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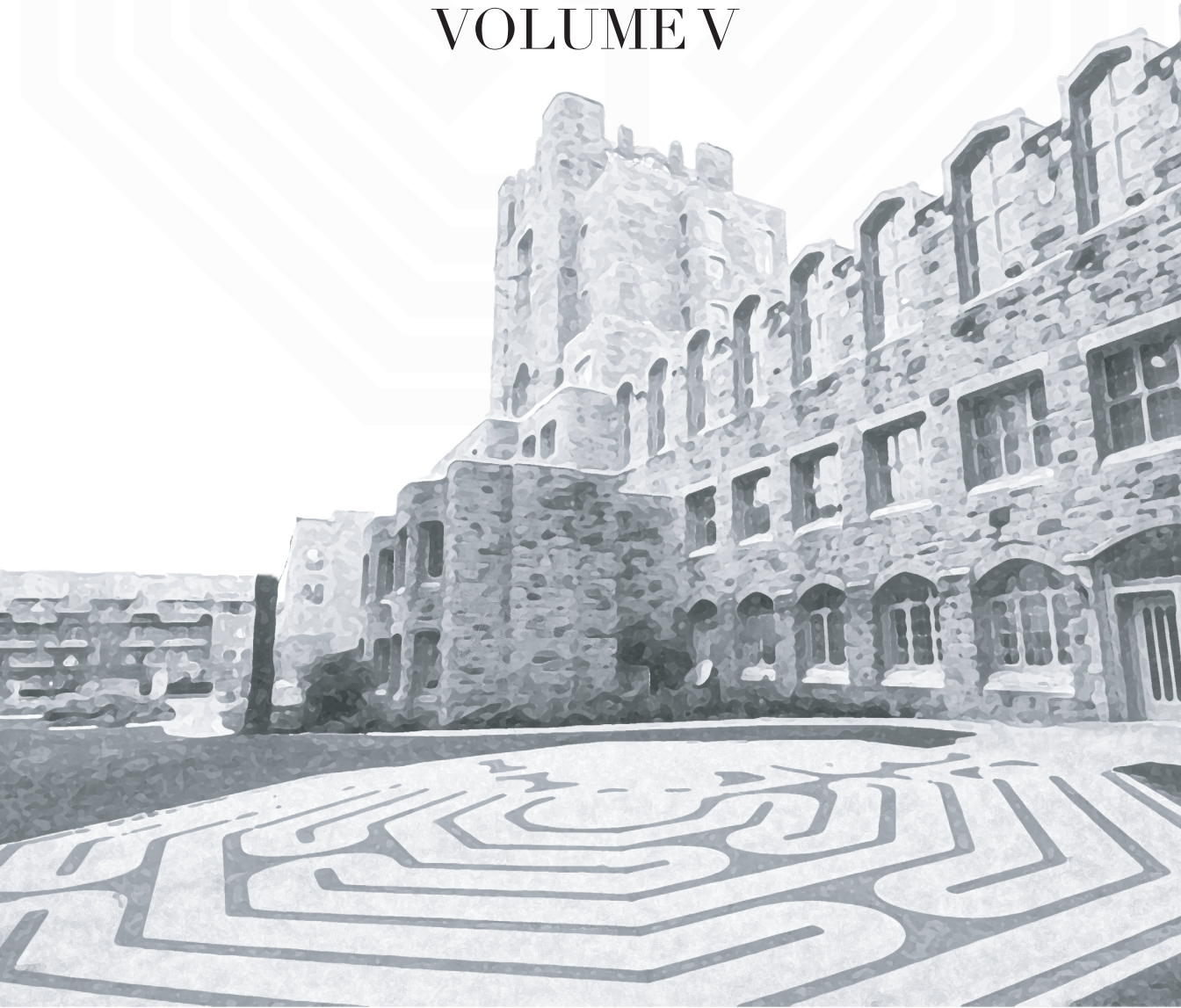

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Vancouver School of Economics

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Vancouver, BC

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Felix, qui potuit rerum cognoscere causas

" Happy is he who has been able to learn the causes of things "

-Virgil, *Georgics II*

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Student Foreword

Dear Reader,

On behalf of the Vancouver School of Economics Undergraduate Society (VSEUS), I would like to congratulate the numerous students at the VSE for sharing their knowledge and ideas through this platform, and commend the extraordinary work done by the IONA Journal team for publishing the fifth edition of their journal. VSEUS strives to support academic success and community engagement, and the IONA Journal has done a tremendous job of facilitating both of those values. Our economics students are among the best and the brightest in the world, and thanks to IONA, we are able to showcase the talented individuals that we have at the VSE by offering a platform on which to demonstrate that even novice scholars are capable of great research. The articles contained in this journal are just one of the ways that our students have been able to take what they learn in the classroom and apply it to today's challenges around the globe. A very special shout-out to Mina Sidhu, the IONA Journal's Editor-in-Chief, and Jessica Dai, the Director of Business Operations, for the countless hours that they and their team have put into making this project a massive success. My hope is that in the pages that follow, you will find topics that interest you, find new interests, and ultimately

expand your knowledge. Whether you are reading this online or reading a hard copy, I hope that you enjoy the fifth installment of the IONA Journal of Economics, and thank you for reading.

Ryan Wong

VSEUS President
2019-2020

Letter from the Editorial Board

Dear reader,

It's been quite a year for everyone in the economics community at UBC. Despite a whirlwind ending to the term, there is much to celebrate in the outstanding work produced by students at the Vancouver School of Economics.

This volume marks five years of operations for the IONA Journal of Economics. It is with great pride that we put out our fifth volume featuring such a bright and diverse body of work. The papers of Volume V address questions of economic confidence and sentiment, political polarization, inhibitors to natural resource use and the equity premium puzzle. Each one, authored by students across the arts major and honours programs, demonstrates both creativity and a great deal of rigour in its approach to finding solutions to difficult questions. The pages that follow illustrate with certainty that the bar for undergraduate economics research continues to be raised, and successfully met.

As a discipline, what is taught by economics is a way of thinking. The applications of this style of thinking go beyond what is captured in question-and-answer research. It shows its value in guiding interpretations of the affairs that surround us. It teaches us to not just look at the *now* for information, but to

search for cause and effect. A showcase of this principle of the study of economics is at the heart of our online series the IONA Exchange, and it is incredibly exciting to feature in this volume, for the first time, some of the Exchange's best work. Authored by a group of student writers, the Exchange presents news articles and think pieces inside of an economic framework. In this volume you will find investigations into the role of happiness in policymaking and the free press's fulfillment of its institutional duties.

From all of us at the IONA Journal: thank you, reader, for being a part of our community. Behind this publication is a group of editors, writers and advisors who contribute countless hours towards its annual production; we are motivated by what we, as undergraduate students, can contribute to our field, and by individuals like you who support us in championing our classmates' voices and ideas.

While you read through this volume, our hope is that you find something that engages you, something that inspires you, and something that you question. Whatever your question may be, and however tough, let the work presented here serve as a reminder of how you too are equipped to search for answers and find solutions, no matter your degree level.

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IONA Journal of Economics Volume V

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I
PAPERS

Federal Open Market Committee Statements, Sentiment and the United States Stock Market

Michael Mak

ECON 490

ABSTRACT

Using public releases from Federal Open Market Committee meetings between January 2000 and March 2019, I analyze the relationship between the sentiment in the statements and possible short-term effects in the S&P 500 Index. I generate sentiment using several sentiment dictionaries, relating to finance and otherwise, created from previous bodies of work. I find that regular and financial sentiment dictionaries do not have a significant relationship with short-term returns in the S&P 500 Index. A sentiment dictionary constructed specifically for language use in central banks, however, has a correlation with future returns when compared with negative sentiment.

Sentiment analysis is a branch of textual analysis where a piece of text is given a quantitative number usually representing the text's polarity; polarity is a measurement of the overall positivity or negativity of the text. Because the applied use of sentiment analysis in economics and finance is still growing, there are opportunities to apply this analytical method to statements from the United States central bank. In the stock market, movements and policy changes from the Federal Reserve, the United States' central bank, are closely watched. However, there is a gap in the research that studies the sentiment of key press releases and statements. This paper seeks to examine whether there exists a relationship between Federal Reserve statement sentiment and the Standard and Poor's 500 Index. I use 19 years of the Federal Reserve statements that follow policy meetings and generate a quantitative proxy for sentiment in order to study the sentiments' short-term effects on the United States stock market. To generate a measure representing sentiment, I take three different sentiment dictionaries from existing literature on this topic and compare the results. A sentiment dictionary is a dictionary where, instead of meanings, words are given a value to quantify the positive or negative feeling that they reflect. One dictionary is generated from a non-economic or finance-related context (De Smedt & Daelemans, 2012). Another dictionary is derived from finance specific terms and meanings (Loughran & McDonald, 2011). The last sentiment dictionary was created by a collection of central bank statements collected from 63 different monetary bodies (Correa, Garud, Londono, & Mislang, 2017).

In this paper, I describe the parts of the United States monetary system that are relevant to this study, and I also look at previous literature that analyzes central bank public statements and conducts

text-based analysis. After retrieving and parsing the relevant statements, I use Python to convert the text data into variables such as polarity, subjectivity, and positive and negative word counts. I find that sentiment dictionaries that were created for general use are ineffective in economic or finance related works. I also find that in a central banking context, the number of negative words in a Federal Open Market Committee statement have a negative correlation with the one-day future change in the S&P 500.

I begin by outlining the Federal Open Market Committee and relevant institutions in Section I, followed by a brief overview of the Standard and Poor's 500 Index in Section II. I then review the academic literature on Federal Reserve actions and statements, sentiment analysis, and applications of sentiment in finance in Section III. Next, I summarize and describe the sources of data used in this paper, with financial data in Section IV-A and sentiment data in Section IV-B. There, I also describe the methodology I use in order to generate custom variables. In Section IV-C, I note the political and regime leaders that I use as categorical control variables in this study. Section V outlines the specification of the models that I test for relationships between sentiment and the stock index. Section VI reveals and discusses the statistical results from the regressions. Finally, Section VII summarizes the results while discussing the implications of the findings, as well as offering potential areas for further research.

I. FOMC, Meetings, and Statements.

The FOMC (Federal Open Market Committee) is a group within the United States' Federal Reserve that meets and sets the monetary policy of the United States Central Bank. In this case, monetary policy

refers to the actions made by the Federal Reserve that affect the nation's money supply and interest rates. The main goal of monetary policy is to maintain a steady inflation rate, while balancing variables such as employment, wage growth, economic growth, and gross domestic product. The Federal Reserve currently conducts monetary policy using three tools: reserve requirements, the ability to set the discount rate, and the ability to conduct open market operations. Reserve requirements are the requirements for banks and similar institutions to place a portion of their total capital in Federal Reserve banks. This requirement serves to not only ensure that there is sufficient capital on hand for banks, but also to control money liquidity and supply. One of the reasons for the capital requirement is to meet potential withdrawal demand; for example, in the case of a run on banks. The discount rate is an integral part of the financial system as it determines the overnight interest rate that financial institutions charge when lending to each other within the Federal Reserve. Open market operations refer to the Reserve's ability to buy and sell government securities in the open market. These tools seek to target a Federal Funds rate that the Committee sets between meetings. The tools and the Federal Funds rate are integral in determining the rate of new investments, and the discounting of future cash flows.

The FOMC meets regularly to discuss and determine the current and future economic state, and how to set monetary policy. Since 1981 there have been eight scheduled meetings each year, in addition to numerous unscheduled meetings and conference calls between them. Since May 1999, a public statement is always released after each scheduled meeting, even if no actions are taken (Lucca & Moench, 2015). Subsequent minutes to each meeting are released approximately 20 days after the release

of a post-meeting statement. Lucca and Moench also indicate the statements were released around 2:15 PM Eastern Standard Time from September 1994 to March 2011 (2015). However, they note that release time has fluctuated since April 2011, with release times ranging between 12:30 to 2:00 PM. Generally, FOMC statements will include the Committee's view on the economy, projections into the future, and changes in monetary policy, all of which will affect an investor's expectations of future cash flows. Changes between statements are monitored very closely by investors and capital market participants as they judge both the tone and words used.

II. The US Stock Market and the S&P 500 Index

The S&P (Standard and Poor's) 500 Index is a price return stock market index that is comprised of 500 publicly traded firms of the United States that are listed either on the New York Stock Exchange or the NASDAQ Stock Market (S&P Dow Jones Indices, 2019). This index is market capitalization weighted, meaning each constituent of the index is more heavily weighted the larger its market capitalization is. By nature of the methodology used, the index consists of only "large-cap" firms. This is due to the component requirement of a market capitalization of at least 8.2 billion United States Dollars as of February 20th, 2019 (S&P Dow Jones Indices, 2019). As the S&P 500 Index represents 80% of the total market capitalization in the United States, it can be a suitable proxy for the stock market (S&P Dow Jones Indices, 2019). As the constituents are publicly traded equities, the index is constrained to market hours, where the market open takes place at 9:30 AM and closes at 4:30 PM, Eastern Standard Time.

III. Related Literature

The idea of examining FOMC statements and subsequent reactions from the stock market is heavily discussed in business media and is widely watched by participants in capital markets. Every time an FOMC meeting nears, there is a flurry of articles and commentary that attempt to predict the Federal Reserve's tone and how it will affect markets. For example, a Forbes article published in September 2018 suggested that the Federal Reserve would almost definitely raise Federal Fund rates at the next meeting, and that "the stock-market could get more challenging and volatile" (Sarhan, 2018). More recently, an article on The Motley Fool discussed why and how a recent FOMC statement had led the stock market to gain (Frankel, 2019).

Research conducted by Neuhierl and Weber indicates that the equity markets may have a predictable effect post-policy decision announcement (Neuhierl & Weber, 2018). Their research identifies a shock in prices that may continue for 15 days, averaging returns of 4.5%. Neuhierl and Weber's "Monetary Momentum" is important as they discover that stock prices move in a predictable pattern prior to monetary policy releases, and they continue to exhibit a predictable return after the release (2018). The returns pre-and post-release depend on whether the monetary policy was a contractionary or expansionary surprise (Neuhierl & Weber, 2018). While Neuhierl and Weber's research did not work with sentiment, their analysis shows the effect that central banks may have on international markets, simply through monetary policy releases.

Carlo Rosa, an economist in the Federal Reserve Bank of New York, has authored an article on the effect of FOMC minutes on general capital markets. In the article he finds that trading volume

and volatility greatly increase in a short window post-release, but the effect of the FOMC minutes release is less than that of the FOMC statement and some important economic indicators, like the nonfarm payroll employment numbers. Rosa also identifies a weakening response to the minutes since 2008, suggesting the increased transparency of the Federal Reserve may have caused the weaker response. Rosa's research supports that there is a tangible effect of FOMC statements on capital markets. In Lucca and Moench's research, they describe an observed effect in U.S. equities where there are abnormal risk-adjusted returns occurring in the 24-hour period leading up to scheduled FOMC meetings (Lucca & Moench, 2015).

In recent years, with the increasing popularity of natural language processing and computational sentiment analysis techniques, a variety of research has been conducted on modeling stock market returns according to various sources of sentiment. A commonly cited piece of research linking textual sentiment analysis and finance is Loughran and McDonald's "When is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks" (Loughran & McDonald, 2011). Loughran and McDonald find ineffectiveness in the Harvard Psychosocial Dictionary when used to process finance-related text data. Specifically, they find that nearly 75% of negative words in the Harvard Dictionary are not considered negative in a financial context. Loughran and McDonald create a dictionary of finance-related words, relating positivity, negativity, and other affective attributes (2011).

Bognár looked at financial news from Google News RSS Feeds, created sentence, document, and daily sentiment scores, and compared them to Apple's daily closing price (Bognár, 2016). In this case, Bognár used two different sentiment dictionaries to compare his results. Ren et al. also studied potential predictive

effects of sentiment on the stock market, by using a Support Vector Machine model to process sentiment and market data (Ren, Wu, & Liu, 2019). To collect sentiment data, Ren et al. used web page crawlers on a set of pages to collect text data and converted the text into sentence-based sentiment scores (2019).

More closely related is Smales and Apergis's "Does More Complex Language in FOMC Decisions Impact Financial Markets?" where they describe effect of the Federal Reserve's increasingly complex statements due to the evolution of unconventional monetary policy over time (Smales & Apergis, 2017). Smales and Apergis show that there is a correlation between language complexity of FOMC statements and trading volume and volatility across equity, debt, and currency markets (2017). Ito et al. studied the minutes of FOMC meetings and used a networked machine learning approach to create a polarity dictionary of words in the minutes (Ito, Izumi, Sakaji, & Suda, 2017). An internal working paper from the Federal Reserve specifically studies the text of financial stability reports (Correa, Garud, Londono, & Mislang, 2017). Correa et al. create a dictionary of positive and negative words specifically addressing sentiment of these words from a central bank financial stability context (2017). In this paper I take techniques learned from the literature and apply it to Federal Reserve statements in order to find whether the sentiment of the statements released by the Federal Reserve have a meaningful relationship.

IV. Data and Key Variables

A. Financial Data

The scope of my analysis focuses on the effects of FOMC statements on the stock market from January 2000 to March 2019, partially due to changes in the post-

meeting statement releases in 1999. Subsequently, the first relevant statement release takes place on February 2nd, 2000, and the range of the acquired data for the S&P 500 Index is January 3rd, 2000 to March 1st, 2019. The Index data is at a daily level, with open, high, low, close, and volume variables, and is obtained from Norgate Investor Services. For my research only close is used, but not directly. The key variable that I create from the S&P 500 Index is the future percentage change over an n-period of days. The formula for calculating the n-day percentage change is

$$(1) \quad \%\Delta y_n = \frac{y_{t+n} - y_t}{y_t}$$

where y_t is the value closing value of the index at time t and n is the number of future days forward. I also use the absolute value of the one-day future return as a measure of the short-term magnitude of price changes.

TABLE 1 - SUMMARY STATISTICS OF S&P 500 CHANGES

	No. Obs.	Mean	St. Dev.	Min	Max	50%
1-Day Percentage Change	4814	0.000207	0.012017	-0.090350	0.115800	0.000533
2-Day Percentage Change	4814	0.000413	0.016342	-0.124174	0.132064	0.001036
3-Day Percentage Change	4814	0.000607	0.019335	-0.139059	0.139480	0.001834
5-Day Percentage Change	4814	0.000999	0.024410	-0.183401	0.191112	0.002649
Previous Day Pct. Change	4814	0.000208	0.012046	-0.090350	0.115800	0.000533
1-Day Absolute Pct. Change	4814	0.008000	0.008969	0.000000	0.115800	0.005335

Notes: These values are raw calculations, not adjusted to percentage points. For example: 0.01 = 1%

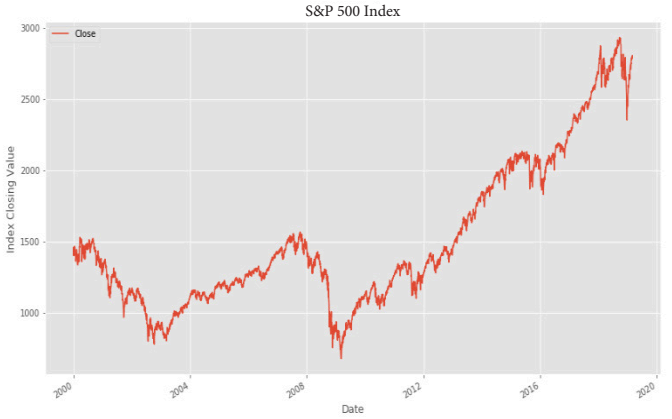

FIGURE 1. S&P 500 INDEX, DAILY CLOSE, JANUARY 2000 TO MARCH 2019

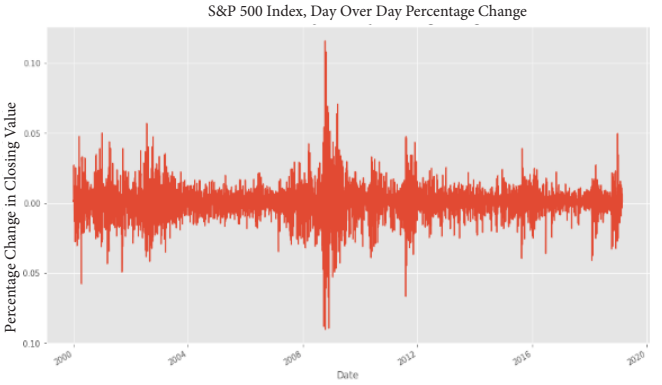

FIGURE 2. S&P 500 INDEX, DAILY PERCENTAGE CHANGE ON CLOSE, JANUARY 2000 TO MARCH 2019

B. Sentiment Data

FOMC statements were acquired from the Federal Reserve Board website. I programmed a Python-based web crawler program for this specific purpose. The script retrieves all webpages that contain press releases from the Federal Reserve Board within a specified time range and parses the HTML to retrieve the relevant text data. The program cleans the text by removing escape characters from the text data (\n, \r, \t, \xa0, \u2003, \u2011). These escape characters are deemed unnecessary as their only purpose is

to change the visual display of the text. The text is then stored in comma-separated value files, each file storing one statement, with each paragraph separated by a comma. I then created a script to retrieve a list of all the dates where an FOMC meeting statement was released. I wrote another web crawler which parsed the relevant dates from the calendars available on the Federal Reserve Board website. I then used the retrieved dates as a filter for the press releases to determine which retrieved statement was relevant.

From this retrieved text data, I was able to programmatically process the data using several methods to return sentiment and text related variables as listed in the following table:

TABLE 2 SUMMARY STATISTICS OF SENTIMENT DATA

	No. Obs.	Mean	St. Dev.	Min	Max
polarity	163	0.080199	0.039870	-0.008750	0.212000
subjectivity	163	0.351940	0.067781	0.100000	0.574091
LM_POS	163	7.785276	5.112008	0	28
LM_neg	163	7.134969	5.285101	0	31
CB_POS	163	4.036810	3.331276	0	20
CB_neg	163	2.656442	2.623212	0	13
word count	163	528.570552	287.55263	70	2122

Note: : These values are raw calculations, not adjusted to percentage points. For example: 0.01 = 1%

The polarity and subjectivity variables are generated by means of a Python package named TextBlob (Loria, 2019). This package itself is a wrapper of several natural language processing libraries in Python, including Pattern and NLTK. Polarity is a measure of the positive versus negative sentiment of the evaluated text. Polarity can take on any value in the range of [-1,1], where a negative number represents a stronger negative sentiment connotation from the text, and a positive number is a stronger positive connotation. Subjectivity is a measure of the text's

objectivity versus subjectivity, where a value in the range of [0,1] can be taken on; 0 is objective and 1 is subjective. Both polarity and subjectivity are generated by means of a vast sentiment dictionary used in Pattern (De Smedt & Daelemans, 2012).

LM_POS and LM_neg are both counts of words from the passed text data which match with the Loughran and McDonald financial sentiment dictionary (2011). LM_POS is the count of positive words in the text as defined by the dictionary. LM_neg is the count of negative words in the text, defined by the dictionary. These word counts were generated using a function that I wrote that takes three variables, the text, a list of positive words, and a list of negative words, and returns the positive count, negative count, and total word count. In calculating the negative word count, I also applied the method used by Loughran and McDonald on negation, where if the words 'NO', 'NOT', 'NONE', 'NEITHER', 'NEVER', or 'NOBODY' are within three preceding words of a positive sentiment word, the word is then considered a negative sentiment word, and added to the count (2011). Loughran and McDonald's research explains that double negatives rarely, if ever, occur in financial related text and thus negative sentiment words that are negated need not be counted.

CB_POS and CB_neg are positive and negative word counts generated using the same method as the LM_POS and LM_neg counts. In this case, the difference is in the positive and negative word lists that are passed in into the function. The dictionary used for these values was pulled from the work of Correa et al. in "Sentiment in Central Banks' Financial Stability Reports", where the used words and their contexts are derived from central bank reports (Correa, Garud, Londono, & Mislang, 2017). The methodology I used to retrieve positive and negative word counts is the

same method used as the previous Loughran and McDonald sentiment word counts. The method of negation words is also applied.

The word count variable is the count of words in each statement. This is created by processing the text data and using the NLTK stop words corpus to remove all stop words from the statement. A stop word is a word that usually does not carry much meaning in the English language and is used as part of grammatical structuring. In this case, it would be words such as 'the', 'or', 'a', and 'and.' Only the remaining words are counted and added to the word count variable. With this sentiment data, I explore some preliminary relationships between them.

Here, it is interesting to note that there is a positive linear correlation between the positive word counts from the Loughran McDonald (LM) dictionary and the Central Bank (CB) sentiment dictionary.

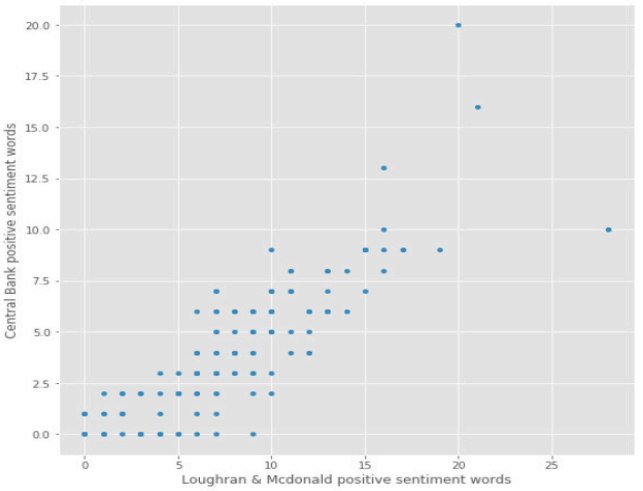

FIGURE 3. POSITIVE WORD COUNTS BETWEEN LOUGHRAN AND MCDONALD DICTIONARY AND THE CENTRAL BANK SENTIMENT DICTIONARY

Conversely, the linear correlation between the negative word counts of both dictionaries is less evident.

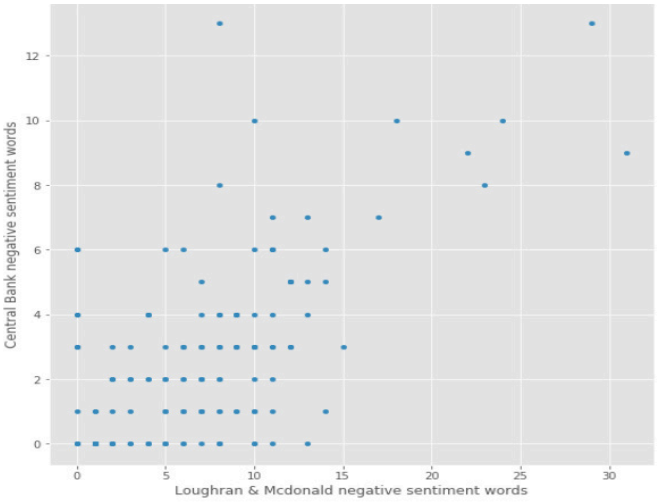

FIGURE 4. NEGATIVE WORD COUNTS BETWEEN LOUGHRAN AND MCDONALD DICTIONARY AND THE CENTRAL BANK SENTIMENT DICTIONARY

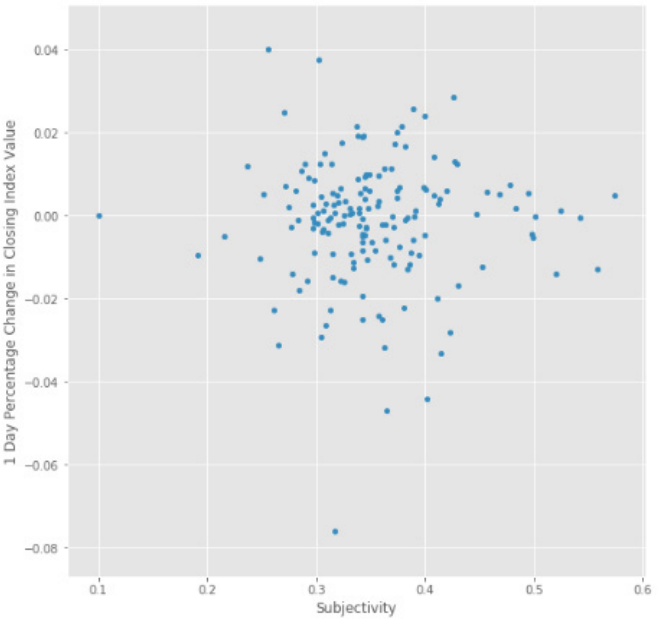

FIGURE 5. RELATIONSHIP BETWEEN SUBJECTIVITY AND THE 1 DAY PERCENTAGE CHANGE

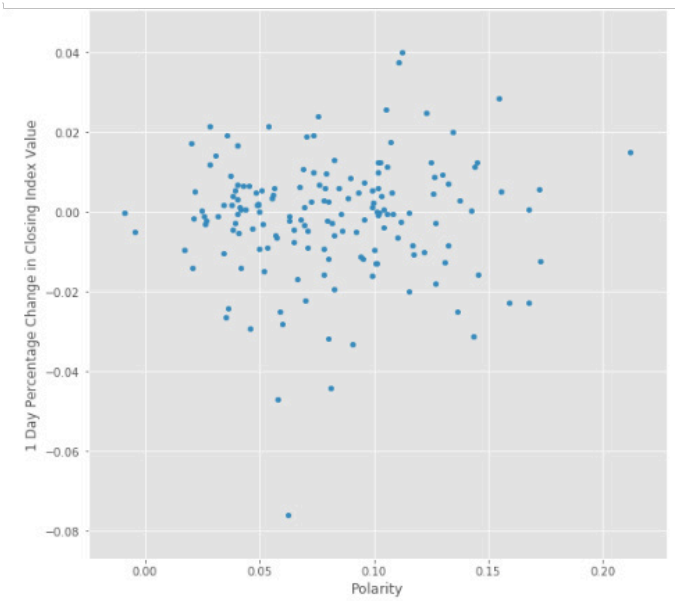

FIGURE 6. RELATIONSHIP BETWEEN POLARITY AND THE 1 DAY PERCENTAGE CHANGE

Finally, a look at the absolute value of the 1-day percentage changes with polarity and subjectivity shows a slight negative correlation between subjectivity and absolute returns, and a more muddled relationship between polarity and the absolute change.

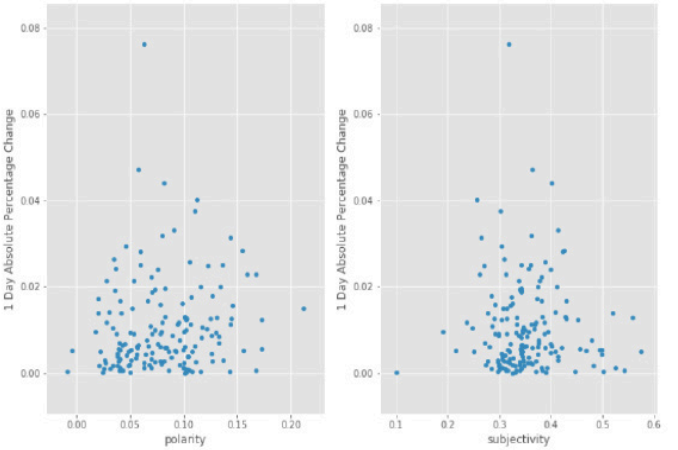

FIGURE 7. POLARITY, SENTIMENT AND THE ABSOLUTE 1-DAY PERCENTAGE CHANGE

C. Political and Policy Leaders

I include the terms of Federal Reserve Chairs and United States Presidents as categorical control variables in my data. These variables are included in part to control for political regimes, as the Federal Reserve is part of the United States Federal government. To create this set, I matched each date in the existing dataset with the corresponding Federal Reserve Chair and the President.

TABLE 3 - FED CHAIRS AND PRESIDENTS

Fed Chair	Greenspan	Bernanke	Yellen	Powell
Relevant business days as Chairman of the Federal Reserve	1327	2088	1045	280
Start	1/1/2000	2/1/2006	2/3/2014	2/5/2018
End	1/31/2006	1/31/2014	2/3/2018	1/3/2019
President	Clinton	Bush	Obama	Trump
Relevant days as President of the United States	275	2087	2089	551
Start	1/1/2000	1/20/2001	1/20/2009	1/20/2017
End	1/20/2001	1/20/2009	1/20/2017	1/3/2019

Note: Start dates for Greenspan and Clinton only point to the first date of the relevant period, not the start of their term.

Note: End dates for Powell and Trump only point to the last date of the relevant period, not the end of their term.

To determine the relationship between FOMC meeting statements, related sentiment, and the stock market, I first look at the immediate effects of a Meeting Statement release itself. This is done using the following two specifications:

$$y_1 = \beta_0 + \beta_1(Statement_i) + \beta_{2,j}(President_{i,j}) + \beta_{3,k}(Fed\_Chair_{i,k}) + e \quad (2)$$

$$y_0 = \beta_0 + \beta_1(Statement_i) + \beta_{2,j}(President_{i,j}) + \beta_{3,k}(Fed\_Chair_{i,k}) + e \quad (3)$$

where:

- y_1 is the one-day future change in price.
- y_0 is the change in price between the close at time = 0 and the previous close.
- $Statement_i$ is whether a statement was released that day: 1 if yes, 0 if no.
- $President_{i,j}$ is a categorical variable, where the value is 1 for each j^{th} President, with

Bush as the base group.

- Fed_Chair$_{i,j}$ is a categorical variable, where the value is 1 for each k^{th} President, with Bernanke as the base group.

These two models are not yet enough to answer the question of whether sentiment influences future stock price changes, but they are needed to examine the baseline effect of a statement itself.

The next three models will use the three sets of sentiment data that I generate from TextBlob eq. (4), the Loughran and McDonald Financial Sentiment dictionary eq. (5), and the Correa et al. Central Bank sentiment dictionary eq. (6) (Loria, 2019), (Correa, Garud, Londono, & Mislang, 2017). The dataset used in the following models contains only the data points corresponding to when a statement was released. This is done to avoid issues where a 0 for any of the sentiment variables can mean that there is no statement, or that the statement is neutral.

Below are the three models:

$$(4) \quad y_1 = \beta_0 + \beta_1(Polarity) + \beta_2(Subjectivity) + \beta_{3,j}(President_{i,j}) + \beta_{4,k}(Fed\_Chair_{i,k}) + e$$

where polarity is the measure of polarity from each statement, and subjectivity is each statement's subjectivity. y_1 is the 1-day future change of the stock index. I use polarity as a proxy for positive and negative sentiment, with subjectivity to determine the effects they may have on short-term future returns. I keep these variables together in this specification mainly due to their origin from the same sentiment dictionary. A significant result from the polarity and subjectivity of the text will reinforce whether sentiment from a FOMC meeting statement has an effect on future stock index prices.

$$(5) \quad y_1 = \beta_0 + \beta_1(LM\_POS) + \beta_2(LM\_neg) + \beta_{3,j}(President_{i,j}) + \beta_{4,k}(Fed\_Chair_{i,k}) + e$$

$$(6) \quad y_1 = \beta_0 + \beta_1(CB\_POS) + \beta_2(CB\_neg) + \beta_{3,j}(President_{i,j}) + \beta_{4,k}(Fed\_Chair_{i,k}) + e$$

Equations (5) and (6) are similar in that they are essentially the same model, but with different inputs. These two specifications seek to find a relationship between both the existence of positive and negative sentiment words and future returns. Unlike the method used in sentiment in central banks' financial stability reports, where an index was created based on the counts of negative words, positive words, and total word count, I decide to keep the positive and negative counts in their raw form to avoid losing any information in index creation (Correa, Garud, Londono, & Mislang, 2017). Using this method, I can determine whether the presence of purely positive and negative sentiment words can affect returns. For all models mentioned above, categorical variables for Federal Reserve Chair, Fed_Chair, and President are in place to act as control variables for political regimes.

VI. Results

The first model, examining only statement effects on a 1-day future percentage change, shows a small but significant estimated effect at the 10% level, which can be explained by the price change of the previous day. Interestingly, when Presidents and Federal Reserve Chairs are controlled for, the coefficients during President Barack Obama's term returns a more statistically significant, positive number (Table 4). However, little can be drawn from this as equities were in an uptrend for most of President Obama's term. The returned estimate on the Statement coefficient with the previous day percentage change is positive, and significant at the 1% level. This result is in line with Lucca and Moench's research on Pre-FOMC

Announcement price drifting (Lucca & Moench, 2015). However, I measured the change from previous close to current close, and their study focuses on the period before announcements. Although my results do not confirm Lucca & Moench's study, it reinforces their argument.

TABLE 4 REGRESSION RESULTS, STATEMENT ONLY

	1-Day Percentage Change Model No Dummies	1-Day Percentage Change Model All Dummies	Prev. Day Percentage Change
Intercept	0.0003	-0.000414	-0.000534
	-0.000176	-0.000441	-0.000442
Statement	-0.0017*	-0.001654*	0.003113***
	-0.00096	-0.00096	-0.000962
Clinton		-0.000082	-0.000236
		-0.000813	-0.000815
Obama		0.0011**	0.001101**
		-0.000554	-0.000555
Trump		0.0014	0.001568
		-0.00102	-0.001022
Greenspan		0.0005	0.00046
		-0.000555	-0.000556
Powell		-0.0008	-0.001071
		-0.001175	-0.001177
Yellen		-0.000296	-0.000327
		0.000553	-0.000554
No. Obs.	4814	4814	4814
R^2	0.001	0.002	0.003

Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Next, I look at the results of applying a polarity and subjectivity variable to all statement dates. Upon doing so, I find that both polarity and subjectivity return positive coefficients. A positive coefficient for polarity indicates a positive correlation between polarity and the subsequent percentage change for the next day. That is, positive sentiment is tied to positive price changes. These results are statistically insignificant at any meaningful p-value level. This is not surprising, as Loughran and McDonald's research

indicated the possibility of irrelevance and differing sentiment meanings when applying non-financial sentiment analysis to a financial text (2011). With this method, it may be impossible to predict the direction of future returns. When the percentage change value is converted to an absolute number, it becomes significant among the polarity and subjectivity variables. While I am wary of the results' polarity significance, as mentioned previously, the significance of the negative subjectivity coefficient has interesting implications. This implies that a higher subjectivity measure, where subjectivity is close to 1, will yield a lower absolute value of the 1-day future return (Table 5). As the subjectivity variable exists between 0 and 1, where 0 is objective and 1 is subjective, this may possibly indicate that a more objective statement can lead to a higher magnitude of the 1-day future price change (Table 5). The subjectivity measure is also interesting as subjectivity is based mainly on

TABLE 5 REGRESSION RESULTS, POLARITY, SUBJECTIVITY

	1-Day Percentage Change Model All Dummies	Absolute 1-Day Percentage Change Model All Dummies
Intercept	-0.0155	0.0230***
	(0.008600)	(0.006)
Polarity	0.013056	0.0427 *
	(0.035487)	(0.025)
Subjectivity	0.025274	-0.0289 **
	(0.020089)	(0.014)
Clinton	-0.011336*	0.0001
	(0.005818)	(0.004)
Obama	0.000704	-0.0038
	(0.003804)	(0.003)
Trump	-0.000528	-0.0066
	(0.006352)	(0.004)
Greenspan	0.010148**	-0.0072**
	(0.004294)	(0.003)
Powell	0.003429	-0.0030
	(0.007268)	(0.005)
Yellen	0.005696	-0.0058**
	(0.003771)	(0.003)
No. Obs.	162	162
R^2	0.067	0.11

Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

the existence of modal words, specifically language intensifiers, which mostly hold similar meanings across different contexts.

Finally, in Table 6, I examine the results of both the LM sentiment dictionary model and the CB sentiment dictionary model. For the Loughran McDonald dictionary, there seems to be a weak relationship between the number of positive and negative words as described by the dictionary. Again, in this case, I propose that this may be a result of Loughran and McDonald's idea that only contextual sentiment dictionaries should have relatable effects.

TABLE 6 LM, CB SENTIMENT

	LM 1-Day Percentage Change Model All Dummies	CB 1-Day Percentage Change Model All Dummies
Intercept	-0.003148	-0.002177
	(0.002983)	(0.002929)
Pos Words	-0.000010	0.000382
	(0.000304)	(0.000441)
Neg Words	-0.000333	-0.001315**
	(0.000250)	(0.000532)
Clinton	-0.009012	-0.009534
	(0.005629)	(0.005565)
Obama	0.002096	-0.000063
	(0.004599)	(0.004094)
Trump	-0.001386	-0.001687
	(0.006378)	(0.006227)
Greenspan	0.009721**	0.009934**
	(0.004294)	(0.003946)
Powell	0.001279	-0.000660
	(0.007254)	(0.007200)
Yellen	0.005696	0.001717
	(0.003748)	(0.003865)
No. Obs.	162	162
R^2	0.067	0.093

Standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

However, when applying the central bank method, there is a negative correlation between negative words as defined by the central bank dictionary, and by the 1-period future price change. Essentially, it appears that the greater number of negative words present in the statement, the larger the effect, as multiplied by the negative coefficient, on following prices. Conversely, positive words appear to have a positive coefficient, but this approach does not

yield a statistically significant result (Table 6).

VII. Discussion and Conclusion

This paper produces three notable results. First, it appears that polarity sentiment created by a non-contextual sentiment dictionary will not be effective in financial applications (Table 5). Second, the subjectivity of a statement has a negative but limited correlation with the magnitude of the future 1-day returns (Table 5). While this may be a result of using non-contextual subjectivity values, it could also mean that market participants view the Federal Reserve's subjective statements as having greater clarity regarding the direction that the Committee will take. A more subjective statement from the Federal reserve may give clearer signals, resulting in smaller price movements. In Table 5, the regression results suggest a maximum subjectivity measure of 1 may have an attributable effect on the magnitude equal to 0.0289, or 2.89%. Third, the quantity of negative sentiment words as defined by a central bank focused dictionary has a significant effect on the immediate 1-day returns of the S&P 500 Index (Table 6). For each negative word derived from the central bank dictionary in the statement, the correlating percentage change is -0.001315, or -0.13%. Positive words, defined in the same context, do not have the same significance in effect. An explanation for this effect is that market participants may not be looking at FOMC meetings for significant good news. As markets represent the present value of future earnings and future economic factors, FOMC meeting statements may only be used for participants to decide whether the current economic environment is increasing or decreasing in risk. In the event of increasing risk while financial stability is decreasing, market participants may be engaged

in liquidating activity in the market. However, if risk is decreasing in the economic environment, market participants may look back towards discounting individual corporate earnings. From a central bank perspective, if the goal is to avoid declines and the creation of risky environments in the stock market following a statement release, the bank could limit its use of negative sentiment words in a financial stability context. While some of these results are statistically significant, the R-squared value for these regression models are extremely small. With 0.067 and 0.093 between the two regressions in Table 6, the models only explain 6 to 9 percent of the total variation seen in the index price changes. These results may indicate an effect, but they are not predictive. Luckily for economic theory and unluckily for us, the stock market remains difficult to predict.

As the study of natural language processing is still growing, there is high potential for further studies that aim to decipher sentiment. As suggested by my research, the idea of sentiment does not hold across multiple disciplines, even ones that are similar in nature. This study has showcased this by using the disciplines of finance and economics. Further, non-lexicon-based analyses can be done to expand upon this work, such as a study that uses machine learning techniques to determine significant words and phrases that give sentiment in a central banking context. My data in this study was also limited at the daily level; thus, the only dependent variables available to study were the changes on a day-by-day basis. As many stock market participants know, large changes and fortunes can happen in the span of minutes. An intra-day study of FOMC meeting statement sentiment effects might prove fruitful.

The Tragedy of The Floodplains: A Theoretical Model to Explain Why Floodplains are Underutilized

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ECON 364A

ABSTRACT

Common pool resources (CPRs), widely referred to as common resources or commons, are resources which are hard to exclude from free-riders and where one person's consumption of the resource reduces the availability of it to others. Ecologist Garrett Hardin argued that due to the nature of CPRs, these resources will be overused and hence lead to a 'tragedy'. However, not all CPRs are over-exploited. Some CPRs, such as floodplains, suffer from the problem of underutilization. Floodplains are becoming increasingly important due to the formation of a rising number of seasonal floodplains resulting from climate change, especially in low lying countries such as Bangladesh. I construct a theoretical model using Ostrom's Social-Ecological System (SES) variables to explain the higher likelihood of underutilization of the floodplains. I argue that most floodplains remain underutilized and ungoverned due to high transaction costs for coordination, limited information and community capacity gaps. I also elaborate on how the unique community enterprise model can help communities sustainably utilize floodplains.

"What is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest."

Aristotle
(Politics, Book II, chapter 3)

Common pool resource (CPR) governance has received considerable attention in the institutional economics and natural resource governance literature, signified by the 2009 Nobel Prize in Economic Sciences awarded to the most well-known scholar in this field, Elinor Ostrom. CPR resources, widely referred to as common resources or commons, are resources which are hard to exclude from free-riders and where one person's consumption of the resource reduces the availability of it to others. CPRs are especially important for the poorest people who live in the communities surrounding them and often rely on the utilization of these resources, by way of the manner in which communities surrounding a common pond can be reliant on fisheries or communities surrounding a forest can be reliant on trades related to forestry.

Hardin argued that due to the nature of CPRs, these resources will be overused and hence lead to the 'tragedy'.[1] However, not all CPRs are over-exploited. Some CPRs, such as floodplains, suffer from the problem of underutilization.[2] Floodplains are seasonal water-bodies formed from the flooding of privately-owned lands during monsoons. Within the CPR governance literature, floodplains have received little attention. But floodplains are becoming increasingly important due to the formation of a growing number of seasonal floodplains as a result of climate change and consequent flooding of agricultural lands, especially in low lying countries such as Bangladesh. When not managed properly, floodplains remain underutilized as an open access CPR where small numbers of naturally available fish within them are captured by

local people. But it can be transformed into a resource via aquaculture and proper management.

I construct a theoretical model using Ostrom's Social-ecological system (SES) variables to explain the higher likelihood of underutilization of the floodplains. Through this model, I argue that most of the floodplains[3] remain underutilized and ungoverned due to high transaction costs for coordination, limited information and the capacity gap in the relevant communities. To illustrate how these challenges predicted by the model can be overcome, I provide a case study of the 'Daudkandi' floodplain in Bangladesh, where a community successfully co-managed a floodplain CPR by partnering with a local NGO.

The paper is structured as follows: first, I provide conceptual clarifications for key terms, followed by a critical analysis of the literature. I examine floodplains and articulate the floodplain "puzzle" regarding their underutilization. Next, I construct a theoretical model and use it to explain why floodplains are more likely to be underutilized compared to other CPRs. Lastly, I analyze the case study of a successful community based management of a floodplain. I conclude by considering future research directions.

Key Concepts

Resources can be broadly classified based on two criteria. The first is excludability, which means the ease with which the producer or property right holder can exclude others from using the resource, especially free riders who do not bear appropriate costs. The other is rivalry in consumption, which refers to the extent to which one person's use of the resource subtracts from what is available to others.

Common pool resources (CPRs) are resources

that are available to more than one person, are difficult to be excluded from free-riders, and have high rivalry in consumption. Hence, CPRs tend to be both under-produced and overused.[4] If free-riders cannot be excluded from use, or if it is very costly to exclude them, then the producers and right holders who bear the cost to produce and maintain the resource have less incentive to continue doing so. At the same time, high rivalry in consumption also leads to the overuse of the resource because people, as rational actors, correctly understand that there is a finite amount of the resource available and each person wants to maximize his own consumption, disregarding the long term sustainability of the resource or the socially optimal level of consumption. Hence, even if someone cares about the sustainability of the resource and wants to abstain from using the resource, the resource depletion will not be stopped as others, especially the free riders, will consume it anyways. Examples of CPRs are fish in the ocean, timber in forests, and vegetation covering a pastureland. Floodplains are CPRs that share the two critical characteristics of excludability and rivalry in consumption, but are unique because of the seasonal tenure system, which will be explored in detail later.

In this essay, I use Cunningham and Mathie's definition of the community, whereby community denotes groups of people who share a "sense of community".[5] However, they also caution against the expectation that communities always share strong social bonds, have high social capital, and are necessarily cooperative, inclusive or caring, just because they live in the same location or belong to the same ethnic group. In reality, due to the power dynamics involved within the group based on identities of gender, race or class, there can be exclusion, mistrust and uneven cooperation within a group. A consequence of this

dynamic is varying coordination costs in different communities, based on their respective contexts.

Literature Review

CPR management has been recognized to be complex due to the nature of the resources; specifically, the characteristics of difficulty in exclusion and high rivalry in consumption. Gordon (1954) provided one of the first economic analyses of CPR management, specifically fisheries.[6] He argued that the equilibrium utilization will be the overuse of the resource without intervention, which is larger than the long-term sustainable level of use. Therefore, fisheries in an open access setting will be overexploited, underproduced and unsustainable. In his 1968 article titled "The Tragedy of the Commons,'' Hardin claimed that common pool resources will inevitably face the 'tragedy' of over-exploitation due to the characteristics of the resources.[1] As a result, Hardin also argued that the only solution was mechanisms of "mutually agreed upon coercion", which meant the CPRs must be brought under state control, and/or privatization.[1] Hardin's assertion inspired a lot of subsequent research on successful CPR management. Although Hardin's recommendation was initially taken to be the right approach, numerous case studies since then have illustrated the limitations of these solutions.[7] Runge (1984), for instance, stressed the fact that in most developing countries, users of CPRs lived together in the same village, possibly for multiple generations, and intended to live together in the future.[8] Given their reliance on the resource for livelihood earning, it is very difficult to be a free-rider, as a user interacts with other users continuously in a community. Hence, there was strategic interdependence between the CPR users. As a result, the 'tragedy of the commons' is not a

free-rider problem but rather a coordination problem whereby local stakeholders fail to coordinate to utilize the resource.[9] Moreover, government ownership of the CPRs, which was a common legislative action in the 1970s and 1980s, often led to several problems.[10] First, the existing indigenous institutions were rejected and actions of local stewards to preserve the resource were outlawed. Second, in many developing countries, the government did not have the resources to properly monitor resource boundaries or harvesting practices. Hence, the CPRs essentially turned into open access resources, and subsequently, there was a race to exploit these resources. The other suggested solution, privatization, was challenged on the grounds that often such action was infeasible, given the nature of the resource; the privatization of a resource like the ocean or the atmosphere is implausible. Furthermore, privatization will also not be feasible when the costs of enforcing private property rights are high, and the economic value of the output produced from the resource is low. Even when privatization was feasible, the CPR at hand was often leased to a commercial entity who exploited the resource to maximize their revenues, disregarding the sustainability of the resource.

Due to the failures of government ownership and privatization, there has been a broad movement among researchers to collect case studies of successfully managed CPRs from around the world. In her book titled *Governing the Commons*, Ostrom collected several successful and unsuccessful case studies, and via her field observations argued that many communities have in fact successfully managed CPRs without government intervention or privatization, contrary to what theoretical models might predict.[7] Ostrom also developed eight design principles, or DPs, positing them to characterize the

robust institutions that have managed common-pool resources successfully.[7] Moreover, almost all CPRs are complex social-ecological systems which have multiple layers, and variables impacting each layer.[3] She identified ten variables that affect the likelihood of self-organized institutions: the size of the resource system, productivity of the system, predictability of system dynamics, resource unit mobility, number of users, leadership, social capital, knowledge of the SES, importance of resource to users, and autonomy of the group. I will use some of these variables to construct my model later.

As one of the social-ecological systems, floodplains have received little attention in the CPR management literature so far.[11] While there have been some case studies illustrating different management institutions, no formal model has been created. Hence, this is the main goal of the paper.

The Floodplain Puzzle

Floodplains are seasonal water-bodies created due to the flooding of land areas during monsoons. Floodplains share the two main characteristics of a CPR. Firstly, everyone has access to them, when they are under open access regime. Secondly, floodplains in the open access regime are also sources of capture fish, fish that are available naturally without aquaculture, and anyone who harvests them subtracts from their availability to others. However, floodplains are distinct from most other CPRs because of the unique tenure system and their associated complexity with property rights regimes. During the dry season, boundaries separating privately owned lands, where agricultural production takes place, are clear and private property rights are easily enforced. During the monsoon season the lands are flooded, making it almost impossible to

distinguish between privately owned lands. Because of this, no landowner can legally exercise property rights over the entire floodplain. Thus, seasonal flooding creates a unique tenure system, whereby the floodplain is neither strictly private or public property. When the flood water recedes after four to five months, the land plots become distinguishable again and private property rights return. Hence, floodplains as CPRs are available for a limited period of time in a year but are also recurring.

Seasonal floodplains should be considered a resource to be utilized because of their enormous potential for aquaculture, given that the water-bodies are suitable to grow fish in. Several studies were conducted which tested the technical feasibility of aquaculture in seasonal floodplains and concluded that floodplains have the productive potential to increase fish production by more than 1 trillion per hectare, per year.[12] Recent studies have reported that if only 25% of the floodplain areas can be brought under community management then about 6.7 million people would benefit, including 2.7 million landless people.[13] For the landowners, there is the additional benefit of floodplain aquaculture increasing subsequent rice yields due to the fertilizing effect of the fish.[14]

Given the productive potential of floodplain aquaculture and the additional benefits that can be brought on from it, it is puzzling to find that most floodplains remain underutilized and that their active management has been very rare.[2] By utilization, I mean using floodplains for aquaculture, which has been proven to have high productive potential compared to the open access regimes. It is important to emphasize that the puzzle of underutilization is not due to a technical problem. There are technologies available by which seasonal floodplains can be turned into water-bodies suitable for aquaculture,

and although it requires capital investment, the cost is not prohibitively high, especially compared to the potential earnings from fish sales. So, what prevents coordination between landowners to practice floodplain aquaculture?

Theoretical Model

Floodplains have enormous productive potential, yet they are mostly underutilized because landowners, whose lands are submerged in the process of forming the seasonal floodplains, do not coordinate or cannot reach an agreement. This is a puzzle because each landowner can receive greater benefits by coordinating and reaching an agreement to practice seasonal floodplain aquaculture. The critical issue, then, is how an individual landowner decides whether to coordinate and enter a contract or not.

In the model, I make two realistic behavioral assumptions about each economic agent, which distinguishes my approach from neoclassical economics.[15] They are: (1) agents have bounded rationality, which means they are neither hyper-rational like the neoclassical "economic man," nor are they irrational. Rather, bounded rationality implies that they have limited capacity for processing all available information and solving complex problems. (2) Some agents are opportunistic. Here, opportunism does not just mean self-interested but also the possibility of not fulfilling a promise or commitment. Realistically, then, one can never fully trust the other in a transaction. This is not to say that everyone is opportunistic, but it is very costly to distinguish opportunistic from non-opportunistic types ex-ante.

Given these assumptions, the users of a resource will coordinate to avert a tragedy of the floodplains, where their expected benefit from coordination is

greater than their expected costs.

$$\text{Expected Benefits (EB)} > \text{Expected Costs (EC)}$$

For each agent in the model, in this case each landowner, the expected benefits and expected costs are expressed mainly via variables identified by Ostrom in the Social-Ecological System (SES) framework to analyze CPRs.[3] Expected benefit (EB) is a function of productivity of the system (P), which determines the revenue from aquaculture in the future, such that:

$$\Delta EB = f(P)$$

Here, productivity refers to the amount of resource units - in the case of floodplains, it is fish- available for harvesting. The higher the productivity, the higher the incentive for coordination will be as users can earn higher revenue from being part of the contract. Productivity depends on various factors including the infrastructure, capacity of the users to effectively manage and harvest the resource units, and the climate.

Expected costs (EC) can be expressed as the sum of the initial investment (I) and the transaction cost (TC) such that:

$$EC = I + TC.$$

The setup cost (I) is the fixed cost of initial investment required to set up the required infrastructure to utilize the resource; in the case of floodplains, there are fixed costs of building an embankment, for example. Transaction costs (TC) are costs associated with negotiation, coordination, monitoring, maintenance and the enforcement of rules.[16] In this model, TC specifically focuses on the

costs of bargaining with other agents to reach an agreement. This cost does not have to be monetary, necessarily.

Transaction cost (TC) is a function of social capital (SC), resource unit mobility (UM) and investment specification (IS). As I is taken to be a fixed cost, we get:

$$\Delta EC = \Delta TC = f(SC, UM, IS)$$

Here, social capital (SC) refers to the level of trust between agents. If there is sufficient trust between the agents involved in the contract negotiations, they will face lower transaction costs in reaching agreements.[3] Resource unit mobility (UM) refers to the mobility of the resource units and is important because the more mobile the resource unit, the higher the cost of observing and managing the system.[3] Investment specification (IS) refers to the nature of the initial investment, rather than the amount, and it can be of two kinds: specialized or general physical capital. Specialized physical capital is not useful to the agent and does not have value outside the specific setting it is essential in. Hence, the more specialized the physical capital, the higher the transaction costs of negotiation are because agents do not have alternative uses for that physical capital.[17]

Application of the Model to the Case of Floodplains

Based on the successful case studies of managed floodplain aquaculture, the realized benefits or revenues are most often far greater than the total costs.[13] Hence, in a perfect world with hyper-rational actors who have perfect information, agents will always choose to coordinate and utilize floodplains via aquaculture, given that the benefits outweigh

the costs. However, based on our assumptions of bounded rationality and agents being opportunistic, the expected costs (EC) can outweigh the expected benefits (EB) in three possible ways:

1. If EB is underestimated
2. If EC is overestimated
3. If both EB is underestimated and EC is overestimated.

For the agents participating in the primary negotiation, who in the case of floodplains are the landowners, if EC is greater than EB they will not coordinate. But why might floodplains uniquely suffer from these distortions in expected values of EB and EC? I provide six reasons explaining the higher likelihood of EC outweighing EB in the case of floodplains.

1. Greater uncertainty: Both EB can be underestimated and EC can be overestimated due to the greater uncertainty associated with the system dynamics of floodplains. Based on numerous case studies, Ostrom found that the more predictable the system dynamics are, the higher is the likelihood of coordination.[3] Aquatic systems tend to be less predictable than other CPRs such as forests.[3] In the case of floodplains, as they are complex systems highly dependent on the climate, there is great uncertainty associated with their productivity and costs.

$$\text{Uncertainty}(\uparrow) \rightarrow \Delta EB(\downarrow) \text{ and } \Delta EC(\uparrow)$$

2. Capacity gap: Both EB can be underestimated and EC can be overestimated due to the lack of availability of the specialized human capital required to attain the maximum productivity from the resource system.

Aquaculture requires people with specialized skills and capacity to effectively manage and harvest from the waterbody. In the case of floodplains, the landowners are primarily engaged in agricultural activity and do not have these specialized skills. Due to the seasonal nature of floodplains, hiring fishermen with the required skills from other communities can be costly. So, if there is a capacity gap, the expected benefits decrease, and as more capital will be required to employ skilled people, the expected costs will increase.

$$\text{Capacity gap}(\uparrow) \rightarrow \Delta EB\ (\downarrow) \text{ and } \Delta EC(\uparrow)$$

3. Knowledge gap: EB can be underestimated due to the limited knowledge of the landowners about floodplain aquaculture productivity (P), given they have no prior experience with seasonal floodplain aquaculture. It is important to note that the limited knowledge of the landowners does not directly impact the productivity of the system. Rather, it impacts the perception of the productivity, which in turn impacts the expected benefits.

$$\text{Knowledge of the system}(\downarrow) \rightarrow \text{perception of P}(\downarrow) \rightarrow \Delta EB(\downarrow)$$

4. Low social capital: EC can be overestimated due to low social capital or trust between the landowners. As floodplains are hard to monitor, to exclude from use and there is rivalry in the consumption of fish, social capital among landowners and all people in the community is critical. In communities where landowners have traditionally worked independently and did not have to coordinate, the level of trust is more likely to be low. Therefore, lower social capital creates higher transaction costs.

$$\text{Social capital}(\downarrow) \rightarrow \Delta EC(\uparrow)$$

5. High bargaining power: EC can be overestimated because each landowner in the negotiation has a high level of bargaining power. Due to highly mobile fish, the resources unit in floodplains, it is very costly to build boundaries within a floodplain to prevent fish from going to the land area of a landowner who did not coordinate. Hence, all landowners must agree to reach a joint contract. Even if one landowner refuses, the contract cannot be reached. Hence, each holds a high level of bargaining power, increasing transaction costs.

$$\text{Resource unit mobility}(\uparrow) \rightarrow \text{Individual bargaining power}(\uparrow) \rightarrow \Delta EC(\uparrow)$$

6. Specialized physical capital investment: EC can be overestimated due to the high initial investment required for specialized physical capital, such as the construction of an embankment. Building an embankment surrounding a floodplain is a necessary investment for aquaculture and all landowners who agree to a joint contract most likely have to contribute. However, this embankment is not useful for any other purpose for the individual landowner, outside the context of floodplain aquaculture. Hence, this is specialized physical capital. Floodplains require many such specialized physical capital, which increases the costs for the landowners.

$$\text{Specialized physical capital investment}(\uparrow) \rightarrow \Delta EC(\uparrow)$$

Case Study

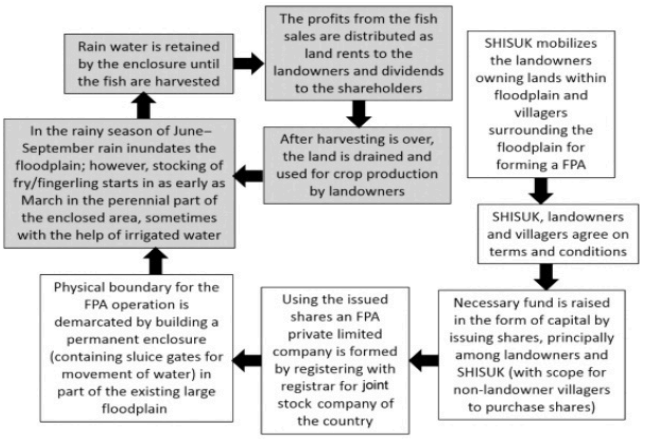
Although floodplains are ungoverned and

underutilized in most cases, there are successful floodplain aquaculture case studies which portray the diversity of governance structures used to successfully overcome challenges and achieve the productive potential of floodplains. I focus on one such case study, the Daudkandi floodplain in Bangladesh. Bangladesh is a delta and more than 55% of the land becomes floodplains during the monsoon, making floodplains one of the major CPRs of Bangladesh.[18] The first floodplain aquaculture management system in Bangladesh was developed by a local NGO named SHISUK, by collaborating with a community in the Daudkandi sub-district in the district of Comilla.[18] I chose this case study because the management system, popularly called the Daudkandi model, has raised annual income of the community by around 100%.[19] Before SHISUK's pioneering approach, the community did not utilize the floodplain for the purpose of generating income. Another important characteristic of the Daudkandi model, which SHISUK formally calls the community enterprise approach, is that it kept the governance and management of the floodplains within the local community.

As in the Daudkandi floodplain, the community enterprise approach (CEA) mobilizes the community and creates enterprises, or cooperative business entities, to manage and utilize the community's assets and resources. This approach combines the power of corporate incentives for efficient management of the resource, with the democratic mandate from the community to involve all community members in the economic development process. After mobilizing the community and the landowners, the community enterprise offers shares to the community, by which community members become shareholders-owners-and are empowered to democratically elect their representatives who make management decisions. So,

the enterprise works like a publicly traded company, except that the shares cannot be traded.

One potential concern of this enterprise model could be that only the rich in the community would be able to buy shares in the enterprise. In practice, to benefit all community members including the most marginalized and poor, SHISUK mandated a maximum cap for each shareholder so that one person cannot possess significant influence, and allocated 5% of the shares to landless farmers. Ultimately, 60% of the shares were owned by the community, 20% by the landowners and 20% by SHISUK, of which 5% were given to the poor.[18] In the following figure is the development and operational cycle of floodplain aquaculture in Daudkandi.[18]



How the Community Enterprise Approach Overcame the Unique Challenges of Floodplains

SHISUK mobilized the entire community using the asset based community development framework.[5] They identified the community assets and networks, built relationships with community leaders, collected stories of community success from community members and involved key community stakeholders in the planning process. Most importantly, they treated community networks as assets and not only did they build a relationship of trust with the community, but they also built social capital among the community

members. The increased social capital significantly lowered transaction costs.

$$\text{Social capital}(\uparrow) \rightarrow \Delta EC\ (\downarrow)$$

SHISUK also conducted capacity building exercises for the community users, given that there was no specialized fishing group in the community prior to their initiative.[18] The training was provided for free and most of the beneficiaries were the landless and marginalized people, who gained a specialized skill and were employed by the enterprise for floodplain aquaculture. SHISUK also provided management support in ways such as arranging external credit when required, performing audits, staffing, and establishing networks with government bodies. These are crucial activities, especially given that a formal enterprise was established and the community had no prior experience in dealing with these issues. Additionally, SHISUK arranged several workshops on the system dynamics of floodplain aquaculture, given that local leaders and landowners lacked experience in commercial aquaculture. Through these initiatives, the capacity and knowledge gaps were addressed.

$$\text{Capacity gap}(\downarrow) \rightarrow \Delta EB(\uparrow) \text{ and } \Delta EC(\downarrow)$$

$$\text{Knowledge of the system}(\uparrow) \rightarrow \text{perception of P}(\uparrow) \rightarrow \Delta EB\,(\uparrow)$$

For initiating a successful management system for a floodplain, the first issue to resolve is the seasonality and the unique tenure system of floodplains. Under the community enterprise approach, the landowners agree to a contract to lease their individual plots in exchange for payments. An embankment was built covering only the parts of the floodplain which

were the land areas of the landowners who agreed to the contract. This enclosed area came under the community enterprise during monsoon, and in the dry season the landowners regained their rights over individually held lands. Thus, via the contract and fixed payments, the uncertainty regarding the seasonality, productivity and costs decreased for landowners.

$$\text{Uncertainty } (\downarrow) \rightarrow \Delta EB(\uparrow) \text{ and } \Delta E((\downarrow)$$

Next, the enclosed land inundated by the floodwater was leased as a whole. Share issuances raised sufficient capital that could be invested in building specialized physical capital such as the embankment. The risk for each shareholder was lower, as most people in the community were part of the shareholder group. Moreover, the community enterprise approach promised greater profits for people who took more risks. Hence, it managed the risk preference of the community members effectively, including that of the landowners.

$$\text{Specialized physical capital investment } (\downarrow) \rightarrow \Delta EC\ (\downarrow)$$

By having a cap on individual shareholding, the community enterprise approach decreased the bargaining power of landowners and the rich, and thus, reduced transaction costs.

$$\text{Individual bargaining power } (\downarrow) \rightarrow \Delta EC\ (\downarrow)$$

This case study of a co-management model of the community and a local NGO is just one of the many ways that the unique challenges of floodplains can be resolved. It is important to note that even though the role of the NGO was crucial in this case, it is not

a necessary condition for successful management of floodplain aquaculture, as there are case studies of successful community driven management without NGOs.

Conclusion

Open access floodplains can be transformed into resourceful aquaculture that generates income for the community and integrates fisheries with agriculture to optimize use of the resources in an ecologically sound manner. Moreover, the process of community mobilization to manage the resource can create more social capital within the community and drive the economic development process from the bottom-up. The aquaculture can also provide poor community members access to nutritious fish at low costs and facilitate social development by mandating part of the profit be invested back in the community. Due to climate change an increasing number of floodplains will be formed and people in low lying areas must find coping mechanisms to adapt to the changing environment. Community based floodplain aquaculture is one such mechanism, and can become a critical part of sustainable community development.

In this paper I identified that no formal model to examine floodplain management systems has been formulated in the literature. Given the productive potential of floodplain aquaculture, it is puzzling to find that most floodplains remain underutilized. To investigate this issue, I used Ostrom's Social-Ecological System (SES) variables, such as social capital, productivity of the system, resource unit mobility, knowledge of the system and predictability of the system, and constructed a theoretical model to explain why floodplains commonly remain underutilized. Through this model, I argued that most

floodplains remain underutilized and ungoverned due to high transaction costs for coordination, limited information and the capacity gap in communities with floodplains. To illustrate how these challenges predicted by the model can be overcome, I provided a case study of the Daudkandi floodplain, where a community successfully co-managed a floodplain CPR by partnering with a local NGO, taking the community enterprise approach. Going forward, more case studies of successful and unsuccessful floodplain management attempts must be collected and analyzed to improve on the model presented in this paper.

The Parsimonious Quality of the von Neumann Morgenstern Theorem: Idiosyncratic Labour Income Risk and The Equity Premium Puzzle

Adrian Schroeder

ECON 490

ABSTRACT

This paper sets out to find empirical evidence for expectation dependent idiosyncratic labour income risk. Further, it proposes a novel way of integrating this risk into a more general mathematical literature by explaining the equity premium puzzle within the von Neumann Morgenstern (vNM) framework. This paper argues that idiosyncratic risk can take on this explanatory role and that it is highly persistent. This is demonstrated by updating a General Method of Moments (GMM) estimator. Compared to past approaches, system GMM is enhanced and GMM instruments are improved by collapsing and restricting. New waves in PSID data have made it interesting to re-examine past findings. Indeed, such a dependency still holds from 1968 - 2017, with an autocorrelation coefficient ρ^h *between 0.76 - 0.82. This empirical evidence supports the existence of risk aversion of order 1 within the vNM paradigm, which in turn explains the equity risk premia without external assumptions.*

Introduction

If I gave you a million dollars, what would you do? After probably more than you wanted is spent on fancy food, clothes, and that well deserved holiday, you would eventually have to think about where to put that money so you don't have to work so hard in the future anymore. Although the modern banking world can look pretty intimidating pretty quickly, there is one thing you will hear of all the time: risk.

How much risk are you willing to take when you make your decision? You could put all your money into bonds, which are safe and don't fluctuate a lot in value. Or you can buy stocks of companies, which tend to be riskier and can change their value in a split-second. There is only one problem: you pay one way or the other. When stocks decrease quickly, you lose. When bonds barely buy you a coffee for the five years you have been holding them, you are paying, too. The difference in returns that you get from stocks compared to bonds is called equity premium. Usually it is positive, meaning that stocks pay off a little more than bonds do.

Coming back to the magic word, risk, there are many theories about how to measure it best. For example, the von Neumann Morgenstern utility framework, hereafter vNM, holds that one can simply weigh all outcomes by their probabilities and add those terms up. This would, for example, tell you how much you would like that stock that you wanted to buy by calculating how much utility you would get when the economy does well. You then multiply this by the probability that this actually happens. Then you do the same thing for the case when the economy does badly and add up the terms. That gives you the total utility you would enjoy from buying the stock. On the other hand, you might also get utility from, or pay for,

avoiding risk. The amount of money you are willing to pay for lower risk is called risk aversion.

One of the main objectives of a theorem in economics, and science as a whole, is the ability to explain real world phenomena such as risk aversion by making as few additional assumptions as possible, which is known as the principle of Occam's razor. Concerning this, the vNM theorem suffered from a certain limitation. When investigating risk aversion, it was only possible to examine quadratic relationships between equity premia and changes in risk-related behaviour (Segal & Spivak, 1990), termed order 2 risk aversion (see Appendix A.1). Nonetheless, this line of vNM reasoning fell short of explaining substantially higher equity premia paid in financial markets when compared to safe assets.

The failure to explain this is called the Equity Premium Puzzle, which describes a peculiar situation occurring in financial markets: the difference in returns of equity versus low-risk assets that can be explained by a plausible amount of risk aversion (Mirakhor & Erbas, 2007). Most standard theories fail to incorporate as large a differential as is observed in the data, which suggests more extreme risk aversion than is actually explainable; or, alternatively, suggesting consumption smoothing which differs from the standard approach (Mehra & Prescott, 1985). Nonetheless, Mirakhor & Erbas (2007) have also shown that this differential is a widespread phenomenon, present in numerous mature and emerging economies and varying from 7.5% to 10.5%, on average. The authors rely on assumptions about a certain type of ambiguity, Knightian, driving up prices via an ambiguity premium which is paid in addition to a risk premium. While this claim is supported by a 3% higher equity premium puzzle in emerging markets, it is hard to track across time and this trend is reversed over some years (Mirakhor

& Erbas 2007). This suggests that there still remains some unexplained differential.

The equity premium puzzle generally arises as a consequence of relying on the vNM utility paradigm, which fails to incorporate order 1 risk aversion. In terms of a mathematical definition, this paper follows Gollier & Schlesinger (2002, section 7):

$$Equity\ Premium\ Puzzle \equiv E[\tilde{x} - P] \qquad (1)$$

Where $\tilde{x}$ represents the expected payoff of the risky asset and P its price. The resulting number often tends to be too high to be readily explained by standard theory.

I would like to propose throughout this paper of how it might be possible to show how this relates back to idiosyncratic labor risk. These are not two very commonly combined concepts; nonetheless, they share the commonality of risk. And the exciting thing is that there are some mathematical papers actually implying that there is a connection between the way that individual risk assessments influence asset pricing in the economy. Particularly, this involves the situation where it is impossible to insure against a certain income loss. If they could, the most risk averse individuals would buy stocks to safeguard them against a potential loss. In this scenario, they cannot do that since they cannot predict this unknown risk to them. If it were possible to show that idiosyncratic labour income risk fits this role by demonstrating persistence, this would combine these two seemingly very unrelated topics. That is what I find so interesting about economics: it all be traced back to one simple theorem.

The paper is structured as follows: the end of the present section will present several attempts of solving the puzzle outside of the vNM paradigm. Conversely, the literature review will be focused

around a theory by Dionne & Li (2014) that shows how it is possible to remain within the vNM paradigm while still explaining the differential. This will lead us to the importance of a dependent background risk which is present when an agent considers investment. That it remains in the background means that this risk occurs randomly and that no insurance against it can be bought. From there, the paper will make the suggestion of using idiosyncratic labour income risk as a candidate for said background risk, which comes from Krueger & Lustig (2010). This comes under the assumption that such a risk is persistent and cannot be hedged against, meaning that it is impossible to offset this risk by taking precautions. The paper then closes by updating a General Method of Moments (GMM) estimator previously employed by Storesletten (1999) to arrive at an autocorrelation coefficient ρh, which describes how strongly any given value of this risk correlates with past realisations of the risk, across different years.

This paper proposes a novel standpoint that would integrate the labour literature on idiosyncratic risk into the broader context of the vNM theorem, were the autocorrelation coefficient sufficiently large. It would also lend support to the parsimonious quality of the vNM framework, which then would explain the equity premium puzzle without making any additional assumptions about imperfect access to markets, transaction costs, or non-representative agents. This is the main point of the paper. Along the way, Storesletten's (1999) GMM estimator is improved upon by introducing the new concept of system GMM and several new robustness checks which were not available at the time. New subsets of the PSID are also included.

Literature Review

Regarding theories outside the vNM framework, Bertola (2004) shows that imperfect insurance in the labour market can result in a second-best equilibrium which might be able to explain the equity premium puzzle. This comes under a set of additional assumptions, in particular relating to bilateral bargaining and worker mobility costs which are hard to describe in a single paradigm. Another approach to the problem consisted of constructing rank-dependent utility models, where it was possible to establish order 1 effects of risk aversion (Quiggin 1982). This requires the use of rank-dependent statistics and loses some of the predictive power of the model through loosening the strict-ness of the vNM transitivity axiom.

In terms of the underlying mathematics, Jang et al. (2007) use an approach very similar to the one chosen by Dionne & Li (2014), namely observing that order 1 effects should not be excluded upfront. Jang et al. (2007), however, do dissect existing transaction cost models rather than tackling the expected utility paradigm per se. It concludes that the equity premium puzzle shrinks if investors are permitted differential strategies during trough and boom periods of the business cycle. Alas, this still leaves a differential of 5.9 % to 8.9 %.

A very relevant approach to this paper was proposed in Lucas (1994), where idiosyncratic risk that is uninsurable is introduced. However, its simulation model assumes imperfect access to financial markets, in addition to nonrepresentative agents which carry a higher-than-normal labour income risk. This would ultimately increase demand for prophylactic savings. In that sense, increased individual volatility in consumption theoretically drives the relationship between idiosyncratic risk and higher risk premia.

However, the paper arrives at conclusions similar to those in the representative agent model and fails to explain the equity premium puzzle. One reason for this might be the focus on labour income alone. This paper will instead focus on total income inclusive of any transfer payments in order to incorporate as precise an approximation of individual risk as possible.

Conversely, the paper by Dionne & Li (2014) proposes a solution within the vNM paradigm and only adapting it to include an uncertain background risk, which is persistent and cannot be hedged against. In eye of its competition, this seems to be the most parsimonious introduction of order 1 effects of risk aversion (see Appendix A.1). The elegance of the paper's result lies in the fact that it can be generalised to a variety of risk-averse preference functions. It sets up a standard two agent, one risky and one risk-free, asset model where the equilibrium price P* of the risky asset is denoted by:

$$P^* = \frac{\mathbb{E}[u_1\tilde{x}(w+\tilde{x},\mathbb{E}(\tilde{y})]}{\mathbb{E}u_1(w+\tilde{x},\mathbb{E}[\tilde{y}])} \tag{1.1}$$

Where $\tilde{x}$ represents the final payoff of the risky asset, w represents the initial wealth invested in the risk-free asset, and $\tilde{y}$ is the uncertain background risk. This holds while assuming that the excess demand for $\tilde{x}$, β_0, = 0 and considering E[background risk] = E[$\tilde{y}$]. Now, through accounting for the background risk accordingly and incorporating it into the individual optimisation problem, a new P** is reached in equilibrium:

$$P^{**} = \frac{\mathbb{E}[u_1\tilde{x}(w+\tilde{x},\tilde{y}]}{\mathbb{E}u_1(w+\tilde{x},\tilde{y})} \tag{1.2}$$

With regards to (1.1), this compares the respective equity premia. Dionne & Li (2014, equation 20, 21) show that the difference depends on the order of conditional dependent risk aversion πcd. Most notably, with $\pi_{cd}>0$ there will be $P^{**} - P^{*} < 0$. This indicates that an expectation dependent background risk would explain higher risk premia in the economy (see Dionne & Li 2014, Proposition 5.1). This paper will use idiosyncratic labour income risk as a proxy for this uncertain background risk.

Similarly, Krueger & Lustig (2010) have demonstrated how such a rise in background risk is only able to raise risk premia when idiosyncratic shocks are dependent on aggregate shocks. Thus, the remainder of this paper will try to find empirical evidence for the dependence and persistence of this background risk, which is now assumed to be represented by idiosyncratic labour income risk.

The following are several pieces of evidence supporting the dependence of idiosyncratic labour income risk as well as its persistence: as mentioned earlier, different investment decisions, as introduced by Jang et al. (2007), bolster the assumption made by Dionne & Li's (2014) model, namely that volatility and investment decisions differ across the bear and bull market periods. In addition, higher and differential transaction costs might explain in part why idiosyncratic income risks display such a high autocorrelation with the business cycle.

Concerning the mechanism of idiosyncratic shocks affecting individuals' asset holdings, as can be seen in McKay (2017), idiosyncratic shocks can result in an increase of precautionary savings motives which are independent from cyclical unemployment risk and constant earning losses. This goes side by side with higher investment in periods following an economic downturn compared to the standard model. This

explains in part why the equity premium puzzle arises under the standard model when idiosyncratic risks are neglected. Any long-lasting impacts of income shocks are not included and understate cyclical volatility.

To illustrate how long-lasting such idiosyncratic shocks can be, consider the empirical evidence presented by Davis & Von Wachter (2011). Through following individual workers after layoffs, this paper established that 10 to 20 years after displacement, average earning losses are as high as 20% for job loss during recessions and 10% during expansions. Moreover, it notes that these findings are highly sensitive to a change in the aggregate unemployment rate, which underlines how dependent idiosyncratic shocks are on the state of the overall economy.

The question now arises of how to measure such a dependency of idiosyncratic background risk on aggregate shocks. The employment of empirical methods seems necessary to arrive at a sound conclusion in this matter outside of mathematical reasoning and construction. Such is the declared objective of this paper. The methodology employed to arrive at an autocorrelation coefficient is taken from Storesletten (1999) and Storesletten et al. (2001). The underlying assumptions are similar to the economies studied in the papers mentioned above but also closely follow the seminal work of Constantinides & Duffie (1996). Most essentially, their paper demonstrated that higher temporal persistence is of importance for a more realistic estimate of equity premia.[1] One should note that this result does rely heavily on incomplete consumption insurance.

Additionally, the life-cycle model in Storesletten et al. (2001) is an important requirement in the sense

1 Whereas models before Constantinides & Duffie (1996) have commonly investigated a stationary Markov chain with highly transitory components, the relaxation of this assumption to include more permanent components has reduced the equity premium puzzle in theory.

that idiosyncratic labour income risk can be made conditional on the age of the household head at time t. In this way, asset holdings can be explained in part by variations across different age groups with different abilities to buy or sell financial assets in the market. As can be seen in Figure C.1, the distribution of income does fluctuate quite substantially with age:

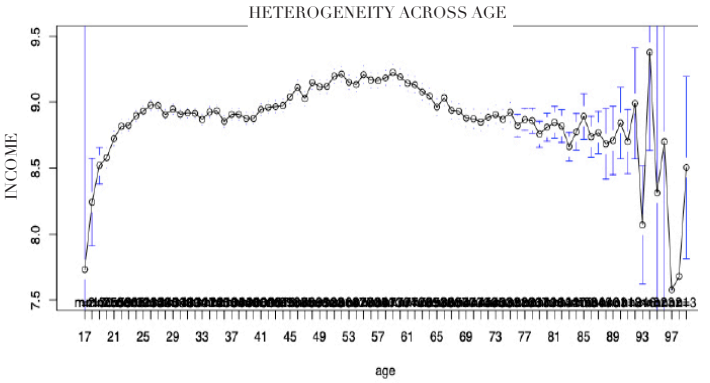


Figure C. 1 Log- income plotted against age with 95% confidence intervals around means

The PSID Dataset

The dataset used to arrive at an estimator comes from the Panel Study on Income Dynamics, provided by the University of Michigan. This paper uses data over the years 1968 to 2017, organised in 38 overlapping panels with a run-time of three years each. Each survey point represents an individual and an associated household at time t. The average number of households included in each year is 1,510 with a SD of 484. A more detailed description of PSID data is described in Moffitt & Zhang (2018).

The original distribution of the data requires several manipulations before they are ready to be analysed. First, as noted in McLanahan (1985), the PSID over-sampled poor households in the original survey. This paper follows a body in the literature where only individuals from the core sample are

included for analysis. Because the General Method of Moments (GMM) estimator will make use of GNP information dating back from 1910, only male heads of households are included. Furthermore, households which report an earnings growth rate of twenty times or higher and a subsequent decrease of twenty times or higher are excluded from the sample on the grounds of measurement error.

Concerning income, the approach taken here makes use of total family income inclusive of net transfers. Specifically, income is the sum of the following PSID variables: total taxable income of family head and wife, taxable income of all other household members, aid to dependent children, plus other transfer income. Since the goal of this paper is to examine idiosyncratic components, all of these are important in the sense that they add individual variation over the years. Income undergoes a series of transformations in order to be comparable across panels. First, the mean CPI by the U.S. Bureau of Labor Statistics for each year is obtained. Net income is then deflated by dividing by the CPI decimal so it can then be compared to other years. Second, each total household income is divided by the number of family members in order to establish per capita income. The final number is expressed as real income with regards to 2012 chained U.S. Dollars. Third, the log of income is used in all further calculations as the raw distribution appears highly non-normal (after transformation $\mu = 8.99$, $SD = 0.77$).

The main education variable contains information about the number of grades completed by each family head plus any post-secondary education completed after, ranging from 0 to 16. 340 observations had to be excluded on the grounds of erroneous data entry; their years of education indicated a value of 99. Another complication arose due to the fact that the

education variable in the family files was missing for the years 1968, 1970 to 1974, and 1985 to 1990. These values were filled in using the education variable from the individual files, which also refer to the household head. Although the definition of some of the answer options differs over time, the main variable of number of years of schooling completed at the time of the interview remains intact. The variables were then merged into one single variable with possible answers ranging from 0 to 16 years of education ($\mu = 9.15$, SD = 5.81).

Specifications of the age variable ($\mu = 45.58$, SD = 16.21) are as follows: for statistical analyses, the initial working age is assumed to be 22. An individual spends two thirds of their lifetime working and one third in retirement. The GMM estimator makes use of this fact and uses all past lags of age going back from the oldest individual in the sample, 99, until the time when he first joined the workforce at age 22, which leaves 77 usable lags of age and all other lags in order to be consistent with this initial assumption. Although the SD might seem large, the organisation in panels as described below creates a more stable pattern.

The 38 Overlapping Panels

For each of the constructed panels, there are on average 450 households included, with a SD of 321. This high fluctuation is due to the mortality occurring during the later years of the survey, where it gets harder to get consistent three-year responses across the panels. When the restriction is eased to two consecutive years of responses, the average rises to 1465 households with a SD of 649. However, with only two years available the predictive power of the GMM estimator is reduced. Thus, it seemed appropriate to retain the three-year panel but to run two separate

analyses, one including and one excluding the later years. This practice is also supported by the fact that the PSID undertook severe recalculations of sample weights and survey structure after the introduction of the Latino and Immigrant samples in 1997 and 1999. This explains in part why the local dispersion in Figure C.2 is visibly higher towards and after these years. Before, the sample demonstrated bias, and after the restructuring, some households were dropped for budgeting reasons to a disconcerting degree (Fitzgerald et al. 1998). The general trend of increasing dispersion over the years is also partially explained by the definition of family income which does include income of offspring. While some households have more children and thus higher family income, others do not have children at all and hence variability is increasing in the number of years passing. Higher rates of non-respondents in later years also adds to this pattern.

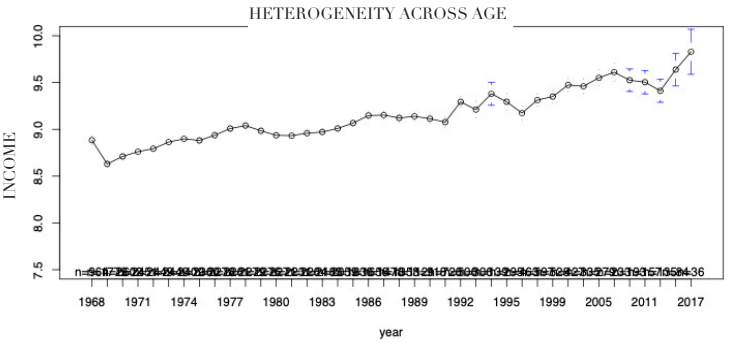


Figure C. 2: Log-income plotted against years with 95% confidence intervals around means. The re-structuring of the PSID in 1990 and 1997 taken together with a dwindling number of respondents as indicated in the text might explain the larger variability towards the end of the sample.

Further, as could be seen in Figure C.1 from earlier in the paper, the distribution of log-income is fluctuating widely across different ages, peaking somewhere between 50 and 60 years of age. To arrive at unbiased estimates of the autocorrelation coefficient that this paper is interested in, a two-steps GMM

estimator constitutes a good choice.

Empirical Specifications

Let us start at the population level. Intuitively, we want to find some random income risk that the average person carries. But there are many factors influencing the likelihood of a person suffering from a loss of income. So, first, we have to calculate out all effects that would be predictable from the basic characteristics of a person. For example, we know that both education and age have a big impact on the earnings risk of a household. When a person is young and well educated, for example, we know it is not very likely that that person will suffer from great losses.

In order to arrive at idiosyncratic variations within total income, which cannot be explained by aggregate shocks, the following population model is being estimated for each of the overlapping panels as taken from Storesletten (1999):

$$y_{it} = g_{it}(y_t) + u_{it} \qquad (3.1)$$

Where yit is the natural logarithm of household i's total income at time t; git(y_t) is comprised of aggregate shocks and fixed effects dependent on household age, numbers of years of education, etc.; y_t is per capita aggregate endowment; u_{it} is the idiosyncratic component of each household.

(3.1) holds by imposing:

$$\mathbb{E}_t u_{it} = 0 \text{ , for all } t \qquad (3.2)$$

Which is also implied by the moment conditions (equation 3.7) of the GMM estimator below. Then, git(yt) can be considered a sum of the following, with regards to the household head:

$$g_{it}(y_t) = \beta_0 + \beta_1 d_t + \beta_2 age_{i,t} + \beta_3 age^2_{i,t} + \beta_4 education_{i,t} + \text{residuals} \quad (3.3)$$

Where dt represents a vector of time-dependent intercept terms estimated by the panel regression model. One could run this as a two-way panel regression with dummy variables for both individual and year intercepts. The reasoning behind this would be that the idiosyncratic variation will come precisely from these individual intercepts, so arriving at an estimator of their coefficient would shed light on any idiosyncratic effects. Controlling for time-effects, on the other hand, serves the important function of filtering out any time-dependent impacts which might drive up the correlation of the error terms, which one ideally wants to model as being normally distributed.

One could naïvely run this as an OLS model [2]and get estimates as reported below:

	PANELS				
	(1)	(2)	(3)	(4)	(5)
age	0.026***	0.008	0.019***	0.012**	0.008
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
I (age^2)	−0.0003***	−0.0001	−0.0002***	−0.0001**	−0.0001*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
educ	0.007***	0.011***	−0.002	−0.004	−0.023***
	(0.001)	(0.004)	(0.003)	(0.004)	(0.007)
observation	2,892	2,445	2,469	2,439	2,439
R^2	0.017	0.005	0.005	0.003	0.005
F Statistic	16.987***	4.065***	4.025***	2.212*	4.229***

Note : *p <o.1 ; **P < o.o5 ; ***p <o.o1

However, the problem arises that the error terms of this model are in fact correlated with past realizations of the dependent variable and lags of the other regressors. Within-group transformed, lagged log-income would be estimated by

2 This is not an attempt of estimating a Mincer equation (notice that the squared terms relate to age, not experience) so both, time and individual effects, should be taken into consideration

$$\log(income)^{*}_{i,t-1} = \log(income)_{i,t-1} - \frac{1}{T-1}\left(\log(income)_{i,2} + \cdots + y_{i,T}\right)$$

and the corresponding error term by $\varepsilon^{*}_{it} = \varepsilon_{it} - \frac{1}{T-1}(\varepsilon_{i2} + \ldots + \varepsilon_{iT})$ which are clearly endogenous (Nickell 1981). Thus, least-squares dummy-variable (LSDV) estimates in this model would be biased. Moreover, as can also be seen in Table B.1, on a sample from the first five panels model fit is quite bad in such a case.

As can be observed in appendix A.2, such endogeneity is not necessarily noticed when running standard LSDV diagnostics such as the Breusch-Pagan test of Lagrange Multipliers. This demonstrates the importance of statistical modelling when handling large N panels where such differences are easily missed. For alternative ways of arriving at an unbiased estimator see the conclusion section of this paper where the usage of AR(1) and AR(2) OLS models are discussed.

The General Method of Moments Estimator

A GMM model was chosen for constructing the model, due to the highly endogenous dependency of idiosyncratic labour income risk on the explanatory variables and past realizations of the dependent variable. Further, the main interest of this paper, the autocorrelation coefficient, can efficiently and robustly be estimated by a GMM model. In order to account for these endogenous factors, an estimation that takes the time structure as well as the lagged nature of the dependent variable into consideration is needed. I chose a two-step system GMM model to arrive at an estimation of ρ^{h}, which means the panel regression described in equation 3.3 is still technically run but only controls for time fixed effects. The residuals of this OLS model can then be separated into an unobserved

error term and the idiosyncratic effect of interest. Using these residuals, the GMM model imposes First Order conditions; thus the name two-step GMM. A system GMM was chosen over a simple difference GMM due to higher accuracy in estimating the parameters of the model. Additionally, this mitigates the danger of running into issues of lagged variables constituting weak instruments for first differenced variables since both lagged levels and lagged differences are used to compute the estimators.

In order to ensure that the lagged components are not correlated with any past realisations, Arellano-Bond autocorrelation tests for first and second lags are reported (Arellano & Bond 1991, Kiviet et al. 2017). Significance of these tests would indicate that there are no gross violations of this sort. As is common in two-steps GMM models, a persistent zit and a transitory component of uit is the starting point. These individual effects are thought of to be stable for each household in the survey:

$$u_{it}^{h} = z_{it}^{h} + \varepsilon_{it}$$
$$z_{it}^{h} = \rho z_{i,t-1}^{h-1} + \eta_{it} \qquad (3.4)$$

Where now the age of the household head h is made explicit and it is assumed that $\varepsilon_{it} \sim N.i.i.d.(0, \sigma^2_{\varepsilon})$, $\eta_{it} \sim N.i.i.d.(0, \sigma^2_{\eta}(Y_t))$ as well as

$$\sigma^2_{\eta}(Y_t) = \begin{cases} \sigma^2_H & \text{if economic upturn at time t} \\ \square & \\ \sigma^2_L & \text{if economic downturn at time t} \end{cases}$$

Where Y_t is the aggregate performance of the economy. This means that the model assumes there is a difference in variances between trough and peak periods of the business cycle. This is supported by the general notion of higher volatility during economic downturns which results in different degrees of risk

assessment (Eeckhoudt et al. 1996). By nature of the GMM estimator, it is possible to use information about the age h of each individual at time t in combination with an assumed working age of 22 to arrive at variance estimates. These variances define the dispersion of the persistent component of idiosyncratic labour income risk around its mean, namely:

$$var(u_t^2+1) = \rho^2[I_t\,\sigma H^2 + (1 - I_t)\,\sigma L^2] + [I_t+1\sigma H^2 + (1 - I^t+1)\,\sigma L^2] + \sigma^2\varepsilon \tag{3.5}$$

Where I_t stands for a dummy variable taking on the value 1 when the economy expanded and 0 otherwise. The definition of economic expansions or contractions for the purpose of this paper is assessed by relative performance of the economy at large, across the sample years. If the growth rate of real GNP below its average, the economy is said to be in contraction. The data has been taken from the U.S. Bureau of Economic Analysis (2019) and the yearly average has been calculated. This definition is flexible and easily adapted to more complex models. Realizations of past values of log-income are presumed to satisfy the following equation:

$$u_{it}^h = \sum_{j=0}^{h-1} \rho^j \eta_{i,t-j} + \rho^h z_{t-h}^0 + \varepsilon_{it} \tag{3.6}$$

Which basically captures the population model of 3.4 and indicates that each realization of the idiosyncratic component depends on past idiosyncratic values plus a disturbance term. Both components are multiplied by the autocorrelation coefficient, dependent on a particular year when transitory and dependent on age when idiosyncratic.

The parameters of this model can then be estimated by using the following system of three moment conditions:

$$\widetilde{\mathbb{E}_t}\left[(u_{it}^h)^2 - \sigma_\varepsilon^2 - \sum_{j=0}^{h-1} \rho^{2j} \left(I_{t-j}\, \sigma_H^2 + \left[1 - I_{t-j}\right]\sigma_L^2\right)\right] = 0$$

$$\widetilde{\mathbb{E}_t}\left[u_{it}^h\, u_{it-1}^{h-1} - \sigma_\varepsilon^2 - \rho \sum_{j=0}^{h-1} \rho^{2(j-1)} \left(I_{t-j}\, \sigma_H^2 + \left[1 - I_{t-j}\right]\sigma_L^2\right)\right] = 0 \tag{3.7}$$

$$\widetilde{\mathbb{E}_t}\left[u_{it}^h\, u_{it-2}^{h-2} - \sigma_\varepsilon^2 - \rho^2 \sum_{j=0}^{h-1} \rho^{2(j-2)} \left(I_{t-j}\, \sigma_H^2 + \left[1 - I_{t-j}\right]\sigma_L^2\right)\right] = 0$$

In this model, the multiplicative relationships between the persistent component of idiosyncratic labour income risk and its past realizations are used as GMM instruments with which one can arrive at an autocorrelation coefficient. This implies that u_it will be modelled as an endogenous variable so that past variables of the dependent variable are allowed to influence present realizations. Further, $u_{it}^h\, u_{it-1}^{h-1}$ and $u_{it}^h\, u_{it-2}^{h-2}$ enter the prediction directly since they are based on values different from that of log(income). Conversely, $(u^h_{it})^2$ is not entered as a GMM instrument since its instrumental matrix would be analogous to the one given by the lags of (u^h_{it}) and its product singular.

I use system GMM to predict ρ^h for each individual in levels. This approach also imposes moment conditions on the levels of the first-pass residuals instead of only its first-level differences. This results in increased efficiency of the estimates by dropping fewer time series in the estimation process. Especially for a two-step process, this also reduces potential biases since all other variables in the model are used as regular instruments in the R function computing the GMM coefficients (Croissant et al. 2008). In order to still account for potential trends in differences, the matrices are differenced and quasi-differenced in a second step. These calculations come under the important assumption that each

household obtains a value of zit close to E[zit] in the general population for each of the panel waves. By investigating the first four moments plotted in Figure C.5 (see Appendix) and Figure C.1 above, it can be seen that although there is a clear trend observable, it does not constitute a severe departure from normality. Hence this assumption likely holds.

Estimation Results

Several additions to the original model have been made in order to better understand the underlying processes. First, rather than solely relying on a two-step GMM estimator, manual first-pass regressions have been run so the residuals of these regressions can be examined. This includes the calculation of the relevant moments used in the estimation and tests for random and fixed effects which might have to be incorporated into the first step of the GMM calculations. Second, a system GMM was used as a robustness check of Storesletten's (1999) results. This differed from the difference GMM they employed. Third, this also incorporates the use of data after 1992, so now a total of 40 instead of 22 panels are investigated. Fourth, several alternative specifications and robustness tests have been calculated for the GMM process, including quasi-differencing and a comparison of different numbers of GMM instruments (lags) of past dependent variables.

The estimation result of autocorrelation ρ^h = 0.76 does exactly lie in-between the two estimates from Storesletten (1999) and Heaton & Lucas (1996), which estimate coefficients of 0.95 and 0.5032 respectively (see table B.2). The calculated robust standard error after the Windmeijer correction is 0.34 which is slightly larger than the one by Storesletten (1999) of 0.24. Again, the more unstable pattern of

panels is likely to be at fault. When only using data before the re-structuring of the PSID sample in 1997, the coefficient increases to $\rho^h = 0.82$ with a SE of 0.34 still (see Table B.3).

Table B 2: Strong instruments, imposing moment conditions 3.7 via GMM, SE in parentheses

	GMM
	System
ρ^h	0.76171* (0.33503)
Sargan test χ^2 (106) distribution	1115.955***
Autocorrelation test (1) normal distribution	−16.69591***
Autocorrelation test (2)	−2.87084***
Lags	27
Observations	25184
Wald test $\chi^2(16)$	645062***

Note : *p <0.05 ; **P < 0.01 ; ***p <0.001

Table B 3: Alternative specification, imposing moment conditions 3.7 via GMM, SE in parentheses

	Subset
	Years < 1997
ρ^h	0.82257* (0.33559)
Sargan test χ^2 (106) distribution	1122.582***
Autocorrelation test (1) normal distribution	−17.18295***
Autocorrelation test (2)	−2.748815***
Lags	27
Observations	24967
Wald test $\chi^2(16)$	633627.5***

Note : *p <0.05 ; **P < 0.01 ; ***p <0.001

Moreover, when only using a subsample of the data which corresponds to the years used by Storesletten (1999), the estimation results approach the unit root. The number of households which can be used in the sample after 1997 does shrink considerably (see Figure C.3 and C.4). This is also reflected in the fact that the SE of the estimate is around 0.10 units

higher than in previous studies.

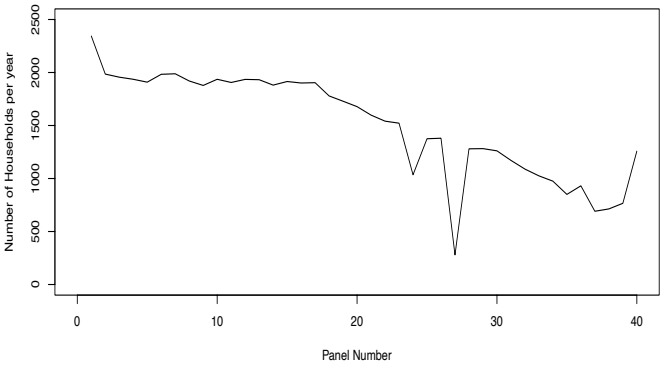


Figure C. 3: Numbers of households per year included across all panels

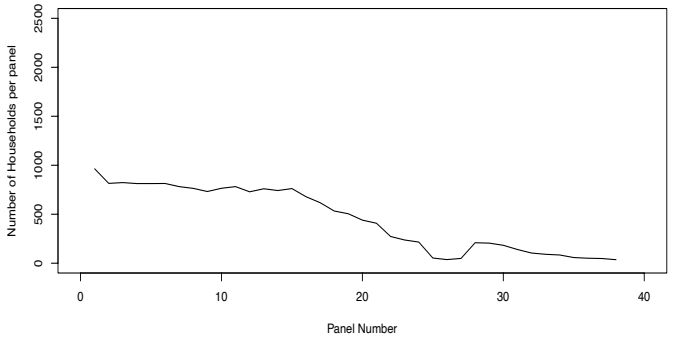


Figure C. 4: Number of households within a panel. Until around panel 20 (the mid-1990s) the number is relatively stable, afterwards numbers plummet due to budget cuts and households being dropped from the survey

Robustness Checks

Due to the short nature of the three year subpanel, the requirements posed on the model are relatively lean. Following Baltagi (2008, page 18), larger biases of coefficients arise mainly within longer-running panels. The use of short panels keeps this concern at bay. Another mitigating factor is the large number of households contained in each panel, which increases the efficacy of the GMM estimator, which is ideally used for large N, small T samples.

Due to the overlapping nature of the panels, a

correction of the covariance matrix is necessary. Rather than employing the exact correction and recalculating an estimate of the autocorrelation coefficient, this paper will employ the Arellano Bond test for autocorrelation (Arellano & Bond 1991) and utilizes a robust correction of SEs (Windmeijer 2005) to arrive at an estimate of the autocorrelation coefficient. This is done in an attempt to simplify the estimation process and cut down on the computational power needed. The reason for this is that such a correction is not readily available in standard software and would surpass the frame of this undergraduate paper. Luckily, a correction using robust SEs is sufficient for the purposes of this paper. It was mainly aimed at demonstrating that such a correlation exists, thus supporting the proposition of a dependent idiosyncratic risk. This is further discussed in the next section.

Differencing and quasi-differencing virtually do not change the estimation results. The same autocorrelation is clearly observable in both level and difference terms. This is not surprising given that a system GMM has now been employed, which goes beyond what was used in the previous literature. However, the validity of the instruments used in the GMM model do make a large difference concerning the estimate of ρ. Especially when weaker instruments are used, the estimation becomes non-credibly large. The explanation for this is that far removed lags do only correlate weakly with current values of log-income. As for intuition, although it is assumed in the model that an idiosyncratic component of labour income risk exists, it might not seem reasonable that such an effect is completely unchangeable across the lifespan. Particularly, as age is made explicit on ρ in (3.6), it is assumed that idiosyncratic effects depend on the age of an individual at any given time t.

The exclusion of weak instruments is also

encouraged by good practice in GMM prediction. One could also run into problems of overidentifying the model when using too many instruments. In order to prevent this, the current paper collapses the estimation matrices and only includes the last 27 out of 77 lags available. This combination of collapsing and restricting lags is endorsed by Kiviet et al. (2017), which notes that coefficient estimates are thus more accurate. The associated efficiency-loss in power is not very severe due to the large number of observations in the dataset and the many years available.

Conclusion

The purpose of this paper is to demonstrate that it is possible to find a dependent idiosyncratic labour income risk that displays great persistence. In the preceding sections, it is shown that this is possible even when expanding the PSID dataset beyond the restructuring in 1997 and investigating alternative specifications of the original GMM estimator. This is a marked improvement over Storesletten (1999), who focused more on the theoretical background. As has been demonstrated, the exact calibration of the GMM estimator makes a great difference and deserves some attention on its own.

Despite some minor shortcomings listed below and slightly inaccurate estimates of the autocorrelation coefficient, the significance of all estimators does at the very least imply that a dependency exists. Additionally, the fact that 27 lags were included and that both the Sargan-Hansen and coefficient estimates were significant indicates that such effects are also highly persistent.

The results of this paper do make the case for the vNM theorem to parsimoniously explain the equity premium puzzle. Since a dependency exists,

a higher equilibrium price than predicted by the standard model can be reached. This is mediated by the employment of order 1 risk aversion effects which were otherwise categorically excluded from appearing within the vNM model. This paper has demonstrated that this is unjustified and that more emphasis should be put on investigating the nature of these order 1 effects. Although this necessitates some mathematical groundwork to be laid, empirical economics can help disentangle which effects are at work and under which circumstances.

One shortcoming of the present study is the lack of implementation of an appropriate correction of the underlying covariance matrix for the overlapping panel structure. Although a robust correction has been implemented, this would increase the accuracy of the autocorrelation coefficient. Accuracy, however, has not been the main interest of this paper. The mere existence of a significant autocorrelation supports the framework proposed by Dionne & Li (2014) and Krueger & Lustig (2010) by which the equity premium puzzle can be reconciled with the vNM paradigm.

On the same note, equivalence scales were not implemented for establishing per capita income. In the future, the dataset should be rebuilt while dividing total household income by the square root of the number family members rather than the absolute number. This would ensure family needs are modelled more realistically according to their size.

Second, the unstable structure of the PSID panel during later years requires fixing. In order to make more stable predictions, a new construction of the dataset seems necessary to confirm autocorrelation estimates after 1997, potentially including offspring instead of the original household head after split-ups.

Third, GMM specifications investigating

alternative income processes, and AR(1) and AR(2) OLS models, should be run to confirm the GMM results reported here. When so doing, researchers should be careful regarding the endogenous nature of error terms in such models though. As seen in the appendix, OLS diagnostics are not infallible tools when working with as large a dataset as the PSID.

Proposition 5.1 in Dionne & Li (2014), taken together with the conclusion reached by Krueger & Lustig (2010), and the empirical evidence derived from this reworked GMM model by Storesletten (1999), demonstrate that a convergence of mathematical predictions and empirical results is efficient in pushing forward the limits of economic theory building. Moreover, estimates of the autocorrelation coefficient by Lucas (1994) and Storesletten (1999) bolster this claim, where all of the coefficients were considered to be of large effect sizes. The social sciences replication crisis of 2014 has demonstrated how dangerous it can be to put too much emphasis on short and counter-intuitive papers written without connecting results to an over-arching theory that can be falsified. I hope that this paper could do its part in providing such a link between bigger ideas in economics and empirical results. In conclusion, further investigation of order 1 risk aversion within the vNM framework seems viable in the future.

A recommended direction for future research is to explore data that is specific to outside of the United States. It would be informative to see whether there exist other economies in which idiosyncratic risk is less dependent. Comparing the magnitude of the estimated coefficient with the magnitude of the equity premium puzzle would be a natural extension of the hypothesis that such a dependence does increase equity premia paid throughout economies.

II

HONOURS THESIS

Does Local Industry Decline Spur or Moderate Political Polarization? Evidence from U.S. Plant Closures

George Radner

ECON 499

ABSTRACT

In the wake of populism's surge in recent years, the extent to which economic adversity influences voter and legislator ideology is an important question. Exploiting variation in the rate of plant closures within U.S. Congressional districts between 2004-2014, I argue that negative shocks to local manufacturing produce more moderate legislators, measured by an ideological score based on roll-call voting. My findings suggest plant closures' moderating effect occurs through two channels: Republican incumbents moving to the centre, and Democratic districts replacing liberals with centrists. Consistent with these district-level results, an analysis of survey data reveals a coincidence between jobless-ness and centrist ideology among Democratic voters. My findings question the common conflation of poor economic conditions and ideological extremism. Closures appear to trigger a pragmatic response rather than the populist one recently associated with trade shocks.

1. Introduction

Does economic adversity influence how individuals vote and how legislators behave? To scholars and casual observers of U.S. politics alike, the answer is likely to be the affirmative. Economic issues are central to today's politics. An example is the well-established pattern of voters punishing incumbent politicians and parties at the polls during poor economic times.[1] In the wake of populism's surge in recent years, a subtler, yet more relevant question is: To what extent does economic adversity influence voter and legislator ideology?

The rise of populist leaders and movements in the West Donald Trump, for example, in the U.S. and Brexit in the U.K. is striking in part because their success has been based more on appeals to ideology than to policy details. Even without populist heads of state, countries such as Germany, France, and the Netherlands are witnessing the ideological shift of politicians towards the extremes, on both the left and right.[2] A similar and equally salient trend is that legislators in the U.S. Congress, particularly Republicans, are becoming more ideologically extreme.

Indeed, a growing body of literature postulates that political polarization in the U.S. is on the rise (see Pew Research Center, 2014; Gentzkow, 2016). A clear example of this phenomenon is the divergence of House Republican and Democratic Nominate scores, an established measure of legislator ideology (see figure 1; McCarty, Poole and Rosenthal, 2006). The Nominate score measures the relative ideological

1 See for example Fair (1978) and Lewis-Beck and Paldam (2000).

2 See for example Rooduijn and Akkerman (2017).

position of Congressional legislators based on their roll call voting behavior; a high positive score indicates conservative, while a low negative score indicates liberal (Lewis, Poole and Rosenthal, 2018).[3]

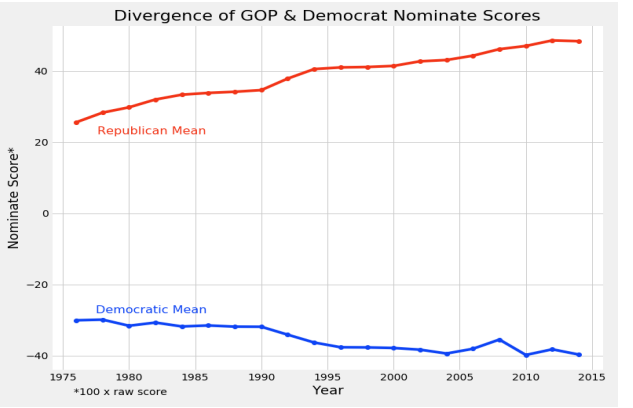


Figure 1: Divergence of Republican and Democratic Mean Nominate Scores. The Nominate score measures legislator ideology based on their roll-call votes. A low score is liberal and high score is conservative.

My research explores whether a particular class of economic shock is accelerating, or decelerating, this Congressional trend toward polarization, measured by changes in legislator Nominate scores. The economic shocks I study are manufacturing closures. Here, a closure refers to a physical establishment, facility or plant, of which a single enterprise or firm may have multiple, that goes from having employees in one year to no employees in the next. In communities historically built around a single industry, plant closures can be crushing. The closing of a major plant can leave swaths of people without work or transferable skills. Individuals may be torn between staying in a

3 My study does not rely on absolute definitions of liberal or conservative ideology. Following the Nominate score method, I discuss the ideology of different of legislators in relative terms.

town where work is scarce or leaving their community behind in hope of better job prospects.

Figure 2 shows the average number of manufacturing establishments in a Congressional district has been steadily declining between 2003-2014. As closures continue to transform com-munities, there is reason to expect electoral consequences. My research specifically asks how shocks to local manufacturing influence the ideology of elected legislators. Further, do plant closures influence ideology by creating turnover, or by changing the behaviour of incumbents?

Using variation in the rate of manufacturing closures

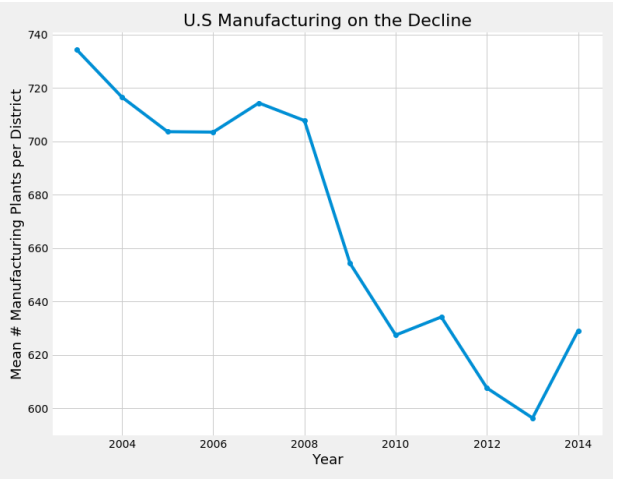


Figure 2: Declining Mean Number of Manufacturing Establishment per District.

within Congressional districts, I argue that negative shocks produce more moderate legislators. Despite the rising trend of political polarization, my findings suggest that between 2004-2014, districts responded to increased manufacturing closures by electing legislators whose subsequent roll-call behavior placed them closer to the ideological centre. The size of this response was modest, but not trivial: a 2% (one standard

deviation) increase in closures brought districts 7.2% (21% of a standard deviation) closer to the ideological centre.

My findings suggest plant closures' moderating effect occurred through two channels: Re-publican incumbents moving to the centre, and Democratic districts replacing liberals with centrists. To explore the latter channel, I examine the connection between job shocks and voter ideology using survey data. I find a coincidence between joblessness and centrist ideology among Democratic voters, consistent with the district-level results. Taken as a whole, the results suggest voters desire moderate, pragmatic legislators to represent them in the face of concentrated local economic adversity.

Political polarization is troubling. For one, there evidence to suggest it may be self-reinforcing. Recent studies have found that some economic phenomena, such as income inequality, financial crises, and local labour shocks from import penetration, lead to more polarization (Mc-Carty et al., 2006; Mian, Sufi and Trebbi, 2012; Autor, Dorn, Hanson, and Majlesi, 2017). Mian, Sufi and Trebbi (2012) also point out that political gridlock seldom results in timely or effective legislation during crises like the Great Recession. In turn, a polarized legislature, plagued by gridlock and partisanship, is less likely to pass sensible public policy to protect workers from trade shocks or to combat income inequality (Voorheis, McCarty and Shor, 2015). Deeper entrenchment of economic woes may lead to further polarization, creating a vicious cycle. My findings question the common conflation of poor economic conditions and political polarization.

2. Literature Review

While my study sets out to explore ideological polarization, it fits naturally within the larger body of literature on the effect of economic shocks, positive and negative, on political out-comes and legislator ideology. Fedaseyeu, Gilje and Strahan (2015), for example, find that shale booms, which created positive, exogenous economic shocks, shift the electorate ideologically to the right. Brunner, Ross and Washington (2011) also find an ideological shift to the right following positive economic shocks in California, which they show decreases support for redistributive policies.

Given these two results, it seems as though negative economic shocks, the focus of my study, would shift voters and legislators to the left. In fact, the evidence is contradictory. Che, Pierce, Schott and Tao (2016) find that increased competition due to trade with China increased Democratic vote share between 1992-2010. Yet, Autor et al. (2017), focusing on a shorter time period in which congressional boundaries are fixed, suggest that increased Chinese import penetration improves Republican vote share.

But party affiliation is a crude measure of ideology let alone ideological polarization. My work builds on scholarship focusing on what roll-call votes reveal about a legislator's ideological leanings. While some scholars, including Fedaseyeu et al. (2015) and Lee, Moretti and Butler (2004), suggest candidate and legislator ideology remains fixed and is not affected by changing voter preferences, Feigenbaum and Hall (2015) use evidence from Chinese trade shocks to suggest incumbents adjust their position on trade legislation based on how their districts are faring economically. In other words, economic shocks to a

legislator's voting base can change how she responds to relevant economic issues in Congress. My study will build on Feigenbaum and Hall (2015) by exploring whether local plant closures which may or may not be rooted in international trade also influence legislator roll-call behaviour, particularly whether they lead to more moderate or more extreme voting.

If incumbents are indeed responsive to their constituents' economic woes, an important question, which part of my study addresses, is how local economic conditions affect voter preferences. In exploring mechanisms behind economic voting, Ansolabehere, Meredith and Snowberg (2014) stress the importance of economic information in voters' decisions at the polls. They show an individual's perception of the aggregate economy's performance depends heavily on their own job security and the economic experiences of members within their social groups. An individual's view on the national economy, in turn informs their voting choices (Ansolabehere, Meredith and Snowberg, 2014).

The studies cited provide a useful background for examining how economic shocks affect the behaviour of voters and legislators alike. But they do not directly address the question of political polarization. A recent force behind political polarization may be the Great Recession. Indeed, Mian, Sufi and Trebbi (2014) find "financial crises move political systems toward systematically more polarized legislatures and fragmented political scenarios" (p. 8). Funke Schularick and Trebesch, (2016) find similar results studying European financial crises.

Another cause of America's current ideological divide may be the rising wealth gap. Recent literature has documented a strong correlation between income

inequality and political polarization (McCarty et al., 2003, 2006, 2013; Gelman Kenworthy and Su, 2010), and posited a self-reinforcing causal link between the two forces (Duca and Saving 2015; Voorheis et al., 2015; Feddersen and Gul, 2013). McCarty et al. (2003), for example, highlight that wealth inequality and political polarization have been growing together since the mid-to-late 1970s, and provide evidence using survey data that income played an increasingly important role in predicting party identification (with high income predicting Republican partisanship) from the 1950s to the 1990s. Voorheis et al. (2015) focus on state legislatures and find perhaps the first causal evidence that income inequality causes political polarization. Voorheis et al. (2015) posit that political polarization can in turn deepen income inequality, a notion which a theoretical model of political competition by Feddersen and Gul (2013) supports.

My research question and methodology resemble the work of Autor et al. (2017), which studies the causal link between trade shocks, Chinese imports in particular, and political polarization using the Nominate scores discussed above (also see Section 3.1). Autor et al. (2017) show that labour markets exposed to Chinese import penetration are more likely to elect a more extreme Democrat or more extreme Republican, though the latter is more typical. They find trade shocks have an anti-incumbent effect but do not influence the ideology of incumbents who remain in power, contrasting Feigenbaum and Hall (2015).

Autor et al. attribute the effect of trade shocks on extreme ideology largely to "increases in foreign competition facing manufacturing industries that are intensive in the employment of non-Hispanic white males" (Autor et al., 2017, p. 40). My study contrasts

with the work of Autor et al. (2017) in part because it examines a broader set of negative economic shocks to the manufacturing sector. Indeed, beyond international trade, there are many factors, from technology change to local competition, that cause manufacturers to close their facilities. Moreover, if the most relevant feature of the manufacturing industry is its non-Hispanic white male labour force, then there is reason to expect a similar political response from shocks to other sectors that employ a similar demographic. I address this lacuna by comparing the effect of closures in manufacturing to closures in other labour intensive, blue-collar sectors.

3. Data

My main results estimate the effect of manufacturing closures on the ideological score, in absolute terms, of the Congressional district's elected representative. The analysis is at the Congressional district level over four election years: 2004, 2008, 2012, and 2014.[4] The analysis excludes special elections, which occur to replace a legislator after death, resignation or indictment.[5] I also omit seven elections of legislators from Independent parties and nine Congressional districts in Texas and five in Georgia due to redistricting between 2000 and 2010. I further exclude districts where closures data are missing (for example, Hawaii and Alaska). My final sample covers 94% of all Congressional districts in the U.S.

4 Throughout this study, the year will refer to the election year. Thus my analysis focuses on the 109th, 111th, 114th and 115th Congresses.

5 Special elections are not comparable with normal elections because they occur in off-cycle years and typically have low turnout. There were a total of 92 special elections during the period of analysis, representing only 2.3% of the total observations.

3.1 Legislator Ideology

I use the DW-Nominate score to measure legislator ideology. The DW-Nominate score, created by Poole and Rosenthal, measures the relative ideological position of a legislator based on her roll-call votes in Congress (Poole and Rosenthal, 1985). The DW-Nominate score is unique in part because it is comparable across different Congresses historically. This allows for a direct comparison of the scores of legislators who were never in office at the same time. The DW-Nominate score measures relative ideology, not absolute ideology. The reason is that even if a legislator's ideological tendencies remain fixed, her score can change over the time based on the shifting composition of her colleagues in Congress. For example, a legislator's score may be in the conservative range in one Congress, but if a batch of far-right legislators enters office, her score will be pushed towards the moderate range, even if she herself has not changed her views.

I specifically focus on dimension one of the Nokken-Poole DW-Nominate score (henceforth simply the "Nominate" score) which ranges from liberal (low, negative score) to conservative (high, positive score) between -1 and 1.[6] For presentation, I multiply the scores by 100.

The minimum score in the sample is -95.4; the maximum is 99.1. The Nokken-Poole scores differ from other DW-Nominate scores because they allow for incumbent legislator's ideological score to change over time based on how they vote in each Congress

6 Dimension one of the Nominate score measures ideology on a liberal to conservative scale, but it is not specific to economic or social issues (Boche et al., 2018). A limitation in my analysis is that I cannot discern whether what types of issues are driving the Nominate score changes I study.

(Boche, Lewis, Rudkin and Sonnet, 2018).

The main dependent variable is the absolute Nominate score, which measures a legislator's distance from the ideological centre. Additional outcomes are indicator variables, constructed from the Nominate score, for whether a district elected a moderate, moderate Democrat, moderate Republican, liberal Democrat, or conservative Republican. I define a moderate score as one in the first three quartiles of the distribution of absolute Nominate scores across my period of study. Liberal and conservative scores are in the fourth quartile for Democrats and Republicans, respectively.[7] As Figure 3 shows, absolute Nominate scores have been increasing since the 1970s, suggesting rising ideological extremism and deeper political polarization. But Congress becoming more extreme on average could occur in a number of ways. The shift could be caused by a decrease in moderates or by an increase in extreme liberals or conservatives. It could be driven by ideological shifts in either or both parties.

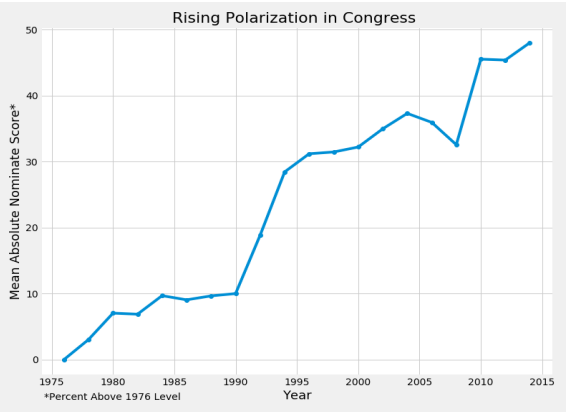


Figure 3: Increasing Mean Absolute Nominate Score. The Absolute Nominate score measures a legislator's distance from the ideological centre.

7 Appendix Table A4 explores the sensitivity of my results to different quantile cutoffs and distributions.

Together, the dependent variables provide a detailed picture of how the legislature is shifting.

3.2 District Manufacturing Closures

Data on the number of establishments, establishment closures and establishment openings by county, year, and industry are from the Statistics of U.S. Business (SUSB), a program of the U.S. Census Bureau. A closure refers to an establishment, facility or plant that had employees in the previous year but none in the current year.[8] I define the manufacturing closure rate as the percentage of manufacturing establishments that close in given district and year. Since Congressional elections occur biannually, I average the closure rate across the election year and the year before it. In later models, I expand my analysis to also include other blue-collar sectors whose dynamics may be similar to manufacturing: mining, quarrying, and oil and gas extraction; utilities, construction; and transportation and warehousing.

A limitation with the SUSB establishment closures dataset is that it does not indicate the size of the establishment or how long it had been in operation. I am interested in closures involving established facilities which affect large numbers of people. But the closures data also capture the failures of small companies or startups in their early years, creating noise in the data. This limitation partially motivates my choice to use the percentage of establishments that close as the main independent variable. Nonetheless, to show robustness, in Appendix Table A2 I replicate my main results using the total number of closures in a district as the regressor.

8 I use plant and establishment interchangeably in this paper.

A final limitation with my data is that establishment closures occur at the county level, while electoral data (and in later models, survey data) occur at the congressional district level. Congressional districts often intersect multiple counties, and a single county can lie in multiple congressional districts. Seventy-one percent of counties in my sample are contained in a single congressional district. For the remaining counties, I perform the following technique to aggregate plant closures at the congressional district level. [9]

Suppose congressional district J intersects N counties: $\{c_1,c_2,\ldots,c_N\}$. Let m_i be the number of congressional districts county i intersects (including district J), and let x_i be the number of plant closures in county i.

Then the number of closures X_J assigned to district J is computed as follows:

$$X_J = \sum_{i=1}^{N} \frac{x_i}{m_i} \quad (1)$$

For a county i falling in only one congressional district, $m_i=1$, so the value of X_J is often simply the total plant closures across all the counties congressional district J contains. The maximum value for m_i, however, is 18 (occurring in the populous Los Angeles County). After aggregating the number of closures and the number of initial manufacturing establishments, I compute the closure rate.

The validity of this aggregation technique relies on the assumption that a county's closures are equally distributed throughout the congressional districts the county intersects. This may be false for certain

9 The calculation below also depends on the year in question, since Congressional boundaries change every ten years.

counties. For example, a county may intersect three districts, but there is no guarantee that the county geographic area and population are evenly divided into thirds, one part to each district. Furthermore, gerrymandered congressional district boundaries may divide a county based on factors such as race and income level. The level of gerrymandering could be correlated with political polarization, my outcome variable. However, without more detailed data, these concerns persist.

Figure 2 shows the average number of manufacturing establishments in a Congressional district has been decreasing since 2003 (likely for even longer). But as Figure 4 suggests, the rate of manufacturing decline fluctuates considerably in the same period. Variation in the closure rate over time, specifically within districts, is the basis for this study's empirical results.

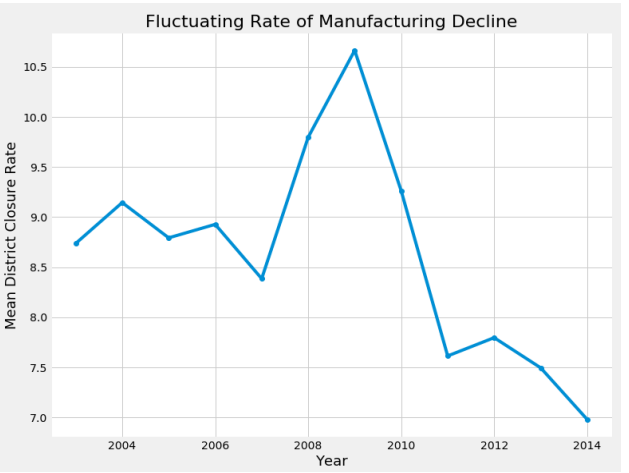


Figure 4: Fluctuating Rate of Manufacturing Establishment Closures

3.3 Controls

Demographic controls include Congressional district population shares for the following groups:

White, Black, Asian, Hispanic, college educated, and female, as well as population shares for nine age groups. I retrieve these data at the congressional district level from the U.S. Current Population Survey (CPS) for the years 2000 and 2010, with a single exception: education data is not available at the congressional district level in the CPS in 2010. This data was gathered from American Community Survey (ACS) 5-year estimates.

My economic controls are a district's unemployment rate and real mean personal income. Unemployment and income data by county and year come from the Bureau of Labor Statistic and the Bureau of Economic Analysis respectively. I aggregate these variables from the county level to congressional districts using the exact same technique described for closures above (see equation 1). Another economic control is the ratio of manufacturing establishments to all establishments in a district at the start of each decade, which I compute from SUSB industry data described above. This control accounts for potential endogeneity arising from certain districts' economies being more manufacturing-intensive than others at the start of the period.

Finally, in some specifications, I include control variables for whether the legislator is an incumbent and their party. These controls reveal whether the effect of closures occurs through turnover in legislators, and whether it is concentrated in the Democrats or Republicans.

4 Empirical Strategy

My estimation strategy is an ordinary least squares model with district and year fixed effects. I estimate regressions of the form:

$$Y_{d,t}=\alpha+\beta ClosureRate_{d,t}+X'_{d,t}\gamma+\Omega_t+\Phi_d+\varepsilon_{d,t} \qquad (2)$$

The independent variable is the district closure rate, defined as the percentage of a Congressional district's manufacturing establishments or plants that shut down in the two years pre-ceding an election. The main outcome variable is the absolute value of the Nominate score of the district's elected legislator. The Nominate score uses a legislator's roll-call votes in Congress to estimate their relative ideological placement. Thus, the absolute Nominate score is the distance a legislator is from the ideological centre. The other key outcomes are indicator variables for electing a moderate, liberal or conservative legislator, described in more detail in the Data Section (3.1). In equation 2, Ω represents year fixed effects, represents ø district fixed effects, and X is a matrix of the district demographic, industry and economic controls described in the Data Section (3.3). In models exclusively examining incumbent legislators, district fixed effects are not applicable, and are replaced with legislator fixed effects.

My claim is that in the presence of controls and fixed effects, manufacturing closures are an exogenous shock. A wide variety of economic forces can cause plants to close, including changing local or international demand for industrial goods, technology change, automation, environmental regulation, offshoring, and international trade. Many of these causes, such as automation and international competition, seem unlikely to be influencing voter preferences independent of their effect through closures. For example, a major U.S. manufacturer of car tires for export may go out of business due to increased competition from rivals in other parts of

the country. But besides leading to the closure, the success of competitors in other U.S. states should have no direct effect on local electoral outcomes. Similarly, I claim technological advances, such as automation, only influence voter preferences through their impact on job security and local economic conditions.

There remain potentially endogenous causes of plant closures, but the fixed effects and controls help account for many of them. Year fixed effects absorb any bias from nation-wide events correlated with closures and elections. District fixed effects, meanwhile, eliminate bias from district-specific characteristics that remain fixed over time. I use a falsification test to address the risk of reverse causality arising from legislators influencing plant closures through policy in the Support Evidence Section (5.3).

I also control for the district unemployment rate and the natural logarithm of mean personal income (in real terms). These controls combat potential omitted variable bias arising from district-wide economic shocks, not specific to the manufacturing industry, that may directly influence electoral outcomes.[10] Shocks of this variety could nonetheless be correlated with manufacturing closures. An example is the 2007-2008 economic crisis, which indeed hurt manufacturing, and according to Mian, Sufi and Trebbi (2012), also led to political polarization in Congress. While the shock was national, it differentially affected districts depending on local labour market conditions, meaning neither district nor year fixed effects are adequate as controls. Hence my motivation for including district unemployment and income controls, which do respond to district- and year-specific economic

10 In general, the direction of the bias from such shocks is unclear because existing literature does not provide a conclusive prior on how economic shocks (positive or negative) influence the ideology of elected legislators.

shocks.[11]

Despite the controls and fixed effects, I am unable to entirely eliminate the risk of omitted variable bias coming from localized economic or political shocks. I discuss this risk in detail in the Discussion (Section 6). Another source of difficulty in this analysis is decennial Congressional redistricting. In my period of analysis, Congressional districts boundaries changed between the Congresses elected in 2010 and 2012. Redistricting renders district fixed effects alone rather meaningless: a district, represented by a state and number (eg: California, 4), is not a fixed location over time. Moreover, redistricting may occur endogenously: it is possible more ideological state legislators modify boundaries to keep themselves and their partisan colleagues in power. As a result, I use district-decade fixed effects rather than district fixed effects. A district-decade is a pair consisting of a Congressional district and a decade (either 2002-2010, or 2012-2020). District-decade fixed effects avoid the issue of redistricting while still controlling for potentially endogenous characteristics of districts that remain fixed within a decade.[12] To avoid the complication of redistricting, I re-estimate my main results within each decade in Appendix Table A3.

5 Results

5.1 Summary Statistics

Table 1 displays summary statistics for my

11 Inclusion of these controls will also reveal that the effect of closures on legislator ideology does not entirely occur through loss of jobs and income. See Results subsection 5.3.2 for a more details.

12 A concern here is that since I only have two observations per decade, the district-decade fixed effects do not capture long-term fixed characteristics of a district. I cannot entirely avoid this issue, but I partially address it in the discussion of Table 3

analysis of Congressional district closures and legislator ideology.

A notable fact from Table 1 is that there are more conservative Republicans than there are liberal Democrats. In fact, 39.6% of Republicans are conservative (Absolute Nominate scores about the 75th percentile), while only 13.1% of Democrats are liberal. Figure 1 presents visual evidence that the mean Republican Nominate score is increasing faster than the Democrat score is decreasing.

In the average district across my sample, 8.02% of manufacturing plants close. The interquartile range for the closure rate is 2.53%. Despite the fact Congressional districts each contain approximately the same fraction of the U.S. population, the actual number of manufacturing establishment closures varies considerably. While no closures occur in some district-years, other district-years have over 1100 closures. The median number of closures is 10, while the mean (standard deviation) is 58.003 (99.663). Seventy-five percent of districts have 72 or fewer closures. Many of the outliers at the high end of the distribution may be the result of the Great Recession: 15 of the 18 observations (83.3%) with more than 800 closures occurred between 2007-2009. The spike in closures around the Great Recession is clearly visible in Figures 2 and 4.

Table 1: Summary Statistics

Type	Statistic	Mean	St. Dev.
Dependent Variables	Absolute Nominate Score	42.637	14.960
	% Moderate Legislator	73.152	44.331
	% Moderate Republican	31.091	46.301
	% Moderate Democrat	42.061	49.381
	% Conservative Republican	20.424	40.327
	% Liberal Democrat	6.364	24.418
Independent Variable	% Manufacturing Closure Rate	8.023	1.980
Economic & Demographic Controls	Unemployment Rate	6.627	1.885
	Log(Mean Income)	11.282	1.515
	% Manufacturing's Establishment Share	24.851	1.201
	% Age: 20-24	6.971	1.299
	% Age: 25-34	13.238	2.181
	% Age: 35-44	13.312	1.188
	% Age: 45-54	14.618	1.217
	% Age: 55-59	6.383	0.689
	% Age: 60-64	5.464	0.784
	% Age: 65-74	7.046	1.507
	% Age: 75-84	4.247	1.116
	% Age: 85+	1.789	0.555
	% Female	50.858	0.919
	% Non-Hispanic White	64.211	22.499
	% Black/African American	12.694	14.246
	% Hispanic	15.796	17.039
	% College educated	9.291	4.913
Political Controls	% Incumbent	79.273	40.547
	% Republican	51.576	49.990

Notes: N = 1,646 Congressional district-year pairs, in Congressional election years 2004, 2008, 2012 and 2014. The Absolute Nominate Score measures an elected legislator's distance from the ideological centre. Closure Rate refers to average parentage of manufacturing establishments that shut down in the two year period before an election.

5.2 District Closures and Legislator Absolute Ideology

Table 2 estimates equation 2 with a legislator's Absolute Nominate score as the outcome variable. Moving across the table, I add the controls shown in Table 1 and district-decade fixed effects. The main specifications (columns 4-6) exploit within-district variation to estimate the effect of closures on legislator absolute ideology.

Columns 1-3 show how the correlation between a district's closures and its representative's absolute ideology varies with the addition of economic and demographic controls. The positive point estimates suggest a correlation between high rates of manufacturing closures and more ideologically

extreme legislators. But the correlation becomes smaller and less precise as I add controls for the unemployment rate and income (it becomes even closer to zero when I include state fixed effects, not shown in the table). Regardless, the cross-sectional correlation is not my main concern: the estimates of interest in Table 2 appear in columns 4-6.

Table 2: Between- and Within-District Effects of Manufacturing Closures on Elected Legislator Absolute Ideology

	Dependent variable:					
	Absolute Nominate Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Closure Rate (%)	0.565**	0.493**	0.403	-1.376***	-1.373**	-1.536***
	(0.238)	(0.251)	(0.270)	(0.517)	(0.539)	(0.553)
Unemployment Rate (%)			-0.845**			1.336
			(0.344)			(0.827)
Log(Mean Income)			-0.587			2.562
			(0.365)			(15.142)
District Controls		X	X		X	X
District-Decade FE				X	X	X
Observations	1,646	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.018	0.035	0.040	0.726	0.725	0.726

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models include year fixed effects. The outcome variable represents an elected legislator's distance from the ideological centre. Closure rate refers to the average percentage of a district's manufacturing establishments that shut down in the two year period before an election. Log(Income) is based on the district's mean personal real income. District controls refer to the demographic variables shown in Table 1, including the ratio of manufacturing firms to total firms in a district at period start. District-decade, rather than district, fixed effects used due to redistricting before the 2012 election. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

In columns 4-6, I capture the within-district effects of closures on an elected legislator's distance from the ideological centre. The estimates in columns 4-6, whose sign is negative, suggest manufacturing closures lead to the election of more moderate legislators. These estimates are statistically significant (t-values between -2.547 and -2.777) and considerable, though not large, in magnitude. Column 6 in Table

2 predicts increasing the rate of closures by the interquartile range decreases the district Absolute nominate score by 3.883 (2.528 × 1.536), which is 25.955% of a standard deviation.

To uncover the mechanism behind my results, an important question is whether the effects are due to legislator turnover or changing incumbent behaviour. In other words, are the effects occurring on the extensive or intensive margin? Table 3 sheds light on this matter by estimating the effect of closures on absolute ideology among seats held by incumbents, which in fact represent 79.2% of the sample.[13] Table 3 compares the within-legislator effects and the within-district effects, the former only capturing changes on the intensive margin.Table 3 also addresses whether Republican and Democratic incumbents respond differently to closures. The two parties often adopt opposing stances on issues relevant to manufacturing closures and subsequent joblessness including industry subsidies, environmental regulation, free trade, and social security. There is ample reason to expect a discrepancy in the response to closures by party.

A final motivation for the table is that the use of legislator fixed effects avoids the issues of districts being incomparable across decades and my reliance on district-decade fixed effects in the previous specification.[14] Table 3 partially serves as a robustness check for Table 2 because the results of the within-district and within-legislator analyses align.

13 Appendix Table A1 reveals that with the full set of controls, closures do not predict incumbency. The table shows that district unemployment rate, an important control to avoid omitted variable bias, is correlated with the removal of incumbents, consistent with literature on economic voting (Fair 1978); Lewis-Beck and Paldam 2000)

14 There remains a concern that redistricting could bias my results. For example, an incumbent may change their behaviour if after redistricting, their new district clearly has slightly different political views. Controlling for changing demographics of the district mitigates this risk, but I cannot entirely eliminate it.

Table 3: Within-Legislator Effects of Closures on Incumbent Absolute Ideology

	Dependent variable:					
	Absolute Nominate Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Closure Rate (%)	-0.708*** (0.269)	-0.882** (0.404)	-0.475 (0.362)	-0.662* (0.372)	-0.998** (0.506)	0.197 (0.486)
Mean	43.674	47.700	39.636	43.674	47.700	39.636
Subsample		GOP	Dem		GOP	Dem
Legislator FE?	X	X	X			
District FE?				X	X	X
Observations	1,414	708	706	1,414	708	706
Adjusted R^2	0.860	0.897	0.841	0.866	0.866	0.838

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. Only district-years where an incumbent was in office (including their first term) are included. All models include year fixed effects. The outcome variable represents an elected legislator's distance from the ideological centre. Closure rate refers to the average percentage of a district's manufacturing establishments that shut down in the two year period before an election. All models include the full set of demographic and economic controls from Table 1, including the district unemployment rate and income. Robust standard errors clustered at the legislator level. *p<0.1; **p<0.05; ***p<0.01

Column 1-3 in Table 3 use legislator fixed effects to capture how closures affect incumbent behaviour. All specifications include year fixed effects and the full set of demographic and economic controls from Table 1. The subsample in this table includes all years where an incumbent held office (including their first year). The negative, statistically significant co-efficient in column 1 (t=2.63) suggests increased closures push incumbents towards the ideological centre. But the magnitude of the within-legislator point estimate, roughly half the size of the within-district estimate, is not large.

Columns 2 and 3 suggest the within-legislator effect is larger and more precise for Republicans compared with Democrats. That said, there is insufficient evidence for rejecting the null hypothesis that the effects are equal. While this study does not empirically explore how incumbents adjust their roll-call votes on specific issues, the following is a potential explanation for why the effect of closures is stronger for Republicans. A conservative Republican legislator,

for example, may be in favour of minimal government interference with business. Her pro-industry stance may help her re-election bid after plant closures occur in her district. But the plant closures and subsequent job loss may also motivate her to work with Democrats or more moderate Republicans to support social security and healthcare for the unemployed. Another possibility, which I explore in the next table, is that conservative legislators become more moderate because they fear challenges by moderate Democrats, whose election becomes more likely in districts with more closures.[15]

Column 4-6 in Table 3 estimate regressions with the same subsample and key variables as columns 1-3. The only difference is that I change the level of the fixed effect from individual legislator to district-decade for reasons of comparison. Comparing columns 1 and 4 reveals the difference between point estimates with district versus individual legislator fixed effects is small relative to the standard errors. Restricting the sample to districts held by Republicans in columns 2 and 5, I find a similarly small difference but with the opposite sign. The similarities of the estimates across the district fixed effect and legislator fixed effects models suggest the results observed in previous tables are at least partially driven by incumbents responding to closures and becoming more moderate. But Table 3 only includes district-years where an incumbent held the seat. It remains possible that in addition to the within-legislator effect in such districts, closures did affect ideology through legislator turnover in the remaining sample.

15 It is also possible I am seeing a sharper effect for Republicans simply because Republican incumbents may be more strategic in their voting behaviour and respond more closely with changes they perceive in voter attitudes. This study, however, does not attempt to mediate these possible mechanisms empirically.

Following Autor et al. (2017), Table 4 explores how closures reallocate House seats among moderates, liberals and conservatives. The regression again estimates 2, adding a control for incumbency in Panel B to reveal whether effects exist on the extensive margin. The outcome variables are indicators for the district electing a moderate (Democrat or Republican), liberal, or conservative. I construct these indicator variables based on the distribution of absolute Nominate scores across all outcome years in the study. A moderate is a legislator whose absolute Nominate score places her below the 75th percentile. The designations liberal and conservative refer to Democrats and Republicans respectively who are not moderates (scores above the 75th percentile). [16]

All estimates in Table 4 include district-decade fixed effects, year fixed effects and the full set of economic and demographic controls from Table 1. Consistent with Table 2, column A1 shows the overall effect of closures is to support moderates. The effect is statistically significant (t=2.09) and its magnitude is modest but non-negligible. Comparing districts across the interquartile range, the district with more closures would have a 9.160% (20.665% of a standard deviation) greater probability of electing a moderate.

Comparing Panels A and B, the only column where the point estimates noticeably change is Column 2, whose outcome variable is electing a moderate Republican. The point estimate in Column B2, which controls for incumbency, is a tenth of the size as the one in Column A2. That controlling for

16 I examine the sensitivity of the results to the choice of quantile cutoffs and distributions in the appendix. Appendix Table A4 reconstructs Table 4 with a moderate legislator defined as one whose Nominate score – no absolute values – falls in the middle three quintiles of the Nominate score distribution. The estimates in Appendix Table A4 are consistent with but less precisely estimated than those in Table 4.

incumbency reduces the magnitude of closures' effect on producing moderate Republicans is consistent with the findings of a strong within-incumbent effect for Republicans in Table 3.

Table 4: Within-District Effects of Closures on the Legislature's Ideological Composition

	Dependent Variable:				
	Elected Moderate	Moderate Republican	Moderate Democrat	Conservative Republican	Liberal Democrat
	(1)	(2)	(3)	(4)	(5)
			Panel A		
Closure Rate (%)	3.624**	0.267	3.357**	-2.239	-1.573*
	(1.733)	(1.833)	(1.659)	(1.471)	(0.923)
			Panel B		
Closure Rate (%)	3.486**	0.024	3.463**	-2.126	-1.551*
	(1.727)	(1.830)	(1.672)	(1.465)	(0.924)
Incumbent Held Seat	4.688	8.292**	-3.604	-3.869	-0.752
	(3.663)	(3.989)	(3.786)	(3.301)	(1.721)
Mean	73.152	31.091	42.061	20.424	6.364
Observations	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.635	0.674	0.741	0.716	0.573

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models include year fixed effects, district-decade fixed effects, and the full set of demographic and economic controls from Table 1, including district unemployment rate and income. Besides the control for incumbency, the panels are identical. The outcomes are indicator variables for whether the district's elected representative was a moderate, moderate Republican, moderate Democrat, liberal Democrat or conservative Republican. A moderate legislator is one whose distance from the ideological centre measured by the absolute Nominate score is below the 75^{th} percentile. Liberals and conservatives are Democrats and Republicans respectively whose absolute Nominate score is above the 75^{th} percentile. Closure rate refers to the average percentage of a district's manufacturing establishments that shut down in the two year period before an election. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

The positive coefficient in column A3 and the negative coefficient in column A5 provide evidence closures shift electoral support from liberal to more moderate Democrats. Both effects are statistically significant at least at the 10% level, but once again, not particularly large in magnitude. The positive and negative estimates in columns A2 and A4 respectively suggest the same pattern may exist for Republicans. But these estimates are imprecise. Comparing columns A3 to B3 and A5 to B5, the size and precision of the estimates are nearly identical.

The interpretation is that changes in incumbent behaviour are likely not responsible for the shift in

House seats from liberal to moderate Democrats. While closures do not predict the victory of a given party (see Appendix Table A1 for details), Table 4 suggests turnover in Democratic legislators is a component of how closures affect ideology in Congress.

The main results in Tables 2 and 4 rely on district-decade fixed effects. As discussed in the Empirical Estimation Section, district fixed effects are problematic in my analysis because redistricting during my sample period. As a robustness check, in Appendix Table A3 I re-estimate the key results from Tables 2 and 4 using district fixed effects within the two decades where boundaries remain fixed. Coefficients in Appendix Table A3 are less precisely estimated, in general, but I partially attribute this to the lower sample size. Appendix Table A3 suggests my main results are driven by the observations in 2004 and 2008.

5.3 Supporting Evidence

5.3.1 Unemployment and voter ideology

Through what mechanisms do closures hurt Democratic liberals and help more moderate ones? And why are the mechanisms different or less pronounced among Republicans? One hypothesis is that economic shocks affect the ideology of individual voters, with Democratic and Republican voters responding differently.[17]

Table 5 tests the "voter ideology" explanation for the district-level findings by estimating the effect

17 As Ansolabehere, Meredith and Snowberg (2014) suggest, local shocks may affect an individual's voting preferences in part through how it changes their economic information set and perceptions about the aggregate economy.

of job loss on voter ideology using survey data from the American National Election Studies. The surveys include individuals' self-reported political ideology and their employment status.

There are numerous factors that could cause unemployment, including ones that are specific to the individual. I seek to capture job loss due to factors such as plant closures, rather an individual's performance or job satisfaction. To isolate joblessness associated with poor local labour market conditions, I interact each individual's job status with either the number of closures or the average number of extended mass layoffs in the individual's Congressional district in a given two year period. According to the Bureau of Labor Statistics' Mass Layoff Statistics, a mass layoffs event is one where more than 50 unemployment insurance claims are filed against an establishment within 5 weeks. A full description of the ANES data and mass layoff data, including summary statistics, is found in the first section of the Appendix.

Table 5 estimates the following regressions:

$$Ideology_{i,t,d}=\beta_1 Unemployed_{i,t,d}+\beta_2 Log(MassLayoffs)_{i,t,d} +\beta_3 Unemployed*Log(MassLayoffs)_{i,t,d}+X'_{i,t}\gamma+\Omega_t+\Phi_d+\varepsilon_{i,t,d} \quad (3)$$

and

$$Ideology_{i,t,d}=\beta_1 Unemployed_{i,t,d}+\beta_2 Log(Closures)_{i,t,d}+ \beta_3 Unemployed*Log(Closures)_{i,t,d}+X'_{i,t}\gamma+\Omega_t+\Phi_d+\varepsilon_{i,t,d} \quad (4)$$

The outcome variable for all specifications in Table 5 is an individual's self-reported ideology on a scale from 1 (liberal) to 7 (conservative). All specifications include controls for an individual's age, race, religion, income, education level, gender, as well as Congressional district and year fixed effects.

Column 1 of Table 5 shows that while

unemployment on its own is correlated with more liberal ideology, unemployment in districts where labour markets are struggling is correlated with more conservative ideology. In districts with mass layoffs in the upper third of the distribution, the overall effect of unemployment on ideology is positive (i.e.: more conservative). Columns 2-3 estimate the same regression as column 1, but among subsamples of the data based on an individual's party affiliation.

Comparing columns 2 and 3, the magnitude of the unemployment and interaction terms is greater for Republicans. But the estimates are more precise for Democrats (t=2.34) than for Republicans (t=1.53). Democrats tend to have liberal (lower) ideological scores, so the positive coefficient in the interaction terms means that for Democrats, being unemployed in a district whose economy is struggling correlates with being a centrist or moderate.

The coincidence among Democratic voters being ideologically centrist and unemployed in an area with a high number of mass layoffs is consistent with the district-level results. Columns 4-6 suggest a similar pattern persists when plant closures replace mass layoffs in the regression. But the correlations here are not statistically significant. The overall evidence, though tentative, appears consistent with a mechanism whereby job shocks in the manufacturing sec-tor cause liberal Democratic voters to become more moderate ideologically, and thus replace liberal Democrats with more moderate ones at the polls.

Table 5: Job Shocks and Voter Ideology

	Dependent variable:					
	Ideology (1 = liberal, 7 = conservative)					
	(1)	(2)	(3)	(4)	(5)	(6)
Unemployed	-1.314**	-3.210	-1.896**	-0.536	-2.502	-1.326
	(0.644)	(2.129)	(0.802)	(1.639)	(4.085)	(3.141)
Log(Mass Layoffs)	-0.308	-0.256	0.196			
	(0.343)	(0.694)	(0.435)			
Unemployed* Log(Mass Layoffs)	0.172**	0.452	0.239**			
	(0.084)	(0.296)	(0.102)			
Log(Closures)				-0.424	-0.622	-0.406
				(1.532)	(2.597)	(1.453)
Unemployed* Log(Closures)				0.072	0.356	0.171
				(0.224)	(0.558)	(0.434)
Mean	4.107	4.102	4.129	4.107	4.102	4.129
Subsample		GOP	Dem		GOP	Dem
Observations	4,267	1,147	1,665	4,267	1,147	1,665

Notes: Unit of observation is an individual. Years are 2004, 2008, 2014. The outcome is an ideology score taking on integer values from 1 (liberal) to 7 (conservative). Mass layoffs refer to the number of individuals whose employment was terminated in large layoff events in the district-year. Closures refer to the number of manufacturing establishments that shut down in the district-year. All models include year and district fixed effects. Socioeconomic controls for individuals include age, gender, race, Hispanic-origin, education, income and religion. Columns 2, 3, 5 and 6 restrict the sample to individuals affiliated with the Republican or Democratic party. Robust standard errors clustered at the district level. *p<0.1; **p<0.05.

5.3.2 Comparing plant closures, plant contractions, and employment shocks

Plant closures coincide with lost jobs, and as Table 5 suggests, unemployment may be a mechanism through which closures influence voter and legislator ideology. But independent of their employment effects, plant closures are unique because they occur at a fixed point in time and may be among the most visible examples of local economic decline. In contrast, phenomena linked to polarization such as increased import penetration and rising income inequality are

likely processes, rather than events (Voorheis et al., 2015; Autor et al., 2017). The former may not be visible to individuals outside the industry. Plant closures also differ from other eco-nomic phenomena because they may have large symbolic or cultural significance, especially in communities historically built around a single manufacturing firm.

The closing of a plant — a visible, potentially symbolic event — may influence the beliefs and behaviour of voters at large, even those never employed by the plant. I explore this possibility in Table 6 by comparing the effects of plant closures, plant contractions, and changes to the district unemployment rate on the absolute ideology scores of elected legislators. I retrieve the number of plant contractions in a county-year, defined as the number of plants whose employment force decreased in size from the previous year, from the SUSB dataset described in the Data Section (3.2) (which includes plant contractions and expansions). I then construct the district contraction rate, defined as the percentage of plants in a district that contract, averaged over the two year period before an election. Plant contractions and the unemployment rate together help isolate the job loss associated with local industry decline. Including these variables as primary regressors and as controls in regressions with plant closures will help reveal the extent to which job loss is driving the main results above.

All estimates in Table 6 are variations of equation 2 with the full set of demographic controls, year fixed effects, and district-decade fixed effects. Columns 1-3 of Table 6 offer a direct comparison of the within-district effects of plant closures, plant contractions, and the unemployment rate on legislator

absolute Nominate score. The coefficient for plant closures is larger in magnitude and more precisely estimated than the coefficients for contractions and the unemployment rate. The results suggest plant closures have a greater influence on legislator ideology than plant contractions and general employment shocks. Plant contractions and changes to the unemployment rate differ from plant closures in part because they are not necessarily visible, symbolic events. Hence it is possible a differentiating quality of plant closures, such as the visibility, is partially driving the observed moderation effect. A limitation of my analysis is that I cannot empirically test which specific aspects of plant closures play the most important role in influencing electoral outcomes.

Table 6: Comparing the Effects of Unemployment, Plant Contractions and Plant Closures on Legislator Absolute Ideology

	Dependent variable:					
	Absolute Nominate Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Closure Rate (%)	−1.394*** (0.538)			−1.299** (0.528)	−1.569*** (0.555)	−1.450*** (0.540)
Contraction Rate (%)		−0.316 (0.261)		−0.180 (0.256)		−0.316 (0.278)
Unemployment Rate			0.713 (0.742)		1.305* (0.764)	1.671* (0.859)
Observations	1,646	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.725	0.721	0.720	0.725	0.727	0.728

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models have year fixed effect, district-decade fixed effects, and the full set of demographic controls in Table 1. The outcome variable represents the distance an elected legislator is from the ideological centre. Closure rate and contraction rate refer to the average percentage of a district's manufacturing establishments that shut down or experienced in a decrease in employment force respectively in the two year period before an election. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

Columns 4-6 of Table 6 estimate the effect of plant closures on legislator absolute Nominate score controlling for plant contractions and the unemployment rate. The coefficient for plant closures is precise across all estimates and relatively stable as I add controls. This result serves as a robustness check and adds depth to our understanding of how plant closures influence legislator ideology. The inclusion of employment controls specifically the unemployment rate do not dramatically impact the estimates, which suggests plant closures do not solely influence legislator ideology through their effect on unemployment.[18] That said, the unemployment rate, while correlated with the rate of plant closures, captures joblessness in all sectors. It may be a noisy measure of job loss from plant closures. Without more granular employment data, I cannot rule out the possibility the unemployment created by plant closures directly influences electoral or political outcomes.

5.3.3 Addressing reverse causality

One concern is that reverse causality is creating endogeneity in my main results. It is certainly possible that legislators influence the rate of manufacturing closures through the passage of legislation in spheres such as industry and environmental regulation, international trade, and corporate taxes and subsidies. A more moderate legislature, overall, may be more effective in finding common ground and passing legislation. Thus, the election of moderate legislators in Congress could directly affect plant closures by the

18 It is worth highlighting once again that I include controls for unemployment rate and mean personal income in nearly all of the main results above to help reduce the risk of omitted variable bias. Across the main results, the inclusion of the unemployment and income controls do not dramatically impact the estimates

next election cycle. Such a pattern, if true, would be consistent with the direction of the effects I observe.

To address the risk of reverse causality, I re-estimate the main results but replace the closure rate in a given election cycle with the closure rate of the next election cycle. This regression estimates the effect of closures in the next two year period on legislator ideology in the current two year period. With the goal of comprehensively ruling out reverse causality in the mind, Table 7 presents regressions with key outcome variables from across the main results. Com-pared with the main results, the point estimates in Table 7 are relatively small in magnitude and not statistically significant. I conclude that reverse causality is unlikely biasing my main results to a concerning degree.

Table 7: Falsification Test of Main Results Using Lead Regression

	Dependent variable:					
	Absolute Nominate	Elected Moderate	Moderate Republican	Moderate Democrat	Conservative Republican	Liberal Democrat
	(1)	(2)	(3)	(4)	(5)	(6)
Following Year's Closure Rate (%)	0.522	-1.327	-1.181	-0.145	0.640	0.687
	(0.805)	(2.937)	(2.979)	(2.769)	(2.359)	(1.727)
Observations	1,225	1,225	1,225	1,225	1,225	1,225
Adjusted R^2	0.627	0.628	0.636	0.661	0.699	0.609

Notes: Each observation is a Congressional district in election years 2004, 2008 and 2012. This falsification test re-estimates the key results with the following two-year period's closure rate. All models include year fixed effects, district-decade fixed effects, and the full set of demographic and economic controls from Table 1, including district unemployment rate and income. The outcome variable in column 1 is an elected legislator's distance from the ideological centre. The remaining outcomes are indicator variables for whether the district's elected representative was a moderate, moderate Republican, moderate Democrat, liberal Democrat or conservative Republican. A moderate legislator is one whose distance from the ideological centre measured by the absolute Nominate score is below the 75^{th} percentile. Liberals and conservatives are Democrats and Republicans whose absolute Nominate score is above the 75^{th} percentile. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

5.3.4 Examining closures in sectors outside of manufacturing

My focus on closures in the manufacturing sector makes my analysis easily comparable with

other literature, such as the work of Autor et al. (2017) examining trade shocks to industry. Manufacturing is also the largest "blue-collar" sector in the U.S., and thus manufacturing closures have the greatest potential to affect a large number of working-class people. Nonetheless, I expect manufacturing closures to present similar dynamics to other blue-collar sectors. In communities centred around a single industry, whether it be manufacturing or mining, establishment closures can have transformative and potentially devastating impacts. Exploring whether the moderation effect persists for a broader set of industries thus adds richness to my analysis.

Moreover, replicating the results for blue-collar sectors excluding manufacturing and for white-collar sectors (or simply non-blue-collar sectors), whose dynamics are likely to be different, serves as a robustness check. For example, if closures across all sectors produced a moderation effect, there may be nothing meaningful about the manufacturing sector.

Using the same SUSB dataset described in the Data Section (3.2), I construct a closure rate variable for the following blue-collar, labour intensive sectors: Mining, Quarrying, and Oil and Gas Extraction; Utilities, Construction; and Transportation and Warehousing.[19] The non-blue-collar sectors I use as a robustness check are Professional, Scientific, and Technical Services; Finance and Insurance; Information; Real Estate Rental and Leasing; and Health Care and Social Assistance.

Resembling Table 2, Table 8 estimates the

19 Nationally, each of these sectors employs over 70% males and over 70% non-Hispanic whites (Bureau of Labor Statistics, 2017). As we describe in the Discussion Section, the results of Autor et al. (2017) and framework of Inglehart and Norris (2016) suggest economic hardship may trigger a particularly large ideological response among non-Hispanic white males.

within-district effect of closures across the sectors above on legislator absolute ideology. Columns 1 and 2 show a downward, precise effect of blue-collar sectors (excluding manufacturing) on legislator absolute Nominate score. This effect becomes larger in columns 3 and 4, when I include manufacturing with the other blue-collar sectors. Figure 5 compares the magnitude of the effect of all blue-collar sectors, blue-collar sectors excluding manufacturing, and manufacturing only. The key takeaway is that the moderating effect of closures persists for blue-collar sectors, but the effect is smaller compared with manufacturing closures on their own.

Table 8 also shows the effect of closures in white-collar sectors in legislator ideology. The magnitude of the point estimates is about half those from manufacturing closures and they are much less precisely estimated. I conclude that our main results pass the robustness check not all types of closures have a strong effect on legislator ideology.

Table 8: Within-District Effects of Blue- and White- Collar Closures on Absolute Ideology

	Dependent variable:					
	Absolute Nominate Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Blue Collar Closure Rate (%)	-0.731**	-0.961**				
	(0.360)	(0.434)				
Blue Collar & Manu. Closure Rate (%)			-1.051**	-1.349***		
			(0.424)	(0.500)		
White Collar Closure Rate (%)					-0.786	-0.938
					(0.804)	(0.870)
Log(Mean Income)		0.374		-0.382		6.722
		(14.372)		(14.109)		(14.546)
Unemployment Rate		1.413		1.570*		0.931
		(0.867)		(0.860)		(0.807)
Observations	1,646	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.724	0.726	0.727	0.724	0.721	0.722

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models have year fixed effect, district-decade fixed effects, and the full set of demographic controls in Table 1. The outcome variable represents the distance an elected legislator is from the ideological centre. Blue-Collar Closure Rate refers to the percentage of establishments that shut down is the blue collar sectors (excluding manufacturing): mining, quarrying, and oil and gas extraction; utilities, construction; and transportation and warehousing. White-Collar Closure Rate refers to the percentage of establishments that shut down in the following sectors: Professional, Scientific, and Technical Services; Finance and Insurance; Information; Real Estate Rental and Leasing; and Health Care and Social Assistance. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

5.3.5 Comparing positive and negative shocks

If manufacturing establishment closures lead to more moderation, what effect do openings have? A related question is whether the percentage change in manufacturing establishments predicts electoral outcomes. Exploring these questions is worthwhile in its own right. More-over, the findings I present below build confidence that the main results about closures are true.

Using the same SUSB dataset described in Data Section (3.2), I construct variables for the percentage of establishments that open and the net change in manufacturing establishments in a district for the two year period before an election. Table 9 replicates the key columns for Table 2, replacing the closure rate with the opening rate and the percentage change in

establishments.All estimates include the full set of controls, year fixed effects and district fixed effects.

Table 9: Within-District Effects of Manufacturing Openings and Net Establishment Change on Absolute Ideology

	Dependent variable:					
	Absolute Nominate Score					
	(1)	(2)	(3)	(4)	(5)	(6)
Opening Rate (%)	0.207	0.227	0.261			
	(0.488)	(0.494)	(0.496)			
Net Change (%)				0.768**	0.762**	0.859**
				(0.372)	(0.378)	(0.387)
Log(Mean Income)			6.661			3.161
			(15.432)			(15.470)
Unemployment Rate			0.897			1.225
			(0.816)			(0.845)
Dem. Controls		X	X		X	X
Observations	1,646	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.720	0.719	0.719	0.724	0.723	0.723

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models have year fixed effect and district-decade fixed effects. The outcome variable is an elected legislator's distance from the ideological centre. District controls refer to the demographic controls in Table 1. Opening Rate refers to the percentage of manufacturing firms that began operations in a district-year. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

The coefficient on opening rate is positive, suggesting openings have the opposite effect as closures, as expected. The positive coefficient for the net change in establishments variable yields the same interpretation as the main results: a decrease in the number of manufacturing establishments leads to the election of more moderate legislators. Figure 6 graphically compares the size and magnitude of the point estimates for openings and closures. The figure shows that closures produce point estimates that are larger in magnitude and more precise point compared with estimates for openings. This finding suggests voters react more strongly to losses than gains, which I consider plausible.

The results suggest there are not major interpretational issues to the closure rate variable. For if on the contrary, I had found that openings or a net

increase in manufacturing establishments also led to legislator moderation, the interpretation of my main results would be meaningless.

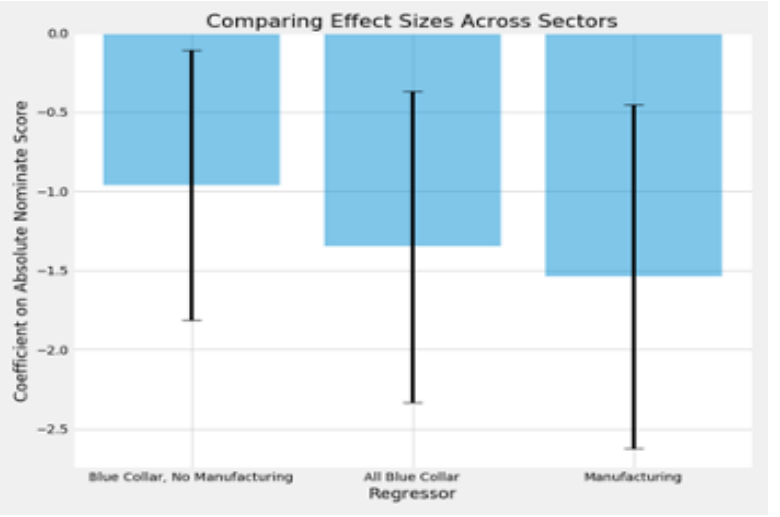


Figure 5: Effects of Closures in Blue Collar and White Collar Sectors on Elected Legislator Absolute Nominate Score. The error bars represent 95% confident intervals.

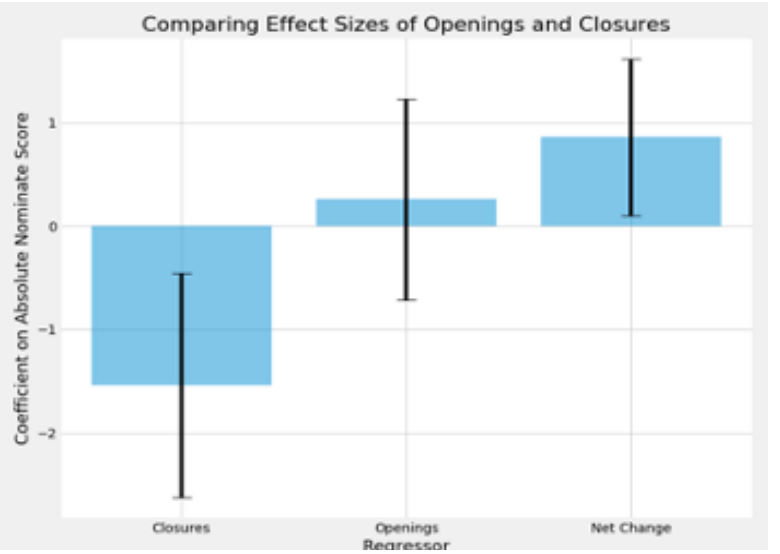


Figure 6: Effects of Manufacturing Closures, Openings and the Net Change in Establishments on Elected Legislator Absolute Nominate Score. The error bars represent 95% confident intervals.

6 Discussion

6.1 Interpretation of the results

My findings suggest local manufacturing decline leads to the election of Congressional moderates. A movement to the centre in response to industry decline is present both within districts and within incumbent legislators.[20] The precise mechanism for how plant closures influence elections is unclear. On the one hand, I find a correlation among voters, particularly Democrats, between being ideologically centrist and being unemployed in areas with high numbers of mass layoffs. This correlation is consistent with a mechanism where voters who lose their jobs in plant closures shift their ideological leanings towards the centre and elect moderate legislators. On the other hand, plant contractions and general unemployment shocks do not produce an immediate effect on legislator voting patterns, suggesting the unemployment caused by plant closures may not be the key driver of political outcomes. Plant closures, as distinct from contractions and general employment shocks, may influence voter and legislator behaviour because they are visible, potentially symbolic events representing economic change and local industrial decline. But without more with more granular data on circum-stances of specific plant closures, I cannot isolate the specific qualities of closures that produce support for moderates.

In light of the existing literature on how negative shocks affect legislator ideology, my results are somewhat surprising. Recent research suggests

20 The within-incumbent effect is notable in part because Autor et al. (2017) find the polarizing effect of Chinese trade penetration occurs primarily through replacing legislators and does not generate a strong response among incumbents.

the potential economic drivers of political polarization include income inequality, financial crises, and trade competition in manufacturing, all of which may be positively correlated with manufacturing closures (McCarty et al., 2006; Voorheis et al., 2015; Mian, Sufi and Trebbi, 2012; Autor et al., 2017). My study calls into question the idea of a universal association of negative economic shocks with political polarization, suggesting the actual picture is more complex.

Accepting my findings together with the recent literature highlights a need to investigate subtleties in the mechanisms behind political polarization. There are several possible mechanisms that reconcile the apparent contradiction between my results and existing literature. To illustrate that such possibilities exist, here I present one hypothesis that reconciles my results and those of Autor et al. (2017) using the theoretical framework and empirical evidence of Ingle-hart and Norris (2016).

Inglehart and Norris (2016) discuss two prevailing theories for the rising voter support in post-industrial societies for ideological extremism and populism on the left and right. In brief, the economic inequality thesis posits that growing economic hardship and inequality has rendered the "left behinds" or vulnerable groups in society for example low-skill workers and the unemployed more "susceptible to the anti-establishment, nativist and xenophobic, scare-mongering exploited of the populist movements, parties and leaders" (Inglehart and Norris, 2016, p. 2). The cultural backlash thesis, on the other hand, argues the "surge in votes for populist parties can be explained not as purely an economic phenomenon but in large part as a reaction against progressive cultural change" (Inglehart and Norris,

2016, p. 2). In effect, this thesis suggests populism is the product of a backlash primarily among older, less educated white males to the "displacement of familiar traditional norms" with progressive values such as multiculturalism, environmental protection, and gender equality (Inglehart and Norris, 2016, p. 3).

While the two theses are not mutually exclusive, Inglehart and Norris (2016) find more robust evidence for the cultural backlash theory. A simple explanation for my counter-intuitive result may be that manufacturing closures, primarily an economic phenomenon, only fit within the economic inequality thesis, which already boasts less support. That said, Autor et al. (2017) suggest their work aligns with the cultural backlash theory because they find the effect of trade shocks on extreme ideology is driven by non-Hispanic white male sectors such as manufacturing. I study the same sectors and do not find negative shocks lead to ideological extremism.

A compelling, though not yet empirically verified, resolution to this puzzle is that trade shocks lead to populism because to manufacturing workers in the U.S., they represent a threat to economic security posed by a foreign nation. Politicians may be able to capitalize on the source of the shock to elicit nativist and xenophobic sentiments among the "left behinds" discussed above typically populations of low-skill, older white men. The success of Donald Trump's "America First" rhetoric supports this case. Manufacturing closures, meanwhile, can come from a wide range of non-trade sources. Closures, in general, may not be perceived as a threat to values but rather as part of a long-term, secular decline of U.S. industry, or as a practical, local problem to solve. Either way, they may trigger a pragmatic response rather than

the populist one associated with the cultural threats described by Inglehart and Norris (2016).

While the framework of Inglehart and Norris (2016) provides an attractive way of explaining my results, I am unable to empirically test its validity in the context of plant closures using my data. Our understanding of the causes of ideological extremism and populism — economic, cultural or otherwise — remains incomplete. My contribution is to highlight that negative economic shocks do not produce a uniform electoral response. Rather than exacerbating the trend of political polarization as income inequality (Voorheis et al., 2015) and Chinese trade do (Autor et al., 2017), plant closures work against it.

6.2 Limitations

Three significant limitations in my study relate to the interpretation of the Nominate scores as relative ideology (see Section 3.1, Data), the nature of the closures data (see Section 3.2, Data) and Congressional redistricting (see Section 4, Empirical Strategy). A final limitation is omitted variable bias.

The only omitted variables that present risk are those that correlate with plant closures, vary over time, are specific to a district, and whose effect on legislator ideology is not absorbed by my economic controls. In light of the support Inglehart and Norris (2016) find for the cultural backlash thesis, economic changes associated with globalization, for example, international trade and offshoring, are candidates. The reason is that aside from their economic impacts, they may present threats directly to cultural values. Consider, for example, individuals who work in the service sector in a community where import penetration has

led to plant closures. Even though the closures do not directly affect them, they are disgruntled by the notion a foreign country is becoming more prosperous at the expense of local, American jobs. My conjecture is that even controlling for import penetration's impact on closures, the cultural connotations of foreign trade may produce sufficient fodder for populists to succeed appealing to the aforementioned individuals on the basis of values and ideology. The direction of the subsequent bias would be upward.

7 Conclusion

Political polarization and the rise of ideologically extreme legislators in Congress represent an alarming but poorly understood trend. I set out to study whether decline in the manufacturing sector spurs or slows political polarization. My study relies on data from Statistics of U.S.

Businesses on local manufacturing closures and the Nominate scores, a measure of relative ideology, of Congressional legislators. I exploit variation in the manufacturing closure rate within Congressional districts to show increased closures lead to the election of more moderate legislators. Between 2004-2014, I find increasing the rate of manufacturing closures in a district by 2% increased the probability of electing a moderate from either party by 7.2%. This despite rising political polarization overall in the same period.

I demonstrate evidence of an effect on both the intensive and extensive margins. On the extensive margin, districts with increased closures appear to shift their support from liberal Democrats towards more centrist ones. On the intensive margin, Republican incumbents ad-just their behaviour, becoming more

moderate, in years where their district is experiencing a higher rate of manufacturing closures. I subsequently show the observed trend in electoral outcomes aligns with a shift in voter ideology in response to job shocks. Indeed, in survey data from the American National Election Studies, there was a coincidence among Democratic voters between being ideologically centrist and unemployed in an area with poor local labour conditions.

In discussing political polarization, scholars describe a growing population of voters whose economic struggles render them susceptible to the nativist, populist appeals of ideologically extreme politicians (Autor et al., 2017; Inglehart and Norris, 2017). If anything, my study finds that in response to manufacturing closures, voters become more practically-minded and legislators more moderate. My findings suggest voters may desire pragmatic, moderate legislators after a negative economic shock. Incumbents may strive to be practical and productive, rather than slowing down political procedures with appeals to ideology.

The results of my study are in tension with some notable recent scholarship. For example, Autor et al. (2017) examine Chinese trade shocks, which can contribute to manufacturing closures (Autor et al., 2013), yet find the opposite effect on legislator ideology. Rather than view these findings as contradictory, further research could illuminate why trade-related economic stress appears to provoke populism, whereas economic stress from plant closures appears to promote pragmatism. Given the emphasis Inglehart and Norris (2016) place on the cultural dimensions of rising populism, such research could include explorations of phenomena where economic conditions remain

fixed, but cultural values explicitly come under threat. Future research could also explore how plant closures and trade shocks influence legislator voting patterns on specific economic and social issues, for example international trade, unemployment benefits, and industry regulation.

III

FEATURES FROM THE EXCHANGE

Happiness and Policymaking

Hana Golightly

Happiness is a twenty-first century buzzword. Cultural and media focus on happiness has elevated the term from the stuff of self-help books to a topic of international development policy. The Kingdom of Bhutan was an early proponent[1] of using happiness to measure national welfare, and the nation's King Jigme Singye Wangchuck first alluded to a concept he called 'Gross National Happiness' (GNH) in interviews in the 1970s.[2] Thereafter, Bhutanese leaders played a key role in the United Nations' adoption of a happiness policy.

In 2011, the UN adopted resolution 65/309, titled "Happiness: towards a holistic approach to development." The document contains ten compact paragraphs that identify happiness as a universal goal of humanity, recognizing that gross domestic product (GDP) "was not designed to and does not adequately reflect the happiness and wellbeing of people in a country."[3] The intent of this document was to clarify concepts economists have been discussing since the origins of the discipline the complicated measurement of what makes a person better or worse off.

There is an inherent challenge in finding a

single measure of the value of a good or service: different people value things differently. When trying to measure something as intangible as happiness, it can quickly get complicated. Imagine rating your own happiness or satisfaction on a numerical scale. Is this year an improvement over the last? Are your grades down, but your health improved? Maybe you're making less money, but you're seeing your family more. Basic consumer theory tells us that a person's willingness to trade between these factors depends on their individual preferences. The utility of these trade-offs is difficult to account for on an individual scale, and happiness research aims for a much larger target, advocating using these metrics to decide global policy. The task of quantifying global happiness requires deciding what makes a life valuable, and the relative worth of living in one place versus another.

These days, the largest project to measure global happiness is the UN's World Happiness Report, an annual survey of the state of global happiness that has been conducted each year since 2012 and is edited by economists John Helliwell, Richard Layard, and Jeffrey Sachs.[4] The report boils happiness down to six key variables: income, healthy life expectancy, social support, freedom, trust, and generosity. However, this happiness metric is only one of many definitions of holistic wellbeing. In 2011, the same year the UN adopted resolution 65/309, the Organization for Economic Co-operation and Development (OECD) launched a happiness project titled the "OECD Better Life Initiative." Two years later, they published guidelines to measuring subjective wellbeing using eleven variables, with the goal of helping national statistical agencies measure wellbeing and improve cross-country comparability.[5] The OECD guidelines grapple with the definition of subjective wellbeing, stating that it "covers a wider range of concepts than

just happiness," including a person's life evaluation, emotional state, and eudaimonia — often translated as "the condition of human flourishing or of living well."[6]

Subjective individual preferences and utility are central concepts in the study of economics, yet measures of GDP per capita dominate international discussions on development and quality of life. Using happiness as an indicator can signal a change in what policymakers deem most important and can also subvert traditional narratives of development. The happiness metric asks: what if there was another way to describe development in terms of social wellbeing?

There is still much debate over the usefulness of happiness indices as a tool for policy. Some economists suggest it is possible to increase someone's reported happiness while making them worse off in terms of utility.[6] Because observed choices are not always made in the pursuit of happiness, this demonstrates that people have other objectives than maximizing their happiness. Therefore, given scarce resources, a push to improve happiness reallocates efforts from other goals. Economists Edward Glaeser, Joshua Gottlieb and Oren Ziv propose that in light of recent research on happiness and utility, welfare economics "does not justify happiness maximization as a policy goal."[7] This means that policies to maximize happiness will not always lead to outcomes that people would choose to maximize their welfare.

If you look at the UN's world happiness rankings you'll notice a correlation between per capita wealth and ranking, but it isn't perfect. Wealthy countries top the global happiness rankings but at a certain point increasing wealth no longer implies an increase in happiness. This suggests what most of us know to be true: money can buy happiness — but with decreasing marginal returns. In an article on the relationship between GDP and life satisfaction

in Europe, economists Eugenio Proto and Aldo Rustichini find evidence that the positive relationship between national income and national life satisfaction flattens out around an income of $30,000 to $35,000, PPP-adjusted at the country level, and becomes negative beyond that point.[8] This phenomenon has been widely studied, notably by American economist Richard Easterlin, who showed that average happiness in the United States was failing to keep up with rapidly increasing national income.

If measurements like GDP can't account for the full complexity of wellbeing, what can? While happiness measurements were meant to fill this epistemological void, evidence from welfare economists suggests we have yet to find our catchall solution. Perhaps the problem with happiness lies not in its fundamental worth as a goal of development policy, but in how accurately it reflects the subjective measure of what people want, which might limit the usefulness of happiness levels as a national policy target. One thing is certain: public policy has been, and will continue to be, impacted by rising global interest in the economics of happiness. The long-term effectiveness of chasing increases in subjective wellbeing remains to be seen.

The Press: Institution or Industry?

Paul Hedlin

The First Amendment of the United States Constitution prohibits Congress from abridging the freedom of the press. No reason is provided for the protection of this freedom but the intent is clear. A functioning democracy requires that facts are widely understood because voters must be well informed if they are to vote according to their interests. For this reason, a free press is a necessary institution. However, in the marketplace any firm which is free from government intervention will ultimately be bound by the motive of profit. With this in mind, it is important to ask whether granting the press absolute freedom is the right approach to ensure it fulfills its institutional duty.

In good faith and bad, the idea that the press isn't working as it should is a widespread one. US President Donald Trump frequently takes to Twitter to rebuke "The Fake News Media", at one point going so far as to brand it "the true Enemy of the People".[1] On the other end of the ideological spectrum, comedian Jon Stewart used his self-described fake news channel The Daily Show to mock outlets like Fox and CNN for what he saw as alarmist and misrepresentative

news coverage, describing the news media as "the country's 24-hour politico pundit perpetual panic conflictinator".[2] A common perception is that the faults of the press stem from the corruption of executives such as Rupert Murdoch and George Soros, who try to exercise political control through biased news coverage. By this logic, it follows that putting the various news media factions into more honest ownership would largely solve the problem. Unfortunately, the problem with the press is much more foundational.

To understand why this is the case, it is necessary to analyze the news media from an economic perspective. News outlets such as CNN, Fox News, and the Huffington Post are producers, while anyone who spends time tuning into their broadcasts is a consumer. As in many markets, the consumer has greater power over the characteristics of the news product because unlike the supplier, the consumer is irreplaceable. There has been a lot of talk lately about how Fox News has transitioned from a conservative outlet to Trump's megaphone during the president's tenure.[3] However, considering Trump's high approval rating among Fox's viewers, it is unlikely that they would be pleased if the network criticized Trump whenever he deviated from conservative values and policy.[4] If pushed too far, the audience would change the channel and leave Fox out of business. By this process, the consumer unknowingly decides what narrative will air. If news consumers were an unbiased group, we would expect consumer power to push the news media to accurately represent the truth because any network that started pushing a false narrative would be quickly identified and replaced. In reality, this is not so.

Consumers in the news market are highly differentiated. Different people are likely to be interested in learning about different types of stories

conditional on their race, gender, age, education, place of residence, political preference, and much else. For instance, if you come from the Rust Belt you are much more likely to be interested in how America's manufacturing industry is going into a recession than you are about California's wildfires.[5] While this may seem intuitive, it is important to remember that the institutional duty of the press is to provide the entire citizenry with a comprehensive rundown of topical issues so that people can come to their own conclusions. Instead, the implication of news consumer heterogeneity is that the viewer is biased towards a certain reality. If a conservative or a liberal doesn't like what a given news network has to say then all they have to do is switch to Fox News or MSNBC and their preference will be satisfied. This phenomenon is called the "filter bubble" and it is the primary feature of a capitalist press (for reference, only 13% of Fox news viewers check out MSNBC for more than 10 minutes).[6] Because of this phenomenon the news market cannot be supplied by a single firm. Instead, niche outlets that are capable of catering to people's biases have flourished and misinformation is running rampant. While it is common knowledge that dictatorships like the Soviet Union push propaganda on their citizens, perhaps the defining quality of the free press is that it grants us the freedom to self-propagandize.

Despite the First Amendment, there are some restrictions on the stories a news network may run. US federal law prohibits "obscene, indecent, and profane content" from being broadcast and the Federal Communications Commission polices against intentional distortion of the news.[7] However, the FCC's authority to respond to such complaints is narrow and these guidelines are often up to interpretation. There are three ways in which a news broadcaster can skirt

the legal boundaries of intentional news distortion. First, with over seven billion people on Earth there is an infinite number of potentially "newsworthy" stories. A story can be an outlier without being false and news organizations can pick and choose among these to promote their chosen narrative, even if it misrepresents reality. Second, broadcasters can squash relevant stories which don't suit their audience. Third, while a broadcaster is not permitted to intentionally distort the truth, pundits like Sean Hannity have made fortunes spinning it, apparently unimpeded.

The result is that the news industry is fully capable of confirming consumers' chosen narratives, nearly independent of where the truth may stand. It is worth noting that even if news consumers were not differentiated, consumer bias towards interesting stories would taint the narrative. For example, in 2016 Americans had a 30.2% chance of dying from heart disease and less than a .01% chance of dying from terrorism but in the same year the New York Times wrote 2.5% of its causes of death articles on heart disease. By contrast, 35.6% were about terrorism.[8]

The consequence of the press's fragmentation has been staggering. Slightly more than a month after the news broke about Trump's Ukraine scandal, the news a person would learn about Trump's impeachment proceedings would depend almost entirely on the outlet they had chosen to learn of it from. On October 24th 2019, CNN, a consistently Trump-critical news outlet, ran a live blog providing updates on the inquiry with headlines like "Democrats have begun discussing the scope and scale of potential articles of impeachment".[9] The same day, Fox News ran the headline "Could Pelosi abandon impeachment effort? Legal analyst predicts she may."[10] Hypothetically, both statements could be true, but if the consumer only listened to one perspective they would likely

be misinformed. This phenomenon has exposed Americans to such divergent information that people belonging to the country's two main parties often cannot agree on reality itself.

With this in mind, it is valuable to consider the concept of incentive compatibility. In economics, a strategy or mechanism design is said to be incentive compatible if it leads agents to the desired outcome. For example, economists endorse markets because in theory they grant the largest profits to companies that do the most good for people at the lowest cost. In other words, markets are desirable because profits are incentive compatible with social benefit. The problem is that what media market consumers want is not aligned with the output that the press is institutionally intended to provide. The press is supposed to inform voters of reality so that they can accurately represent their interests on election day, but the media consumer treats truth like a commodity and is frequently driven to confirm their predetermined beliefs. This being the case, the profits that shape the news media market are not incentive compatible with maintaining the objective and informative institution that democracy requires.

The solution to this problem is not obvious. Granting control of the press to the state is a proven method of substituting market-propaganda for that of Uncle Sam. On the other hand, if the industry is allowed to persist the situation will only get worse. News outlets will further tailor their product to suit their audiences and will thus reinforce existing filter bubbles. However, in trying to reform the press, we do have clear outcomes that the system must be incentive compatible with: the news must be representative of reality and it must not be selectively divided among the country's constituents.

To achieve such outcomes, it may be necessary

for the press to divorce itself from the motive of profit. Leaving the press to the forces of the free market has been so problematic it has bred questions of whether the press is an institution to be protected or fake news. It is capitalism that is responsible for the breakdown of the press as an institution, and it must be fixed if democracy is to survive.

III

REFERENCES AND APPENDICES

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III. FEATURES FROM THE EXCHANGE

Federal Open Market Committee Statements , Sentiment, and the United States Stock Market

Michael Mak

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On the Parsimonious Quality of the von Neumann Morgenstern Theorem: Idiosyncratic Labour Income Risk and the Equity Premium Puzzle

Adrian Schroeder

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B. APPENDIX

Mathematical Appendix

A.1 *Order 1 and 2 risk aversion*

As defined by Segal & Spivak (1990): for a fair random variable $\tilde{\varepsilon}$, there exists a risk premium $\pi(t)$ which represents the decision-maker's willingness to pay to avoid $t\tilde{\varepsilon}$. His attitude is said to be of order 1 if for every $\tilde{\varepsilon} \neq \delta_0$ such that $E[\tilde{\varepsilon}]=0$, then $\partial\pi/\partial t|_{t=0^+} \neq 0$.

Conversely, risk aversion is said to be of order 2 if for every such $\tilde{\varepsilon}$: firstly, $\partial\pi/\partial t|_{t=0}=0$ and second, $(\partial^2\pi)/\partial t^2|_{t=0^+}\neq 0$.

A.2 *Comparison Fixed- versus Random-Effects LSDV model*

Testing the first pass fixed-effects regression model against the alternative of a random effects model yields:

Hausman Test:

data: *income = age + (age)² + educ*
chisq = 10.944, df = 3, p-value = 0.01203
alternative hypothesis: one model is inconsistent

The null hypothesis is rejected. A fixed effects model is hence an appropriate choice.

A.3 *Lagrange Multiplier Test for Random Effects - (Breusch-Pagan) for unbalanced panels*

data: *income age + I(age²) + educ*
chisq = 0.82811, df = 1, p-value = 0.3628
alternative hypothesis: significant effects

This is testing the opposite null-hypothesis of a significant effect of random effects:

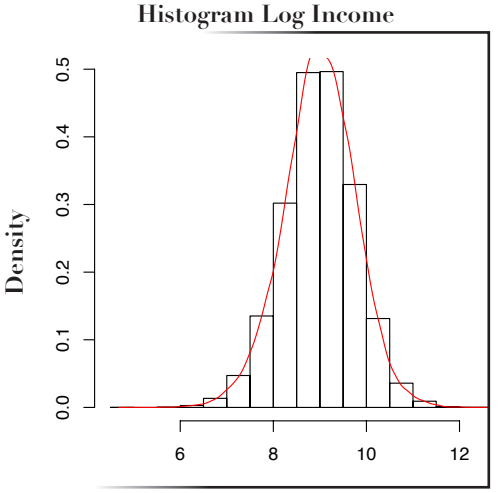
Thus, through rejecting the former (A.2) and retaining the latter (A.3) null hypothesis, it seems like it is appropriate to use a fixed-effects model to predict household income. See text, section 3, for detailed explanation.

A.4 Testing significance of time effects:

Lagrange Multiplier Test for Time Effects - (Breusch-Pagan) for unbalanced panels

data: *income age + I(age²) + educ*
chisq = 92.037, df = 1, p-value < 2.2e-16
alternative hypothesis: significant effects

Thus, the null hypothesis that only individual effects exist is rejected and now a model with time-fixed effects will be utilized.



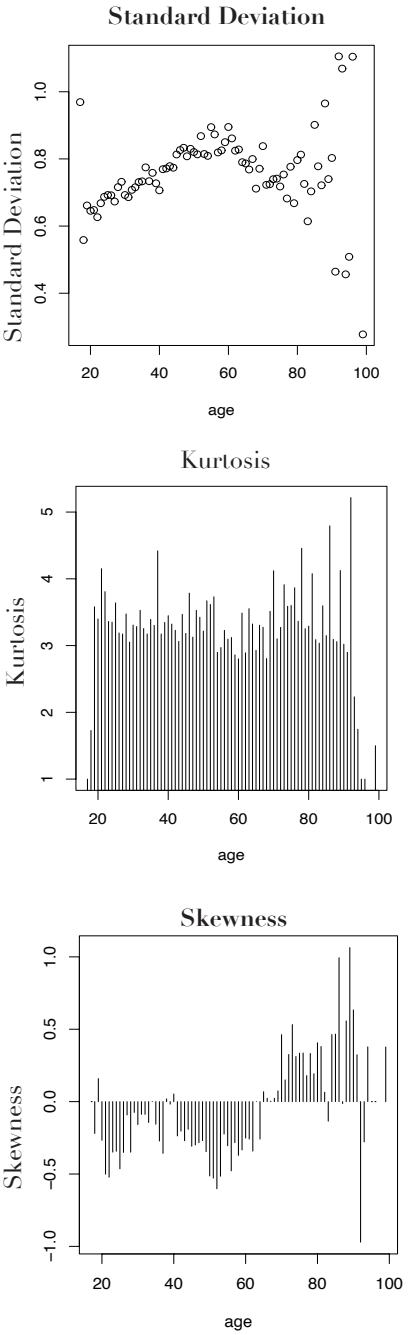


Figure C. 5: Three sample moments of log-income and histogram with added density, across three-year panels

The Tragedy of Floodplains: A Theoretical Model to Explain Why Floodplains are Underutilized

Mir Muhtadi Faiaz

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Does Local Industry Decline Spur or Moderate Political Polarization? Evidence from U.S. Plant Closures

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B. APPENDIX

Data Summary for Analysis of Unemployment and Voter Ideology

To support my analysis the Congressional district level, I examine the effect of job loss on voter ideology: see Table 5. I use on survey data from the American National Election Studies (ANES), in particular, the Time Series Cumulative Data File. The ANES conducts times series survey in presidential years (2000, 2004, ...) and one congressional election year during my time period, 2002. The Cumulative Data File includes all questions asked more than three times in ANES surveys from 1948-2016. The wider ANES survey is time-series but there is no panel data for the questions I explore in the analysis in Table 5. The ANES is also cross-sectional, but I choose not to use the given weights because I exclude a significant number of observations with missing values. The ANES includes the state and congressional district of the respondent, allowing me to merge the survey with aggregate economic data.

The main dependent variable is a respondent's political ideology, which survey respondents report on scale from 1 (liberal) to 7 (conservative). One limitation with the ideological score variable is that it is missing for 24.7% of the respondents in the survey during my time period of interest. The high number of missing values, however, should not present a problem: the means of my dependent variables among those who did not answer the ideology question is statistically similar to the means among the entire survey population. For example, the mean (standard deviation) of the indicator variable for being unemployed is 0.089 (0.283) among those without ideology score responses and 0.080 (0.271) in the wider sample.

The independent variables of interest are whether a respondent is unemployed[1] and the number of individuals laid off in mass layoffs in the respondent's Congressional district. A limitation with the ANES for the purposes of my study is that there is no question regarding the length of a respondent's unemployment spell or whether the respondent was fired or quit (in general, why they left their last job). Such details are important to my study as my research question is specifically focused on the effect of exogenous or involuntary job shocks on ideology. Endogenous job loss, for example unemployment due to poor job performance or behaviour, is not relevant and could bias my results.

Since not all key details about the job loss circumstances are included in the survey, I use a measure of poor local labour market conditions to isolate involuntary job loss. Specifically, I interact the indicator for a respondent being unemployed with the number of individuals who lost jobs in mass layoff events in the Congressional district and year in question. The number of individuals unemployed in extended mass layoff events comes from the U.S. Mass Layoff Statistics (MLS), a program of the Bureau of Labor Statistics. According to the MLS, "monthly mass layoff numbers are from establishments which have at least 50 initial claims for unemployment insurance (UI) filed against them during a 5-week period. Extended mass layoff numbers (issued quarterly) are from a subset of such establishments where private sector nonfarm employers indicate that 50 or more workers were separated from their jobs for at least 31 days."[2] I focus on extended mass layoffs aggregated yearly at the county level between 2000 and 2012. Data

1 In all the questions used for dependent variables, only labour force participants (those employed or looking for a job) were included. Students, retired people, etc., were removed.

2 See MLS program overview: www.bls.gov/mls/mlsover.htm

is not available past 2012 because the MLS program was discontinued.

Additional variables serving as controls are the respondent's income group, Hispanic origin, race, age group, gender, religious identity, and education level. A limitation here is that potentially important controls such as whether the respondent lives in an urban or rural setting, and the respondent's occupation, are not available from the survey.

See Appendix Table A5 for summary statistics.

APPENDIX TABLES

Table A1: Within-District Effects of Closures on Incumbency, Party Turnover

	Dependent variable:				
	Incumbent	Same Party	R Won	R to D	D to R
	(1)	(2)	(3)	(4)	(5)
Closure Rate (%)	2.933	0.300	-1.784	0.759	-1.059
	(2.504)	(1.801)	(1.438)	(1.232)	(1.387)
Log(Mean Income)	33.436	10.907	48.465	-12.128	1.222
	(84.016)	(61.360)	(43.682)	(45.965)	(42.968)
Unemployment Rate	-10.420**	-4.565*	3.306*	-0.205	4.770**
	(4.353)	(2.760)	(1.924)	(2.144)	(2.046)
Observations	1,650	1,650	1,650	1,650	1,650
Adjusted R^2	0.106	0.087	0.846	0.020	0.007

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. All models have year fixed effect, district-decade fixed effects, and the full set of demographic controls in Table 1. R and D refer to Republican and Democratic parties respectively. R to D refers to a switch from a Democratic to Republican held seat. All the outcome variables are indicators multiplied by 100 to allow for percentage change interpretation. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

Table A2: Re-estimation of Main Results With Number of Closures Replacing Closure Rate

	Dependent variable:					
	Absolute Nominate	Elected Moderate	Moderate Republican	Moderate Democrat	Conservative Republican	Liberal Democrat
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Closures)	-11.516***	25.868*	2.809	23.060*	-16.603	-11.126
	(4.374)	(13.936)	(14.507)	(12.816)	(12.157)	(6.874)
Observations	1,649	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.725	0.633	0.674	0.740	0.715	0.571

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. Closures refer to average the number of manufacturing establishments that shut down in the two year period before an election. All models include year fixed effects, district-decade fixed effects, and the full set of demographic and economic controls from Table 1, including the district unemployment rate and income. In addition, all models include a control for the initial number of manufacturing establishments present in the district-year (in log terms). The outcome variable in column 1 is an elected legislator's distance from the ideological centre. The remaining outcomes are indicator variables for whether the district's elected representative was a moderate, moderate Republican, moderate Democrat, liberal Democrat or conservative Republican. A moderate legislator is one whose distance from the ideological centre measured by the absolute Nominate score is below the 75^{th} percentile. Liberals and conservatives are Democrats and Republicans whose absolute Nominate score is above the 75^{th} percentile. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

Table A3: Within-Decade Effects of Closures on Absolute Ideology and Legislature Composition

	Dependent variable:					
	Absolute Nominate	Elected Moderate	Moderate Republican	Moderate Democrat	Conservative Republican	Liberal Democrat
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: 2004 & 2008 only					
Closure Rate (%)	-2.022**	3.226	-0.809	4.035	-1.438	-1.788
	(0.810)	(2.359)	(2.623)	(2.484)	(1.920)	(1.374)
Observations	828	828	828	828	828	828
Adjusted R^2	0.643	0.596	0.645	0.665	0.660	0.600
	Panel B: 2012 & and 2014 only					
Closure Rate (%)	-0.583	2.315	-0.172	2.487	-1.700	-1.056
	(0.788)	(2.702)	(2.525)	(2.297)	(2.253)	(1.453)
Observations	818	818	818	818	818	818
Adjusted R^2	0.805	0.658	0.704	0.817	0.748	0.536

Notes: Each observation is a Congressional district in election years 2004, 2008 (Panel A), and 2012, 2014 (Panel B). Aside from applying to different subsamples based on election year, Panels A and B are otherwise identical. All models include year fixed effects, Congressional district fixed effects, and the full set of demographic and economic from Table 1, including the district's unemployment rate and log mean personal income. Closure rate refers to the average percentage of a district's manufacturing establishments that shut down in the two year period before an election. The outcome variable in column 1 is an elected legislator's distance from the ideological centre. The remaining outcomes are indicator variables for whether the district's elected representative was a moderate, moderate Republican, moderate Democrat, liberal Democrat or conservative Republican. A moderate legislator is one whose distance from the ideological centre measured by the absolute Nominate score is below the 75^{th} percentile. Liberals and conservatives are Democrats and Republicans whose absolute Nominate score is above the 75^{th} percentile. Robust standard errors clustered at the Congressional district level. *p<0.1; **p<0.05; ***p<0.01

Table A4: Closures and Legislature Ideological Composition Using Alternate Definition of Moderation

	Dependent Variable:				
	Elected Moderate	Moderate Republican	Moderate Democrat	Conservative Republican	Liberal Democrat
	(1)	(2)	(3)	(4)	(5)
			Panel A		
Closure Rate (%)	1.949	-0.088	2.038	-1.695	-0.254
	(1.345)	(1.454)	(1.554)	(1.194)	(0.625)
			Panel B		
Closure Rate (%)	1.858	-0.329	2.187	-1.582	-0.276
	(1.351)	(1.446)	(1.572)	(1.194)	(0.632)
Incumbent Held Seat	0.031	0.082**	-0.051	-0.039	0.008
	(0.038)	(0.035)	(0.038)	(0.033)	(0.018)
Mean	73.152	31.091	42.061	20.424	6.364
Observations	1,646	1,646	1,646	1,646	1,646
Adjusted R^2	0.635	0.674	0.741	0.716	0.573

Notes: Each observation is a Congressional district in election years 2004, 2008, 2012, and 2014. Instead of the definition of moderate used in the main results, here a moderate legislator is one whose Nominate score is above the 20^{th} and below the 80^{th} quantile. Liberals and conservatives are Democrats and Republicans respectively whose scores are in the outer quintiles. All models include year fixed effects, district-decade fixed effects, and the full set of demographic and economic controls from Table 1, including district unemployment rate and income. Besides the control for incumbency, the panels are identical. The outcomes are indicator variables for whether the district's elected representative was a moderate, moderate Republican, moderate Democrat, liberal Democrat or conservative Republican. Closure rate refers to the average percentage of a district's manufacturing establishments that shut down in the two year period before an election. Robust standard errors clustered at the district-decade level. *p<0.1; **p<0.05; ***p<0.01

Table A5: Summary Statistics for Individual Level Data

Statistic	Mean	St. Dev.
Ideology	4.107	1.481
Unemployed	0.081	0.273
Log(Deaths)	3.850	0.462
Log(Layoffs)	7.515	1.029
Female	0.472	0.499
Age 17-35	0.341	0.474
Age: 35-55	0.466	0.499
White non-Hispanic	0.753	0.431
Black non-Hispanic	0.102	0.302
Hispanic	0.105	0.306
Protestant	0.468	0.499
Catholic	0.234	0.423
No college	0.309	0.462
College grad	0.377	0.485
Income: bottom third	0.207	0.405
Income: middle third	0.366	0.482

Notes: N = 4267 individuals. Years are 2004, 2008, 2012. Individual level data from the American National Election Survey. Closures data from the U.S. Census Bureau. Mass layoff data from the Bureau of Labor Statistics.

Happiness and Policymaking

Hana Golightly

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The Press: Institution or Industry?

Paul Hedlin

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Authors

ADRIAN SCHROEDER

ECONOMICS
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Adrian will graduate in May 2020 with a double major in economics and psychology, and plans to pursue an MA program on the east coast. Ideally, he would like to get into behavioural economics through his graduate studies. While at UBC, Adrian held an assistantship and later conducted an independent research project investigating societal biases and their economic implications. Adrian hopes to apply these insights to research in central banking and multinational institutions, and help make policies more realistic by keeping in mind that they are always dealing with people, not just numbers.

GEORGE RADNER

HONOURS ECONOMICS
MATHEMATICS

George has long had the career ambition to work in the field of international development on issues such as climate change, gender equality, poverty and early childhood development. An honours economics major and mathematics minor, George chose his degree to develop the analytical tools and technical skills necessary to better understand and create change on these issues. George has also been active in student sustainability and climate groups in his time at UBC. Working with Common Energy UBC and the UBC Sustainability Collective, George and his team successfully advocated for climate action as a priority in UBC's Strategic Plan and founded the UBC Climate Hub. George has recently started full-time work as the executive director of Be the Change Earth Alliance, a Vancouver-based charity focused on empowering the next generation of changemakers through action-oriented environmental and social justice education.

MICHAEL MAK

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Michael Mak graduated in 2019 with a Bachelor of Arts in economics and commerce. While studying at UBC, Michael spent time as the co-president of the UBC Quant Finance Club and developed a passion for data science. He is currently a senior analyst in economics at the Canada Mortgage and Housing Corporation, where he actively applies scientific programming tools and methods to develop economic forecasts in addition to analyzing the housing market at a micro-level. Outside of his interests in economics and finance, Michael works as a director of music for a military marching band and is a classically trained pianist. Looking forward, Michael intends to obtain the CFA designation and potentially seek further education in finance or economics.

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Faiaz is graduating from UBC as an international scholar with specializations in political science and economics. He is passionate about learning, social impact, public policy and global affairs. His research interests are focused in political economy, development economics, the politics of development, democratic challenges, politics of globalization, identity politics and security studies. In his spare time, Faiaz loves reading, running and writing for his blog curiouscommentator.com. In summer 2020 Faiaz will join the municipal government in Hinton, Alberta.

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Hana is a fifth-year economics student minoring in urban studies. She is deeply interested in human behaviour, planning and design, and individual and societal health in cities. Hana hopes to obtain a master's degree in economic geography or urban planning, and eventually work towards building more sustainable and equitable cities.

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Paul is a fourth year student in the Bachelor of International Economics program. His interests include monetary economics and the study of market failures. After graduation he plans to continue his economics education into graduate school and he hopes to eventually work in government economic policy making.

IONA Team

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Mina is a senior undergraduate student pursuing a major in economics and minor in commerce. Mina's aim with IONA is to provide a platform for the incredible work and voices of economics students at UBC through The IONA Journal, The Exchange, and the newly established podcast IONA On. Particularly interested in how corporate social responsibility can play a larger role in sustainable economic development, Mina would like to contribute to reform within the fashion industry upon graduation and support efforts for economic development as a lifelong project.

DIRECTOR OF BUSINESS OPERATIONS

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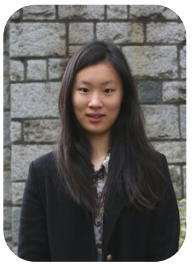

Jessica is a fourth year student completing a combined major in philosophy and economics with a minor in commerce. She is interested in behavioural and developmental economics and hopes to integrate her studies for a future career in law. Being a part of the IONA Journal has encouraged her to explore the different facets of economics and she hopes that it will inspire the readers as well.

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Yumna is a third year student pursuing a major in economics. She holds a keen interest in global political economy and socio-political happenings across the globe. An avid reader, Yumna is the author of Britain In My Backyard, a book that discusses how the fear of globalization is shaping our future economies. After her undergraduate degree, she plans on pursuing a Master's in International Economics and working in the policy sector.

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Felipe is a third year student at UBC pursuing a major in honours economics with a minor in philosophy. He is fascinated by the interrelationship between education and the discipline of economics. Felipe wants to explore new ways of thinking about educational systems to decrease educational inequality in his home country of Puerto Rico. After graduation, he plans to look for experiences that will help him develop the skills to research this relationship further.

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Charlotte is a fourth year economics student at UBC. She is interested in environmental policy and the future of Canada's green economy. After graduation, Charlotte hopes to further her education by pursuing graduate studies in resource economics.

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Akash is in his third year of the Bachelor of International Economics program, in which he has been exposed to topics ranging from open economy macro to how behavioural economics can explain decision-making. Through the IONA Journal, he hopes to shine a light on outstanding undergraduate research as he progresses towards a career intertwining economic analysis and policy evaluation.

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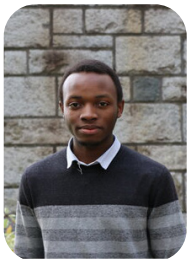

Florent is a first year Bachelor of International Economics student. He is interested in exploring governance and incentives as well as their applicability for economic development in Sub-Saharan Africa. After graduation, he hopes to pursue a masters degree with a continued focus in economics.

OLIVER GIANACOPOULOS

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Oliver is currently in his 4th year of the Bachelor of International Economics program. He is passionate about the relationship between economic prosperity, cultural traditions and political institutions. Oliver has travelled extensively in both Europe and Asia and plans to broaden his global view further by spending more time abroad. Career-wise, Oliver is interested in business development and entrepreneurship.

RACHEL LEE

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As a second-year student in the Bachelor of International Economics program, Rachel's interest in economics continues to be developed by her economics classes and life experiences. She became involved with the IONA Journal to gain exposure to the multifaceted field of economics, and to have a positive impact on economics undergraduate students and their pursuits. One aspect of economics that she is passionate about is how economic efficiency and environmental goals must be balanced. In addition to enhancing her knowledge of environmental economics, Rachel hopes to pursue how values for equality or equity can influence our economic decisions.

JUNIOR EDITORS

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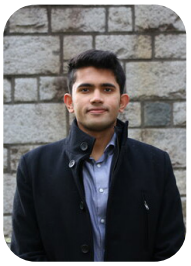

Aayush is a third year student pursuing philosophy and economics. He is interested in the intersection of game theory and ethics, and financial economics. Aayush is passionate about investing and after graduating he wants to pursue a career in buy-side finance.

ISHA TRIVEDI

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Isha is a second year Bachelor of International Economics student from California. She researches and writes on topics in sustainable urban planning, social media analytics, consumer behavior, and politics. She has worked in hospitality management, career services, and the nonprofit sector. After completing her degree, she plans to work, pursue graduate studies, and continue advocating for the Oxford comma.