Minimum Wages and the Macroeconomy: Exploring the Aggregate Effects of State Wage Floor Divergence

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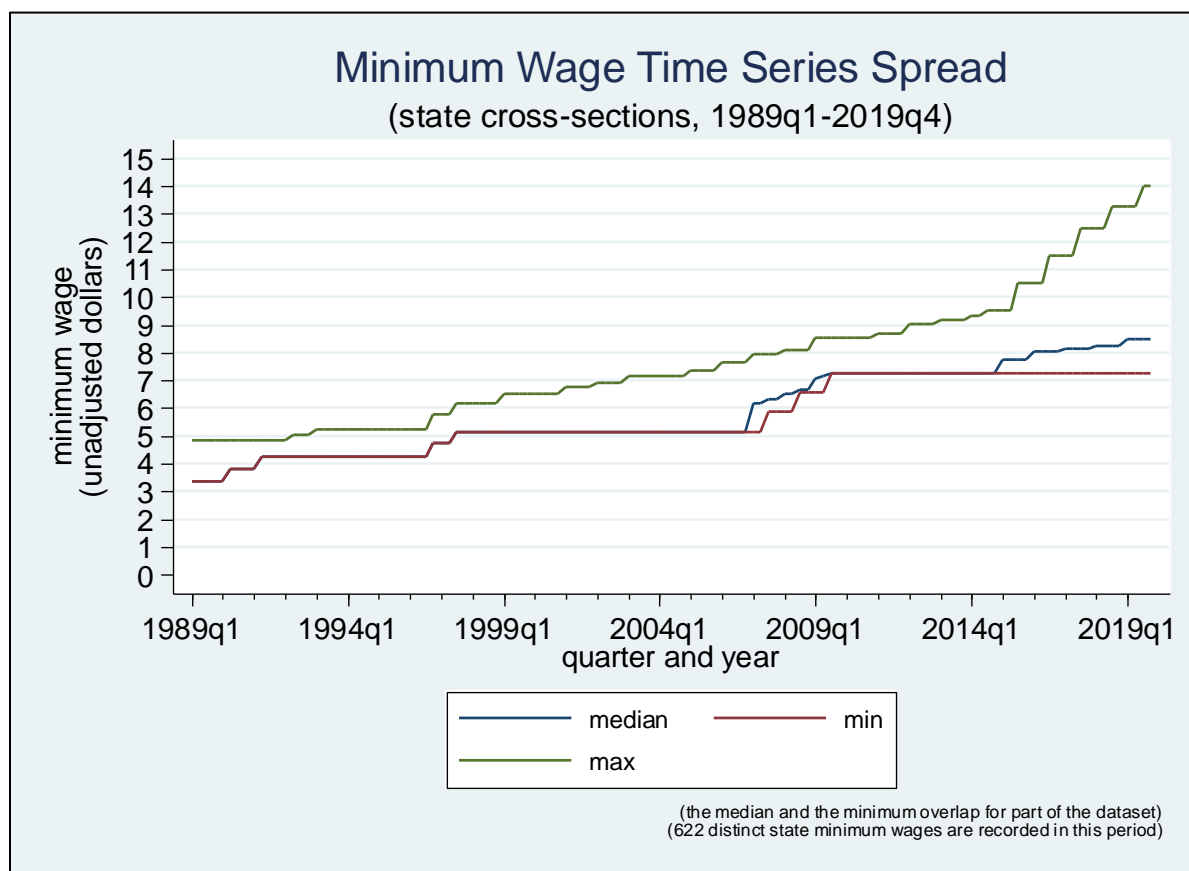Second Reader: Dr. Jason Abrevaya

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Abstract

Following widespread local-level wage floor legislation in the past decade and a continued debate on whether or not to increase the federal minimum wage, this study looks to exploit the increase in minimum wage variation to revisit the macroeconomic effects of minimum wages on inflation and labor market outcomes. State level panels spanning 31 years from 1989 to 2019 are used to examine this relationship, which is estimated using a fixed effects regression model. 571 discrete minimum wage changes are examined in this way. The empirical results suggest statistically insignificant price effects that are directionally consistent with previous studies, and negligible employment effects for a comprehensive labor market vector of unemployment, labor force participation, and employment to population ratio, that are less directionally stable. Overall, imprecision of the estimation method leads to a conclusion that minimum wages are not an aggregate economic concern and are most appropriately discussed in terms of affected subsections.

1. Introduction

First introduced across the nation in 1938 under the Fair Labor Standards Act, minimum wages mandate a minimum hourly rate that an employee in the bounded area can legally be compensated for their work, and have long been used as a tool for maintaining an acceptable standard of living for those at the bottom of the income distribution. These wage floors exist at both the federal and the state level, with the higher of the two being the effective rate in any given state. Historically, increases in the federal

minimum wage have been small and infrequent, which has sometimes led to states taking a

proactive stance in setting their own wage floors based on the needs of their local

economies. Such has been the case over the last decade. As the current federal minimum

wage of $7.25 has not moved since 2009, a decade of inflation has eroded approximately

17% of its real value, which has prompted states to respond with an unprecedented volume

of minimum wage legislation. Since 2009, 29 states plus the District of Columbia have

mandated wage floors exceeding that of the federal level (Cooper et al 2019). Figure 1

shows this increase in variation, in which the maximum, minimum, and average state

minimum wage visibly diverge. 622 state minimum wages are recorded, with 571

occurrences of minimum wage increases.

Minimum Wage Time Series Spread
(state cross-sections, 1989q1-2019q4)

(the median and the minimum overlap for part of the dataset)
(622 distinct state minimum wages are recorded in this period)

Coinciding with this heightened activity in minimum wages, the United States experienced a period of robust economic growth that had produced remarkably consistent wage growth across the entire income distribution prior to the Covid-19 pandemic. Such evenly distributed gains have been rare in the past forty years, as since around the late 1970s wage growth patterns have been characterized as chronically inadequate and unequal. For reference, real wages increased 138% for the top 1% as compared to only 15% for the bottom 90% between the years 1979 and 2013 (Mishel et al 2015). The result is that real mean hourly wages in 2018 were no higher than those in 1978 (Desilver 2018). This trend was exacerbated by the Great Recession, which further depleted prospects for most, while minimally impacting those at the top. However, beginning around 2014, the post-recession labor market started producing wage gains that, unlike previous years, favored those at the bottom. Following a widened gap between low and high earners during the recession, median percentage wage gains for those in the 1st quartile sharply increased in 2014 and overtook the overall growth rate in 2015 (frbatlanta 2019). Economists have partially explained this anomaly as a product of tightening labor markets, as similarly low unemployment rates in the late 1990s lead to mirrored labor market outcomes. Yet it is unlikely that these low-income gains are unrelated to the abundance of local minimum wage increases that they occurred in tandem with.

A possible positive relationship between minimum wages and wage growth is apparent when separating and comparing the different quartiles of income distribution. While wages grew in general after the recession, those at the bottom quartile, who are most directly affected by minimum wages, saw the largest percentage income gains

(frbatlanta 2019). Wage data from 2010 to 2018 showed that growth for the 10th percentile

(5.1%) outpaced that of the 50th percentile (2.5%) by a factor of 2 to 1, as would be

expected from a policy targeted towards uplifting those at the bottom (Nunn and

Shambaugh 2020). Disaggregating into states with and without minimum wage increases

shows that in 2019, states that mandated an elevated wage floor experienced 1.5 times

faster bottom quartile growth than those that did not (Siegel and Van Dam 2020). Even

more insight is found when separating the 29 states plus DC that had raised their minimum

wages between the years end of 2009-2018 into those with a larger and those with a

smaller increase than the median amount. While small increases in the minimum wage

correlated with varied results, states with larger increases experienced superior wage

growth below the 20th percentile, while casting doubt upon the influence of tight labor

markets due to their lower overall percentage gains at the 50th and 90th percentiles

compared to states without any raised wage floors (Nunn and Shambaugh 2020).

These results seem to suggest that local level minimum wage legislation is correlated

with superior labor market outcomes, but it would be premature to draw any meaningful

conclusions from this alone. Fully understanding the efficacy of these wage floor policies

involves more than just a casual analysis of nominal wage trends and requires that we study

the price and employment effects as well, as they have significant implications for whether

or not minimum wages can actually improve the material conditions of low-income earners.

In the case of inflation, increases in the labor costs that minimum wage employers face

could potentially lead to increases in prices to compensate. The result would be an effect on

real wages smaller than that of the legislated nominal wage increase. Loss of employment

could also occur as a result of the increased labor costs, as firms that are unwilling to accept losses to their profit margins would need to adjust their cost structures to include fewer employees. Both of these possibilities have some basis in the theoretical and empirical literature, and thus are crucial questions in determining the welfare-increasing potential of minimum wages. This paper seeks to add to the existing literature on the price and employment effects of minimum wages by exploiting the recent increase in minimum wage variation to improve precision of estimation and explore these effects in the aggregate economy. Specifically, the effects of interest are the all-industry-inclusive minimum wage semi-elasticities of inflation and a comprehensive set of employment measures including unemployment, labor force participation, and the employment to population ratio at the state level. All of these effects are found to be statistically identical to zero but are imprecisely estimated with wide confidence intervals that range in both the positive and negative directions. The general conclusion is that only certain low-income population groups or minimum wage intensive industries experience any effects, with little to no spillover across the aggregate economy.

2. Theoretical Discussion

In this section I will explore the mechanics through which price and employment effects of minimum wages can occur. The neoclassical and Keynesian models are the primary theoretical frameworks used in the literature for this task and will frame this discussion. Firm profit maximization will be assumed in both cases.

The neoclassical model has been the most widely accepted paradigm through which minimum wage effects are identified and concludes that minimum wages are a destabilizing force to the market equilibrated wage rate (Herr et al 2009). Therefore, increasing minimum wages would result in reduced employment. Underlying this conclusion are the assumptions that low-skilled labor markets, which minimum wages are effective in, exhibit similar dynamics to normal product markets and are competitive in nature. This means that the sum total of wage bargaining between employers (labor demand) and workers (labor supply) would set the market clearing wage rate, and neither party would possess significant market power over the other. Individual firms and employees would both be forced to accept the market wage, which would be equal to the marginal product of labor. Thus, the most efficient employment and wage outcomes would be naturally arrived upon absent any external disturbances or market imperfections. This implies that the model conclusively predicts a disemployment effect if the minimum wage is higher than the market wage rate. When a new minimum wage rate is introduced that is higher than the equilibrium wage rate, firms that experience this increase to their labor costs will reduce their demand for labor just as consumers would in a regular product market. The magnitude of this effect would depend upon the slope of the labor demand curve, but the sign would be unambiguously negative. Figure 2 illustrates this.

Figure 2: The Neoclassical Model

Real wage (W/P)
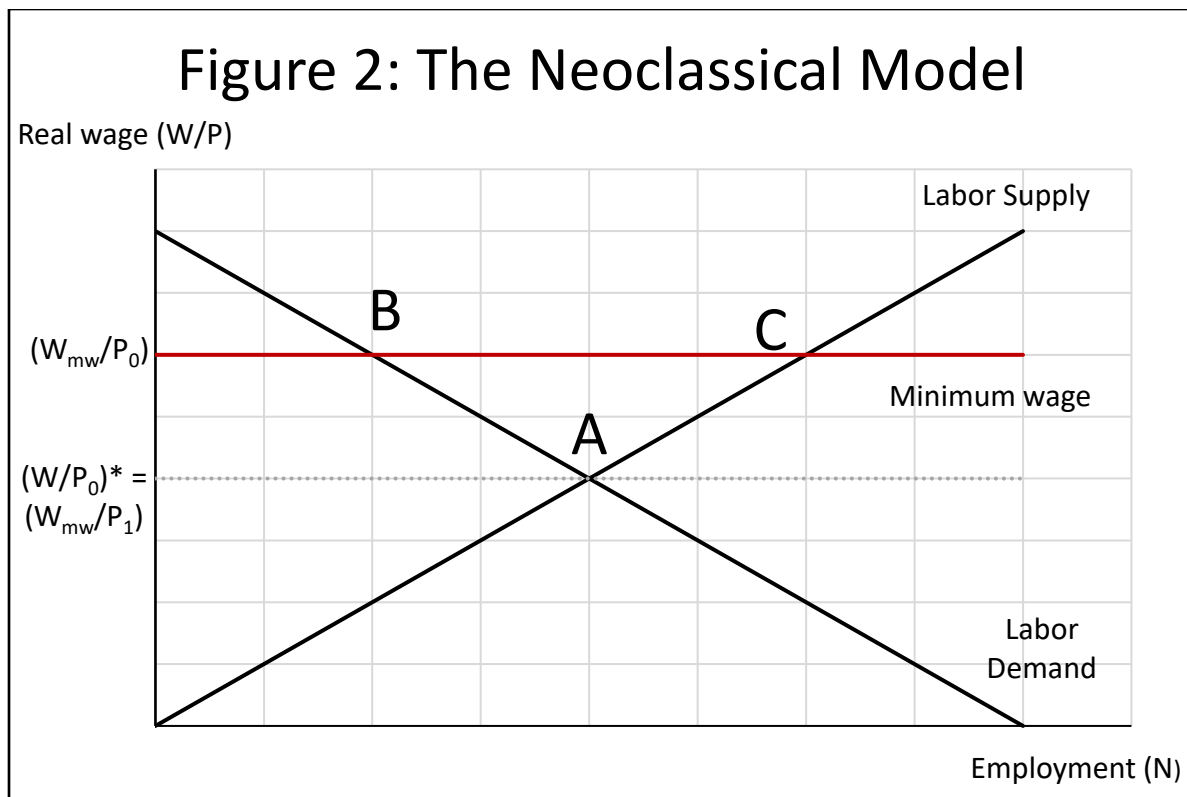
At equilibrium, the wage rate is found at the intersection of the labor supply and demand curves and is denoted by point A. The imposition of a new minimum wage that exceeds the equilibrium wage will therefore disrupt this equilibrium and create an imbalance between quantity of labor supplied and quantity of labor demanded. The difference between these two, (point C – point B), is the unemployment effect. Proponents of the neoclassical model cite this inefficiency, and generally conclude that minimum wages create a tradeoff between increased income for some and loss of employment for others. The economic value of the income gain compared to the employment loss would depend on the elasticity of labor demand. The more elastic labor demand is due to different substitutes like technology, the greater the negative impact.

Theoretically, this imbalance in the labor market could be brought back to equilibrium by an increase in prices to absorb minimum wage costs, but the neoclassical theory does not provide any predictions of price effects occurring (Herr 2002). This is due to two key assumptions. The first assumption is that firms and employees negotiate real wages ($W/_P$) and that changes in nominal wages also change real wages. This means that price does not adjust to minimum wage increases, which are set in nominal dollars. Figure 2 illustrates this.

When a new minimum wage is introduced that increases nominal wages to where $W_{mw} > W$, the real wage, which remains denominated in P_0, increases and results in point B. Should price increase from P_0 to P_1, then the real wage would be brought back to its original position, point A. However, the second assumption is that the money sphere is separate from the wider economy and exogenously determined by the central bank, and therefore price level cannot be influenced by labor market outcomes. Only the central bank can control the price level in the economy by expanding or contracting the money supply, so absent any accompanying monetary policy, an increase in the minimum wage has no counteracting price effects and is fully absorbed through employment losses.

One caveat to the neoclassical model is the case of monopsonistic competition, under which conditions Stigler (1946) first identified the possibility of minimum wages actually increasing employment. The standard monopsony model presents a firm that takes its output prices as given but has market power over its labor inputs due to there being no competing employers. As a monopolist would decrease output to exercise markup pricing, a

monopsonist would suppress employment to push wages below the marginal product of labor. In both of these situations the market price would be shifted away from the equilibrium level and therefore cause a loss of social welfare. A monopsony scenario can arise when limited choice in labor demanding firms is paired with significant search costs, travel barriers, or any other frictions in finding alternative employment. The most common example of this is coal mining towns, where the entire local economy revolves around a single dominant firm that therefore has significant wage setting capacity (Ashenfelter et al 2010). Figure 3 shows the effects of introducing a minimum wage to a monopsonist environment.

Figure 3: The Monopsony Model
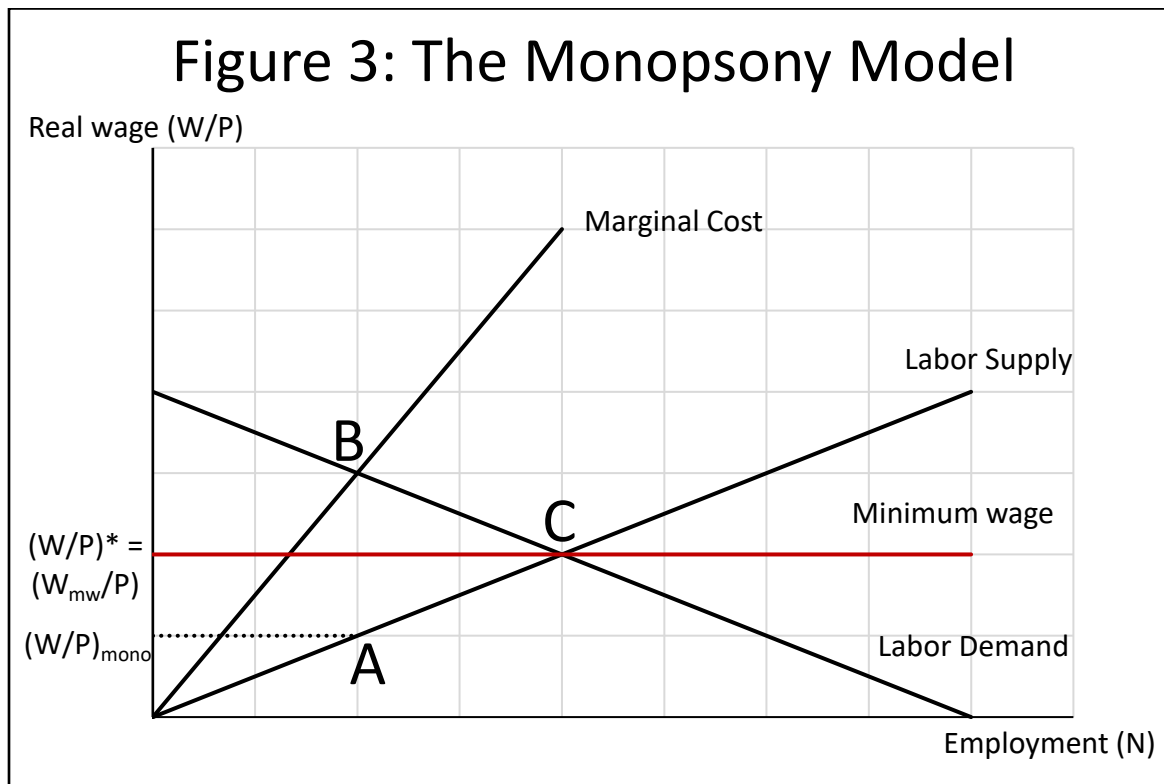
As illustrated, a monopsonistic employer exercises its market power by employing a quantity of workers such that marginal cost equals labor demand, and then offering the

marked down wage provided by the supply curve. The difference between these two (point B - point A) is the size of the mark down. When a new minimum wage is introduced, the marginal cost curve is replaced with the minimum wage line as the monopsonist can no longer legally pay a wage lower than that floor. The monopsonist would then move down their demand curve to the new point at which it intersects their new marginal cost curve. In the case of a minimum wage that is equal to the equilibrium nominal wage, point C, the competitive market equilibrium, will be arrived at. Thus, a moderately sized minimum wage can theoretically increase employment. When a monopsonist employer loses its ability to set wages, it no longer has an incentive to suppress employment and therefore adjusts to demand workers at the competitive labor market level. It is important to note, however, that a large increase in the minimum wage could further decrease employment if it is so large that it exceeds point B.

The Keynesian model in contrast to the neoclassical model primarily has the cost of minimum wages absorbed through price increases rather than employment losses. The major assumption in this case is that while wages are negotiated between employers and employees, prices are unilaterally decided by the production side (Herr 2002). This implies that wages are set in nominal rather than real terms as price levels, and therefore real wages, are determined by the collective pricing decisions made by firms across the entire economy. Depending on their degree of market power, individual profit maximizing firms have the ability to protect their margins by raising prices. Therefore, the more inelastic overall demand is in industries whose input costs are affected by a minimum wage increase, the more this cost will be transferred to consumers in the form of higher prices.

This is not to say, however, that minimum wage costs that are not absorbed in price increases will necessarily appear in employment effects. In general, related employment effects in the Keynesian model are ambiguous and occur in two opposing vectors. The first of these is indirect disemployment due to the aforementioned price increases and price elasticities. When an employer is faced with a new minimum wage and the elasticity of their demand function does not allow them to mark up prices to the amount that would cover their profit losses, some unemployment can be expected to occur. Firms will attempt to substitute away from low-skilled labor towards new technologies or lower quantities of higher skilled workers. How successful they are at this will determine the size of the disemployment effect. In practice, this effect is unlikely to reach beyond the directly affected industries, as most firms that rely on minimum wage labor in their cost structures trade in final goods such as fast food or groceries. Thus, these firms do not produce inputs used in other industries and "ripple effects" are unlikely to occur.

The second potential effect is the increase in minimum wages causing an income effect. When minimum wages increase, it can be expected that some workers experience an increase to their income while others become unemployed and therefore earn net zero wages. In the case that the income gains outweigh the income losses, aggregate demand will increase since low-income earners have a higher propensity to spend than higher income workers. This in turn leads to an increase in employment and production given that the economy has the spare capacity available to meet this new, higher level of demand. Overall, these two opposing effects make it impossible to predict employment effects from theory alone. However, as opposed to the neoclassical model, the Keynesian model places

more emphasis on aggregate demand than labor markets when determining employment and production outcomes.

3. Literature Review

As minimum wages have been in effect for nearly a century, the existing literature on minimum wages' inflationary and labor market effects is extensive. Research methods include both local level case studies and national panel approaches like ours and have expanded greatly since the revitalization of the minimum wage debate by Card and Krueger's 1990s publications. Analysis of this literature will be restricted to studies conducted contemporary to or after Card and Krueger, as they simultaneously reflect the underlying schism of economic thought on minimum wages and benefit from the same divergence in regional minimum wage variation that this study utilizes.

A. Price Effects

Studies of this category have looked to estimate the pass through of minimum wages into consumer prices. Most price pass through studies in the past twenty years have focused on individual product markets that involve significant minimum wage labor costs, and do not measure aggregate price movements like this study does. The most common of these industries studied is the fast-food restaurant industry. Such firms often employ a large share of minimum wage workers in their labor structure and have easily available price data, so, theoretically, estimates of minimum wage elasticities of price should be relatively accurate and detectable. The common consensus from these studies is that higher

minimum wages are associated with a small increase in restaurant prices, with an elasticity

generally around 0.04.

Card and Krueger (1994) is the most cited local level price effect study and uses the

Philadelphia-Camden multi-state metropolitan area, which in 1992 experienced a minimum

wage increase effective in New Jersey but not Pennsylvania. This allowed for the

researchers to perform a natural experiment in which the Pennsylvanian portion of the

metropolitan area served as a convincing counterfactual. The overall relative price increase

in New Jersey as compared to Pennsylvania was found to be approximately 4%, but precise

minimum wage elasticity estimates were unable to be made in part due to the use of self-

reported survey data resulting in large standard errors. A similar study was conducted by

Allegretto and Reich (2016), in which the effect of a 25% increase in San Jose's city

minimum wage in 2013 is estimated through online restaurant price data. The data used in

this study came directly from restaurants' online menus and lead to a more accurate

restaurant price elasticity estimate of 0.058. Business flight in the form of businesses

leaving San Jose for areas with a lower prevailing minimum wage was also found to be

negligible.

Card and Krueger (1995) again explores minimum wage price effects using a national

panel of 29 cities and BLS food away from home (FAFH) CPI data from 1989-1992. Similarly-

low and imprecise estimates to their 1994 study were found using this national level

method, and a null hypothesis of zero price pass through for the 1990 and 1991 federal

minimum wage increases was unable to be rejected. Also using city cross-sections and FAFH

data, Aaronson (2001) finds a price elasticity of 0.056 that is statistically significant at the

15

1% level for the years 1978-1995. Full price pass through is concluded from this result.

Similar methodologies, results, and conclusions were reported in Aaronson, French, and

MacDonald (2008), Basker and Khan (2016), and MacDonald and Nilsson (2016).

Lemos (2008) and Allegretto and Reich (2016) provide a broad survey of these fast-food

restaurant studies and find that elasticity estimates are generally around 0.04. This equates

to a 10% increase in the minimum wage resulting in an estimated 0.4% increase in

restaurant prices. Lead and lag effects were also found to be negligible, with price effects

centered within the two months surrounding a minimum wage increase. Lemos (2008)

further surveys price effects obtained through all-industry inclusive studies. Minimum wage

elasticity estimates from these studies are slightly lower, but primarily utilize older data

from before 1980 and estimation methods that are not used in more recent research.

B. Labor Market Effects

For most of its history, the research on the employment effects of minimum wages

maintained a consensus on a model of competitive low-income labor markets, and thereby

minimum wage increases leading to a tradeoff between income and employment. Card and

Krueger's 1990s publications disrupted this consensus and separated the literature into two

opposing fields; the "canonical" side follows the prior economic theory and finds significant

negative minimum wage elasticities of around -0.165, while the "new minimum wage

research" spurred by Card and Krueger contends that these effects are statistically

indistinguishable from zero when employing new research methods such as quasi-

experimentation or including controls for regional labor market heterogeneity. Of those

who found negligible employment effects, Card and Krueger in the 1990s, and Dube, Reich, and colleagues in the 2010s are the primary authorities in the debate. Neumark and Wascher unofficially represent the former group in both periods. Central to this debate is the effectiveness of different methods of obtaining counterfactuals.

Using a survey of Texas restaurants before and after the April 1st, 1991 federal minimum wage increase from $3.80 to $4.25, Katz and Krueger (1992) identifies firms that had already paid higher than $4.25, and thereby were not affected by the heightened wage floor, as a control group to compare against a treatment group of firms that didn't. The observed result was that firms that were affected by the wage increase experienced superior employment growth to those that were not, which strongly contradicted the previous literature. Card and Krueger (1994) furthered the evidence for this result, in which the New Jersey and Pennsylvania based case study found a 13% increase in New Jersey, the treatment state, compared to Pennsylvania, the control state. The joint conclusion of these two studies was that minimum wages of a moderate size did not lead to disemployment.

These results were challenged in Neumark and Wascher (2000), in which the use of telephone survey data for New Jersey and Pennsylvania restaurants was criticized as causing a lack in accuracy and was replaced with administrative payroll data directly from a sample of establishments. Using this payroll data, a direct replication of Card and Krueger's methodology lead to contrasting results of an elasticity between -0.21 and -0.22, which was consistent with the canonical literature. Card and Krueger (2000) addressed the criticism of their 1994 study by retesting the payroll data provided by Neumark and Wascher and including new ES-202 data from the Bureau of Labor Statistics. They again found either no

employment effect or a small positive effect, and that a single franchisee in the payroll data had on its own driven the negative effects reported by Neumark and Wascher. Ultimately, Card and Krueger maintained their original conclusion that no effect was probable, and a slight increase was possible, while Neumark and Wascher narrowed their conclusion to minimum wages certainly not increasing employment.

Following this discussion, Neumark and Wascher (2007) synthesized the entirety of the new minimum wage research and found that variation of estimates between studies had expanded dramatically since the summary of the canonical literature by Brown et al (1982). Dube et al (2010) and Allegretto et all (2011) attributed this divergence to a failure of previous studies to control for unobserved spatial heterogeneity in labor markets, which led to both a downward bias on estimates of employment effects in national panel studies and an overstatement of precision in regional case studies. These two studies jointly argued that differences in regional employment patterns made it problematic to use states from different regions as controls for each other and addressed this issue in two separate methods. In an extension of the method used in Card and Krueger (1994), Dube et al (2010) uses a panel of all 318 pairs of counties that were bisected by a state border and provided continuous data between 1990 and 2006, in which these cross-state counties would serve as counterfactuals for each other. Employment effects were found to be statistically identical to 0, with a 95% confidence interval excluding elasticities more negative than -0.178. Similar results were found in Allegretto et al (2011), in which controls for census division-specific time effects and state-specific time trends were added to the standard national panel that only controls for time and state fixed effects. This method caused states

to only be compared to those in the same census division and yielded a positive but non-significant elasticity of 0.047, with a 95% confidence interval that ruled out estimates more negative than -0.072.

4. Data

To measure the relationship between minimum wages and macroeconomic outcomes over time and geographical area, the empirical model uses a panel data set that covers a 31-year period at a quarterly frequency from 1989 to 2019, with each state plus the District of Columbia serving as the cross-sectional units. Minimum wages are the independent variable, and the four dependent variables are inflation rates, unemployment rates, labor force participation rates, and employment to population ratios. Though national level minimum wage studies that include price effects are more commonly done using metropolitan area observations due to the lack of federal reporting on state level inflation, the recent availability of reliable state inflation figures from independent studies grants the opportunity for a state level analysis. Compared to extrapolating price data from the few large metropolitan areas that the BLS reports consumer price index information for to entire states, the new state inflation rates rely on BLS micro-data across entire states, which factors in general price differences between large cities and lesser populated areas. It would not make sense to believe prices in Houston are the same as in its surrounding areas.

Additionally, states at the all-inclusive division are the most disaggregated level at which all of the variables of interest are available. Labor force participation and employment to population ratio in particular are not available at lower cross sections such as metropolitan

areas. Further breaking estimates down into specific industries, which much of the previous literature has done, would not make sense either when including these two labor market indicators as there is no relevant "population base" for an industry. Also, viewing minimum wage effects through subpopulations such as teens or low-wage workers as is done in the employment effect literature excludes price identifying capabilities. Therefore overall, this state level approach is the most logical and allows for both a complete area coverage for prices in each state, and access to comprehensive labor market statistics directly from the Bureau of Labor Statistics.

Using state data as opposed to metropolitan areas has several additional advantages. First, the problem of certain metropolitan areas covering multiple cities and states and thereby holding multiple minimum wages is eliminated. As seen in Card and Krueger (1994), the Philadelphia-Camden metropolitan area includes both Pennsylvania and New Jersey and hosted two different prevailing minimum wages concurrently during the time frame of the study. A national panel study at the metropolitan level would require that such observations either involve intermediate estimates or be omitted. State data does not face this problem, and therefore reduces the possibility of estimation error and data omission. Furthermore, states have universally defined boundaries, so the variables of interest represent the exact same geographical area. Definitions of metropolitan area boundaries vary, which leads to area of coverage inconsistencies as unemployment statistics are reported by MSA and inflation is reported by CMSA.

One key disadvantage of state data, however, is that intrastate minimum wage variation is eliminated. For example, San Jose city proper has a higher minimum wage than the rest of

the state of California, as do many other cities within the state. This is problematic since much of the identifying information used to calculate state level statistics comes from these cities. Philadelphia in particular highlights this issue, as it is the largest city in the state of Pennsylvania and in 2019 had a city minimum wage over 80% higher than the rest of the state, which maintains the federal minimum wage of $7.25. New York City's 2019 minimum wage was only 35% larger than the rest of the state's, but the city constituted 43% of the state population. Therefore, given these cities' importance to their states' economies, it is likely that the distorting impacts of this state approach is nontrivial, and that there is a tradeoff between complete state-geographic coverage for prices and a full labor market indicator vector on one hand, and recognition of intrastate variation on the other. In other words, given the current availability of data, some inconsistencies in the pairing of minimum wages to the dependent variables will be present regardless of the methodology used.

Table 1 provides descriptive statistics for state minimum wages and each of the dependent variables.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Minimum wage	6324	6.039	1.688	3.35	14
Inflation	3943	2.333	1.418	-4.034	9.352
Unemployment	6324	5.48	1.9	1.8	14.4
Labor force participation	6324	66.315	4.204	52	75.83
Employment to population ratio	6324	62.708	4.558	46.93	73.6

Sources by variable:
[1] Minimum wage: Vaghul and Zipperer (2016) https://equitablegrowth.org/working-papers/historical-state-and-sub-state-minimum-wage-data/ and various state labor department websites.
[2] Labor variables: Bureau of Labor Statistics https://data.bls.gov/cgi-bin/surveymost?la
[3] Inflation: Hazell et al (2020) https://sites.google.com/view/jadhazell/state-consumer-price-index

A. Minimum Wage Data

The primary independent variable used in this paper is state level minimum wages and is documented in annual time series format by the Department of Labor. Values reported on the DOL website reflect the legislated wage floor in each state as of January first of each year and do not include effective dates, so data provided by Vaghul and Zipperer (2016) and various state labor websites were used to find these dates. Each of these dates of minimum wage increases are then corresponded with the quarter in which they occur in. 571 discrete minimum wage changes are documented in this panel set and are detailed in Table A1.

Worker coverage for minimum wages is defined by the Department of Labor to extend to nonsupervisory, nonfarm, private sector employment. In the case where state minimum

wages differ from the federal level, the higher of the two is adopted as the effective minimum wage. Certain irregularities are present in the minimum wages, as some states opted to legislate different levels for firms of different sizes, using criteria such as number of employees and annual receipts. In these cases, the highest value is the one included within the data set, as the lower values are reserved for only a small share of employers.

B. Dependent Variable Data

Since inflation is not documented at the state level by any federal agencies, unofficial estimates by Hazell et al (2020) are used as a substitute. Estimated inflation rates drawn from this study are annualized quarterly inflation rates and cover the years 1989-2017 for 33 states plus DC. These figures were originally used to study the behavior of the Phillips Curve, and are constructed using Bureau of Labor Statistics micro-price data that covers approximately 70% of consumer spending in the United States. Advantages of these inflation estimates over those of other studies that are based on cost-of-living estimates or scanner price data are its longer sample period, extensive geographic coverage, and calculation method that does not rely on data from other regions to fill the gaps in BLS reporting.

Data for state unemployment, labor force participation rates, and employment to population ratios are taken directly from the Bureau of Labor Statistics website, which relies on their Local Area Unemployment Statistics (LAUS) program to collect and report state, county, metropolitan, and other local level labor force statistics. These estimates are available at the month and year frequency and rely on estimation models that use

information from several surveys and unemployment insurance claim counts. Figures for

states are adjusted to sum to the national estimates reported in the Current Population

Survey.

The inclusion of these three different measures of employment allows for a complete

analysis of the employment effects, as each of these variables represents a different

subpopulation with definitions as follows:

1. $Unemployment\ Rate = \frac{unemployed\ workers}{total\ labor\ force}\ x\ 100$

Unemployed workers are classified as those who were not employed during a survey

reference week and had made at least one effort to find a job in the preceding 4 weeks,

whether it be formally taking part in an employment process or simply seeking assistance

from social connections. Discouraged workers and other potential workers who had not

made efforts to find employment in the preceding four weeks are not classified as

participants in the labor force, which is itself the sum total of those who are either

employed or unemployed. Thus, these individuals are excluded from unemployment

figures, and separate metrics that are not denominated in total labor force are needed to

account for this coverage gap.

2. $Labor\ Force\ Participation = \frac{total\ labor\ force}{civilian\ noninstitutional\ population}\ x\ 100$

Civilian noninstitutional population is the general population base that the Bureau of

Labor Statistics concerns itself with, and refers to all individuals over the age of sixteen who

are neither serving active duty in the armed forces nor institutionalized in jails, correctional

facilities, etc. Relating total labor force to the civilian population base measures aggregate self-selection behavior in the labor force, which helps correct for the blind spots of the unemployment rate as those individuals who were previously unaccounted for are made visible by this statistic.

$$3. \quad Employment\ to\ Population\ Ratio = \frac{employed\ workers}{civilian\ noninstitutional\ population} \times 100$$

Often referred to as the "employment rate," this figure is dissimilar to the unemployment rate in that it is denominated in civilian noninstitutional population rather than total labor force, and therefore does not equate to an inverse of the unemployment rate. The employment rate and the unemployment rate do not sum together to 100%.

Employed workers is defined as anyone who, within the survey reference week, worked for at least 1 hour under employee status or self-employment, were temporarily absent from a job to which they would return, or worked without pay for a minimum of 15 hours at a family-owned enterprise. Like the labor force participation rate, the ratio between employed workers and civilian population remedies the workforce-absence coverage gap in the unemployment rate.

5. Empirical Model

To estimate the effect of minimum wages on inflation and employment, four different fixed effects specifications are run on each of the dependent variables: inflation, unemployment, labor force participation, and employment to population ratio. This strategy is common in minimum wage research and allows for the geographical and time

related variation in minimum wages to be fully captured and accounted for. The inclusion of three different employment indicators allows for full population coverage such that all possible effects experienced in the labor market will be accounted for. Minimum wages in log format are the independent variable in each of these regressions and will be related to the four dependent variables in level format. Clustered standard errors at the state level are built into the fixed effects regression method. The estimation models are as follows:

A. Baseline:

$$Inflation_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + \rho_{st} + u_{st}$$

$$Unemployment_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + u_{st}$$

$$LFParticipation_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + u_{st}$$

$$Emp/pop_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + u_{st}$$

where subscripts *s* and *t* represent state and quarter-year values. State indicators (β_s) and year indicators (γ_t) are included to control for time invariant heterogeneity between states and general time trend effects. ρ_{st} is a control for the unemployment rate and is only used in the inflation regression. u_{st} is a time and state variant error term.

B. GDP Controlled:

$$Y_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + \rho_{st} + \varphi X_{st} + u_{st}$$

Y_{st} represents the exact same dependent variables as in the former specifications. X_{st} represents an additional control vector for state GDP in order to separate effects caused by minimum wages and effects caused by macroeconomic variation.

C. Time-variant State Heterogeneity

An additional set of two specifications that include time-variant state effects where *time* is

the actual year and quarter value rather than an indicator are detailed in general form as

follows:

$$Y_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + \rho_{st} + \beta_s * time + u_{st}$$

D. Full Specification

The final specification includes all previously introduced controls:

$$Y_{st} = \alpha + \beta_s + \gamma_t + \delta \log(minwage_{st}) + \rho_{st} + \varphi X_{st} + \beta_s * time + u_{st}$$

Lead and lag variables to adjust for serial correlation are not included in any of these

specifications as previous studies have found their importance to be negligible. To obtain

direct elasticities, each of the dependent variables except inflation is logged. Negative

inflation estimates within the dataset do not allow for this variable to be logged, so

elasticities are alternatively obtained by dividing inflation's coefficient by its mean value.

6. Empirical Results

In this section I discuss the price and employment effects that are estimated using the

previously described methods. These effects are separated between price and employment

effects and are measured in level-log models for ease of interpretation. Each of the

coefficients are therefore semi-elasticities and are interpreted as a 1% change in minimum

wages associating with a $\frac{\beta}{100}$ change in levels. The dependent variables, the inflation rate,

the unemployment rate, the labor force participation rate, and the employment to

population ratio, are all denoted in percentage points. This means that a hypothetical semi-elasticity of 0.5 would be interpreted as a 1% increase in the minimum wage equating to a 0.005 percentage point increase in the dependent variable. Standard errors for these estimates are clustered at the state level by default in the fixed effects regression models. The model with the full set of controls is the preferred specification, and is given extra consideration in interpreting each of the variables' regression results.

A. Price Effects

Table 2 summarizes the four different specifications for inflation. The reported β value for Log(minwage) is the minimum wage semi-elasticity of inflation.

Table 2:
Regression results for inflation semi-elasticities.

Specifications		(1)	(2)	(3)	(4)
		Baseline	GDP	Time Variant	Full Model
Log(minwage)					
	β	0.043	0.214	0.334	0.685
	se	(0.466)	(0.82)	(0.539)	(0.927)
	95% CI	[-0.90, 0.99]	[-1.46,1.88]	[-0.76, 1.43]	[-1.20, 2.57]
Unemployment					
	β	-0.084*	0.021	-0.071	0.019
	se	(0.047)	(0.066)	(0.057)	(0.067)
GDP					
	β		-0.004		-0.001
	se		(0.007)		(0.007)
Constant					
	β	1.854*	1.11	0.75	-1.742
	se	(1.024)	(1.796)	(1.125)	(1.393)
Observations		3943	1767	3943	1767
R-squared		0.547	0.557	0.56	0.594
GDP		No	Yes	No	Yes
Time-variant state effect		No	No	Yes	Yes

Clustered standard errors are in parentheses. Indicator variables omitted in the output table.
*** $p<.01$, ** $p<.05$, * $p<.1$

For model 1, which only includes controls for unemployment, year, and state fixed effects, the minimum wage semi-elasticity of inflation is estimated to be 0.0431 and is statistically insignificant. This is interpreted as a 10% increase in the minimum wage being associated with a 0.00431 percentage point increase in the inflation rate. Using a hypothetical inflation rate of 2%, this value would increase to 2.00431%. Including further controls in the rest of the specifications fails to increase this estimate by any meaningful amount, and statistical insignificance is found across each of the models. Model 4, which has a full control vector, produces the highest semi-elasticity of 0.685 which is interpreted as a 10% increase in the minimum wage being associated with a 0.0685 percentage point increase in the inflation rate. In terms of economic significance, this effect would be negligible.

Along with small coefficients, the models are also estimated with a high degree of imprecision, which is evidenced by the large standard errors and wide confidence intervals that range in both directions around zero. Adding GDP as a control in model 2 increases the coefficient to 0.2137, but the standard error also increases by more than 75%. An issue with this estimate is the reduction in sample size due to GDP data being unavailable for much of the dataset. Data for GDP, which is measured in annualized percentage change from the previous quarter, is only reported by the Bureau of Economic Analysis starting in 2005. This effectively shrinks the number of observation periods by more than two times between the specifications with and without GDP, which leads to potential biases in the coefficient and standard error calculations in models 2 and 4. Model 3 adds a control for time-variant state

effects to the baseline specification in model 1 and sees a further increase in the semi-elasticity to 0.334. No loss of identifying information occurs in this model, so the increase in the standard error is more modest than in model 2. All of the controls are included in model 4, which as noted has the highest semi-elasticity estimate, but also has the highest standard error. The 95% confidence interval for this model is (-1.20, 2.57), and means that the true effect of a 10% minimum wage increase on the inflation rate is anywhere between a 0.12 percentage point decrease and a 0.257 percentage point increase with 95% certainty.

Overall, each of the specifications returned a positive semi-elasticity that is directionally consistent with the literature but is statistically insignificant. These coefficients are economically immeasurable in magnitude and are estimated with a high degree of imprecision that is evidenced by large standard errors and wide confidence intervals that further increase/expand when including additional controls, GDP in particular. This suggests that economy-wide price effects are near negligible at the observed levels of minimum wage increases, or at least more modest than those found in the standard literature that focuses on specific industries.

B. Employment Effects

The following regression tables show the minimum wage effects on labor markets, with unemployment, labor force participation, and employment to population ratio used in conjunction to achieve full coverage. Table 3 details the effects of minimum wages on unemployment.

Table 3:

Regression Results for unemployment semi-elasticities

Specifications		(1)	(2)	(3)	(4)
		Baseline	GDP	Time Variant	Full Model
Log(minwage)					
	β	-0.372	-0.248	-0.455	-0.735
	se	(.713)	(1.079)	(.976)	(1.356)
	95% CI	[-1.80, 1.06]	[-2.42, 1.92]	[-2.41, 1.51]	[-3.46, 1.99]
GDP					
	β		-0.01		-0.001
	se		(0.006)		(0.007)
Constant					
	β	4.116**	3.809	2.562	13.761***
	se	(1.54)	(2.351)	(1.93)	(2.507)
Observations		6324	3060	6324	3060
R-squared		0.721	0.819	0.76	0.85
GDP		No	Yes	No	Yes
Time-variant state effect		No	No	Yes	Yes

Clustered standard errors are in parentheses. Indicator variables omitted in the output table.

*** p<.01, ** p<.05, * p<.1

The baseline specification provided by model 1 shows a semi-elasticity of -0.372, which seems to contradict the canonical assumption of a positive association between minimum wages and unemployment. However, this estimate is statistically insignificant. Adding GDP as a control in model 2 reduces the estimate to -0.248, and models 3 and 4 which include time-variant state effects again produce negative semi-elasticities of -0.455 and -0.735 respectively. None of the models estimate a statistically significant semi-elasticity, and the large standard errors produce imprecise 95% confidence intervals that extend in both the positive and negative direction. Model 4 again has the largest coefficient by magnitude and the largest standard error, which gives us a confidence interval of (-3.46,

1.99). This means that the true effect of a 10% increase in the minimum wage on the

unemployment rate is between a 0.346 percentage point decrease and a 0.199 percentage

point increase. Assuming an unemployment rate of 5%, the minimum wage change will

result in a new unemployment rate between 4.654% and 5.199%. This confidence interval

leans further in the negative direction, but the wide range paired with a statistically

insignificant coefficient is very weak evidence against the canonical literature.

     Table 4 details the minimum wage effects on labor force participation.

Table 4:
Regression Results for labor force participation semi-elasticities

Specifications		(1)	(2)	(3)	(4)
		Baseline	GDP	Time Variant	Full Model
Log(minwage)					
	β	0.925	1.194	0.325	-0.277
	se	(1.1)	(1.144)	(0.81)	(0.889)
	95% CI	[-1.28, 3.13]	[-1.11, 3.49]	[-1.3, 1.95]	[-2.06, 1.51]
GDP					
	β		-0.007		-0.011
	se		(0.005)		(0.005)
Constant					
	β	61.809***	61.199***	63.936***	51.603***
	se	(2.32)	(2.429)	(1.573)	(1.688)
Observations		6324	3060	6324	3060
R-squared		0.643	0.736	0.808	0.841
GDP		No	Yes	No	Yes
Time-variant state effect		No	No	Yes	Yes

Clustered standard errors are in parentheses. Indicator variables omitted in the output table.

*** p<.01, ** p<.05, * p<.1

Model 1 provides a baseline estimate of 0.9251, which is statistically insignificant but directionally suggests that increases in minimum wages are associated with increases in labor force participation. Controlling for GDP in model 2 leads to a slightly larger coefficient and a nearly identical standard error. The time-variant state effects added in models 3 and 4 lead to much reduced estimates of 0.3247 and -0.2769 respectively, with the latter being the only negative semi-elasticity. None of the estimates are significant, and the difference in sign between model 4 and the other three models is of note. While models 1, 2, and 3 suggest a positive relationship between minimum wages and labor force participation, the coefficient for model 4 is interpreted as a 10% increase in the minimum wage associating with a 0.0277 percentage point decrease in the population's engagement in the job market. This complicates directional conclusions about the effect of minimum wages on labor force participation, which can only be assumed to be ambiguous from these regressions alone. Later we will see that this relationship can be predicted contingent on the semi-elasticities of the other labor market variables.

Table 5 details the minimum wage effects on the employment to population ratio.

Table 5:

Regression Results for employment to population ratio semi-elasticities

Specifications		(1)	(2)	(3)	(4)
		Baseline	GDP	Time Variant	Full Model
Log(minwage)					
	β	1.198	1.434	0.715	0.373
	se	(1.215)	(1.309)	(1.12)	(1.365)
	95% CI	[-1.24, 3.64]	[-1.2, 4.06]	[-1.53, 2.97]	[-2.37, 3.11]
GDP					
	β		0		-0.009
	se		(0.005)		(0.008)
Constant					
	β	59.121***	58.609***	62.125***	42.689***
	se	(2.547)	(2.805)	(2.198)	(2.516)
Observations		6324	3060	6324	3060
R-squared		0.657	0.731	0.796	0.814
GDP		No	Yes	No	Yes
Time-variant state effect		No	No	Yes	Yes

Clustered standard errors are in parentheses. Indicator variables omitted in the output table.

*** p<.01, ** p<.05, * p<.1

Like for the previous two employment variables, the calculated minimum wage semi-elasticities for the employment to population ratio are insignificant and imprecisely estimated across the four models. The baseline semi-elasticity in model 1 is 1.1978, to which controlling for GDP in model 2 appears to mildly increase both the coefficient and the standard error. Including the time-variant state effects in models 3 and 4 reduces the semi-elasticity estimates to 0.7154 and 0.3727, respectively. Standard errors do not change dramatically between the four models. The coefficient for model 4 can be interpreted as a 10% increase in the minimum wage associating with a 0.0373 percentage point increase in

the proportion of the population that it is employed. Models 1, 2, and 3 suggest a similar relationship. While these effects are all statistically insignificant, the consistency in direction indicates a likelihood of a positive true effect such that increases in the minimum wage are expected to increase the employment to population ratio. The 95% confidence intervals further support a positive relationship as the absolute value of the upper bounds exceed those the lower bounds.

Overall, estimates for each of the three employment variables provide no evidence of statistically significant employment effects of minimum wages, but large standard errors and wide confidence intervals present a nontrivial possibility of random estimation error. Because of this it is difficult to conclude a consistent 0 semi-elasticity. Assuming nonzero effects, the regressions suggest a possibility of a negative relationship with unemployment and a positive relationship with the employment to population ratio due to the estimates' directional consistency. The effect on labor force participation was found to be directionally ambiguous and is mathematically dependent upon whether the decrease in unemployed individuals or the increase in employed individuals is larger. This is because civilian noninstitutional population can be reasonably assumed as constant in this context, so labor force participation, which equals total labor force (employed individuals + unemployed individuals) divided by population, must therefore change through the numerator. However, since the point semi-elasticities are statistically insignificant and imprecise, these relative magnitudes cannot be determined, and no conclusions can be drawn on the labor force participation effects of minimum wages.

7. Conclusion

As regional minimum wage legislation has expanded greatly within the last decade and provided new research opportunities, the debate over the efficacy of these wage floors has taken a primary role in our national economic discourse. Prominent in the news is the contentious proposal for a new $15 federal minimum wage, which necessities further contributions and discussions in the minimum wage literature. In this paper, I employ a state cross-sectioned national panel identification strategy spanning 1989-2019 to utilize the recent increase in regional minimum wage variation, and pair this with newly available state inflation data and a comprehensive set of employment measures to obtain updated estimates of the aggregate price and employment effects of minimum wages.

After testing this model and including ancillary specifications that control for GDP and time-variant state effects, no statistically significant effects were found, with large standard error calculations resulting in imprecise semi-elasticity estimates. Inflation semi-elasticity estimates were positive and directionally consistent with the previous literature, but much smaller in magnitude. The insignificant p-values of these estimates suggest a possibility of 0 detectable price effects across the macroeconomy, however their imprecision leads to a more modest conclusion that these price effects are at least considerably smaller than those found in the standard individual-industry studies. That is not to say, however, that price effects do not occur in these minimum wage intensive industries, but that across the entire economy these effects are diluted and hidden by the mass of product markets that are not affected. Results for employment elasticities are also statistically insignificant yet are more varied in their directional effect. Labor force participation semi-elasticities in

particular change in sign between model 4 and models 1, 2, and 3. As model 4 is the preferred specification, this makes it difficult to conclude a directional relationship. Semi-elasticities for unemployment and employment to population ratio are more stable across specifications, which suggests that the true treatment effect for these variables is most likely either statistically indistinguishable from zero, or slightly negative and positive, respectively. Overall, these results appear to be consistent with the new minimum wage research that primarily finds no detectable effects of minimum wages on employment but cannot be said to provide conclusive support for that premise.

Finally, this method of analyzing aggregate price and employment movements induced by minimum wages does indeed seem to be predisposed towards producing statistically insignificant and imprecise results. As noted, minimum wage earners comprise less than 3% of the work force and are constrained to industries that trade in final consumer goods. Therefore, neither large direct impacts nor indirect impacts through increased input costs for other industries can be expected to occur. Finding no economic differences between states of differing wage floors is not without value, but models with stronger point estimation capabilities are more appropriate for informing future policy decisions that depend on the accurate appraisal of the effects incurred by those that the policy is intended to target. Further research that disaggregates into individual minimum-wage-intensive industries or low-income subpopulations such as teens is needed to retest this paper's findings. Takeaways from this study are that future minimum wage debates should be centered on affected subsections rather than the economy as a whole, as evidently minimum wages are not an aggregate economic concern.

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9. Appendix

Table A1: State Minimum Wages

State	Number of minimum wages	State	Number of minimum wages
1. Alabama	8	2. Alaska	13
3. Arizona	16	4. Arkansas	12
5. California	14	6. Colorado	18
7. Connecticut	19	8. Delaware	16
9. District of Columbia	14	10. Florida	19
11. Georgia	8	12. Hawaii	12
13. Idaho	8	14. Illinois	11
15. Indiana	8	16. Iowa	8
17. Kansas	8	18. Kentucky	8
19. Louisiana	8	20. Maine	16
21. Maryland	13	22. Massachusetts	13
23. Michigan	13	24. Minnesota	13
25. Mississippi	8	26. Missouri	15
27. Montana	18	28. Nebraska	10
29. Nevada	10	30. New Hampshire	9
31. New Jersey	14	32. New Mexico	9
33. New York	15	34. North Carolina	8
35. North Dakota	9	36. Ohio	16
37. Oklahoma	8	38. Oregon	23
39. Pennsylvania	8	40. Rhode Island	16
41. South Carolina	8	42. South Dakota	13
43. Tennessee	8	44. Texas	8
45. Utah	8	46. Vermont	26
47. Virginia	8	48. Washington	23
49. West Virginia	10	50. Wisconsin	10
51. Wyoming	8	**Total**	**622**

Note: There were 8 Federal minimum wage amounts during this period, which is why "8" appears so often in this table. A total of 571 changes to state minimum wages occurred, which is obtained by subtracting 51 from the total to remove the initial wage floor level