neither" in my data. This likely means that my criteria to label a member as a hawk has a much higher threshold. The members that I have categorized as hawks are probably much

more extreme in their inflationary focussed voting behaviors. While 39% of the members Istrefi analyzed at were hawks, only 27.5% of my selected members were. This could either mean that the sample of FOMC members we analyzed varied greatly, or that once again, the threshold I used to consider a member a hawk is much more extreme.

By comparing my results to Wilson's, I can see that it is once again confirmed that Yellen is an extremely dove-like Chairman. Similarly to Istrefi, Wilson labeled Greenspan and Bernacke as a hawk, which disagrees with my data.

In response to Conti-Brown's reservations about performing any research with FOMC voting histories, I believe that for the 29 members with 20+ voting records, my analysis yielded accurate results. However, the 27 remaining FOMC members I collected data on did not have enough voting history to draw any accurate conclusions. With the few similarities between my research and other past hawk/dove categorization research, my results are just and credible. My results yielded had a p-value of less than 0.05, which shows high statistical significance and little room for error.

6 Conclusions

While my data is finite and only spans across two decades, I have been able to make many conclusions about FOMC members and their policy preferences. Through my methodology of utilizing the FOMC voting histories and Taylor Rule responses, I have found that many FOMC members that are often perceived as monetary hawks are actually neither hawks, nor doves. In my analysis, to be considered a hawk the threshold is higher than in other studies. I have also found that in recent years, there has not been a strong hawk presence on the FOMC. Instead, doves have been the majority on the committee since 2007. Disregarding the years spanning the financial crisis, the economy seemed to perform best under dove-like policies. The Misery Index was at its lowest point with 6+ doves on the FOMC.

After categorizing FOMC members as inflationary hawks and doves based off of their Taylor Rule responses, it became evident that FOMC members do not typically use the classical version of the Taylor Rule. This confirms that there tends to be an innate bias in most committee members and their policy preferences. While members usually avoid sharing their personal opinions, they often showcase their opinions in their voting decisions. Although there are many possible ways to categorize monetary policy makers as inflationary hawks or doves, my methodology seems to be a simple and standardized way to easily arrive at these conclusions. The quanitative nature of my methodology removes any space for human judgement or inference, which makes it easy to directly compare member's preferences to one another.

Future studies can further explore if a hawk or dove-dominated FOMC is most effective at keeping the Misery Index low, and therefore, the economy healthy. A more expansive analysis can be achieved by utilizing data from before 2001 and adding in the most up to date data. While my analysis only included eighteen years of FOMC meetings, my methodology can easily be replicated to categorize both past and future FOMC members. This can allow economists to better understand FOMC member's voting patterns and better predict what the target Federal Funds Rate will be before the FOMC Minutes are released.

7 References

Bordo, Michael, and Klodiana Istrefi. “Perceived FOMC: The Making of Hawks, Doves and Swingers,” 2018.

Conti-Brown, Peter. “5. The Vestigial and Unconstitutional Federal Reserve Banks.” *The Power and Independence of the Federal Reserve*, 2016, 103–26.

Hanke, Steve H. “Hanke's Annual Misery Index 2018: The World's Saddest (and Happiest) Countries.” *Cato Institute*, 3 Apr. 2019.

Istrefi, Klodiana. “In Fed Watchers’ Eyes: Hawks, Doves and Monetary Policy ,” January 2017, 1–21.

Malmendier, Ulrike, Stefan Nagel, and Zhen Yan. “The Making of Hawks and Doves,” May 1, 2018, 1–24.

“Meetings, Calendars, Statements, and Minutes.” *Board of Governors of the Federal Reserve System*.

Nikolsko-Rzhevskyy, Alex. Monetary Policy Estimation in Real Time: Forward-Looking Taylor Rules without Forward-Looking Data. Journal of Money, Credit and Banking, Aug. 2011.

“Real Time Dataset: Full Time-Series History.” *Historical Data Files for the Real-Time Data Set - Philadelphia Fed*.

Taylor, John B. *Discretion versus Policy Rules in Practice*. Carnegie-Rochester Conference Series on Public Policy, 1993.

Thornton, Daniel L. “When Did the FOMC Begin Targeting the Federal Funds Rate? What the Verbatim Transcripts Tell Us.” *The Federal Reserve Bank of St. Louis*, 26 July 2005.

“United States Misery Index.” *Quandl*, 2020.

Wilson, Linus. “A Dove to Hawk Ranking of the Martin to Yellen Federal Reserves.” *SSRN*, University of Louisiana at Lafayette, 10 Oct. 2019.

Wu, Cynthia, and Fan Dora Xia. “Wu-Xia Shadow Federal Funds Rate.” *Federal Reserve Bank of Atlanta*, 6 Jan. 2016.