STATE MINIMUM WAGE POLICIES AND UNEMPLOYMENT RATES

A Thesis

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Department of Public Policy and Administration

Abstract

of

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For the past 20 years, a major debate has unfolded between academics, economists, and legislators regarding the effects of raising the minimum wage. The main point of contention is if increasing the minimum wage will cause higher rates of unemployment. However, as the federal government remains stagnate on taking action towards increasing the federal minimum wage, income inequality in the nation is on the rise and the purchasing power of those living on the minimum wage is steadily decreasing. To combat these socio-economic concerns, many individual states are taking action to ensure the resiliency of the value of the minimum wage over time by automatically indexing increases of the minimum wage to factors such as the Consumer Price Index. This thesis attempts to provide greater clarity on the relationship between minimum wage policies and unemployment rates through regression analysis.

Data utilized for this study come from the Bureau of Labor Statistics, the Department of Labor, the Bureau of Economic Analysis, the National Council on State Legislatures, and the American Community Survey for all 50 states (and the District of Columbia) between 2010 and 2014. Twenty-eight different independent variables were collected for each state. Variables were categorized under the four following themes: state minimum wage policies, state economic output, state education level, and state

demographics. The primary form of regression analysis was a fixed-effects panel regression model to account for time differentials and individual state characteristics.

The results from the regression analysis suggest that if a state has a policy of automatically indexing the minimum wage, unemployment is higher by an average of 0.69%, keeping all factors constant. This means policymakers will have to weigh the purported socio-economic benefits of indexing minimum wages against the possible unemployment effects. Another key finding is that once a state's minimum wage amount expands above 38.45% of the all industry average wage amount within that state, unemployment starts to rise at an increasing rate. This result is important for two reasons. First, this provides policymakers and economists another type of benchmark to assess the possible effects of different minimum wage amounts on unemployment. Second, by utilizing this factor of analysis, policymakers can accurately formulate an appropriate minimum wage amount at the highest extent possible to bolster the purchasing power of those living on the minimum wage, while at the same time, preventing the unemployment rate from potentially increasing. The last significant finding is that increasing the education attainment level of the populace through higher rates of high school graduation and college advancement should remain as a top priority for policymakers as this study strongly shows that a more educated populace is a more employed populace.

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Date

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INTRODUCTION

One of the most hotly debated public policy issues currently facing the United States is the decision of raising the federal minimum wage amount and if so, to what extent. Nationally, labor and anti-poverty groups are calling on Congress to adopt a $15 minimum wage policy to help address the issue of income inequality in America (Klepper and Peltz, 2015). These groups are also pressing their cause in state legislatures and local governments to gain ground wherever possible. Recently, these organizations scored major victories in both California and New York as each state adopted a $15 minimum wage that will go into effect incrementally as early as 2018 (New York) and as late as 2022 (California). Although no states as of January 2016 have raised their minimum wages to $15, some major cities like Los Angeles, San Francisco, and Seattle have either already instituted a $15 wage policy or have enacted plans to do so in the near future (National Employment Law Project, 2015). Most states have not moved forward on this policy issue because one of the key concerns surrounding the minimum wage debate is its potential effect on the overall unemployment rate.

Once a state adopts a new wage law, essentially every business and local governmental entity must follow it, barring some exceptions based on the statutory language. Some of these exemptions where employers may pay a lower amount than the state minimum wage include small businesses with a very small workforce or modest gross annual income, particular occupational fields or industries, and if other forms of

compensation such as health benefits are provided (Department of Labor, 2015a). A blanket minimum wage increase at the state level does not take into account important factors such as a constantly changing and unpredictable economic environment and the vast geographical differences between different parts of that state. A higher minimum wage might make perfect sense for the City of San Francisco, which has a large population, diverse economy, and a very high cost of living. On the other hand, smaller lesser-known rural towns could potentially suffer adverse effects on employment because those types of smaller scale economies might have difficulty withstanding an increase in the costs of goods and services (Scheiber, 2015a).

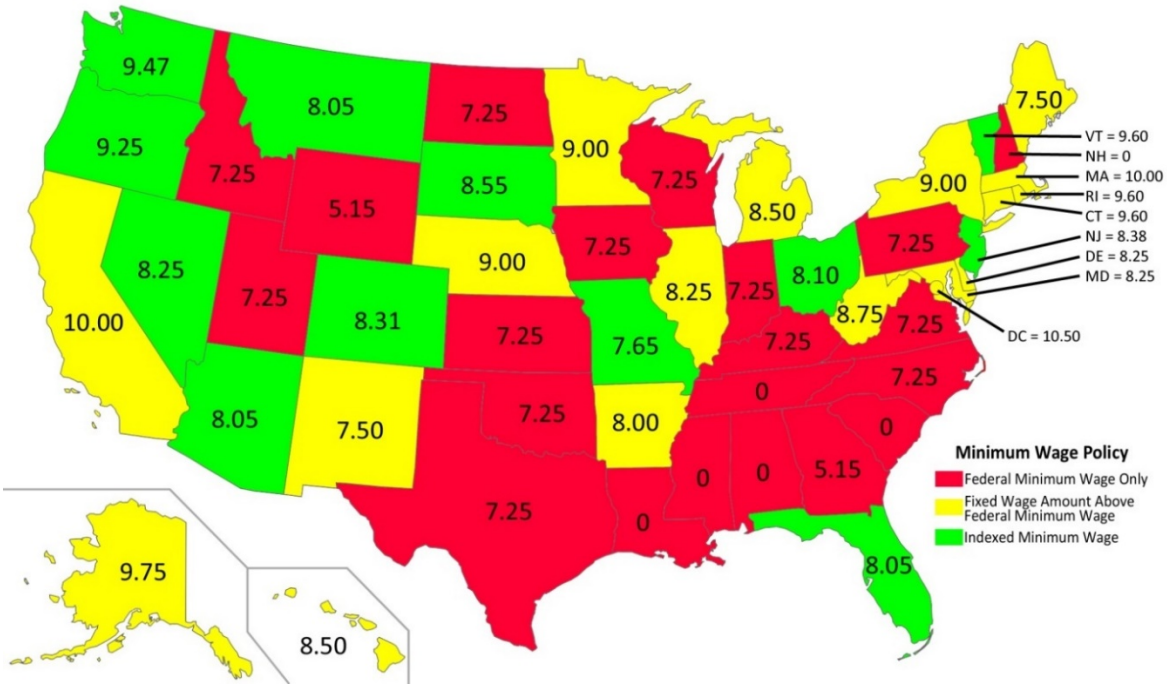
My goal is to investigate this complex topic and attempt to determine if there is a relationship between the minimum wage policy of a state and its unemployment rate through regression analysis. The main dependent variable I utilize is the yearly average seasonally adjusted unemployment rate percentage from 2010 to 2014 for all 50 states and the District of Columbia (five years for 50 states and the District of Columbia, or 255 total observations). I control for other explanatory variables such as a state's economic output, education attainment level, and population demographics to analyze if there are different potential factors related to the unemployment rate.

The key explanatory variables I will be investigating are the minimum wage laws in place for each state. These variables are if a state has a higher wage amount above the federal minimum, if a state has an automatically indexed wage policy, and what the minimum wage amount is as a percentage of the all industry average mean wage within that state. Currently, minimum wage laws fall under two different types of categories: a

fixed wage rate or an indexed variable wage rate. A fixed wage rate is a static wage policy that remains the same year-to-year until the state Legislature, along with the approval of the Governor, enacts a different amount. The federal minimum wage of $7.25 is an example of a fixed wage rate policy. There are 38 states that have a fixed wage rate policy in place and 21 of those states only use the federal minimum wage.

An indexed variable wage rate is if a state has a minimum wage law that automatically changes every year through cost of living adjustments (COLAs). These COLAs are based on a multitude of economic factors, such as the costs of basic goods and services under the Consumer Price Index (CPI) and/or monetary inflation. For example, the State of Washington in 2015 had a $9.47 minimum wage policy in place. In 2014 however, Washington had a minimum wage policy of $9.32. Between 2014 and 2015, Washington's indexed wage rate policy increased the minimum wage by $0.15, which constituted a 1.59% rate increase (Washington State Department of Labor and Industries, 2014).

Figure 1.1: State Minimum Wage Policies and Dollar Amounts ($) as of January 2016



Note: any state with a minimum wage less than the federal minimum wage of $7.25 are required to enforce this amount due to the Fair Labor Standards Act.

(Source: National Council of State Legislatures, 2016)

As seen above in Figure 1.1, states are broken down into three categories: federal minimum wage only, fixed wage amount above federal minimum wage, and indexed minimum wage. In addition, each state shows the minimum wage dollar amount each state has adopted individually. There are two states that have a minimum wage policy less than the federal minimum wage and six states do not have any minimum wage at all. Each of these states must comply with federal law by instituting a minimum wage of at least $7.25.

For the remaining portions of this introductory section, I will first provide a brief history of the minimum wage and the range of theories that helped drive the development of different approaches towards assessing the impacts of this policy. I will then provide current federal and statewide statistics concerning wage policies and unemployment rates, with a focus on particular demographics and inflationary fluctuation. Lastly, I will give an overview of the major political debate brewing over the recently enacted minimum wage legislation adopted by the State of California and will conclude with an overall roadmap of the format for the rest of this paper. Although the basis of the research for this thesis will be about all 50 states, I chose to write about California in particular for this introductory section to highlight some of the key factors legislators consider when contemplating a minimum wage law that institutes an indexing COLA and the politics that typically come into play.

Historical Context and Theoretical Benefits of Minimum Wage Laws

The labor movement scored a strategic victory in 1938 with the creation of a basic price floor for the minimum amount a worker should be paid (Grossman, 2010). This economic concept, labelled as a "minimum wage," was to give working people greater equity in terms of wage fairness. Policymakers specifically designed the minimum wage to protect the most economically vulnerable parts of the population and to provide an overall higher standard of living for society. This watershed policy action was an important step toward not only preventing industries from exploiting workers with extremely low wages, but allowed for much greater economic mobility for many individuals trapped in a cycle of poverty (Konczal, 2014). An additional benefit to the

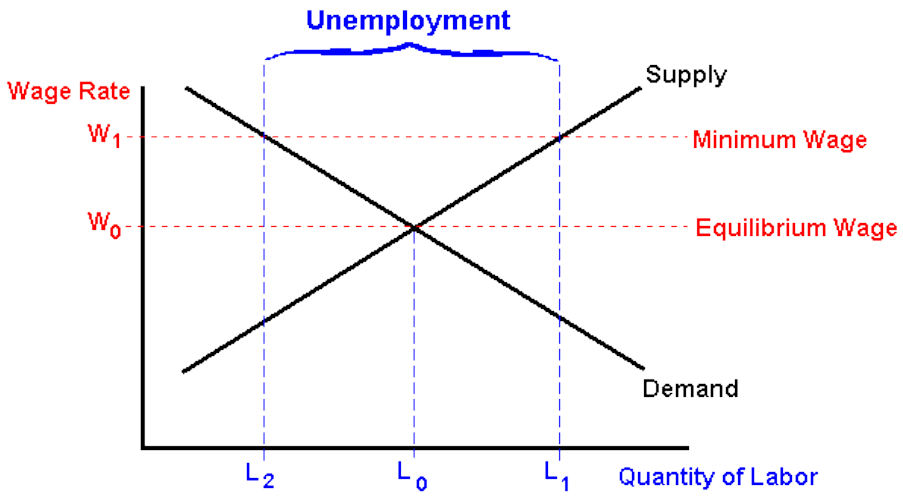
minimum wage policy is the spillover effect it has on wages that are slightly above the minimum wage rate. In most instances, workers who fit that demographic typically receive increases in their level of pay to maintain their income gap differential above lower level employees (Congressional Budget Office, 2014). For more than 75 years, the establishment of the minimum wage has been one of the cornerstone policy achievements of labor groups.

Economic Theory and the Divisiveness of the Minimum Wage

Ever since the inception of the minimum wage, it has been a fiercely debated issue. Businesses and conservative groups typically claim that a minimum wage policy actually hurts workers because it prevents the free market from determining what wages should truly be (Blasingame, 2015). These groups contend that if the minimum wage amount is higher than what is feasible for what businesses should be paying in terms of particular market signals and the health of the economy, it can lead to unintended consequences that directly affect workers. In this scenario, businesses are unable to hire more workers, have to let go of current employees to cut costs, or have to shut down altogether. Theoretically, there needs to be a balanced price point (or equilibrium wage) between the supply of workers and the demand that businesses have for those workers (Hill and Myatt, 2010). In this model, businesses are simply “wage-takers” who do not have the power to set the price of wages. A host of market factors determines this “price,” which is mostly based on the summation of costs of doing business (Hill and Myatt, 2010). When the government imposes a regulated price floor through a minimum wage policy, it is by design that the new wage amount is higher than the equilibrium wage

amount. However, within a market economy, this scenario creates a risk that if the mandated wage amount is above the equilibrium wage amount, it could reduce the demand businesses will have for labor as the costs of labor will be too expensive. Businesses, as wage-takers, will have to accept a heavier negative financial burden through paying higher wages than they would otherwise without a minimum wage (Hill and Myatt, 2010). Therefore, a surplus in the supply of workers would be caused by this "price floor" inefficiency because the demand for new workers would be lower than the supply, which would in turn increase unemployment overall (Mallard, 2012).

Figure 1.2: Law of Labor Supply and Demand with a Minimum Wage Policy



(Source: Wyoming Department of Research and Planning, 1999)

On the other hand, if the economy is healthy and performing strong, the minimum wage might be inadequate. In this case, the true equilibrium wage amount could be higher than the minimum wage amount set by the government, meaning workers' wages are

actually lower than what the market could be paying them (Economic Policy Institute, 2015). This is why some labor groups are calling for a minimum wage as high as $15. In theory, a minimum wage policy could hurt workers unintentionally because incentives are decreased for businesses to pay workers better wages above the minimum obligation. Businesses can instead be incentivized to race to the bottom by keeping wages at or near the minimum wage level to just meet the basic governmental requirement.

Similarly, if a business performs well within the free market economy and is profitable, employees could receive higher wages because the business can afford to reward its employees. This economically natural increase in the wage amount would directly affect workers in a positive way without the need of a minimum wage law requirement. Another benefit to this type of economic climate is that businesses may be able to hire more workers altogether, as wages are more acceptable and predictable. This increase in the demand would move down the supply curve, which would theoretically have the effect of decreasing the unemployment rate as more workers are hired. All of the above arguments are in line with centuries of classical neo-liberal economic theory. Conservative legislators, economists, and lobbyists alike use these arguments to caution the populace when it comes to formulating new minimum wage policies.

A Different Theoretical Perspective on Minimum Wage Effects

While minimum wages have only increased over time, unemployment rates have fluctuated greatly between very high and very low levels. Typically, macroeconomic factors that affect the entire economy as a whole are the biggest causes of this oscillation in unemployment rates. Conservative groups typically purport that economic models

show that increasing the minimum wage policy is one of the underlying root causes of unemployment, especially for low-skilled laborers (Wilson, 2012). However, this perplexing fluidity of the unemployment rate in relation to minimum wage policy has caused political actors and economic theorists to question the validity of the conservative free market economy models because the predictive value of these models can be relatively inaccurate (Ozimek, 2012).

When analyzing the influence of a minimum wage, economists use a labor market model in which supply is the "hours willing to work" at a given wage amount and demand is the number of hours a firm utilizes workers at a given wage. There are some very specific assumptions that go into the derivation of these labor supply and demand curves that are questionable. The calculation and utilization of these assumptions calls into question the concept of unemployment rate increases generated from minimum wage policies. Working in unison with identical information, having equal market power, and being able to make the correct business decisions are some of the key assumptions of establishing a perfectly competitive market (Mallard, 2012). In the real world, businesses instead have imperfect information and unequal market power. This causes different business actors to be unable to act together in unanimity in response to diverse market signals to perfectly maximize their profit and cost margins. Therefore, these supply and demand models might overestimate the effect minimum wage policies have on the actual unemployment rate.

A model known as the "monopsony of the labor market" suggests that businesses have market power and are more often wage-setters rather than wage-takers (Hill and

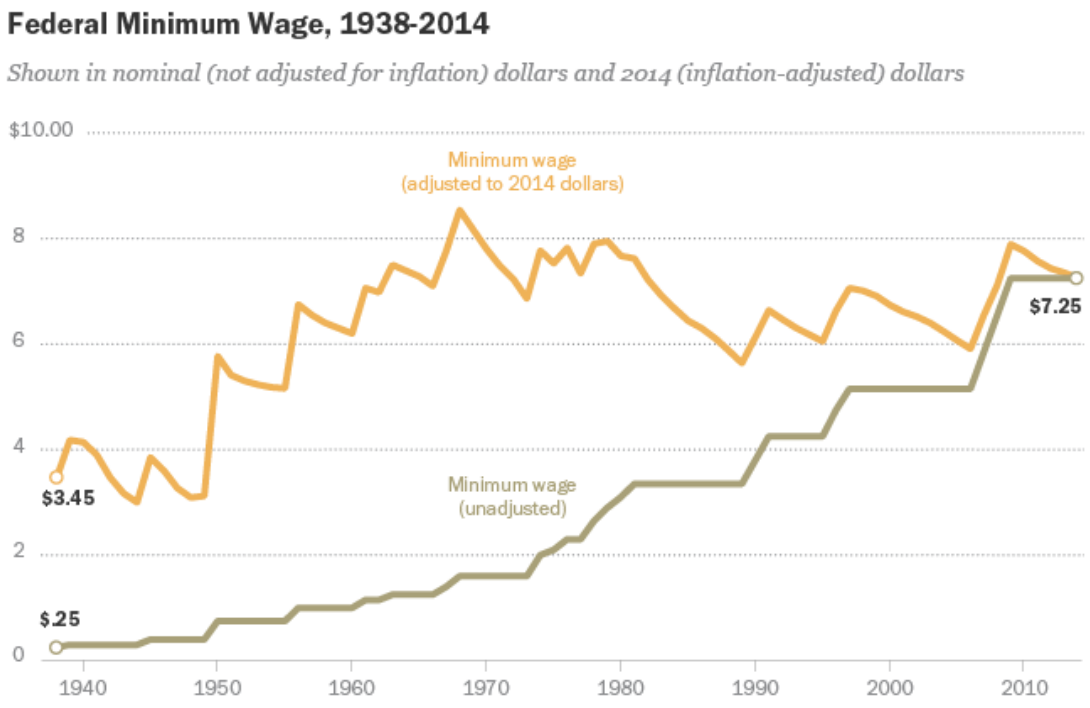
Myatt, 2010). This model establishes that businesses can endure moderate increases in the minimum wage, as they are not always completely beholden to market forces and extremely tight profit margins. Additionally, employees and employers have a very symbiotic relationship when it comes to wages. The perfectly competitive market model suggests that if a business reduces worker pay by one cent less than the equilibrium wage, all of the workers will quit because workers as rational actors will only work for jobs that give them a wage amount equal to or greater than the equilibrium amount (Hill and Myatt, 2010). However, there are market "frictions" that prevent workers from making these types of calculations. Frictions include the time and resources it takes for the workers to find a new job or the increased costs of commuting. Frictions can also be personal preferences, such as the attachment to fellow co-workers, a particular benefit offered by the company, or the fact the job itself is simply enjoyable (Hill and Myatt, 2010). Free market models do not take into consideration these frictions, which skew the entire neoliberal analysis. Since there is no actual market in the world today that fits the scheme of a perfectly competitive market, computing the effects of minimum wage laws on factors such as unemployment is very difficult.

Overview of the Minimum Wage Policy and Key Statistics

In 1938, the federal minimum wage under the Fair Labor Standards Act (FLSA) was $0.25, which would be $4.20 in 2015 when adjusted for inflation (Department of Labor, 2016b; Bureau of Labor Statistics, 2016a). The federal minimum wage has increased 23 times based on changes to the 1938 FLSA statute (Department of Labor, 2016b). The longest period of time during which the minimum wage remained static was

from 1997 to 2007. The last time the federal government raised the minimum wage was in 2009 and the amount went from $6.55 in 2008 ($7.21 with 2015 inflation) to $7.25 in 2009 ($8.01 with 2015 inflation). However, when adjusted for inflation today, the purchasing power of the federal minimum wage peaked at $10.90 in 1968 according to the CPI calculator from the Bureau of Labor Statistics (Bureau of Labor Statistics, 2016a). The Pew Research Center (2015) estimates that the federal minimum wage has lost 8.1% of its purchasing power to inflation since 2009.

Figure 1.3: Comparison of Federal Minimum Wage Amounts in Nominal and Inflation-adjusted Dollars



Note: wage rates adjusted for inflation using implicit price deflator for personal consumption expenditures. (Pew Research Center for Analysis, BLS CPI Calculator)

(Source: Pew Research Center, 2015)

As seen in the above diagram, the actual purchasing power of a particular wage amount has fluctuated over time. Yet, the $7.25 value of the current nominal federal minimum wage will soon be outpaced by inflation, making the minimum wage inadequate.

As of 2016, twenty-nine states and the District of Columbia have already acted to raise their individual wage policies above the federal level. The remaining 21 states have opted to maintain the federal minimum wage amount at $7.25. Additionally, 12 of the 29 states that have wages higher than the federal amount modify their minimum wage rate

every year through an automatic index. As state economies have been rebounding from the Great Recession that began in 2008, the unemployment rate in every state since 2012 has fallen, some faster than others. As of March 2016, the state with the lowest unemployment rate is South Dakota at 2.5%, while the state with the largest unemployment rate is Alaska at 6.6% (Bureau of Labor Statistics, 2016b). When the United States began measuring the unemployment rate in 1948, the highest rate of unemployment was 10.8% in November of 1982 and the lowest was 2.7% in December of 1952 for the entire nation (Bureau of Labor Statistics, 2016c). In addition to these statewide statistics on minimum wage policies and unemployment rates, it is important to highlight some of the key demographical information related to this policy as well. Approximately 3 million hourly workers are at or below the federal minimum wage, which accounts for 2.3% of all wageworkers in the United States (Pew Research, 2015). Roughly half (48.2%) of those 3 million workers are ages 16 to 24 and an additional 22.4% of those workers are age 25 to 34 (Pew Research Center, 2015). About 20.6 million people or 30% of all hourly, non-self-employed workers ages 18 and older are "near-minimum-wage" workers, which are workers that make more than the minimum wage, but less than $10 an hour (Pew Research, 2015). The restaurant and food service industry is the single biggest employer of near-minimum-wage workers and employs over 3.75 million people (Pew Research, 2015).

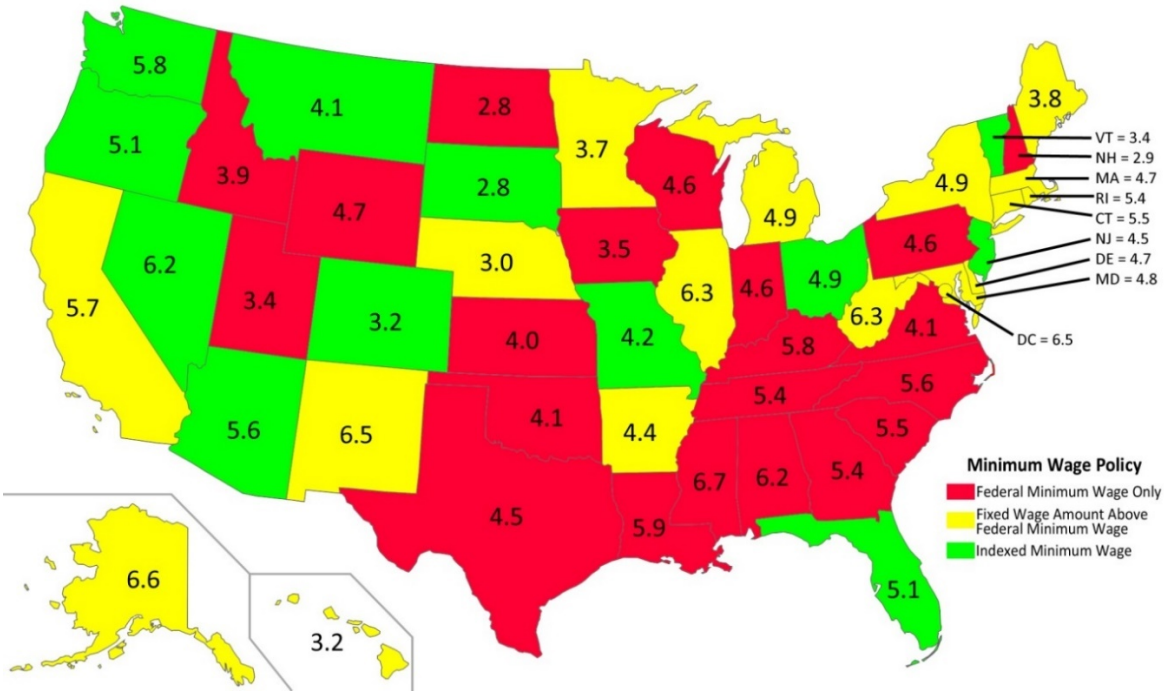
The Evolution of Wage Policy in 2001: Automatically Indexed Minimum Wages

From 1938 to 2000, minimum wage laws enacted at both the state and federal level were solely through fixed rates. One issue with the fixed wage rate policy is that in most cases, raising it again becomes highly political and difficult to pass through a legislative body. Instead of a newly proposed minimum wage simply matching an increase in the cost of living in an unbiased and economically driven process, politics typically dictates the formulation of this policy. On one hand, conservatives will typically fight to ensure that a minimum wage increase is either as small as possible or that increases happen slowly over a certain time-period. On the other hand, liberals will normally demand that wages are set as high as possible and that the changes are immediate. Thus, in a fixed wage rate governmental model, political negotiations typically take place to find the middle ground between these two ideologies. The outcome of these negotiations can be problematic. If the subjectively chosen wage amount is too low, then working people in the lowest income brackets will be hurt as their wages might not be able to maintain a basic standard of living and the number of people living at or near the poverty level could increase. If the wages are set too high, it could cause severe financial pressure on businesses, leading to slower economic growth and an increase in unemployment.

In 2001, the State of Washington was the first state to embark on a historical change on how it would alter the minimum wage through the implementation of yearly automatic raises based on COLAs. These COLAs are a reflection of key indicators in an economy, such as the consumer price index, monetary inflation, and the prices of

commonly purchased goods and services (Washington State Department of Labor and Industries, 2016). This way, instead of a state legislature tinkering with the minimum wage through somewhat arbitrary and often political means, minimum wages would slowly increase over time naturally due to fluctuations in the economy at a variable rate. This would ensure that wages could maintain a certain standard of living, while at the same time, not be as intrusive on businesses as the increases would theoretically be smaller and less abrupt (Munoz, 2007). Since 2001, eleven other states currently have a similar law as Washington and many more states are currently considering the policy of automatically indexing their minimum wage rates (National Council of State Legislatures, 2016). However, no major study has taken under consideration the effect this policy has on the unemployment rate in comparison to states with fixed wage rates, which is what this thesis attempts to do. On the following page in Figure 1.4, I provide a breakdown of each minimum wage policy a state has and the unemployment rate of that state as of January 2016.

Figure 1.4: State Minimum Wage Policies and Unemployment Rates (%)
as of January 2016



(Sources: Bureau of Labor Statistics, 2016; National Council of State Legislatures, 2016)

The western side of the United States has more states that index wages. However, the largest states that currently index wages are Florida and Ohio, which are on the eastern side of the United States. The south has the greatest concentration of states that only currently offer the federal minimum wage. The north east portion of the United States has the highest amount of states that offer minimum wages greater than federal minimum amount. To put the unemployment rate of each state in perspective, the average unemployment rate of the United States in January of 2016 was 4.8%.

A Glimpse at Minimum Wage Policy and Politics: The California Example

In 1916, the State of California adopted a minimum wage policy at $0.16 ($3.48 in 2015), which was 22 years before the federal government adopted the FLSA and was only four years after Massachusetts adopted the first minimum wage law within the United States (California Department of Industrial Relations, 2016). Historically, California has always had a state minimum wage higher than the federal minimum wage. California has raised the minimum wage 26 times since 1916. Most notably, in 1947 California increased the minimum wage from $0.45 to $0.65, constituting the largest increase in state history at 44.44% (California Department of Industrial Relations, 2016). California's current minimum wage is tied with Massachusetts as the second highest in the nation at $10 an hour, which is $2.75 higher than the federal policy (Washington D.C. is the highest at $10.50 an hour). California is also unique in that many major cities such as Berkeley, Oakland, Los Angeles, Richmond, Sacramento, San Diego, San Francisco, and San Jose have all raised their minimum wage laws (some policies being delayed until 2017 or later) above the state policy (National Employment Law Project, 2016). The highest current local government minimum wage policy in California is $14.44 in the City of Emeryville, which is also the highest city minimum wage policy in the nation (Yurkevich, 2015).

This topic is particularly interesting because California, the most populous state in the union, is currently on the forefront of this debate of raising minimum wages through COLAs. One of the first bills introduced in the 2015–16 Legislative Session, Senate Bill (SB) 3 sponsored by Senator Leno of San Francisco, was recently approved by the State

Legislature and signed into law by Governor Edmund G. Brown. This bill will raise the minimum wage to $10.50 an hour in 2017, $11.00 in 2018, and an additional dollar each year until 2022 when the minimum wage will be $15.00 an hour (Assembly Appropriations Committee Analysis, 2016). Additionally, in 2022, SB 3 will automatically index wages to inflation by no more than 3.5% of the previous year (Senate Labor and Industrial Relations Committee Analysis, 2016). This legislation is a great example of how policy and politics typically intersect when attempting to increase the minimum wage.

Since 2006, the California State Legislature proposed legislation in every two-year session to have a minimum wage increase tied to COLAs. In every instance however, legislators removed language related to the COLA before the bills reached a final vote on the Floor to avoid controversy. In 2013, Governor Brown signed Assembly Bill (AB) 10, proposed by Assembly Member Luis Alejo of Salinas, which raised the minimum wage in California for the first time in six years to $9.00 in 2014 and $10.00 in 2016 (California State Assembly Floor Analysis, 2013). However, to have his legislation successfully pass the Senate Floor, he amended AB 10 to remove language related to auto indexing through COLAs (Staff Report, 2013). SB 3, which was introduced the year after AB 10, was another attempt to not only increase the minimum wage further, but to also re-introduce the indexing policy again. After successfully passing out of the Senate, SB 3 was placed on the Assembly Appropriations Committee suspense file and Senator Leno postponed the hearing of the bill in August of 2015. At that time, SB 3 was unlikely to make it out of the committee process in the Assembly due to heavy opposition from

many business advocacy organizations, including the California Chamber of Commerce, which specifically targeted this legislation and labeled it as a job killer bill (Chamber of Commerce, 2015). All of the Republicans in both legislative bodies were either against this bill in chief or preferred other options to address the problems outlined by proponents of the legislation. Additionally, there were concerns from fellow legislative Democrats in the Assembly who represented the more rural parts of the state on how this legislation would affect their districts.

No movement was made on this legislation until a statewide proposition, which was promoted mostly by labor unions, officially qualified for the ballot. This proposed ballot proposition would have increased the minimum wage to $15 by 2021 and instituted a wage index (Myers, 2016). The growing sentiment within the State Capitol was that if this proposition was officially placed on the ballot during the upcoming election, it would likely pass with a wide majority. The Governor and the Legislature were concerned that if they did not act quickly, the state's hands would be tied from participating in the process and that the proposition might move too aggressively without any “off ramps” to alter the course if an economic or budgetary downturn occurred in the near future. SB 3 instantly came back into play and was amended by Senator Leno to mirror the ballot proposition, but with minor modifications. Some of these differences included: adding a cap that protects small businesses by slightly delaying the implementation of the minimum wage increases, making the increases less aggressive (i.e. only having a $0.50 increase in 2017 rather than a full dollar and not reaching the $15 mark until 2022 instead of 2021), giving the government powers to delay the wage increasing process if an

economic calamity occurred, and capping the indexing clause increases to a max of 3.5% from the previous year (Senate Floor Analysis, 2016). After successful negotiations took place between the government and labor groups sponsoring the initiative, the proposition was essentially removed from the ballot and SB 3 was signed into law.

Regression Analysis and Paper Overview

The research question I will specifically attempt to answer through regression analysis is: does the type of minimum wage policy a state has affect the unemployment rate of that state? This paper will include the following chapters: a literature review of current research, the methodology I utilized and why I selected it, a description of the data I collected and the findings from the analyses, and a conclusion with a discussion of state policy implications.

The next chapter is a literature review that summarizes the studies I used for the basis of this paper and for the selection of the variables utilized in the analysis. In my literature review, I structure my analysis through three specific themes, which I discovered to be some of the most prevalent findings unearthed by researchers:

1) Do different types of minimum wage policies affect unemployment?
2) Does the economic output of a state affect unemployment?
3) Do different education attainment levels within a state affect unemployment?

In my methodology section, I describe how I designed my statistical analysis utilizing a panel data regression model with corrections for heteroskedasticity and autocorrelation. For my data and results section, I describe and analyze the specific details of the statistical outputs and the important aspects concerning the raw data. Lastly, I conclude

with a summary of my findings and discuss the potential outcomes and considerations of implementing different minimum wage policies at the state level, as well as my state policy recommendations.

Chapter 2

LITERATURE REVIEW

For the past 20 years, a major debate has unfolded between academics, economists, and legislators concerning the effects of raising the minimum wage. The main point of contention typically focuses on one key factor: does increasing the minimum wage cause job losses and, therefore, higher rates of unemployment. This section of my thesis focuses on current research concerning minimum wage policies. Although there is a wide breadth of scholarly research articles written since 1960, I specifically examine more contemporary work between 1994 and 2014 and present opposing findings to create balance.

A common theme when researching the subject of the minimum wage and its impacts on unemployment rates is that there is a great amount of controversy over how to analyze the data due to the fact that there are so many competing theories or conclusions being published on a regular basis. For example, authors Allegretto et al. and Neumark et al., who are some of the top researchers in this field, have each written a series of influential research papers with opposing interpretations on how to quantify and analyze minimum wage effects on the unemployment rate. These authors also commonly critique each other's work and provide an ample analysis on how to improve particular statistical models. There are many other instances in which the sole purpose of a study is to directly contradict a previous study in order to challenge and refute its findings. Schmitt (2013) agrees with the above-stated claim that recent research has been more about competing

authors debunking each other's research designs, which shows there is no discernable conclusion on the matter yet. Schmitt also believes that this reduces the confidence level for individuals wanting to utilize particular studies towards evaluating different policy options.

On one hand, the perpetual friction within academia surrounding this topic creates innovative research constantly pushing the limit of economic theory and provides a wealth of knowledge for everyone to utilize and extract. On the other hand, this lack of consensus leaves policymakers without a clear path in regard to crafting legislation that will both boost and secure the common welfare of the populace while at the same time not endangering the economy as a whole. Another detriment is that each conflicting finding can also embolden the controversy further, as each entity with a stake in the matter will purport particular literature that solely supports their specific cause or political philosophy. This literature review will take into account a wide range of peer-reviewed regression studies that control for factors that influence statewide unemployment. When thematically looking at the research, the three most common explanatory factors are individual state minimum wage policies, the economic output of a state, and the education level of the population.

In this chapter I will explain how previous regression studies utilized different independent variables relating to state unemployment, as characterized by the general causal factors. Then I will clarify individually, in detail, the three major themes described above with an emphasis on how each study considered variables within a particular theme. Lastly, I will conclude with a short summary of the most substantial research

highlights and other noteworthy considerations involving important factors that influence state unemployment rates. I will particularly highlight how I will take those ideas, methodologies, and concerns into account for the formulation of this thesis.

Explanatory Factor One: State Minimum Wage Policy

Every major study referred to within this thesis used state minimum wage policies as a factor to determine if it was a major influence towards causing unemployment rates to rise or fall. In most cases, the monetary amount of the minimum wage, reflected through real adjusted dollars for inflation, ended up being one of the most common factors that had statistical significance in comparison to the multitude of other variables taken under consideration.

From 1960 to 1990, some of the most prominent research on the question of minimum wage policies causing unemployment typically found that increasing the minimum wage could potentially lead to rising rates of unemployment in general. In 1994 however, Card and Krueger produced one of the most significant studies that sparked heated debate about the minimum wage because they found that raising the minimum wage actually decreases unemployment. Card and Krueger analyzed two states in close proximity to each other, New Jersey and Pennsylvania. New Jersey adopted a wage increase, but Pennsylvania did not have a wage increase during the same period. They specifically compared employment growth (the dependent variable) in fast food stores in each state to estimate the effect of a higher minimum wage. They surveyed and controlled for different store characteristics, such as the ratio of full-time workers per part-time workers, the number of hours a store was open, if employees had meal discount

incentives (discounted low-price meals or free meals), the wage profile of stores (average time for first wage raise and usual amount of raise), state demographics, and time-frame variables. The authors found that in the 410 fast food chain restaurants analyzed in New Jersey and Pennsylvania, New Jersey fast food chain restaurants such as McDonalds and Kentucky Fried Chicken hired more workers than those similar restaurants in Pennsylvania (Card and Krueger, 1994). Pennsylvania's chain restaurant hiring rate overall was not as strong as New Jersey's and, in turn, the unemployment rate for workers in those industries in Pennsylvania was higher even though there was a lower minimum wage. This research flipped years of economic theory on its head and many studies still to this day commonly reference or utilize Card and Krueger's analysis.

Partridge and Partridge (1999) on the other hand found that an increase in the minimum wage correlated positively to long-term unemployment rates after a lag period, which is a period of six months after a wage increase takes effect. Some of the important variables they used for their regression were the logs of the minimum wage of each state, the amount of people covered under the minimum wage policy, an industry mix of employment growth (or decline) from year-to-year, and different state demographics. One of their goals was to refute the Card and Krueger study by gathering a larger data set at a much larger scale, as they had criticized the 1994 study for using only two states with two industries. Partridge and Partridge calculated data from all 50 states through the logs of the labor market, minimum wage policies, the non-supervisorial labor force covered by minimum wage legislation, hourly manufacturing production worker wage, the employment growth rate of a state in comparison to the national rate at the time, and

different demographic groups. The authors then utilized a panel data regression model to control for state fixed effects and time effects. The main dependent variable was the long-term unemployment rate, which is an unemployment duration longer than 26 weeks. The important outcome to this study showed that when analyzing unemployment rates after raising the minimum wage, the first six months will not have any significant effect, but after that lag period, unemployment rates typically started to rise and show the true effects of the wage increase. After correcting for autocorrelation and heteroskedastic effects with their panel data model, they found on average that a 27% wage increase leads to a long-term unemployment rate increase of 1.35%. However, the sum of contemporaneous and lag minimum wage coefficients was only modestly statistically significant at the 10-20% level. This study was quite robust in terms of the scope of data analyzed, but it did not fully consider teen unemployment, which is a common category a majority of studies include. It is important to note that this research was the second oldest study in this literature review. The data came from the 1984 to 1989 time period, which might not be as helpful for comparison purposes, as it is a completely different world in terms of the makeup of the global economy, the advancement of vastly superior technology, and the numerous dissimilarities in demographics. Raising minimum wages was found to be a statistically significant factor in terms of higher unemployment rates in a majority of the studies analyzed for this literature review (Abdeljawad et al., 2014; Greer et al., 2014; and Neumark et al., 2014;).

In response to all the studies that have found positive relationships between wage increases and rising unemployment, Allegretto, Dube, and Reich (2013) sought to change

the method of analysis. These authors wanted to measure employment rate effects through spatial approaches accounting for time-varying heterogeneity. This was composed of analyzing 741 county zones across the country from the period 1990 to 2012. The three main dependent variables they analyzed were the log of teenage workers, the log of restaurant employment, and the log of other private industry employment over those 741 zones. They also controlled for time variables that had a focus on breaking apart particular economic boom and bust periods. The important difference in this analysis is that it was on the local county level, rather than the broad state level, which theoretically would allow for better comparisons of similar regions over the same period of time with counties physically touching each other near state borders. When using this method, they found no statically significant effects of minimum wage increases on either employment for teens or restaurant workers, the two demographics who make up the majority of people who feel the impact of minimum wage policies (Allegretto, et al., 2013).

A year after the Allegretto 2013 report, authors Neumark, Salas, and Wascher (2014) responded with their own analysis that tweaked the variables to show that increasing the minimum wage does cause higher rates of unemployment. Their study challenged Allegretto's local county method because they believed there were too many variables to control for, especially when comparing counties that shared borders with counties in other states. In some cases, different states had vastly different minimum wage policies and labor laws, so proximity may not have been the best form of analysis. Instead, Neumark et al. chose to group states into five regions, as prescribed by the

Bureau of Labor Statistics, and calculated their regression analysis. They found strong evidence indicating unemployment effects with teenagers and restaurant workers, causing a –0.15% change in the employment rate for those two groups when the new wage policy came into effect.

Lastly, one important aspect that I want to note is that no study specifically addressed the comparison of states that automatically index their minimum wage every year based on factors such as the CPI or inflation. The National Federation of Small Business critiques how California's AB 10 (2014), which at one point included a COLA for minimum wage increases, would hypothetically cause increasing levels of unemployment for small businesses if the COLA adjustment was at either 2% or 4% levels (Chow, 2013). Only one non-peer reviewed study used regression analysis on state and federal minimum wage law differences and they found there was no effect or statistical significance of a states' unemployment rate and the law type (Abdeljawad et al., 2014). It is important to note that Abdeljawad et al. found that when looking solely at just the connection between unemployment rate and minimum wage variables, the coefficient was 0.7, and after considering other variables, the coefficient became 0.9. This meant that there was almost a one-to-one relationship between the two variables. However, when using a dummy variable to compare whether states followed the federal minimum wage rate or not, the minimum wage variable was no longer statistically significant in either the single regression or the multiple regression model. Furthermore, a state's minimum wage's correlation with unemployment actually decreased significantly when using the dummy variable, as the coefficient went from 0.9 to being only 0.2.

Munoz (2007) argues, albeit with no particular statistical evidence, that a state that links their minimum wage policy to the CPI would withstand increases in the minimum wage better because the increases are typically small year-to-year, especially in comparison to the larger arbitrary ones that state legislatures adopt every few years.

Explanatory Factor Two: State Economic Output

The economic output and robustness of a state is a very important factor to analyze when attempting to discern factors that affect the unemployment rate. States that are stronger economically tend to have lower rates of unemployment and can stave off any potential negative unemployment effects due to a higher minimum wage threshold increase (Greer et al., 2014). Furthermore, Savitski et al. (2015) argue that the decision to raise a minimum wage should not only depend on the statistical relationship between wage and employment, but that a diverse array of economic variables needs to also be considered. A common variable used to determine the economic health of a state is the gross domestic product (GDP) or gross state product (GSP) of the state. In some studies, GDP was broken down into a few key industries where minimum wage effects would likely have the most effect, such as food services and accommodation services. To be clear, one concern of using this factor for analysis is that when GDP is an explanatory variable, having employment (or unemployment) be the dependent variable could actually be due to endogeneity. In other words, the same factors that cause GDP to fluctuate also cause employment or unemployment to vary. Economic theorists have coined this relationship as “Okun’s Law,” which simply states that as unemployment increases, GDP will decrease, and vice versa (Knotek, 2007).

Greer, Castrejon, and Lee (2014) divided their analyses into three periods: pre-recession, recession, and post-recession to shield their findings against the tumultuous economic period of 2003 to 2013 for each state. These results found that when states were economically stronger in a pre-recession period, the wage effect had no significance on unemployment, but during the other two periods when the states had weaker economies, the minimum wage effect had a large significant effect. Using the yearly gross domestic product variables also showed this effect, which outlined the importance of including economic factors.

Some economic theories suggest that the macroeconomic effect of minimum wage increases on GDP is ambiguous (Sabia, 2015). Minimum wage increases may increase labor costs and reduce a firm's profits, which could reduce GDP. However, increases in the minimum wage could incentivize workers to increase their output and could allow workers to have a higher marginal propensity to consume an additional dollar of income, which could potentially boost GDP (Sabia, 2015). Furthermore, Sabia reveals simple correlational evidence on different time periods where the minimum wage increased showed sharp declines in GDP or strong growth in GDP. For example, from 2007–2009, as Congress instituted new minimum wage laws, real GDP trended negatively (Sabia, 2015). Although the author does not directly mention that the Great Recession should be the most important factor to take under consideration during this instance, it is strongly implied that factors other than minimum wage laws must garner attention when evaluating different time periods. To the contrary, when the federal minimum wage rose in 1996–1997, GDP grew positively until 2000 (Sabia, 2015).

Other studies typically included the GDP of a state or at least a variable that analyzed industry specific effects with the purpose of showing how well a particular industry was faring in each state, predominantly after there was a wage increase. Many other studies used common GDP (or GSP) factors to give a diversified degree of a state economy and to measure particular industries affected by minimum wage increases. The most common industry used was the restaurant and food service industry. Six of the eight studies in this literature review made note of key economic indicators, but different models and measurements lead to different outcomes on the level of significance on industry performance and unemployment rate movement.

Explanatory Factor Three: State Education Level

Surprisingly, one independent variable that became a reoccurring theme during my research was the usage of varying education demographics of a state as a factor to see how the unemployment rate can fluctuate. Three studies I examined that used this variable defined a state's education level in different ways. Some models had a smaller educational attainment benchmark, such as analyzing the population of those who have a high school degree or not. Other models were more specific surveying a state population's highest degree level, usually in the form of high school diploma, undergraduate degree, and advanced degrees. Greer, Castrejon, and Lee (2014) found that states that had lower education levels, which were states that had a populace of people who did not have a high school diploma, had a statistically significant effect on unemployment at the 1% significance level, indicating a decrease of unemployment by

-0.16% in the pre-recession period and -0.23% during the period of the Great Recession. The most revealing part from their analysis was that the education factor was more significant towards effecting unemployment than the minimum wage policy factor. This suggests that in general, populations that have at least a high school diploma or greater will have an easier time finding employment than those who do not, leading to a decrease in unemployment in both non-recession and recession time periods. Additionally, their findings further suggest that during the Great Recession, the portion of the population of those having a high school diploma or greater likely had an easier time finding or maintaining employment than those who did not have a diploma.

On the other hand, two other studies did not find as much of a statistical significance or correlation between the two variables. Abdeljawad et al. (2014) determined that there was no relationship between education level and unemployment as the variables were not statistically significant. Pedace and Rohn (2011) also found no strong significance between education and unemployment, but results did indicate increases in the minimum wage were associated with decreases in unemployment in the instance of males that had at least graduated from high school. For the age group of 19 to 25, a $1 increase in the minimum wage was associated with a 17% decrease in the amount of time people who fit that demographic were unemployed. Additionally, Pedace and Rohn found that lower skilled females who did not have a high school diploma faced longer spells of unemployment when minimum wages increased than their male counterparts.

Literature Review Summary and Conclusion

The primary focus of this thesis is to distinguish states based on their minimum wage policy, especially those states that have adopted the more progressive policy model of automatically indexing wages to the CPI or inflation. Unlike a majority of the studies (except for Abdeljawad et al. (2014)) I will not have as wide of a year range due to the lack of availability of certain variables for particular years. For a panel regression study, it is vital that there is an equilibrium of all variables across all years for each individual state; meaning that the variables for each state for each year must have a number that is consistently measured and/or calculated the same way for each year in the data set for the regression to work. There are formulas and statistical estimation tools that could fill in potential gaps of data for years that did not contain the necessary information needed to analyze a particular year, but I believe those methods would only complicate my study and potentially weaken any statistically significant findings in my simple research model.

An important lesson I learned when building my model was to ensure real dollars (or real numbers) are used to control for inflationary effects and all of the studies I analyzed used this proper form of measurement. My study also conforms to how Greer et al. (2014) and Abdeljawad et al. (2014) break down education groups into the percentage of the population of those who do not have a high school diploma all the way to those who have a graduate degree by using the American Community Survey (ACS) through the Census Bureau. Lastly, many of the studies focused on different regional components or specific industries, but my study will be more along the lines of Partridge and Partridge (1999) since it will be more of a top-level analysis on minimum wage effects.

For a future study with this topic, I will likely use more time controls (e.g. pre-Great Recession versus post-Great Recession) and compare initial wage increase shocks to specified lag periods as in Sabia (2015), Greer et al. (2014), and Partridge and Partridge (1999). This would provide more analysis to see if there is a time delay in which the impacts of a minimum wage increase could have on unemployment, as private businesses and public firms adjust to a new wage law. Additionally, this design could give a better indication of how the overall economic health of the country (or an individual state) has on unemployment, and how various minimum wage laws during different economic climates may intensify or diminish the influence a particular policy has on unemployment rates.

There is plenty of room for more investigation when it comes to analyzing how a minimum wage policy can affect the unemployment rate. When analyzing the 50 states in the United States and the District of Columbia, the three most common explanatory factors are the minimum wage policy, the economic output of a state, and the education level of the state populace. However, the source of where these numbers come from and how they are calculated is potentially causing some of the major differences in the findings. Particularly, there has been sparse research on indexed wage rate policies, which my thesis focuses on. The next chapter of this thesis explains my research model that I used for my analysis and describes in detail all of the variables I gathered for regression purposes.

Chapter 3

METHODOLOGY

I decided to utilize multiple regression analysis for this thesis over other methodologies because of two main reasons. First, there are a plethora of reliable numerical data readily available. Second, the most impactful studies concerning this topic typically use quantitative approaches because measuring the positive or negative effects different variables might have on the unemployment rate is very straightforward and relatively easier to analyze within regression models. If this thesis was about the effects a minimum wage law had on equally important social issues, such as reducing poverty, there are many unquantifiable considerations to analyze and understanding how the law effects the lives of those living on a minimum wage would be ripe for a qualitative design. In this manner, a qualitative approach could fully examine the many gradations and subtleties within those topics. Just simply calculating the numbers would not provide the type of justice that this real world issue deserves.

Regression analysis is a statistical method for estimating the relationship among different variables. Regression models can potentially unearth interesting correlations that may be unknown absent such analyses and can help untangle complicated theoretical constructs. Using a statistical analytical model, I examined 28 different variables across 50 states (and Washington D.C.) over a period of five years to assess the direction and strength of the correlation each variable had towards each state's individual unemployment rate. The most important benefits to highlight about analyzing the

relationship between minimum wage rates and its potential effect on unemployment through a regression analysis process is that there is an abundance of different types of variables that are consistently measured, continually available, and easily acquirable for each state across the same periods of time. These factors are crucial towards increasing the reliability of a multiple regression analysis model. The public can access many federal governmental websites, such as the Bureau of Labor Statistics, the Bureau of Economic Analysis, and the Census Bureau with a high degree of confidence in the quality of data.

This methodology section outlines the justifications for the variables I chose to use in my research design, with a particular emphasis on how the independent variables relate to my dependent variable. I will describe how my model reflects the three major themes identified in the literature review: wage policy, economic output, and education attainment level. I will show descriptive statistics for each variable and will dive into specific details concerning some of the notable aspects of these variables. In addition, I will describe my regression model in simplified mathematical terms and will clearly emphasize the importance of why I chose to use a panel data linear regression model with fixed effects. Lastly, I will address the expected direction of each causal theme toward its intended effect on unemployment rates.

Dependent Variable: The Unemployment Rates of States

I chose the dependent variable as the unemployment rate of a state because it is one of the key factors policymakers and economists look at when debating the impacts of enacting minimum wage increases. In addition, it is a less ambiguous figure to evaluate in

terms of its potential relationship to the benefits or detriments of minimum wage laws as other variables such as changes in the poverty rate, strengthening the purchasing power for consumers, or reducing the dependence of social welfare services can be very complex to fully evaluate within a regression model. In many cases, the data can either be incomplete or incongruent for all the years needed for a robust and reliable analysis. Although those other societal economic factors are very interesting and play a key role in the overall debate of raising the minimum wage or not, the unemployment rate is a straightforward type of measurement. Those additional dynamics typically have many shades of grey and a plethora of interlinking components behind them. For example, when trying to assess if the law would help increase the purchasing power of individuals living on a minimum wage, a researcher would have to consider a host of different variables that may be measured inconsistently, unavailable for easy acquisition, or simply unknown. If people living on the minimum wage received higher wages and spent their increased earnings mostly paying down debt rather than purchasing more goods or services they actually needed, then the economic improvement effects might not be captured properly. Additionally, it is a common argument that as wages increase, so does the costs of doing business. Therefore, businesses may end up passing off the additional costs to the consumer through higher prices, which could actually undermine and negate some of the positive effects of the law on truly increasing purchasing power. How much prices exactly increase for what type of goods and how many businesses actually increase prices would be difficult to find. Another nuance to consider is that while large corporations could likely absorb the increased costs of higher wages as their capital is

much greater, smaller businesses that have a much tighter profit margin might have to increase prices to a larger degree to make ends meet. Collecting all of the data necessary to quantify just a few of the important considerations I listed above for each state within an extensive timeframe would be quite difficult. Furthermore, creating a model of analysis that can put it all together and appropriately measure the effects a minimum wage policy has on any of those types factors would be just as challenging and complex towards determining if a statistical relationship truly exists.

The unemployment rate on the other hand is consistently measured every month under similar standards and is available across a wide timeframe for every state. This makes analysis more reliable and reduces the potential of measurement errors, limitations, or biases within the study. I obtained information related to the unemployment rate from the United States Bureau of Labor Statistics (BLS) for the years 2010 to 2014. The unemployment numbers distributed by the BLS are the yearly average seasonally adjusted rates. The reason for choosing seasonally adjusted data over the raw data is that the BLS uses this measurement to smooth out the average month-to-month fluctuation in unemployment. Otherwise, the raw data would throw off the figures and could potentially cause misjudgment in the factors affecting unemployment at a given time. Specifically, seasonally adjusted data are important to utilize in regression analysis because some companies or industries substantially increase their hiring rates during specific seasons of the year, but then release a vast majority of those workers once the season has ended, therefore showing sharp increases and decreases in a very short time period. One example of this includes department stores hiring increasingly more stockers

in November and December in preparation for Black Friday and the Christmas holiday shopping sprees. Another example is when businesses hire teen workers during the summer while those teenagers are on vacation from school. When that particular season is over however, these firms reduce their payrolls, or, in the youth worker example, the student workers leave to go back to school. These ever-changing data could leave many analysts potentially making incorrect conclusions about the actual causes of unemployment (or employment), as there would be both upward and downward spikes during particular seasons. Overall, out of all the variables that I considered, the unemployment rate left me with the fewest concerns and was the easiest data to collect for each state and time period.

Unemployment Rate Model and Explanatory Variables

The three main themes that I expected to cause variation in a state's unemployment rate are: 1) state minimum wage policies; 2) state economic output; and 3) state education level. These three themes arose through my research of this topic and are a culmination of other researchers' theoretical frameworks that I described in Chapter 2. A fourth factor that I considered in my model is the demographics for each state. I did not include this factor as a major theme for my thesis because these are mostly just control variables and I wanted to focus my analysis on similar models that other researchers found to be the most influential elements within this topic. However, demographic factors are crucial to include in regression analysis as it helps create the different makeup of each individual state, allows for better apples-to-apples comparisons, and bolsters my ability to control for as many factors as possible that could alter unemployment.

The main goal of choosing all of my explanatory variables was to do my best to ensure that they represent the broad casual factors that could potentially cause variation in unemployment rates. The functional form of my unemployment rate model is as such:

State Unemployment Rate = f(State Minimum Wage Policies, State Economic Output, State Education Level, and State Demographics);

State Minimum Wage Policies = f(State wage rate either automatically indexed or fixed, fixed state wage amount higher than federal amount or not, state wage minimum wage as a % of the all industry mean state wage, right-to-work law enacted or not);

State Economic Output = f(Gross state product of potential minimum wage affected industries as a percentage total of the entire gross state product including: agriculture, manufacturing, retail trade, food services and accommodation, and government);

State Education Level = f(% high school diploma, % associates degree, % bachelor's degree, and % master's degree);

State Demographics = f(state civilian noninstitutionalized population, % male, % Hispanic or Latino, % Black or African America, % Asian, % people of two different races or more, % ages 15 to 19 years old, % ages 20 to 30 years old, % ages 40-59 years old, and % ages 60 or more years old)

For the state minimum wage policy function, the four variables were clear-cut and fit well within my research design. I want to note that in my original models I utilized the actual minimum wage amounts for all of the states from 2010 to 2014. When I was performing my regression analysis however, this variable never became significant and in some iterations, the variable sign would alter between increasing or decreasing unemployment within a wide range of different values. This problem was likely due to an omitted variable issue my data set was not fully capturing. An example of an omitted variable issue would be if states with high minimum wages also possess another uncontrolled for characteristic (perhaps a stronger overall economy) that is correlated along with it, thus driving lower unemployment. It was very important to me to have some type of variable that gauged the effect the actual minimum wage dollar amount had on unemployment because my other two variables were only dummy variables ("dummy" meaning there were only two options for the variable; i.e. 1 = indexed wage policy or 0 = fixed wage policy). After spending time researching other variables that could fill this void and help measure the policy effect more consistently, I found an article that analyzed the effect a minimum wage had on a city by dividing the minimum wage amount by the all industry median wage amount within the city (Scheiber, 2015b).

Mathematically, this would derive the percentage the minimum wage is towards the all industry median wage, which would show how close or far the minimum wage is to the average wage. Scheiber theorizes that as the minimum wage amount starts moving closer to the average median wage of a location, negative economic impacts would likely start occurring, such as increases in unemployment. Below in Figure 3.1, I display Schreiber's work that indicates how a $15 minimum wage would compare with a few notable U.S. city median wages in 2020:

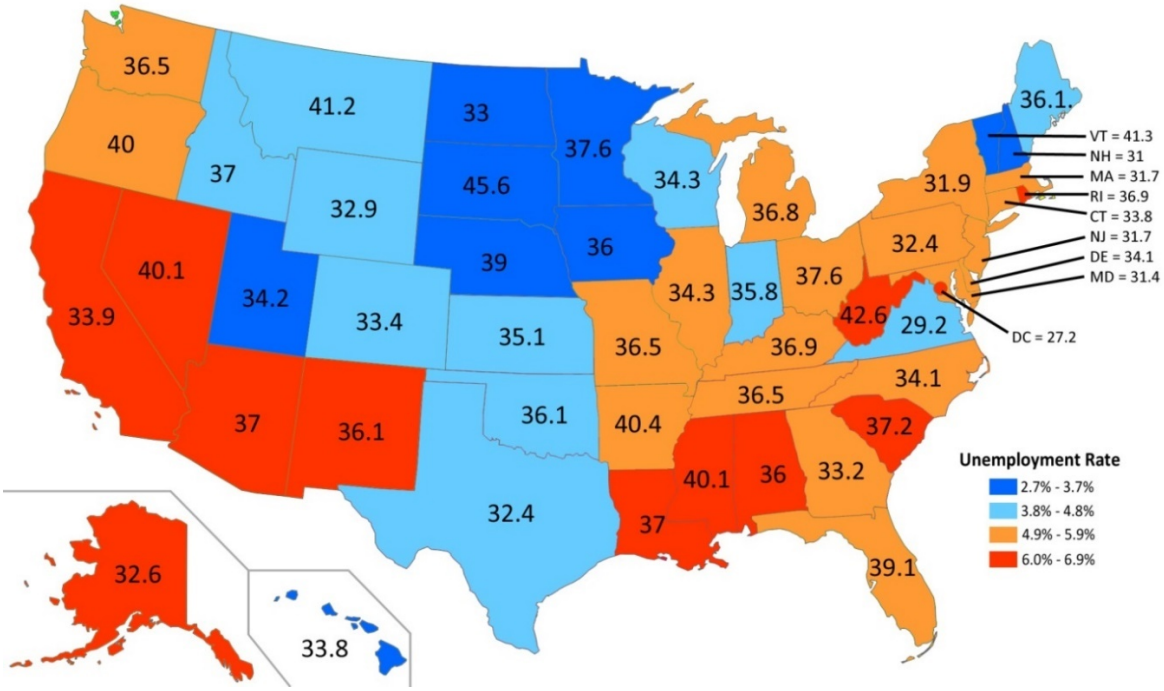
Figure 3.1: Regional Differences in City Minimum Wages Calculated as a Percentage of the All Industry Median Wage

Note: the median wage for 2020 calculated by Scheiber assumed 2% annual growth of the median wage for full-time workers.

(Source: Scheiber, 2015)

To test Scheiber's hypothesis further within my research design, I utilized a similar calculation, but for the state level. The only difference was that I used the average mean wage of all industries within the state instead of the all industry average median wage. Below in Figure 3.2, I provide some descriptive statistics on the minimum wage as a percentage of the all industry wage within each state during 2015 in comparison to the unemployment rates of 2015 as well:

Figure 3.2: State Minimum Wage Amounts as a Percentage of the All Industry Mean Wage in Comparison to the Unemployment Rates of Each State as of May 2015



Note: for comparison purposes, the all state average of the minimum wage as a percent of the all industry wage was 35.69%. The all state average unemployment rate was 5%.

(Source: Bureau of Labor Statistics, 2016)

The one policy that is not directly tied to wages, but could influence wage policy, is how strong union power is within a state. One way to measure the presence of this effect is to take into account if a state has a right-to-work policy or not. States that have a right-to-work policy generally have much weaker union power, which theoretically, could cause lesser representation for workers to push for policies that increase the minimum wage (or wage increases within specific industries) by ceding more power to the free market economy to determine wage amounts (Sherk, 2015). When looking at the California minimum wage policy and politics example in Chapter 1, the main factor that led to the Legislature and the Governor adopting the new minimum wage law was due to labor unions successfully qualifying a ballot initiative for the general election to raise the minimum wage. Furthermore, California is not a right-to-work state, which is one of the reasons why unions have a stronger role towards labor related matters. This is just one example of why I decided to include this type of policy as a variable within my regression design.

For each of my explanatory (independent) variables, I tried to remain consistent with sticking to specific government sources of information for the years 2010 to 2014. The state economic output GSP variables show the diversity of each state's individual economies with a focus on industries that are usually impacted by minimum wage policies. State education levels and the state demographic controls measure percentages of the population to account for differences in each category for each state. For all my state demographics (such as race, gender, age groups, and educational attainment), I used the American Community Survey (ACS), which is an ongoing survey undertaken by the

United States Census Bureau. The ACS surveys a representative simple random sample of people residing in each state every year to make yearly estimations about the population. I define "education attainment level" under the exact same categories the ACS uses: the percentage of those that have a high school diploma, an associates degree, a bachelor's degree, or a master's degree (respondents only claim their highest degree completed). For the education data, I only used the population estimations that were surveyed between the ages 25 or older because that way there would be more consistent data for each category. For example, by including the 19 to 24 year old age group, it is highly likely that a majority of those respondents would be in the midst of achieving an associates or bachelor's degree, but would have to mark themselves as "high school graduates only" when being surveyed. This could overestimate the effects the high school degree attainment level has towards unemployment. The only downside to condensing this variable is that my regression design could underestimate or overestimate the effects in other education attainment categories, leading to modeling errors in the analysis.

When assessing my age related demographic variables, I slightly modified the ACS age categories to have a wider range of ages in each category to reduce the number of categories within the data set. I created these larger population age clusters by simply adding the categories together when necessary. The benefit in doing this is that the regression analysis would have more focus on the general impacts demographic factors could have on unemployment. The age categories were so numerous that it could potentially lead to incorrect implications and conclusions on the true effects of certain age groups. For example, it would be difficult to fully determine discernable differences

between those in the 30-35 age category than those in the 36-40 age category. The downside to creating larger age clusters is that it could overgeneralize the population and could reduce my ability to see if certain smaller age ranges truly had a significant effect on unemployment rates. The ACS is one of the very few data sources with information about estimated demographics in percentage terms between the Census Bureau's 10-year constitutionally required population evaluations, which allows researchers to find more up-to-date information on state characteristics. The disadvantage to using this information is that it is only estimated data measured on a much smaller scale than the census. This could lead to an increase in modeling errors as it might not fully represent the targeted population. Lastly, the population data I gathered was the non-institutionalized population, which is composed of those who are ages 16 years or older, who are not active duty military members, and who are not residing with particular institutions such as prisons, mental health facilities, or assisted living. The purpose of using this version of population data is because it is a better gauge of those who are active participants in the workforce who are more likely actual residents within each state. One last nuance to mention is that for the population variable to not produce a modeling error under a fixed effects panel regression model, I had to divide the whole number of the population by a hundred thousand.

For my GSP by industry variables, I used the real data of 2009 adjusted for inflation dollars. The industries I chose were agriculture (which includes forestry, fishing, and hunting) manufacturing, retail trade, food service and accommodation, and government as prescribed by the Bureau of Economic Analysis (BEA). The data are

seasonally adjusted at annual rates within the yearly four quarters that were measured within the 2010 to 2014 timeframe. To get these data in percentage terms, I divided industry specific yearly GSP (adding all four quarters together) by the total yearly state GSP, and then multiplied by 100. My goal was to pick specific industry categories that minimum wage policies could have more of an impact on and that would at the same time give a solid snapshot of the economic demographic differences of each state to help reveal different economic relationships. I did not use all of the industry categories listed by the BEA because some industries did not make sense within my model or typically only have workers with much greater wages in general. However, by condensing the amount of categories available I could reduce my ability to fully capture the true economic makeup of a particular state and could create modeling errors concerning the true effect of state GSP on unemployment. In a larger future study, I would consider gathering more data on a few other industry categories to see if those commercial activities had a significant impact on the unemployment rate.

Lastly, for my state wage policy variables, I used the National Council of State Legislatures, the U.S. Bureau of Labor Statistics, and the U.S. Department of Labor's website to find the information related to the different wage polices, the all industry average mean wage amounts, and the right-to-work laws each state has. One important consideration is that for my state wage policy dummy variable, I broke it down into if a state has a static wage policy (0) or an automatically indexed wage variable policy (1). Doing this allowed me to measure if the policy type made a difference on unemployment rates. However, it is important to note that not all automatically indexed policies are the

exact same for each state. For example, Montana, Ohio, and Oregon just simply index the minimum wage through increases in the CPI (National Council of State Legislatures, 2016). Vermont calls for a 5% annual increase or an increase based on the CPI, whichever is less. Missouri allows for either increases or decreases in the wage amount, depending on the CPI, and is the only state to allow for a potential decrease in the minimum wage amount. The importance of noting these differences is that there could be modeling errors on the true effect of the indexing policy due to the mere fact that these laws differ slightly and are not exactly the same. As for the few states that have different tiers of minimum wages (due to particular exemptions), I always chose the highest wage available. For example, Nevada requires businesses without health insurance to pay a minimum wage of $8.25, while businesses that provide health insurance only have to pay the federal minimum wage of $7.25. Thus, in the case of my fixed wage dummy variable, I marked this state as a "1" instead of a "0" because the minimum wage is not solely based on just the federal minimum wage amount only.

Descriptive Statistics Summary

Table 3.3 below details the variables that I chose for this project. This table illustrates detailed information related to the mean, standard deviation, minimum amount, and maximum amount for each variable. The first three dummy variables under the state wage variables are in percentage form out of a maximum of 100%. This allows for better understanding of the percentage of states that fall into that particular category. The variable with the biggest numeric range is the population because it is a whole number. Agriculture shows a value of zero because the District of Columbia did not provide at

least $500,000 GSP output for that industry. Additionally, the states of Rhode Island and Delaware keep this economic information confidential. The state that has the race category “Asian” at a maximum of 38% is Hawaii. For the master’s (or professional) degree variable, it has a maximum of 32.4% within the populace of the District of Columbia. This may be due to the large number of people within the District pursuing advanced degrees or work as lawyers, lobbyists, or other professionals with employment related to federal government.

Table 3.3: Descriptive Statistics for All State Variables from 2010 to 2014

	Mean	Standard Deviation	Minimum	Maximum
Unemployment rate (%) ^	7.56	2.09	2.70	13.7
State Wage Variables				
Indexed state wage policy dummy*	0.20	0.40	0	1
Fixed state wage higher than federal wage dummy**	0.38	0.49	0	1
State minimum wage as % of average state wage	35.87	4.04	22.27	44.45
Right to work state dummy***	0.45	0.50	0	1
Economic Output Variables ^^				
Agriculture gross state product (%)	1.46	1.81	0	8.63
Manufacturing gross state product (%)	12.08	6.22	0.10	32.30
Retail trade gross state product (%)	5.99	1.36	1.10	8.57
Food service / accommodation gross state product (%)	3.05	1.80	1.82	14.55
Government gross state product (%)	14.19	4.29	8.99	35.46
Education Variables				
High school diploma (%)	29.08	4.19	17.70	41.6
Associates degree (%)	8.15	1.61	2.80	13.8
Bachelor's degree (%)	18.06	2.82	10.90	24.3
Master's degree (%)	10.82	3.70	6.30	32.4
State Demographic Variables				
Population**** (hundred thousands)	47.51	53.15	4.21	299.94
Male (%)	49.33	0.81	47.30	52.6
Hispanic or Latino (%)	10.90	9.93	1.10	47.3
Black or African American (%)	10.90	10.81	0.30	50.5
Asian (%)	3.74	5.35	0.50	38
People of two different races or more (%)	2.47	2.62	0.90	19.7
Ages 15 to 19 years old (%)	6.95	0.36	5.90	8.1
Ages 20 to 39 years old (%)	26.66	2.20	22.70	39
Ages 40 to 59 years old (%)	27.57	1.66	21.40	31.9
Age 60 or more years old (%)	19.35	2.14	12.20	24.3

Sources: Bureau of Labor Statistics, Bureau of Economic Analysis, Department of Labor, National Council of State Legislatures, American Community Survey (Census Bureau).

Notes: Unweighted N=255, 50 states and District of Columbia from 2010 - 2014.

^ The unemployment rate was seasonally adjusted.

^^ State GSP output variables are calculated as percentage of a state's total GSP output

* State has either a fixed dollar amount (0) or a yearly variable indexed amount wage law (1).

** State has the federal min. wage (0) or has a fixed min. wage higher than the federal min. wage, not indexed (1).

*** State allows unionization (0) or a state has a "right to work law" prohibiting unionized bargaining (1).

**** Population = 16 years or older, not institutionalized, and not Active Military.

Regression Model and Expected Direction of Variable Effects

Since my data covers the years 2010 to 2014 for all 50 states and the District of Columbia, I will be utilizing a panel data linear regression model with fixed effects to evaluate how my independent variables affect the unemployment rate over different periods of time and location. The panel data linear regression model with fixed effects can control for variables that you may not be able to measure or observe. Some of these factors could be cultural or historical, the difference in business hiring practices across companies in individual states, or variables that change over time but not across entities, such as particular alterations in state laws and regulations in some states but not others (Torres-Reyna, 2007). A panel data linear regression model also helps to account for heterogeneity, which is when excessive variation exists within a large data set of diverse variables. This allows my regression analysis to more accurately capture the potential effects of different minimum wage laws on unemployment rates over time for each state.

Lastly, Table 3.4 below shows the potential cause and effect each variable could have on the unemployment rate of a state:

Table 3.4: Projected Variable Effects on State Unemployment Rates

Potential Cause and Effect Table	
Positive effect = + Negative Effect = - Uncertain Effect = ?	
Note: + = increase in unemployment, - = decrease in unemployment	
CAUSE	**EXPECTED EFFECT**
State Wage Variables	
Indexed State Wage Policy Dummy	+
Fixed State Wage Higher than Fed. Dummy	+
State Minimum Wage as % of Avg. State Wage	-
Right to Work Law Dummy	?
Economic Output Variables	
Agriculture Gross State Product (GSP)	-
Manufacturing GSP	-
Retail Trade GSP	-
Food Services and Accommodation GSP	-
Government GSP	-
State Education Variables	
High School Diploma	-
Associates Degree	-
Bachelor's Degree	-
Master's Degree	-
State Demographic Variables	
Population	?
Male	?
Hispanic or Latino	?
Black or African American	?
Asian	?
People of Two Different Races or More	?
Ages 15 to 19 Years Old	+
Ages 20 to 39 Years Old	?
Ages 40 to 59 Years Old	?
Ages 60 or More Years Old	?

As outlined in my introductory chapter, some economic theory generally suggests that the higher the minimum wage, the higher the unemployment rate. Additionally, more than half of the studies in my literature review chapter indicated that minimum wage laws led to increases in unemployment rates. Therefore, for this thesis, I estimate most of the wage policy variables could lead to an increase in unemployment. Sherk (2015) suggests that the right-to-work policy would theoretically lean more toward decreasing unemployment due to businesses having more power in the state, but I could not find a definitive answer on this within my research that did not come from a conservative think tank, so I left that variable's effect as uncertain. The state economic output variables should lead to decreases in unemployment because economic theory states that strong economic output should correlate to unemployment. Greer et al. (2011) from my literature review discusses how unemployment rates correlate with the pre-recession, recession, and post-recession periods of the Great Recession. For the state education level variables, I believe the higher the education level, the more marketable a person will be in terms of being able to obtain a job. Therefore, not having a degree would increase unemployment while states with more people having advanced college degrees within its population would have a decrease in unemployment. Although the research in my literature review could not find any correlational effects that were either positive or negative concerning education levels and unemployment rates (Pedace and Rohn, 2011; Abdeljawad et al. 2014), I have a more robust model testing those relationships. I left almost all of the state demographic variables as uncertain, as none of the research I investigated discussed these variables in detail in terms of the effect on unemployment.

The one variable that some of the research showed towards likely increasing unemployment would be a state that has a higher population of 15 to 19 year olds, which also makes intuitive sense as that would be the population most likely unemployed. In the next chapter I will discuss the statistical outputs from my model concerning all of the variables discussed in this chapter.

Chapter 4

REGRESSION RESULTS

For this chapter, I will discuss the technical details concerning the fixed-effects panel data regression model I used to analyze the data. The primary focus is to see how different variables affect the unemployment rate of a state. First, I will describe the statistical tests I performed on my data to determine if there were any technical issues or concerns with the variables I used in the regression model. If a particular statistical issue arose, I will discuss if it is a concern and will demonstrate how my model accounts for any potential problems. Second, I will outline the process I used step-by-step on conducting my panel data regression model analysis and point out critical information important to the reader throughout the discussion to show why certain steps were performed. Lastly, I will show all of my results, describe the negative or positive effects of statistically significant variables, and outline any important considerations in my regression that will affect the policy implications in Chapter 5.

As discussed in Chapter 3, the model I used is a fixed-effects panel data regression model. The purpose of using this model in comparison to a standard ordinary least squares model is that it allows me to isolate the effects of time and the intrinsic differences in individual state characteristics as much as possible. Specifically, this type of model will allow me to capture changes in state minimum wage laws, economic production, education attainment levels, and key demographics from 2010 to 2014 for each state. The purpose of this regression design is that it can calculate if a particular

variable will either potentially increase or decrease the unemployment rate of a state, holding all factors constant. I used the statistical calculation program STATA version 13 to determine my results and to execute all of my tests, which I describe in detail in the next few sections below.

Multicollinearity and the Variance Inflation Factors Test

Multicollinearity is a statistical error in which two or more predictor variables in a multiple regression model are highly correlated, leading to potential erroneous conclusions about the nature of these variables influencing the target dependent variable. Most importantly, it biases the regression coefficient's standard error calculated for this dependent variable up, while biasing the t-statistic down; thus likely leading observers to conclude there is a lack of statistical significance when in fact it exits. To assess for the possibility of multicollinearity, I utilized a Variance Inflation Factor (VIF) test, as seen in Table 4.1 below. A value above 5.0 should be construed as possibly exerting multicollinearity bias. As the value for a variable increases above the 5.0 level, the effects of multicollinearity potentially present increase for that variable.

Table 4.1: Variance Inflation Factors of Independent Variables

Multicollinearity Test (VIF)		
Independent Variable Names	**VIF**	**1/VIF**
Master's Degree	18.76	0.053
Ages 20 to 39 Years Old	17.85	0.056
Asian	12.86	0.078
People of Two Different Races or More	12.45	0.080
Ages 60 or More Years Old	11.28	0.089
High School Diploma	9.84	0.102
Male	9.44	0.106
State Minimum Wage as % of Average State Wage	9.22	0.108
Bachelor's Degree	8.24	0.121
Ages 40 to 59 Years Old	6.9	0.145
Black or African American	6.37	0.157
Government GSP	5.86	0.171
Hispanic or Latino	5.53	0.181
Retail Trade	4.37	0.229
Associates Degree	4.32	0.232
Food Services and Accommodation GSP	3.64	0.275
Right to Work Law Dummy	3.55	0.281
Population	3.5	0.285
Ages 15 to 19 Years Old	3.44	0.291
Agriculture GSP	3.23	0.309
Fixed State Wage Higher than Federal Wage Dummy	2.86	0.349
Manufacturing GSP	2.86	0.350
Indexed State Wage Policy Dummy	2.41	0.415
Mean VIF	**7.34**	

The above test shows that a little less than two-thirds of my variables may exhibit the potential for some form of multicollinearity. Ten variables are under 5.0 showing very little potential for multicollinearity, eight variables have a low-to-medium potential for multicollinearity (5.1 to 9.9), and the remaining five variables have a medium-to-high

level of potential multicollinearity present (10.0 or greater). Although there are many variables with some form of multicollinearity potentially present, it is important to note that the key explanatory variables were found to have very little potential multicollinearity (e.g. Index State Wage Policy and Fixed State Wage Policy Dummy variables).

To further analyze multicollinearity in my model, I performed a pairwise correlation coefficient analysis, which measures exactly how each variable is correlated with every other variable in the data set. Table A.1 located in Appendix A encompasses all correlation coefficients between all variables, indicating statistical significance at the 99%, 95%, and 90% levels. As two variables register closer to 1.0, the more those variables move together in the same direction. So as one unit or percent increases, so does the other corresponding unit along with it. However, if the number is closer to -1.0, the variables run in opposite directions; so as one variable increases, the other decreases. Numbers that are in bold indicate that a set of variables are correlated at the .80 (or -.80) level or higher, which indicates the partial correlation between two explanatory variables is potentially great enough to generate multicollinearity. When analyzing variables equal to or above .80 (or -.80 respectively), it is important to see if the number is both highly correlated and at least statistically significant at the 90% level.

The only variables that I found to be above the .80 threshold was the correlation between the state demographics of the population percentage that identifies to be Asian or those who identify to be of two races or more. For this thesis, I will simply make the reader aware that I tested and found some multicollinearity to be present, but will not

alter my model to attempt to fix it as I would potentially lose key state variables for my study. Deleting these variables could reduce the effectiveness of my model towards determining unemployment rate effects, could cause me to make erroneous conclusions about the results of my regression analysis, or could expose my study to omitted variable bias issues.

Heteroskedasticity and the Breusch-Pagan/Cook-Weisberg Test

Heteroskedasticity occurs when the variables in the data set have a high degree of unequal variance. For example, there would be a large heteroskedastic effect when comparing variables from the State of California to the State of Delaware, as those states vary greatly in size, economic production, population, and other key factors. Heteroskedasticity is a problem because comparing all these vastly different independent variables for both of these states together would lead to a faulty regression model implying that it can truly estimate or predict the dependent variable for either state. So theoretically, although the regression itself would indicate there were no problems on the surface when looking at the numbers, I would falsely conclude that the factors that affect California's unemployment rate would also be the same factors that would have an equal effect on Delaware's unemployment rate.

To test for heteroskedasticity, I used the Breusch-Pagan/Cook-Weisberg test, which analyzes the entire data set and determines if there is a pattern of large variance among different variables. If the test is significant with a 95% level of confidence (0.05 or lower), then I can conclude that my data set has heteroskedasticity. Table 4.2 below shows the results of the test:

Table 4.2: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

Ho: Constant variance (0.05 or >)
Variables: fitted values of unemployment rate
chi2(1) = 6.48
Probability > chi2 = 0.0109

Since my result was .0109, it is below the .05 threshold, therefore confirming that my data set clearly has heteroskedasticity. Although heteroskedasticity exists in my model, I corrected for this problem in my fixed-effects panel data regression model by running a command that helps maintain constant variance for all factors for each state. Correcting for heteroskedasticity is necessary as it allowed me to make better apples-to-apples comparisons on factors that affect unemployment, rather than an apples-to-oranges comparison if heteroskedasticity was left uncorrected when comparing the states.

Fixed Effects or Random Effects Model with the Hausman Specificity Test

When using a panel data set regression model, I had to first determine if my data set had fixed effects or random effects. Fixed effects is when a covariate (such as a state) has an independent variable that is particularly consistent for each time instance accounted for (such as the measurement of a year). Random effects however are when the covariates have independent variables that have little consistency over a particular time frame. When setting up a panel data set regression, I must first set my state identification parameters (1-51, representing all 50 states and Washington D.C., e.g. Alabama = 1, Alaska = 2, etc.) and my timeframe identification parameters (1-5, representing the years of 2010 to 2014, e.g. 2010 = 1, 2011 = 2, etc.). Table 4.3 below shows this process and

additionally identifies that the variables within my panel parameters are strongly balanced.

Table 4.3: Panel Data Model Parameters

Panel Variable: StateID *(Strongly Balanced)*
Time Variable: YearID, 1 to 5
Delta: 1

It is important for the model to have strong balance because it ensures that the state data I collected for each state is present for each year being measured. In other words, I did not have any instances where some state variables had information while others did not (i.e. unbalanced is if I recorded Alabama's 2010 manufacturing GSP, but not Alaska's). Having a strongly balanced data set also increases the ability for my regression model to more accurately estimate the effect a particular state independent variable will have on the unemployment rate of a state because full comparisons can be made between each state for each year for each variable.

I then utilized commands to set up both a fixed effects regression model and a random effects regression model, storing the results for each model separately. To see the results of each uncorrected model, please review Table B.1 and Table B.2 in Appendix B at the end of this thesis. To test for which model would be best, I performed the Hausman Specificity test, which compares the coefficients of both the fixed effects model and the random effects model to determine which type of panel data set would be the best form of analysis. A result of 0.05 or higher on the Hausman test would indicate that the differences in the coefficients are not systematic, therefore meaning that a random effects

model would be the better format to use to estimate unemployment effects. However, in Table 4.4 below, the result from the Hausman test was 0.000, indicating that my coefficients are very systematic and that I would need to use a fixed effects regression model.

Table 4.4: Hausman Specificity Test

b = Consistent under H0 and Ha; Obtained from xtreg
B = Inconsistent under Ha, efficient under Ho; Obtained from regress
Test: Ho = Difference in coefficients are not systematic (.05 or >)
Chi2(25) = (b-B)'[(V_b-V_B)^(-1)] (b-B)
Probability > Chi2 = 0.0000
(V_b-V_B is not positive definite)

The Hausman test made theoretical sense as the data from each year I gathered was more or less systematic each year, showing subtle differences in how variables would change year-to-year. A more detailed version of Table 4.4 showing all of the coefficient differences is located in Appendix B (noted as Table B.3). Although the Hausman test gave confirmation that I would indeed be using a fixed effects panel data set regression model, I also needed to perform the Woolridge test to determine if autocorrelation is present before proceeding to my final regression.

Autocorrelation and the Woolridge Test

Autocorrelation is a concern in a regression model containing a time series with multiple independent variables. When autocorrelation is present, results might indicate that certain variables are highly correlated because the system assumes that since the variables are very close in variance year-to-year, the variables must automatically correlate to one another. Using a fixed effects time series data set strongly increased the

likelihood that my statistical model would suffer from autocorrelation effects. To assess my model for autocorrelation, I performed the Wooldridge test, and if the result of the test registers equal to 0.05 or greater, then there is no autocorrelation present. However, in Table 4.5 below, the Wooldridge test indicates that my regression model has autocorrelation because the statistic was 0.0001, meaning that my data in one year was essentially automatically correlated with data to the following year if left uncorrected.

Table 4.5: Woolridge Test for Autocorrelation in Panel Data

H0: no first order autocorrelation (.05 or >)
F(1, 50) = 17.253
Probability > F = 0.0001

After I finally finished testing for the most common problematic regression concerns of multicollinearity, heteroskedasticity, systematic variance (fixed versus random effects), and autocorrelation, I was able to produce my final results through the Prais-Winsten model.

Final Results with the Prais-Winsten Regression Model

The purpose of using the Prais-Winsten regression model is that it corrects for heteroskedasticity and autocorrelation, which were my two last remaining issues that needed to be corrected for my final results. Table 4.6 below shows the results of the regression:

Table 4.6: Prais-Winsten Regression, Heteroskedastic Panels Corrected Standard Errors

Group Variable: State Identification Number (50 States and DC)	Number of Observations: 255
Time Variable: Year Identification Number (Years 2010 - 2014)	Number of Groups: 51
Panels: Heteroskedastic, Balanced	Observations per Group: 5
Autocorrelation: Common AR(1)	Min = 5, Max = 5, Avg = 5

Estimated covariances = 51	R-squared = 0.8404
Estimated autocorrelations = 1	Wald chi2 (26) = 501.92
Estimated coefficients = 28	Probability > chi2 = 0.00

Dependent Variable = Unemployment Rate						
Independent Variables	**Coefficients**	**Standard Errors**	**z**	**P>|z|**	**95% Confidence Interval**	
State Wage Policy Variables						
Indexed State Wage Policy Dummy	0.6919363	0.3931236	1.76	0.078	-0.0785719	1.462444
Fixed State Wage Higher than Federal Wage Dummy	0.2009998	0.2743063	0.73	0.464	-0.3366306	0.7386302
State Minimum Wage as % of Average State Wage	-1.191892	0.449695	-2.65	0.008	-2.073278	-0.3105057
State Wage Average Amount Squared	0.0154878	0.0061233	2.53	0.011	0.0034864	0.0274893
Right to Work Law Dummy	-0.7971672	0.3392084	-2.35	0.019	-1.462003	-0.1323311
Economic Output Variables						
Agriculture Gross State Product (GSP)	-0.3169813	0.1887991	-1.68	0.093	-0.6870206	0.0530581
Agriculture GSP Squared	0.0328451	0.0186018	1.77	0.077	-0.0036137	0.0693039
Manufacturing GSP	0.059033	0.026058	2.27	0.023	0.0079604	0.1101057
Retail Trade GSP	-1.091424	0.3540917	-3.08	0.002	-1.785431	-0.3974174
Retail Trade GSP Squared	0.0914081	0.0350908	2.6	0.009	0.0226314	0.1601848
Food Services and Accommodation GSP	0.1643851	0.1275684	1.29	0.198	-0.0856444	0.4144146
Government GSP	0.0537402	0.0509912	1.05	0.292	-0.0462007	0.153681
State Education Variables						
High School Diploma	-0.270397	0.0663094	-4.08	0	-0.4003611	-0.1404328
Associates Degree	-0.3397419	0.1121509	-3.03	0.002	-0.5595536	-0.1199302
Bachelor's Degree	-0.3900949	0.0856738	-4.55	0	-0.5580124	-0.2221774
Master's Degree	-0.4680538	0.0998	-4.69	0	-0.6636582	-0.2724493
State Demographic Variables						
Population	2.13E-07	8.00E-08	2.67	0.008	5.67E-08	3.70E-07
Population Squared	-9.1E-15	2.86E-15	-3.18	0.001	-1.47E-14	-3.49E-15
Male	-0.5917523	0.2581658	-2.29	0.022	-1.097748	-0.0857566
Hispanic or Latino	-0.006335	0.0233793	-0.27	0.786	-0.0521577	0.0394877
Black or African American	-0.0305679	0.0199972	-1.53	0.126	-0.0697618	0.0086259
Asian	0.1739706	0.0526847	3.3	0.001	0.0707105	0.2772307
People of Two Different Races or More	-0.3584391	0.0996015	-3.6	0	-0.5536545	-0.1632237
Ages 15 to 19 Years Old	1.855526	0.4523195	4.1	0	0.9689957	2.742056
Ages 20 to 39 Years Old	0.35676	0.1687315	2.11	0.034	0.0260523	0.6874677
Ages 40 to 59 Year Old	0.586006	0.1406612	4.17	0	0.3103152	0.8616968
Ages 60 or More Years Old	0.0527721	0.1349325	0.39	0.696	-0.2116908	0.317235
_cons	44.02679	22.0306	2	0.046	0.8476183	87.20596
rho = .5380654						

The first component of this result is that the R-squared value is very high at 0.8404. This means that the variables fit very well together within the entire model and that the model can explain 84% of the variance in the data. When looking at the regression, the other two important factors to look at are the Coefficients and the P>|z| results. The coefficient column indicates the effect each variable has on the unemployment rate. A positive number in this category indicates that unemployment is increased by the variable for each unit increase in the coefficient. A negative number shows that the variable decreases unemployment for each unit increase in the coefficient. The number itself in that column shows how much that variable would increase or decrease a state's unemployment rate. For example, when looking at the first variable of Indexed State Wage Policy Dummy, it shows that if a state that has an indexing minimum wage policy in effect, that policy will on average increase a state's unemployment rate by 0.69%. To put this in perspective, the average unemployment rate in this data set (2010-2014) was 7.56% and the standard deviation was 2.09%. Thus, if a state currently has the average 7.56% unemployment and chose to adopt an indexing minimum wage policy (and holding all factors constant), the unemployment rate could rise to 8.25%.

The second most important statistic to look at is P>|z|, which indicates if the variable is statically significant and can with a high degree of confidence predict the probability that the coefficient has an effect on unemployment. Any value of z above 0.10 (90% confidence) means the coefficient is not statistically significant, and indicates that I cannot conclude this variable accurately predicts unemployment. Variables between .10 and .051 are borderline statistically significant at a moderate level. If a variable is equal

to or below .05 (95% confidence), this indicates that there is a very strong statistically significant relationship. Below in Table 4.7, I put together the most statistically significant variables in order of the largest positive effect to largest negative effect a particular variable has on influencing unemployment.

Table 4.7: Statistically Significant Variables in Order of Largest Positive Influence to Largest Negative Influence on Unemployment

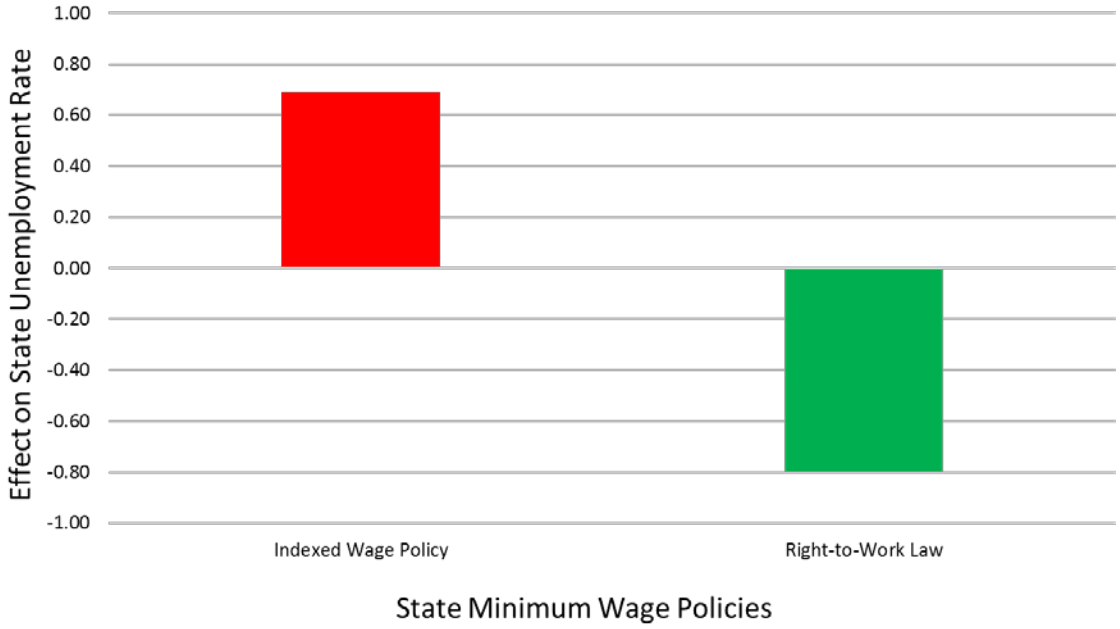
Independent Variable Names	Coefficients	Standard Errors	z	P>|z|	95% Confidence Interval	
Ages 15 to 19 Years Old	1.86	0.45	4.1	0	0.969	2.742
Indexed State Wage Policy Dummy	0.69	0.39	1.76	0.078	-0.079	1.462
Ages 40 to 59 Years Old	0.59	0.14	4.17	0	0.310	0.862
Ages 20 to 39 Years Old	0.36	0.17	2.11	0.034	0.026	0.687
Asian	0.17	0.05	3.3	0.001	0.071	0.277
Retail Trade GSP Squared*	0.09	0.04	2.6	0.009	0.023	0.160
Manufacturing GSP	0.06	0.03	2.27	0.023	0.008	0.110
Agriculture GSP Squared*	0.03	0.02	1.77	0.077	-0.004	0.069
Population*	0.02	0.008	2.67	0.008	0.006	0.037
State Min. Wage as % of Avg. State Wage Sq.*	0.015	0.01	2.53	0.011	0.003	0.027
Population Squared*	-0.00009	0.00003	-3.17	0.002	-0.0002	-0.00003
High School Diploma	-0.27	0.07	-4.08	0	-0.400	-0.140
Agriculture GSP*	-0.32	0.19	-1.68	0.093	-0.687	0.053
Associates Degree	-0.34	0.11	-3.03	0.002	-0.560	-0.120
Bachelor's Degree	-0.39	0.09	-4.55	0	-0.558	-0.222
Master's Degree	-0.47	0.10	-4.69	0	-0.664	-0.272
Right to Work Law Dummy	-0.80	0.34	-2.35	0.019	-1.462	-0.132
Retail Trade GSP*	-1.09	0.35	-3.08	0.002	-1.785	-0.397
State Minimum Wage as % of Avg. State Wage*	-1.19	0.45	-2.65	0.008	-2.073	-0.311

**Note: the coefficient effect for any variable that has a corresponding squared variable does not directly effect unemployment in the same way as the other variables do. A calculation between the original non-squared variable affect along with the squared variable effect must be paired together to show the true estimation of what the effect will have on unemployment (i.e. Agriculture GSP and Agriculture GSP Sq. must be utilized together along with an estimated Agriculture GSP output % to see what the effect that % will have towards unemployment)*

Table 4.7 illustrates that the variable “Ages 15 to 19 Years Old” has the highest positive relationship with unemployment, meaning that states that have a higher percentage of the population that is between the ages of 15 to 19 years old experience a 1.86% increase of statewide unemployment for every 1% increase of that variable. The strongest negative relationship to unemployment is the variable “Right to Work Law Dummy” which decreases unemployment by 0.80% in states that have this policy in place. Although the “Retail Trade GSP” and “State Minimum Wage as % of Avg. State Wage” variables show a stronger negative coefficient, these variables are quadratic, meaning that the relationship can either increase or decrease unemployment depending on where the base value is in comparison to the inflection point. These types of variables must be paired with the corresponding squared variables in an equation to determine what the true effect on unemployment will be. I will spend the rest of Chapter 4 discussing the above results in relation to the three themes outlined in this paper: state minimum wage policies, state GSP output, and state education attainment level.

State Wage Policy Variable Results

Figure 4.1: Statistically Significant State Wage Policy Variables Comparison



Note: statistically significant squared values and the corresponding non-squared values are not included in the above figure because those individual variables do not directly affect unemployment until calculated together.

Table 4.8: State Wage Policy Variables in Order of Largest Positive Influence to Largest Negative Influence on Unemployment

State Wage Policy Variables	Coefficients	Standard Errors	z	P>|z|	95% Confidence Interval	
Indexed State Wage Policy Dummy	**0.69**	0.39	1.76	0.078	-0.079	1.462
Fixed State Wage Higher than Fed. Dummy***	**0.20**	0.27	0.73	0.464	-0.337	0.739
Right to Work Law Dummy	**-0.80**	0.34	-2.35	0.019	-1.462	-0.132
State Minimum Wage as % of Avg. State Wage	**-1.19**	0.45	-2.65	0.008	-2.073	-0.311
State Min. Wage as % of Avg. State Wage Sq.	**0.02**	0.01	2.53	0.011	0.003	0.027

*** Indicates that a variable is not statistically significant at the 90% confidence level (P>|0.10|)

Note: squared values are purposely out of order because those values must be paired with the non-squared values in an equation to determine what the effect will be on unemployment.

Four out of the five variables in this category were statistically significant at the 90% confidence level. For this theme, the variable that had the highest positive effect on increasing unemployment was the instance where a state had an indexed minimum wage policy in place. Therefore, if a state has a COLA-type of minimum wage policy that is indexed yearly, that state experiences an increase of 0.69% unemployment compared to states that do not have a COLA in place. The variable with strongest direct negative effect on unemployment was if a state has a right-to-work law policy in place or not.

One of the most interesting variables in this regression analysis was the result of the state minimum wage as a percentage of the all industry average state wage. The purpose of applying the squared value to this variable was to determine if the relationship was quadratic or not. If I did not include the squared value of this variable in my regression, I would have made the incorrect conclusion that as the percentage of the state minimum wage towards the state average wage rises, unemployment would continually decrease at a rate of 1.19%. However, by mathematically utilizing both the standard coefficient form and squared form of this variable in an equation, I was able to determine an inflection point to where this variable can either increase or decrease unemployment, depending on where the value of the variable is in terms of that inflection point. The inflection point in this model is when a state's minimum wage becomes 38.45% of the all industry average state wage. Visually speaking, that means in a diagram with the unemployment rate variable on the Y axis and the "State Minimum Wage as % of Avg. State Wage" variable on the X axis, this relationship looks like a valley. The valley reaches its minimum at the inflection point of 38.45%. Thus, a rise in this percentage

beyond the inflection point is expected to raise unemployment at a positive and increasing rate. For instance, when this variable is one standard deviation (4.04) from the mean (35.87%), which is 39.91%, a one percent rise (40.91%) is expected to increase unemployment by 0.06%. When this variable is two standard deviations from the mean (43.95%), a one percent rise (44.95%) is expected to increase unemployment by 0.22%. The formula for determining the effect that this variable will have on unemployment when moving from different data points is as follows:

X= Standard non-squared coefficient of variable
Y = Squared term coefficient of variable
Z1 = Base value of the minimum wage as a percent of the average mean wage
Z2 = Estimate value of the new minimum wage as a % of the avg. mean wage

$$(X*Z1) + (Z1*Z1)*Y = A$$
$$(X*Z2) + (Z2*Z2)*Y = B$$

A – B = Increase or decrease in unemployment rate with the new estimate value

For comparison purposes, Table 4.9 below shows the 11 states between the years 2010 and 2014 that on average had a minimum wage amount that was greater than the 38.45% inflection point of the all industry wage average amount:

Table 4.9: States with Minimum Wage Amounts Over 38.45% of Average Industry Wage Between 2010-2014

State Name	Min. Wage % of All Wages	Unemp. Rate
Arkansas	41.01	7.54
Idaho	38.84	7.38
Mississippi	42.67	9.3
Montana	41.57	6.22
Nevada	40.24	11.36
Oklahoma	38.70	5.7
Oregon	40.31	8.98
South Carolina	38.92	9.34
South Dakota	42.01	4.36
Vermont	40.18	5.16
West Virginia	40.97	7.64
Sample Average	**40.49**	**7.54**
All State Average	*35.87*	*7.56*

Note: each value is calculated as the average value between the years 2010–2014.

(Source: Bureau of Labor Statistics, 2016; Department of Labor 2016)

The only variable that was not significant, meaning that the relationship is not statistically strong enough for me to conclude it has an effect or not, is if a state has a fixed minimum wage that is higher than the federal minimum wage. This means that the effect of a state legislature having the ability to control the minimum wage could not be determined with this model.

State Economic Output Variable Results

Figure 4.2: Statistically Significant State Manufacturing GSP Variable

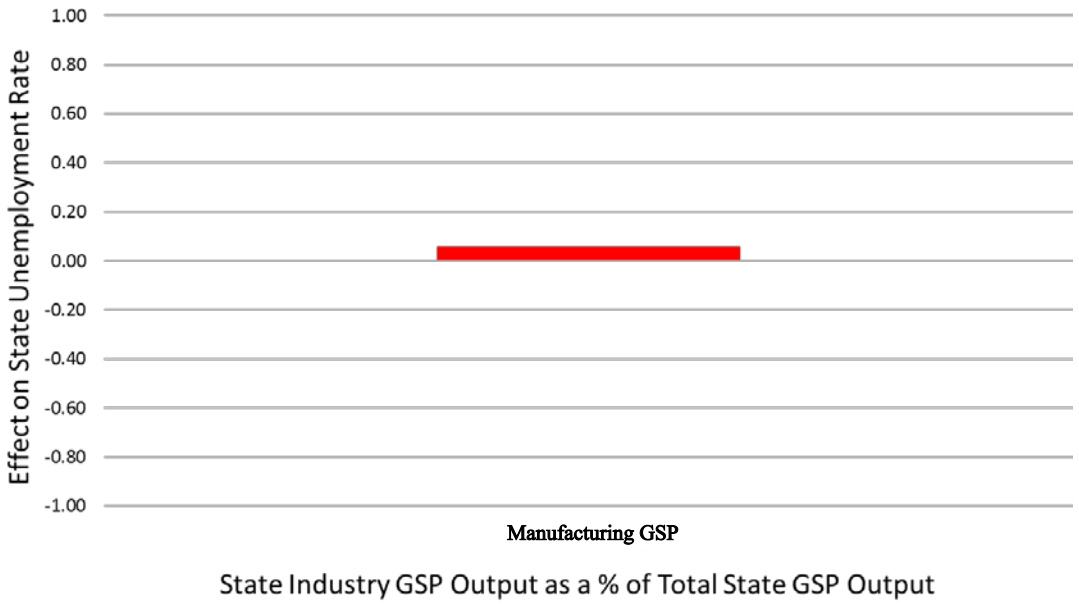


Table 4.10: State GSP Variables in Order of Largest Positive Influence to Largest Negative Influence on Unemployment

Economic Output Variables	Coefficients	Standard Errors	z	P>|z|	95% Confidence Interval	
Food Services and Accommodation GSP***	0.16	0.13	1.29	0.198	-0.086	0.414
Manufacturing GSP	0.06	0.03	2.27	0.023	0.008	0.110
Government GSP***	0.05	0.05	1.05	0.292	-0.046	0.154
Agriculture GSP	-0.32	0.19	-1.68	0.093	-0.687	0.053
Agriculture GSP Squared	0.03	0.02	1.77	0.077	-0.004	0.069
Retail Trade GSP	-1.09	0.35	-3.08	0.002	-1.785	-0.397
Retail Trade GSP Squared	0.09	0.04	2.6	0.009	0.023	0.160

*** Indicates that a variable is not statistically significant at the 90% confidence level (P>|0.10|)

Note: squared values are purposely out of order because those values must be paired with the non-squared values in an equation to determine what the effect will be on unemployment.

Five out of seven variables in this theme were significant. The one variable that had a direct positive effect on unemployment is if a state had a higher percentage of manufacturing GSP in comparison to its total GSP output. In this instance, states experienced an increase of unemployment by 0.06%. When including the squared values for both the agricultural industry and the retail trade industry, I was able to determine that these GSP variables are a valley type of shape as well. This means that as the percentage of an industry specific GSP rose in terms of a state's total GSP output, the variable would increase unemployment. The inflection point thresholds are just 4.83% for agricultural GSP and 5.97% for retail trade GSP. Thus, once agricultural GSP rises above 4.83% of total state GSP and retail trade rises above 5.97% of total state GSP, unemployment will increase. Utilizing the same equation described above in the previous section will provide the different outcomes on unemployment when moving from one GSP percentage output to a different GSP percentage output. Lastly, the two variables that were not statistically significant in this model were food services and accommodation GSP, and government GSP.

State Education Level Variable Results

Figure 4.3: Statistically Significant State Education Variables Comparison

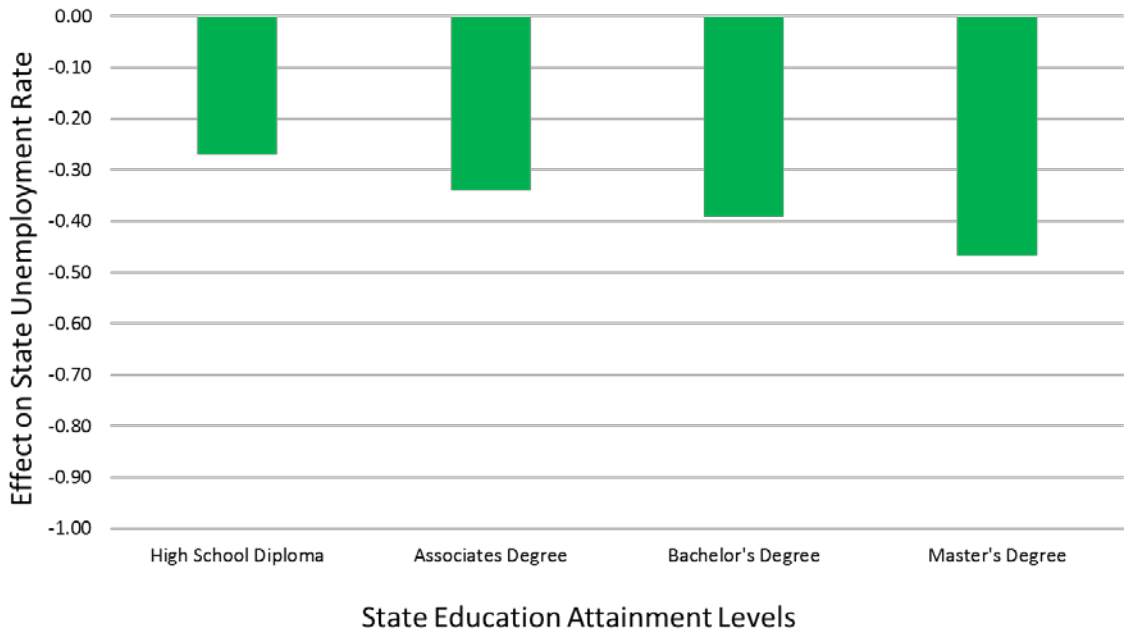


Table 4.11: State Education Variables in Order of Largest Positive Influence to Largest Negative Influence on Unemployment

State Education Variables	Coefficients	Standard Errors	z	P>|z|	95% Confidence Interval	
High School Diploma	**-0.27**	0.07	-4.08	0	-0.400	-0.140
Associates Degree	**-0.34**	0.11	-3.03	0.002	-0.560	-0.120
Bachelor's Degree	**-0.39**	0.09	-4.55	0	-0.558	-0.222
Master's Degree	**-0.47**	0.10	-4.69	0	-0.664	-0.272

All four variables in this theme were highly statistically significant and led to a decrease in statewide unemployment. The most interesting factor with these data is that as a state's population becomes more educated, the unemployment rates decrease in stronger amounts as well per category. Thus, the percentage of the population at least having a high school diploma will decrease unemployment by 0.27%, but if a state has a higher percentage of those with Master's degrees, unemployment decreases much more strongly at 0.47%, which constitutes a 0.20% difference just in that category alone. It is important to note that a base category of the data was left out of the regression to avoid multicollinearity and to create a comparison point. In the case of this theme, the variable that was not included was the percentage of the population above the age of 25 years old who did not have a high school diploma (or GED equivalent) in a state. The above regression shows that as the percentage of a state's population attains higher levels of education above the base (not having at least a high school diploma), the more powerful the negative effect will be on decreasing unemployment. This was the only theme where each variable was statistically significant.

State Demographic Variable Results

Figure 4.4: Statistically Significant State Demographic Variables Comparison

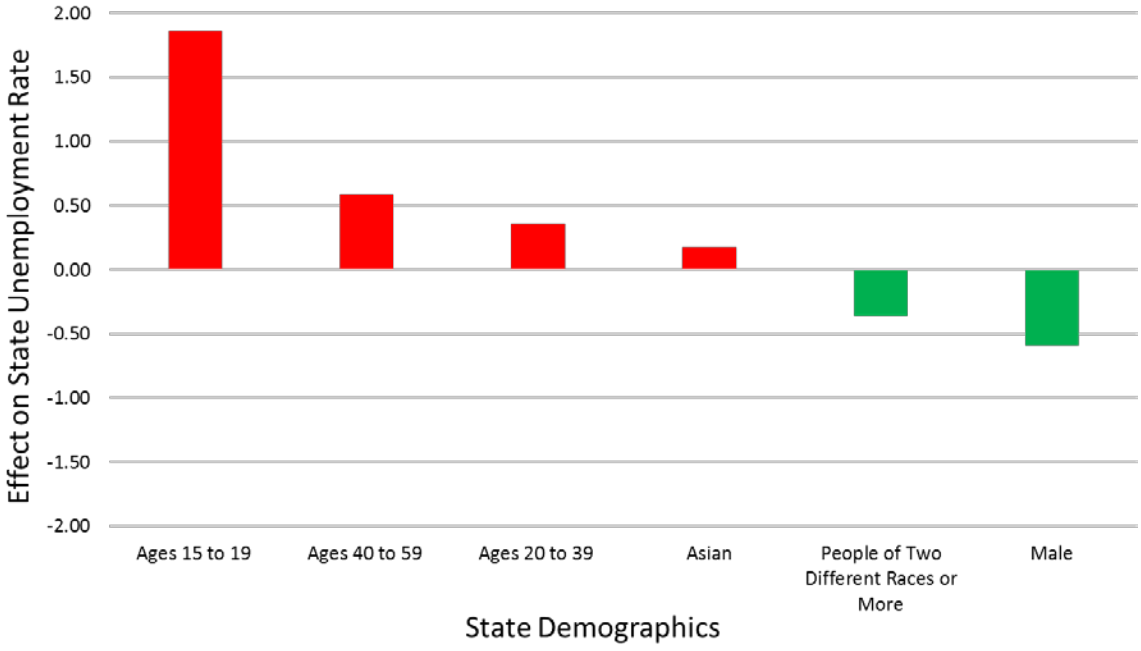


Table 4.12: State Demographic Variables in Order of Largest Positive Influence to Largest Negative Influence on Unemployment

State Demographic Variables	Coefficients	Standard Errors	z	P>|z|	95% Confidence Interval	
Ages 15 to 19 Years Old	1.86	0.45	4.1	0	0.969	2.742
Ages 40 to 59 Years Old	0.59	0.14	4.17	0	0.310	0.862
Ages 20 to 39 Years Old	0.36	0.17	2.11	0.034	0.026	0.687
Asian	0.17	0.05	3.3	0.001	0.071	0.277
Ages 60 or More Years Old***	0.05	0.13	0.39	0.696	-0.212	0.317
Population	0.02	0.008	2.67	0.008	0.006	0.037
Population Squared	-0.00009	0.00003	-3.17	0.002	-0.0002	-0.00003
Hispanic or Latino***	-0.01	0.02	-0.27	0.786	-0.052	0.039
Black or African American***	-0.03	0.02	-1.53	0.126	-0.070	0.009
People of Two Different Races or More	-0.36	0.10	-3.6	0	-0.554	-0.163
Male	-0.59	0.26	-2.29	0.022	-1.098	-0.086

*** Indicates that a variable is not statistically significant at the 90% confidence level (P>|0.10|)

Note: squared values are purposely out of order because those values must be paired with the non-squared values in an equation to determine what the effect will be on unemployment.

Eight out of the 11 variables in this category were statistically significant. The variable with the highest positive effect on unemployment were states that had a higher percentage of the population between the ages of 15 to 19 years old, resulting in an increase of unemployment of 1.86%. This variable also had the strongest effect on increasing unemployment out of all the other variables in the entire regression. Each age category led to an increase in unemployment, but it moved upward as age increased. Thus, unemployment increased by only 0.36% in the age 20 to 39 years old category, but increased further by 0.59% if the state had a higher level of the population between the ages of 40 to 59 years old. The variable of those that were age 60 or more years old was found to be statistically insignificant however. As for the racial demographics, half were significant and the other half were not. The two variables that were significant were the percentage of the population who identified themselves as either Asian or those who identify being two different races or more. States that had higher percentages of those who identified as Asian had an effect of increasing unemployment by 0.17%. When looking at the individual data cells in the model, most states had less than 6% of the population that identified as Asian, but 36% of residents of the State of Hawaii identified as being Asian and it is unknown if this has any effect on the analysis. People in states that identified themselves as those who are of two races or more also had a similar concern, as most states only had 4% or less on average identifying in this category. Again, the State of Hawaii had on average 19% of its population identify themselves with this variable. The base category for the racial demographics that was left out were those who identified as white. My findings show that as a race category rises above 1% and the

white base demographic drops by 1%, the regression coefficient for the race categories would show the expected effect on unemployment moving in the same direction as the variable indicates. As for the population variable, the quadratic form of this variable moves in a negative direction as the population grows to the inflection point, indicating a hill type of relationship. However, the inflection point for this negative change to begin occurring is quite unrealistic as a state population would have to consist of 116.7 million people, which is well outside the range of observed values in the dataset. The last demographic variable in which I left the base category out was the percentage of the female population within a state. The regression coefficient shows that as the percentage of males in a state are larger than the female population within a state, the effect on unemployment is negative and decreases unemployment by 0.59%. Just like the race demographic category, as the female population percentage decreases or increases by 1%, the male population would move in the opposite direction by 1%, which would make the regression coefficients move in a similar fashion in terms of how unemployment is affected.

Expected Variable Effects Compared to Actual Variable Effects

In Chapter 3, I provided a chart that outlined my assumptions of the expected effects independent variables would have on unemployment rates. That analysis was a culmination of other studies I examined in Chapter 2. In Table 4.13 below, I show a comparison of the effects I expected variables to have on unemployment to the actual effects as seen in my regression analysis:

Table 4.13: Projected Variable Effects Compared to the Actual Effects on State Unemployment Rates

Potential Cause and Effect Table

Positive effect = + Negative Effect = - Uncertain Effect = ?

Note: + = increase in unemployment, - = decrease in unemployment

CAUSE	EXPECTED EFFECT	ACTUAL EFFECT
State Wage Variables		
Indexed State Wage Policy Dummy	+	+
Fixed State Wage Higher than Fed. Dummy	+	?
State Minimum Wage as % of Avg. State Wage	-	- / +
Right to Work Law Dummy	?	-
Economic Output Variables		
Agriculture Gross State Product (GSP)	-	- / +
Manufacturing GSP	-	+
Retail Trade GSP	-	- / +
Food Services and Accommodation GSP	-	?
Government GSP	-	?
State Education Variables		
High School Diploma	-	-
Associates Degree	-	-
Bachelor's Degree	-	-
Master's Degree	-	-
State Demographic Variables		
Population	?	- / +
Male	?	-
Hispanic or Latino	?	?
Black or African American	?	?
Asian	?	+
People of Two Different Races or More	?	-
Ages 15 to 19 Years Old	+	+
Ages 20 to 39 Years Old	?	+
Ages 40 to 59 Years Old	?	+
Ages 60 or More Years Old	?	?

Note: any effect that is - / + is because that value moves along a curve. This means that the variable can have a negative or positive effect on unemployment depending on where the base value is in comparison to the inflection point.

For my expected effects category, my model agreed with 13 out of the 23 predictions listed in Table 4.13. There were zero instances in which I expected a positive or negative relationship to be present and the actual effect was the opposite. All 13 cases were an instance of an expected effect being undecided before the regression taking place, leading to a positive or negative relationship after the regression, or vice versa.

Conclusion on Regression Results

In this chapter, I discussed all of the important technical components of utilizing a fixed-effects panel data regression model to obtain my results to see how different variables might theoretically affect the unemployment rate of a state. I discussed the important statistical tests I performed to analyze my regression for multicollinearity, heteroskedasticity, model specificity, and autocorrelation. After correcting for each of the above technical issues as necessary, I displayed the results of my regression analysis and described the effects of every statistically significant variable. I found that the variable with the largest positive effect on increasing unemployment (1.86%) were states that had a higher youth population (ages 15 to 19 years old) and the strongest negative effect on decreasing unemployment (-0.80%) was if a state had a minimum wage right-to-work law. I also provided an equation to determine the effect my quadratic variables will have on unemployment. In Chapter 5, I will conclude with a discussion about the implications of these findings and will provide policy recommendations.

Chapter 5

CONCLUSION

In this section, I evaluate the findings for my main three themes I discussed throughout this thesis. While Chapter 4 analyzed in detail the statistical relationships the regression model found in terms of how particular variables affected unemployment rates, the analysis below focuses more on discussing the possible real world explanations of why these relationships may exist. I also add commentary that alludes to the theoretical reasoning behind why a variable had a particular effect and I deliberate about different areas in which future studies may help to make these assumptions and speculations more clear.

This thesis examined the effect different minimum wage laws have on state unemployment rates. Chapter 1 introduced the historical context of the minimum wage, discussed the conservative and liberal ideologies on the purported effects of increasing minimum wages, and provided an overview on why analyzing the policy implications of the law are important. The main gap in current research that I wanted to focus on was the effect indexed minimum wage policies have on state unemployment. Chapter 2 gave an overview of current research surrounding the topic with an emphasis on the core significant findings and conclusions that were central to my methodical approach. I also describe in Chapter 2 the three major themes I focus on that could affect unemployment; state minimum wage policy, state GSP output, and state education attainment levels. Chapter 3 described every variable I gathered in detail, the expected effects of each

variable, and a discussion on potential weaknesses within my regression design. Chapter 4 provided the results of my regression analysis and information on the different statistical tests I used to determine if any errors happened to exist within my dataset. Most importantly in Chapter 4, I discussed the positive or negative effects of my statistically significant findings and provided a clear breakdown on the strength or weakness each variable had toward either increasing or decreasing unemployment rates. The purpose of Chapter 5 is to discuss in further detail some of the reasons why certain variables potentially affect unemployment, which implications of my research policymakers might take into consideration when developing public policy on minimum wages, and how a researcher could improve upon my regression model for a similar study in the future.

State Wage Policy Findings

In the case of the state minimum wage policy variables used in this thesis, one variable increased unemployment and one variable decreased unemployment. States that had an indexed minimum wage policy increase unemployment by 0.69% in comparison to states that did not have an indexed minimum wage policy. The average unemployment rate in this data set (2010-2014) was 7.56%, with a standard deviation of 2.09%. The highest unemployment rate was 13.7% and the lowest was 2.7%. The wide range of these values for this variable indicate that the additional 0.69% increase in unemployment may be relatively small for some states while for others it may be more substantial. The reasons why this variable showed positive effects could be due to the fact that many businesses typically view this type of policy as undesirable (Chow, 2013; California

Chamber of Commerce, 2013). This negative outlook could establish a perception that a state may have an unfriendly business environment. Predictability and being able to create a long-term business plan are critical components for a commercial entity to be successful. Knowing the cost of labor is crucial to the business planning process. Businesses may believe an indexed minimum wage, which changes every year, reduces their ability to properly estimate and predict how many workers they will be able to hire in the future because the costs are unknown and continually changing. This policy may make businesses less apt to hire new workers due to this uncertainty. A similar viewpoint is that paying workers a perpetual wage increase every year is a long-term commitment that may concern businesses because the costs of doing business will likely have to increase in a reciprocal fashion. However, if this is just a perception issue, then the next question has to be: do the actual internal mechanisms of the law really have an attributable effect?

In theory, this type of paradigm would potentially mean that the effects of this policy may be more about a negative perception of the law itself, rather than the actual monetary amount that the minimum wage increases year-to-year. I make this point for two reasons. First, my variable “indexed wage dummy” only measures if a state has an indexing wage policy or not. This variable does not include the actual monetary amounts. As discussed in Chapter 3, when including the actual minimum wage amounts of each state in different models, this variable never became significant. My reasoning of why this was potentially the case is because there may be some type of omitted variable issue in that states with high minimum wages also possess some other type of uncontrolled for

characteristic, such as a stronger overall economy correlated along with it. Furthermore, my other important dummy variable that measured if a state had a fixed minimum wage policy that was higher than the federal minimum wage lacked statistical significance in a majority of the regressions I performed. I think there may be interesting relationships happening between all of these wage policy variables, but unfortunately my study was unable to fully isolate the effects different monetary amounts had on unemployment. This may be an indicator that the perception of an indexing policy may actually have more of an effect towards unemployment than states that actually have higher wages through fixed legislative mandates.

Secondly, in combination with my previous point, although an auto-indexing minimum wage would increase the minimum wage each year, there has not been a case yet where wages have risen above 5% in one year. In many cases, the small increase in wages each year through indexing are substantially less of a raise than that of state legislatures authorizing minimum wage increases through fixed rates. For example, when the California State Legislature increased the minimum wage in 2014 from $8.00 to $9.00, this constituted a 12.5% increase in just a single year. Additionally, that same legislation required that the following year the minimum wage would increase to $10.00, which would be an 11% increase. To put this in perspective, in 2015, the CPI change from 2014 provided by the BLS was just 0.6%. The average CPI increase over the years within my data set was 1.74%, with 3% (2011) being the highest increase in the CPI (Bureau of Labor Statistics, 2016c). In comparison, if an auto indexing state increased minimum wages to just 3% a year (using the highest CPI single year change in recent

years), it would take that indexing state more than seven years to reach the same amount of a wage increase that California did in just two years, holding all factors constant.

From this viewpoint, it seems that although the indexed wages are more unpredictable as they change every year, the employment costs on businesses could theoretically be less than if a business is located within a state where the legislature can increase the minimum wage by much higher amounts on their own accord. On the other hand, it is important to note that historically, minimum wage changes within fixed wage states have been usually few and far between. Thus, in the long run, indexation commits businesses to wage increases in perpetuity. These continual increases could also be compounded to a very large degree if the economy were to incur higher than average increases in the CPI over the span of multiple years. This type of scenario could be another concern businesses may have with automatically indexed wages. After analyzing all of the above considerations, I theorize that my findings of auto indexing minimum wage policies potentially increasing state unemployment is due to the perception of the policy itself, rather than the actual internal policy mechanisms of wage increases.

One variable that led to a decrease in unemployment rates were states that had a right-to-work policy in place. For the right-to-work law variable, unemployment was about 0.80% less when states had this type of policy in place. As discussed in some of the theories in my literature review, one of the factors that businesses may take into consideration is that a right-to-work policy will decrease union influence, therefore potentially establishing a more profitable and business friendly environment. Holmes (2000) found similar effects when looking at statewide business policies (including right-

to-work laws) affecting industries such as manufacturing. Although this finding is interesting, this theme was not a direct focus of my thesis. I only used this variable as a guide to gauge union influence within a state because union strength is typically associated with labor being able to achieve policies to raise wages to address income inequality and other socio-economic issues. Obtaining more research and expanding the regression model to include other state business policies would be necessary for future studies to help pin down the effects this type of law has on unemployment rates.

The variable that measured the percentage a minimum wage amount is in comparison to the all industry average wage amount is an equally important finding alongside my indexed minimum wage result. This variable was not only one of the most statistically significant variables, but it also potentially has one of the strongest effects towards unemployment, depending on how far these values are from the inflection point. My results indicate that as states increase the minimum wage above 38.45% of the average wage amount, unemployment starts to rise at an increasing rate. As discussed in Chapter 1, Scheiber (2015) provided a similar analysis, but with a focus on city minimum wages and average median wages. My results confirm some of the findings of that study, but on a state level with mean wages.

With my results, I agree with Scheiber's theoretical framework that as minimum wages start moving close in proximity toward the median wage (and even more so over that amount) unemployment increases. As I described in Figure 1.2 of Chapter 1, which utilizes a minimum wage law within a simple supply and demand market model, the equilibrium wage amount (the amount that the market can actually afford) in some cases

could be higher than the minimum wage amount set by a minimum wage law. This means that the minimum wage is actually lower than what the market could be paying laborers and the minimum wage could be increased without increasing unemployment.

With the findings of my research, one way to gauge the actual equilibrium amount is to set it at the inflection point of my variable that shows the minimum wage as a percentage of the all industry wage of a state. In Chapter 4, I discuss that the inflection point is when a minimum wage is 38.45% of the average wage because at that point, unemployment effects start to increase as wages rise above that percentage. This is because as wages rise above the equilibrium point, businesses will have to let go of employees they cannot afford anymore and at the very least be less likely to hire more laborers seeking employment. This finding is important because it could re-conceptualize how minimum wages are calculated and implemented. One of the problems I noted in Chapter 1 about creating a minimum wage law is that sometimes the reasoning behind why a particular dollar amount is chosen is not always built on solid statistical evidence or economic information. Furthermore, I discuss that when state legislatures have control on setting wages, the actual dollar amounts decided upon can be based more heavily on political factors over other forms of analysis, which can lead to minimum wages actually being set too low or too high. Instead, policymakers could now utilize the average wage of a particular area as a guidepost to where the minimum wage could fall.

Along with Scheiber's analysis, I also theorize in tandem that this factor leads to less unemployment because if it were put into effect, the minimum wage amount would be intrinsically relative to the commercial and industrial makeup of a particular location.

Put plainly, some locations can sustain a higher minimum wage threshold than other places. For example, in Chapter 1, I discuss that while a $15 minimum wage in San Francisco is very practical and equitable, a $15 minimum wage in a small rural town that is economically different in every conceivable way may not be as feasible for that market to handle. Therefore, if the goal of a policymaker is to create a policy that not only wards off adverse unemployment effects, but can actually decrease unemployment in some cases and improve the purchasing power of those living on the minimum wage, basing the minimum wage amount as a percentage of the mean wage would be the best option. The last important factor I want to address once again is that if the goal of raising the minimum wage is based on factors other than unemployment effects (such as lifting individuals out of poverty) then it would be vital for a policymaker to consider other factors related to the minimum wage along with my policy suggestions.

Economic Output Findings

The GSP economic variables had divergent effects as the level of output from two industries lead to fluctuating unemployment rates, the level from one industry increased the unemployment rate, and the output level from the other two industries I analyzed did not have a statistically significant effect on unemployment. I originally estimated in Chapter 3 that as the percentage of total state GSP rose for the five industries I selected in my model, unemployment would likely decrease. The two industries that could increase or decrease unemployment as the percentage of GSP output increased were agriculture and retail trade. This may be due to these industries not being influenced as much by the global economy and international trade in comparison to other industries where jobs are

easily outsourced to other countries. However, as noted in Chapter 4, I found that this effect happens at an increasing rate, so there is a limit to how much a state should raise a particular industry GSP output if it does not want to increase unemployment. I believe this also means that a state needs to have a diverse economy to thrive, which will in turn help ward off unemployment effects. A future study would likely need to include many more industries in a similar regression model to see if an abundance or deficient amount of any industry increases or decreases unemployment. Interestingly, states that had higher levels of manufacturing GSP had higher levels of unemployment. This could be due to the rust belt states and other highly manufacturing centric states experiencing the detrimental effects of manufacturing jobs being shipped overseas to cheap foreign labor. Thus, states with high manufacturing output in the past might be having trouble adjusting the emphasis of their economy to other economic sectors to provide more job opportunities.

One surprise in my model was that the industry of food services and accommodation showed no statistical significance. I point this out because one of the more prominent studies in my literature review found that as wages increased through minimum wage increases, this industry type was disproportionately impacted (Neumark et al., 2014). There may be other factors that would need to be included to help gauge this type of variable to help reveal if there is truly any effect on the industry, its GSP output, and the overall unemployment rate of a state.

Lastly, to compare the effects of the GSP control variables to the minimum wage variable effects, while a 1% increase in manufacturing increased unemployment (to 0.06),

the effect was very small. As discussed above, states that have an auto indexing minimum wage clause would increase unemployment by 0.69%, which is more than 11 times the effect this variable had on increasing unemployment than the manufacturing output variable.

Education Attainment Findings

Each variable in this theme showed that as a population in a state increases its education attainment level, unemployment rates were lower than states that had less educational attainment. Interestingly, this effect was present with each variable from high school degrees to graduate degrees, as each variable had statistical significance. Furthermore, as states had higher percentages of the population achieving higher degrees, the magnitude of the effect became stronger as more people achieved high school degrees (0.-27%), to associates degrees (-0.34%), to bachelor's degrees (-0.39%), and to master's degrees (-0.47%). This is likely due to the fact that as individuals attain higher degrees of education, they are more marketable candidates when seeking employment. Additionally, if certain jobs require a minimum degree level for that profession, job-seeking candidates with higher degrees will have fewer roadblocks from obtaining these types of jobs than those who do not have the necessary degree. None of these variables were that much of a surprise as I expected higher levels of education attainment within a state to lead to lower levels of unemployment rates. If states were able to increase all of the educational attainment categories by just a factor of one at the same time, the magnitude would be the strongest in the data set, leading to a decrease of unemployment by as much as 1.47% holding all factors constant.

State Demographic Finding

Although there were quite a few statistically significant variables for state demographics, there is only one that I believe warrants a discussion because of the societal implications it may have. I found that states that had higher percentages of male populations lead to decreases in unemployment by 0.59%. Since the female variable was the excluded variable by design, this meant that as the percentage of males within a state decreases, unemployment rises. I bring this finding up because this may be a factor providing further insight on issues related to gender inequality women encounter in the workplace. For my model to show employment equity for both females and males, the statistical relationship should show a 0% effect on unemployment, meaning that neither being a male or female makes any difference on the unemployment factor. Albanesi and Şahin (2013) found that while the gender unemployment gap has been closing over time since 1970, women fare better in terms of employment than men during recessionary economic periods, but the effects during recovery periods could not be explained. It would be interesting to include my findings with the results of other studies like this to assess the progress of women achieving economic equality.

Policy Implications

This section will examine some of the policy implications policymakers may want to consider when deciding to increase the minimum wage and the potential unemployment effects resulting from different policy options. My recommendations only focus on variables this thesis analyzed and of which had the strongest statistically significant positive or negative effects on the unemployment rate. Although there may be

other very interesting results that I found in my regression model, I would need to examine those variables more closely in another study before making any policy recommendations. One very important component I want to preface to anyone reading this policy implication section is that any of these recommendations listed below should be taken into consideration amongst other findings and recommendations from other researchers within this topic.

Policy Implication #1: Index Minimum Wages with Caution

My research finds that states that adopt an auto indexing minimum wage policy experience slightly higher rates of unemployment than states that do not have such a policy in place. On average, unemployment rates were 0.69% higher for states that indexed wages to increases in inflation, CPI, or other factors. This variable was found to have the second highest level of magnitude towards increasing unemployment, right behind the control variable of states having higher percentages of the population of those 15 to 19 years old (1.86% increase in unemployment). If a policymaker's sole concern is adopting policies that do not have a chance of increasing unemployment, then this economic tool might not be the best option. However, I must clearly point out that when choosing a strategy to increase the minimum wage (or not), concerns about a particular law type potentially increasing unemployment should not be the only litmus test or deciding factor about either the effectiveness of the policy or the overall impact of the policy. Policymakers must consider this unemployment rate factor as one piece of a large puzzle because the issues of improving the quality-of-life for people, lifting individuals out of poverty, protecting economic sustainability for businesses, and ensuring wage

equity for workers are all concerns that are equally important to evaluate before making a final decision on the matter. It is safe to say that if an auto-indexing policy can improve any of the above items, then the concern of potentially increasing unemployment could be outweighed by the other benefits.

Policy Implication #2: Use the Average State Wage Amount of All Industries as a Factor of Analysis Towards Determining a State Minimum Wage Amount

My analysis finds that states that have a minimum wage amount that is above the 38.45% inflection point wage amount of all industries within that state have higher rates of unemployment. One key theme discussed in Chapter 1 is that sometimes policymakers can have trouble finding a reliable measurement that will help them gauge the appropriate amount a minimum wage should be set at and this variable could be that key piece of information. By utilizing this factor of analysis, policymakers can accurately formulate an appropriate minimum wage amount at the highest extent possible to bolster the purchasing power of those living on the minimum wage, while at the same time, preventing unemployment from potentially increasing to a high degree. Interestingly, with this type of measurement, states could also adopt a policy that is more like a scalpel than a hammer when choosing how much to raise the minimum wage. For example, states legislatures may want to consider having reflexive policies within individual counties, allowing for different minimum wage policies for different areas. This would make minimum wages more organic within the economic makeup of that county. However, there are a few downsides to having variable rates across different counties (or other subsets of local governments). The two concerns that come to mind with this type

of policy is that it could create an incentive for businesses to move their place of operations to a surrounding county where the wage might be slightly below the other county. This would theoretically lead to a race to the bottom, which is the opposite of the purpose of a minimum wage. To combat this, a state would still need to have a robust statewide minimum wage amount that provides a strong floor that would make county-to-county changes very marginal rather than very substantial.

Policy Implication #3: Increase the Education Attainment Level of the Populace to the Fullest Extent Possible

One of the most consistently powerful tools to reduce unemployment rates for states is for policymakers to focus on increasing the education level of the populace as much as possible. The range of decreasing unemployment by increasing the education attainment level was 0.27% for larger populations consisting of high school graduates to 0.47% for larger populations achieving master's degrees. If the state was to achieve a goal of increasing the percentage of the population by a factor of one for each of these degree types combined at the same time (while holding all factors constant) unemployment could decrease by a total of 1.49%. This would potentially make this theme have the largest magnitude towards affecting unemployment out of all the policy implications. Not only were each of these variables with the highest statistical significance, but they also were variables within my study with the most consistent effect on reducing unemployment in each iteration. There needs to be a focus on ensuring at least everyone graduates with a high school degree at a minimum because not only would that factor help decrease unemployment, but obtaining a high school diploma is the

gateway towards being able to achieve higher degrees, which would lower employment even further.

One point to consider is that if a state is concerned about potential increases in unemployment due to adopting an indexed minimum wage law, a state can stymie this effect by investing through means that would encourage the population to attain higher degrees of education. Overall, investing in K-12 schools (especially with a focus on increasing high school graduation rates), community colleges, and the university systems should be a top priority for policymakers looking to decrease unemployment rates within their state overall.

Study Limitation, Improvements, and Pathways for Future Analysis

With any academic research literature, it is very important from an ethical standpoint for the author to note a study's limitations, weaknesses, and ways in which a future thesis could improve the analysis further. Below are three areas in which I believe I could have improved my regression analysis if I had more resources and time. This section also provides other researchers a blueprint on ideas to be expanded upon for a similar study of their own.

Improvement #1: Increase the Year Range

Originally, the goal I had when creating my data set was to collect data from 2001 to 2015. The year 2001 is important because that was when the State of Washington was the first state to adopt an auto-indexing clause for increasing the minimum wage. The data for my "State Minimum Wage Policy" variables, my "Economic Output" variables, and the unemployment rate were all available for those extra years, but the major obstacle

was finding accurate and consistently measured demographic data (including the “State Education Variables”).

Having more years of data consisting of states that adopted indexing clauses would give a much better estimate of the true effect this policy has on statewide unemployment. Additionally, this data would have been a better indicator of how this type of law affects states between the different economic climates during that time period. This could reveal potentially interesting insights such as the indexing law having less of an impact on unemployment through expansionary economic periods and stronger negative effects during recessionary periods. This model would reflect how Greer et al. (2014) tested minimum wage effects on unemployment during economic boom and bust periods, as discussed in Chapter 2. I bring up this scenario because in 2015 when I originally put this data set together, I only had data available from 2010 to 2013. With a very similar model to the regression I performed with this thesis, the effect of indexing minimum wages was slightly higher towards increasing unemployment than during the 2010 to 2014 timeframe for this fully completed thesis. The one notable change from adding the year 2014 in the data set for this regression is that the United States economy was expanding and unemployment rates were starting to drop much more rapidly with each state that year. It would be interesting to use this same dataset updated for 2015 because the economy expanded even further during that time and unemployment rates dropped closer to pre-Great Recession levels.

Improvement #2: Increase the Amount of Units Being Compared

The purpose of choosing the 50 states (and Washington D.C.) was because the information was readily available and my goal with this thesis was to test the "big picture" in terms of how minimum wage laws potentially affect unemployment rates. The downside to using just statewide data is that some states are so diverse county-to-county (large versus small size, different economic strengths and weaknesses, different demographics, etc.) that the regression I performed would deliver an answer that is more of a "one size fits all" type of analysis for the entire state. For example, as discussed in Chapter 1, California is adopting a $15 minimum wage, which would make California and New York the states with the highest minimum wages in the nation. However, California has a few large cities such as Los Angeles and San Francisco where a $15 minimum wage is more in line with the costs of living, but the impacts the law could have on much smaller cities and rural towns could be large. If the data set was able to measure counties as the unit of comparison, then the model could potentially measure the effects of this law across smaller units of area, especially when looking at the minimum wage amount as a percentage of the average industry wage variable. This type of analysis would conform to how Allegretto et al. (2013) and Scheiber (2015) did their study as I described in Chapter 2, where they analyzed counties and cities as the unit of measurement. This expanded form of analysis would allow for better apples-to-apples comparisons on minimum wage effects.

Improvement #3: Increase the Amount of Independent Variables

Although my regression model provides a satisfactory snapshot of the variables that make up each state, there is plenty of room for more variables to be included to make the regression even more robust. Some examples of improving my model would be including more statewide GSP by industry variables to see if the relative size of different economic sectors influence state unemployment rates. Once more GSP variables are included, I could have utilized more GSP interaction terms in the model to see if a particular minimum wage law in combination with a particular GSP industry has a stronger effect on increasing or decreasing unemployment. For example, this could show that if states have industries that potentially increase unemployment (such as the Manufacturing GSP example), adding an indexed minimum wage policy could compound the effect of unemployment for that state. Also, my model did not produce any discernable results between my different age categories, except for the 15 to 19 years old demographic variable. This may be due to the fact that I likely grouped the other age groups in too large of a unit (i.e. ages 20 to 39 and ages 40 to 59 were my other groups). Lastly, there may be other measurements out there that could help isolate the effect a particular minimum wage dollar amount (or law type) has on unemployment rates that I did not consider.

Returning Back to the California Example

As discussed in Chapter 1, the State of California is a perfect example of the intersection between the policy and politics of determining minimum wage law. As of April 2016, California Governor Edmund G. Brown signed into law the highest minimum

wage law in the United States and California will become the largest state in the nation to index minimum wages by 2022. Between 2017 and 2022, California's minimum wage will raise incrementally to $15. Once the $15 wage is in full effect, the state will begin automatically indexing minimum wages by no more than 3.5% each year for inflation.

There are two themes at play with my thesis and California's new minimum wage policy. The first theme is that by including the minimum wage index, California may experience unemployment levels greater than states that only have fixed wage rates. As stated earlier in this section, my regression analysis only covers the recent years where economic expansion has been at its strongest since the Great Recession in 2008, so the magnitude of the effect of the auto indexing law increasing unemployment is not entirely certain. The second theme is that by raising the minimum wage to $15 in 2022, this would greatly expand the minimum wage as a percent of the all industry average wage in the state. As of 2015, California's minimum wage ($10.00) was 37.63% of the state median wage ($26.57). To estimate what California's all industry wage would be in 2022, I added each wage amount increase from the past six years (2010-2015) and divided it by six to get the yearly average amount increase, which equated to a $0.40 increase in the all average industry hourly wage per year. Adding $0.40 to each year, California would have an average industry wage of $28.97 in 2022. Therefore, if California had a $15 minimum wage in 2022, the minimum wage would be 51.78% of the average industry hourly wage, which is well over the 38.45% inflection point. This means that California may experience higher rates of unemployment, keeping all factors constant.

Concluding Comments

The investigation on the effect that minimum wage policies have on unemployment is a top concern of economists, academics, and policymakers. My study attempts to answer this question with a fixed-effect panel data set regression analysis model for each state for the years 2010 to 2014. One good takeaway from this study is looking at how high the R-squared is for my results, which is an indicator of how well my data fit my statistical model in my regression analysis. My R-squared value registered at 0.8404, which means that my data could successfully explain 84% of the variation in the data. My regression results therefore indicate that I can justify my initial claim at the beginning of this paper that the state wage policy a state has does have an attributable effect on the unemployment rate of a state, holding all other factors constant.

As for policy implications, my data simply suggests that if a state is potentially deciding on raising the minimum wage amount through a policy of auto indexing, policymakers may want to be aware of the potential increase of the unemployment rate that could be caused. This may not be the most important factor for that decision because there are other societal effects of raising the minimum wage that should be considered, but at least it can provide an insight on the tradeoffs in choosing such a policy. Additionally, utilizing the average mean wage of all industries within the state may be a good gauge to see where an appropriate minimum wage should be set at to reduce the chance of having undesirable unemployment effects. Lastly, increasing educational attainment of the populace should remain a high priority as my study shows that a more educated populace is a more employed populace. However, all of these findings need

to be considered along with other studies in this field and it is vital that additional steps should be taken to improve this study before making any final conclusions on the matter.

Appendix A: Table A.1: Pairwise Correlations with 99%, 95%, and 90% Significance

VARIABLE NAMES	Unemployment R.	Indexed Wage	Fixed Wage > Fed.	Avg. Wage	Right to Work
Unemployment Rate	1				
Indexed State Wage Policy	0.1298**	1			
Fixed State Wage Higher than Federal Wage	0.2330*	0.4816*	1		
State Minimum Wage as % of Avg. State Wage	-0.0267	0.2537*	-0.1221***	1	
Right to Work Law	-0.1255**	-0.1614*	-0.4660*	0.3944*	1
Agriculture GSP	-0.4727*	-0.0848	-0.2496*	0.4370*	0.3647*
Manufacturing GSP	0.1329**	-0.0266	-0.1787*	0.4031*	0.1827*
Retail Trade	-0.0012	0.2155*	-0.1147***	0.6659*	0.3716*
Food Services and Accommodation GSP	0.2161*	0.3426*	0.1958*	0.1842*	0.1015
Government GSP	0.0726	-0.1241**	0.0836	-0.2690*	-0.108***
High School Diploma	-0.0287	-0.1231**	-0.3532*	0.5222*	0.0698
Associates Degree	-0.4425*	0.0368	-0.0925	0.2496*	0.1412**
Bachelor's Degree	-0.2988*	0.1036***	0.2604*	-0.6081*	-0.3297*
Master's Degree	0.042	-0.0217	0.3650*	-0.7674*	-0.4491*
Population	0.2945*	0.0258	0.1002	-0.2212*	-0.0428
Male	-0.3245*	0.1482**	0.0091	0.2383*	0.1337**
Hispanic or Latino	0.2362*	0.1437**	0.3080*	-0.1851*	-0.001
Black or African American	0.3336*	-0.2163*	-0.1585**	-0.2640*	0.1871*
Asian	0.0337	-0.0441	0.0447	-0.3249*	-0.2542*
People of Two Different Races or More	-0.1262**	-0.0185	-0.0081	-0.1156***	-0.1526**
Ages 15 to 19 Years Old	0.1820*	-0.2480*	-0.0828	0.0439	0.1645*
Ages 20 to 39 Years Old	0.0961	-0.0947	0.0807	-0.4671*	0.0875
Ages 40 to 59 Years Old	0.1013	0.0637	0.1839*	-0.1039***	-0.5041*
Ages 60 or More Years Old	-0.1731*	0.2010*	0.059	0.3337*	-0.1521**

VARIABLE NAMES	Agri. GSP	Manu. GSP	Retail GSP	Services GSP	Govt. GSP
Agriculture GSP	1				
Manufacturing GSP	0.0894	1			
Retail Trade GSP	0.2060*	0.2545*	1		
Food Services and Accommodation GSP	-0.1611*	-0.3217*	0.1113***	1	
Government GSP	-0.1327**	-0.4625*	-0.3702*	0.1007	1
High School Diploma	0.0679	0.2842*	0.3783*	-0.0133	-0.3167*
Associates Degree	0.5352*	0.0503	0.2307*	0.003	-0.3572*
Bachelor's Degree	0.0171	-0.2909*	-0.4003*	-0.1283**	0.0596
Master's Degree	-0.3517*	-0.3453*	-0.5837*	-0.1054***	0.4996*
Population	-0.2442*	0.0836	-0.0122	-0.1083***	-0.2627*
Male	0.3814*	-0.1838*	0.0645	0.1885*	-0.1446**
Hispanic or Latino	-0.2012*	-0.2411*	-0.0623	0.2045*	0.0539
Black or African American	-0.3140*	0.0144	-0.1970*	-0.0427	0.3888*
Asian	-0.2043*	-0.3353*	-0.4525*	0.3549*	0.2192*
People of Two Different Races or More	-0.0838	-0.3158*	-0.3926*	0.3114*	0.3140*
Ages 15 to 19 Years Old	0.1091***	0.2141*	0.1693*	-0.3045*	-0.1423**
Ages 20 to 39 Years Old	-0.103	-0.2788*	-0.5627*	0.0647	0.5514*
Ages 40 to 59 Years Old	-0.2651*	0.0128	0.0702	-0.0268	-0.2270*
Ages 60 or More Years Old	0.1022	0.0606	0.2987*	0.0658	-0.1769*

Note: * denotes 99% significance, ** denotes 95% significance, *** denotes 90% significance

Pairwise Correlations with 99%, 95%, and 90% Significance (continued)

VARIABLE NAMES	High School	AA Degree	BA Degree	MA Degree
High School Diploma	1			
Associates Degree	-0.0165	1		
Bachelor's Degree	-0.6827*	0.1654*	1	
Master's Degree	-0.5694*	-0.4122*	0.6484*	1
Population	-0.2150*	-0.1345**	0.0419	0.0276
Male	-0.0984	0.5245*	0.0352	-0.4578*
Hispanic or Latino	-0.5150*	-0.1467**	0.087	0.1071***
Black or African American	-0.058	-0.5856*	-0.1423**	0.3643*
Asian	-0.2612*	0.0695	0.2725*	0.1428**
People of Two Different Races or More	-0.09	0.1412**	0.1169***	-0.0315
Ages 15 to 19 Years Old	-0.1091***	0.0029	-0.0265	-0.1048***
Ages 20 to 39 Years Old	-0.6215*	-0.3314*	0.2758*	0.5183*
Ages 40 to 59 Years Old	0.3164*	0.0123	0.1034***	0.0821
Ages 60 or More Years Old	0.5238*	0.2077*	-0.1896*	-0.1478**

VARIABLE NAMES	Population	Male	His. Or Latino	Black or AA	Asian
Population	1				
Male	-0.1637*	1			
Hispanic or Latino	0.5226*	0.1159***	1		
Black or African American	0.1122***	-0.6702*	-0.1264**	1	
Asian	0.1886*	0.1539**	0.2003*	-0.0921	1
People of Two Different Races or More	-0.1276**	0.3449*	-0.0231	-0.2004*	0.8568*
Ages 15 to 19 Years Old	0.1036***	0.0099	0.0773	-0.0043	-0.3079*
Ages 20 to 39 Years Old	0.076	0.0072	0.2449*	0.4139*	0.1621*
Ages 40 to 59 Years Old	-0.0178	-0.1802*	-0.2977*	-0.134**	0.0055
Ages 60 or More Years Old	-0.1461**	-0.2917*	-0.2703*	-0.1774*	-0.0597

VARIABLE NAMES	2 Races or More	Ages 15-19	Ages 20-39	Ages 40-59	Ages 60+
People of Two Different Races or More	1				
Ages 15 to 19 Years Old	-0.3419*	1			
Ages 20 to 39 Years Old	0.1173***	0.0254	1		
Ages 40 to 59 Years Old	-0.0491	-0.1413**	-0.6353*	1	
Ages 60 or More Years Old	-0.0223	-0.5054*	-0.6580*	0.4115*	1

Note: * denotes 99% significance, ** denotes 95% significance, *** denotes 90% significance

Appendix B: Regression Outputs and Supplementary Statistical Information

Table B.1: Uncorrected Fixed-effects Regression Output

Fixed-effects (within) Regression

Group Variable State Identification Number (50 States and DC)	Number of Observations: 255 Number of Groups: 51 Observations per Group: 4 Min = 4, Max = 4, Avg = 4

Corr(u_i, Xb) = -0.9971	R-squared = 0.7950
F (27,126) = 18.09	Between = 0.0482
Probability > F = 0.00	Overall = 0.0270

Dependent Variable = Unemployment Rate						
Independent Variables	**Coefficients**	**Standard Errors**	**t**	**P>|t|**	**95% Confidence Interval**	
State Wage Policy Variables						
Indexed State Wage Policy Dummy	0.0917769	0.7159707	0.13	0.898	-1.32511	1.508662
Fixed State Wage Higher than Federal Wage Dummy	0.0369975	0.3204655	0.12	0.908	-0.59719	0.671189
State Minimum Wage as % of Average State Wage	-2.10775	0.5725314	-3.68	0	-3.24077	-0.97473
State Wage Average Amount Squared	0.028602	0.0081788	3.5	0.001	0.012417	0.044788
Right to Work Law Dummy	-0.1715175	0.5037532	-0.34	0.734	-1.16843	0.825395
Economic Output Variables						
Agriculture Gross State Product (GSP)	0.0057865	0.477652	0.01	0.99	-0.93947	0.951046
Agriculture GSP Squared	0.0068547	0.0408874	0.17	0.867	-0.07406	0.08777
Manufacturing GSP	0.1695801	0.0926195	1.83	0.069	-0.01371	0.352871
Retail Trade GSP	1.395343	0.6809629	2.05	0.043	0.047738	2.742949
Retail Trade GSP Squared	-0.1921347	0.0694659	-2.77	0.007	-0.32961	-0.05466
Food Services and Accommodation GSP	0.3331038	1.060522	0.31	0.754	-1.76564	2.431846
Government GSP	0.4112369	0.2056259	2	0.048	0.004309	0.818164
State Education Variables						
High School Diploma	-0.1935477	0.1231025	-1.57	0.118	-0.43716	0.050069
Associates Degree	-0.2249282	0.2187077	-1.03	0.306	-0.65774	0.207888
Bachelor's Degree	-0.2772973	0.1652325	-1.68	0.096	-0.60429	0.049693
Master's Degree	-0.2664343	0.1722015	-1.55	0.124	-0.60722	0.074347
State Demographic Variables						
Population	-7.13E-01	1.70E-01	-4.2	0	-1.05E+00	-3.77E-01
Population Squared	0.0010166	0.0003434	2.96	0.004	0.000337	0.001696
Male	0.6403508	0.4450281	1.44	0.153	-0.24035	1.521048
Hispanic or Latino	0.7388311	0.4161044	1.78	0.078	-0.08463	1.562289
Black or African American	0.3399271	0.4223423	0.8	0.422	-0.49588	1.17573
Asian	1.152279	0.5489077	2.1	0.038	0.066007	2.238551
People of Two Different Races or More	0.36921	0.3610441	1.02	0.308	-0.34529	1.083706
Ages 15 to 19 Years Old	0.6785417	0.7949344	0.85	0.395	-0.89461	2.251694
Ages 20 to 39 Years Old	-0.4482662	0.5790699	-0.77	0.44	-1.59423	0.697696
Ages 40 to 59 Years Old	-0.1169207	0.5068807	-0.23	0.818	-1.12002	0.886181
Ages 60 or More Years Old	-1.205584	0.3728956	-3.23	0.002	-1.94353	-0.46763
_cons	65.19307	34.88787	1.87	0.064	-3.849	134.2351
F Test that all u_i = 0: F(50,126) = 10.11						

Table B.2: Uncorrected Random-effects Regression Output

Random-effects GLS Regression	
Group Variable State Identification Number (50 States and DC)	Number of Observations: 255 Number of Groups: 51 Observations per Group: 5 Min = 5, Max = 5, Avg = 5

Corr(u_i, X) = 0 (assumed)	R-squared = 0.7320
Wald Chi2(26) = (.)	Between = 0.5016
Probability > Chi2 = (.)	Overall = 0.5525

Dependent Variable = Unemployment Rate						
Independent Variables	**Coefficients**	**Standard Errors**	**z**	**P>|z|**	**95% Confidence Interval**	
State Wage Policy Variables						
Indexed State Wage Policy Dummy	1.128158	0.553639	2.04	0.042	0.043045	2.21327
Fixed State Wage Higher than Federal Wage Dummy	-0.180385	0.2934586	-0.61	0.539	-0.75555	0.394783
State Minimum Wage as % of Average State Wage	-1.183629	0.5091108	-2.32	0.02	-2.18147	-0.18579
State Wage Average Amount Squared	0.0148437	0.0069323	2.14	0.032	0.001257	0.028431
Right to Work Law Dummy	-1.222728	0.4050524	-3.02	0.003	-2.01662	-0.42884
Economic Output Variables						
Agriculture Gross State Product (GSP)	-0.410214	0.3146718	-1.3	0.192	-1.02696	0.206531
Agriculture GSP Squared	0.0505414	0.0339504	1.49	0.137	-0.016	0.117083
Manufacturing GSP	0.0697431	0.0420275	1.66	0.097	-0.01263	0.152116
Retail Trade GSP	-0.323813	0.5526003	-0.59	0.558	-1.40689	0.759264
Retail Trade GSP Squared	0.0172246	0.0542191	0.32	0.751	-0.08904	0.123492
Food Services and Accommodation GSP	0.2182332	0.1667379	1.31	0.191	-0.10857	0.545034
Government GSP	0.1926357	0.0794852	2.42	0.015	0.036848	0.348424
State Education Variables						
High School Diploma	-0.118922	0.0946936	-1.26	0.209	-0.30452	0.066674
Associates Degree	-0.295051	0.1612184	-1.83	0.067	-0.61103	0.020931
Bachelor's Degree	-0.424283	0.119835	-3.54	0	-0.65916	-0.18941
Master's Degree	-0.503403	0.1191761	-4.22	0	-0.73698	-0.26982
State Demographic Variables						
Population	2.39E-07	1.28E-07	1.88	0.061	-1.08E-08	4.90E-07
Population Squared	-1.06E-14	4.63E-15	-2.29	0.022	-2E-14	-1.5E-15
Male	-0.7901	0.375159	-2.11	0.035	-1.5254	-0.0548
Hispanic or Latino	-0.005663	0.0375999	-0.15	0.88	-0.07936	0.068031
Black or African American	-0.074069	0.0334256	-2.22	0.027	-0.13958	-0.00856
Asian	0.2384821	0.0997487	2.39	0.017	0.042978	0.433986
People of Two Different Races or More	-0.569255	0.1956602	-2.91	0.004	-0.95274	-0.18577
Ages 15 to 19 Years Old	1.378925	0.5184244	2.66	0.008	0.362832	2.395018
Ages 20 to 39 Years Old	0.4569992	0.275155	1.66	0.097	-0.08229	0.996293
Ages 40 to 59 Years Old	0.5809439	0.2209976	2.63	0.009	0.147797	1.014091
Ages 60 or More Years Old	-0.298523	0.1786852	-1.67	0.095	-0.64874	0.051694
_cons	55.1648	30.79657	1.79	0.073	-5.19537	115.525
Sigma_u = 0.96829973 Sigma_e = 0.57212626 Rho = 0.74122859 (Fraction of variance due to U_i)						

Table B.3: Hausman Specificity Test Expanded Version from Chapter 4

Dependent Variable Unemployment Rate	Coefficients (b)	(B)	(b-B)	Sqrt (diag (V_b-V_B))
Independent Variables	Fixed	Random (.)	Difference	S.E.
State Wage Policy Variables				
Indexed State Wage Policy Dummy	-0.444	0.577	-1.021	0.648
Fixed State Wage Higher than Federal Wage Dummy	0.104	0.677	-0.573	(.)
State Minimum Wage as % of Average State Wage	-1.291	-0.952	-0.339	(.)
State Wage Average Amount Squared	0.016	0.012	0.004	(.)
Right to Work Law Dummy	-0.865	-0.611	-0.254	0.244
Economic Output Variables				
Agriculture Gross State Product (GSP)	-0.454	-0.212	-0.242	0.416
Agriculture GSP Squared	0.037	0.017	0.020	0.032
Manufacturing GSP	-0.059	0.042	-0.101	0.078
Retail Trade GSP	1.334	-1.448	2.782	0.476
Retail Trade GSP Squared	-0.191	0.119	-0.310	0.053
Food Services and Accommodation GSP	0.594	0.179	0.415	0.813
Government GSP	0.437	0.045	0.392	0.13
State Education Variables				
High School Diploma	-0.189	-0.271	0.082	0.088
Associates Degree	-0.383	-0.339	-0.044	0.143
Bachelor's Degree	-0.476	-0.336	-0.140	0.14
Master's Degree	-0.411	-0.55	0.139	0.117
State Demographic Variables				
Population	-3.96E-06	1.85E-07	-4.10E-06	1.00E-06
Population Squared	5.54E-14	-8.01E-15	6.34E-14	1.98E-14
Male	0.126	-0.932	1.058	0.305
Hispanic or Latino	1.224	-0.013	1.237	0.315
Black or African American	0.254	-0.037	0.291	0.335
Asian	0.338	0.167	0.171	0.4
People of Two Different Races or More	0.197	-0.388	0.585	0.302
Ages 15 to 19 Years Old	-0.439	1.585	-2.024	0.473
Ages 20 to 39 Years Old	-0.903	0.354	-1.257	0.446
Ages 40 to 59 Years Old	-1.072	0.543	-1.615	0.397
Ages 60 or More Years Old	-1.89	0.021	-1.911	0.272

b = Consistent under H0 and Ha; Obtained from xtreg

B = Inconsistent under Ha, efficient under Ho; Obtained from regress

Test: Ho = Difference in coefficients are not systematic (.05 or >)

Chi2(25) = (b-B)'[(V_b-V_B)^(-1)] (b-B)

Probability > Chi2 = 0.0000

(V_b-V_B is not positive definite)

Table B.4: Woolridge Test for Autocorrelation in Panel Data
Expanded Version from Chapter 4

Fixed-effects (within) Regression with AR(1) Disturbances

Group Variable State Identification Number (50 States and DC)	Number of Observations: 204 Number of Groups: 51 Observations per Group: 4 Min = 4, Max = 4, Avg = 4

Corr(u_i, Xb) = -0.9971	R-squared = 0.7949
F (27,126)= 18.09	Between = 0.0484
Probability > F = 0	Overall = 0.0271

Dependent Variable = Unemployment Rate						
Independent Variables	**Coefficients**	**Standard Errors**	**t**	**P>|t|**	**95% Confidence Interval**	
State Wage Policy Variables						
Indexed State Wage Policy Dummy	0.118723	0.716286	0.17	0.869	-1.29879	1.536232
Fixed State Wage Higher than Federal Wage Dummy	0.028801	0.3201092	0.09	0.928	-0.60469	0.662288
State Minimum Wage as % of Average State Wage	-2.109201	0.5725121	-3.68	0	-3.24219	-0.97622
State Wage Average Amount Squared	0.028563	0.0081777	3.49	0.001	0.01238	0.044746
Right to Work Law Dummy	-0.1658766	0.5036936	-0.33	0.742	-1.16267	0.830918
Economic Output Variables						
Agriculture Gross State Product (GSP)	0.0022137	0.4776907	0	0.996	-0.94312	0.947549
Agriculture GSP Squared	0.0071453	0.0408873	0.17	0.862	-0.07377	0.08806
Manufacturing GSP	0.1702109	0.0925769	1.84	0.068	-0.013	0.353418
Retail Trade GSP	1.392893	0.680879	2.05	0.043	0.045454	2.740333
Retail Trade GSP Squared	-0.1920054	0.0694572	-2.76	0.007	-0.32946	-0.05455
Food Services and Accommodation GSP	0.3363242	1.060417	0.32	0.752	-1.76221	2.434859
Government GSP	0.4160942	0.2053184	2.03	0.045	0.009775	0.822413
State Education Variables						
High School Diploma	-0.1927405	0.1230893	-1.57	0.12	-0.43633	0.05085
Associates Degree	-0.2265945	0.2186475	-1.04	0.302	-0.65929	0.206103
Bachelor's Degree	-0.2778484	0.1651646	-1.68	0.095	-0.6047	0.049007
Master's Degree	-0.2669995	0.1721341	-1.55	0.123	-0.60765	0.073649
State Demographic Variables						
Population	-7.13E-06	1.69E-06	-4.21	0	-1.05E-05	-3.78E-06
Population Squared	1.02E-13	3.42E-14	2.97	0.004	3.38E-14	1.69E-13
Male	0.644448	0.4447734	1.45	0.15	-0.23575	1.524642
Hispanic or Latino	0.7319061	0.4161544	1.76	0.081	-0.09165	1.555463
Black or African American	0.3405796	0.4222733	0.81	0.421	-0.49509	1.176246
Asian	1.157915	0.5488742	2.11	0.037	0.071709	2.244121
People of Two Different Races or More	0.374555	0.3610547	1.04	0.302	-0.33996	1.089072
Ages 15 to 19 Years Old	0.6723011	0.7945604	0.85	0.399	-0.90011	2.244713
Ages 20 to 39 Years Old	-0.458827	0.5790929	-0.79	0.43	-1.60484	0.687181
Ages 40 to 59 Years Old	-0.1252518	0.5066804	-0.25	0.805	-1.12796	0.877454
Ages 60 or More Years Old	-1.208755	0.3726135	-3.24	0.002	-1.94615	-0.47136
_cons	65.66848	34.89468	1.88	0.062	-3.38706	134.724
Rho_ar = 0.167703 Sigma_u = 24.747637 Sigma_e = 0.52768674 Rho_fov = 0.99954555 (Fraction of variance due to u_i)						
F test that all u_i = 0;	F(50, 126) = 10.10			Probability > F = 0.000		

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