

A Time-series Evaluation from 1977 to 2012 of the Effect of Minimum Wage Policies on Employment

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Abstract

Inequality in the US is steadily growing as a result of the increasing gap in wages due, among other factors, to the erosion in the real value of minimum wages. Although minimum wage policies intend to tackle this problem, an intense partisan debate among politicians has led to the current stalemate of minimum wages. Despite the emerging consensus in academia that the increase of minimum wages has a very limited effect on unemployment, previous research has yielded opposite findings. This is the first study that relies on time series state level data of a long period of time, from 1977 to 2012, to analyze the effect of minimum wages on employment. Using a fixed effects estimator with a sample of 1,576 observations, the findings of this study are in line with the emerging consensus, namely that there is no evidence that the minimum wage has an effect on employment. The results show that the employment elasticity of minimum wage is insignificant in the whole period. However, when analyzing the effect within different sub-periods (pre-1990, 1990-1999, and post-1999), the results show that the effect is changing substantially through time. The elasticity was negative before 1990, insignificant in the 1990s, and positive in the 2000s. It seems that the increasing power of firms is turning an efficient low-income labor market before 1990 into a monopsony low-income labor market in the 2000s. The effect is more significant for youth, particularly for women. It suggests that current minimum wage policies in the US can worsen the lingering high youth unemployment rates.

Acknowledgments

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Inequality and poverty rates in the US are steadily growing (USCB, 2013) as a consequence of the increasing gap in wages and the decline in real value of earnings of low-income workers. The stalemated real value of minimum wages is considered one of the main factors that is driving low-income workers into poverty (Addison & Blackburn, 1999; Daly & Valletta, 2006; Lee, 1999; Leigh, 2007). While minimum wage policies intend to tackle this problem, there is an intense partisan debate about the benefits and risks of imposing a minimum wage. Republicans and the industry oppose any increase in the minimum wage alleging that it will entail employers hiring fewer workers, thus potentially leading to higher inequalities (Crittenden & Nelson, 2014). President Obama has signed an executive order raising the minimum wage for federal contractors (Parsons, 2014) because “no one who works full time should ever have to raise a family in poverty” (Obama, 2014, parr. 50). Polls show broad support for raising the minimum wage (Crittenden & Nelson, 2014). Almost three-fourths (73%) of the public favors raising the federal minimum wage to overcome increasing inequalities (Pew Research, 2014).

Minimum Wage Policies

Minimum wage policies started in 1938 when the federal government established a minimum wage under the Fair Labor Standards Act. Currently, five states do not impose a minimum wage, five states impose a minimum wage under the federal level and forty two states impose a minimum wage equal or above the federal level (DOL, 2014a).

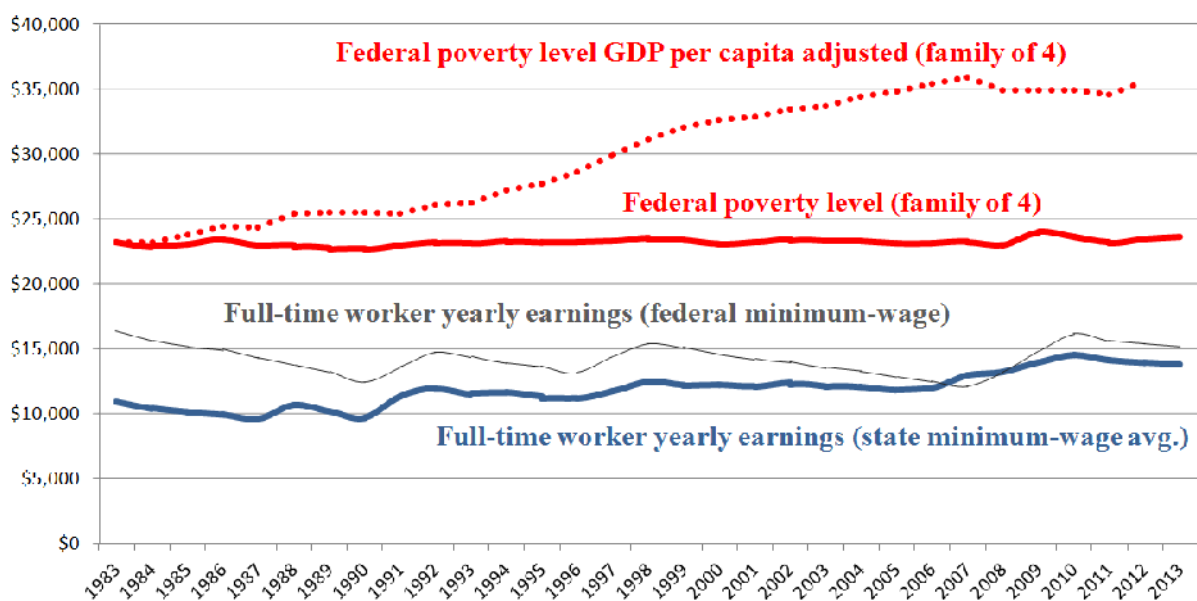
A Social Problem of Poverty among Low-Income Workers

The relevance of the social problem behind minimum wage policies can be easily seen by comparing the poverty level for a family of four (HHS, 2014) to the yearly income of a full-time worker earning the average of states minimum-wages (DOL, 2014a). A full-time worker earning

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the minimum wage is far below the poverty level and the situation has only slightly improved in the last 30 years. The problem is exacerbated when considering that the level of poverty in real terms has remained the same, although the real GDP per capita has increased 52% in the same period (DOC, 2014; DOL, 2014b). Current minimum wages condemn low-income workers to poverty as can be seen in figure 1.

Figure 1: Full-time worker earnings and poverty level (in 2013 real terms)



Source: Compiled by the author based on (DOC, 2014; DOL, 2014a, 2014b; HHS, 2014)

Do Minimum Wage Policies Reduce Inequality?

Inequality has grown steadily in the US in the last years due, among other factors, to the increase in wage gaps. Minimum wage policies are intended to take low-income workers out of poverty and to tackle increasing inequality. The evolution of the Gini index compared to the federal minimum wage is shown in figure 2. From 1969 to 1989 most of the rise in family income inequality was due to the growing dispersion of earnings (Daly & Valletta, 2006). The

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observed growth in inequality in the 1980s among low-income workers (Lee, 1999) and women (DiNardo, Fortin, & Lemieux, 1995) was explained by the erosion in the minimum wage which decreased by 27% in real terms between 1979 and 1988 (DiNardo et al., 1995). In the 1990s inequality (Daly & Valletta, 2006) and poverty rates (Addison & Blackburn, 1999) grew at lower rates because of the 16% increase in real terms in the federal minimum wage between 1989 and 1998. However, it is usually stated that minimum-wage policies contribute to destroy low-income employment, thus potentially increasing both inequality and poverty. Moreover, the effect of minimum wages on poverty household may be overstated because most of these workers, namely young students, are evenly distributed along the entire spectrum of family incomes (Horrihan & Mincy, 1993, p. 251). According to Leigh (2007) the effect of the minimum wage on inequality is unclear because it depends on wage and labor demand elasticities of the industries.

Figure 2: Evolution of the household GINI index in the US compared to the federal minimum wage



Source: Compiled by the author based on (CBO, 2011)

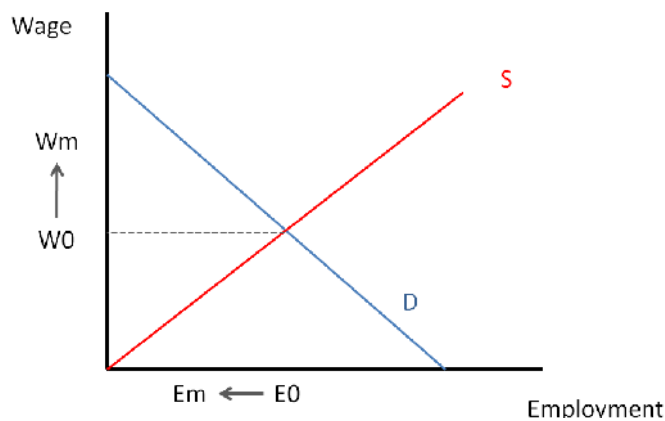
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Literature Review

Theoretical Framework

The economic orthodoxy suggests that in a perfect labor market, an increase in the minimum wage imposes a floor to wages that exceeds the competitive wage, thus decreasing employment (C. C. Brown et al., 1982, p. 488; Cahuc & Zylberberg, 2004, p. 718) as shown in figure 3. This classical view is supported by the industry to defend its arguments against minimum wage policies.

Figure 3: Simple Supply-Demand Model of the effect of minimum wage on employment

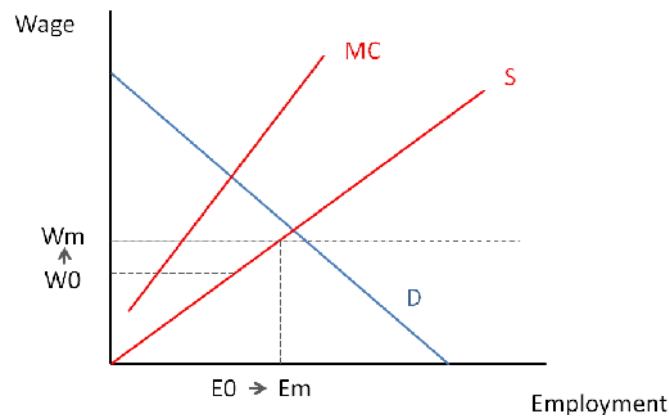


Source: Compiled by the author based on (C. C. Brown et al., 1982; Cahuc & Zylberberg, 2004)

However, several factors such as imperfect information, commuting costs, and inertia can generate monopsony powers to firms. The monopsony model shown in figure 4 suggests that an increase in the minimum wage could increase employment because the imposed minimum wage makes employers price-takers and more workers are willing to work at that wage (C. C. Brown et al., 1982, p. 489; Cahuc & Zylberberg, 2004, p. 721).

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Figure 4: Monopsony Model of the effect of minimum wage on employment



Source: Compiled by the author based on (C. C. Brown et al., 1982; Cahuc & Zylberberg, 2004)

Research before 1990 Supports the Simple Supply-Demand Model

Research in the 1970's and 1980's, mainly based on time-series analyses, supported the traditional view by finding statistically significant negative employment effects resulting from minimum wage increases (Fox, 2006, p. 3). Several authors (Bernstein & Schmitt, 1998; Card & Krueger, 1995) criticized previous findings by pinpointing important flaws and publication bias. They suggested that these flaws were not analyzed because the results were so thoroughly aligned with the prevailing theory that they were not called into question (Fox, 2006). Neumark and Wascher (1998) evaluated Card and Krueger's suggestions to conclude that the results of previous studies were not biased.

Further Research Challenges the Traditional View

Further research has found opposite results. Some studies used cross-sectional regional level data (Lee, 1999) and time series state-level data (Addison & Blackburn, 1999) to find a positive effect of minimum wages on reducing inequality and poverty. Other studies found a

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positive effect of minimum wage on employment analyzing data of firms and workers using difference-in-difference estimators (Card, 1992; Card & Krueger, 1993) or OLS and 2SLS regressions (Katz & Krueger, 1992).

These findings were highly criticized by Cahuc and Zylberberg (2004) and Neumark and Wascher (1995), but they established a new long-term trend. Today, there is an emerging consensus that the increase of minimum wages has very limited effect on unemployment (EPI, 2006, p. 1). Nobel Laureate Joseph Stieglitz of Columbia University has not found evidence of the effect of minimum wage on unemployment rate and that the minimum wage increase “was totally swamped by other factors going on in the economy” (Chipman, 2006, parr. 25). A statement signed by over 650 economists, including five Nobel laureates in economics and six past presidents of the American Economic Association, stated that modest increases in state and federal minimum wages can “significantly improve the lives of low-income workers and their families, without the adverse effects that critics have claimed” (EPI, 2006, p. 1).

The dynamic and inefficient nature of low-wage labor markets seems to challenge the traditional view (Bernstein & Schmitt, 1998). Low-wage labor markets seem to generate monopsony powers to firms, thus making them inefficient at the current minimum wage (Ashenfelter, Farber, & Ransom, 2010; Dube, Lester, & Reich, 2011; Manning, 2003). Addison and Blackburn (1999) found that the effect was very different in the 1980’s compared to the 1990’s, suggesting that there might be dissipation through time of the effect of minimum wages on unemployment. It could explain the results of research in the 1970’s and 1980’s.

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Some Researchers Still Support the Traditional View

Although the increasing consensus and evidence that the old way of thinking about minimum wage is inappropriate, there are some economists that continue describing negative effects of minimum wages on employment. These economists based their analysis on the findings of Neumark and Wascher (1995) that suggested a negative elasticity of minimum wages on employment of -0.22 using data collected by the industry. These findings were criticized by Card and Krueger (2000) that found that the results of Neumark and Wascher were biased due to sample and measurement errors. Ropponen (2011) tried to reconcile Card & Krueger and Neumark & Washer findings by suggesting that the results depended on the effect on the demand side, namely that workers earning more money became also clients of the fast-food restaurants. In a recent study Neumark, Salas, and Wascher (2013) continued supporting that minimum wages contribute to decreasing employment arguing flaws in others specification models. Dube (2013, p. 30) reviewed nearly all existing elasticities of the poverty rate with respect to minimum wages from 12 different papers to find that only the study of Neumark, Schweitzer, and Wascher (2005) suggested that minimum wages actually increase poverty by using an unconventional methodology and making a number of problematic assumptions.

Different Models to Evaluate the Effect of Minimum Wages on Employment

Different models have been used to assess the impact of minimum wages on unemployment rate: correlations between minimum wage and employment using time series or cross-sectional data, natural experiments using difference in difference estimators, and micro data of firms and workers (Cahuc & Zylberberg, 2004, p. 729).

Before 1990, researchers drew upon cross-sectional and time-series data of groups particularly affected by minimum wage policies, namely youth, women, and minorities. The

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most common dependent variable was the ratio of employment to population that was supposed to reflect more accurately the real effect of the minimum wage than the unemployment rate. The independent variable was the minimum wage in level or log form. Some authors used a complex index to take into account the level of minimum wage compared to market-average wages and the level of coverage in the industry. They also controlled for other factors that could affect the supply and demand of labor (C. Brown, Gilroy, & Kohen, 1983; C. C. Brown et al., 1982).

Other studies drew upon industry-level data of firms and workers (Card, 1992; Card & Krueger, 1993; Katz & Krueger, 1992). Card and Krueger (1993) compared the effect of minimum wages on employment in 1992 using difference-in-difference estimators and drawing upon a natural experiment in two neighborhood states, New Jersey and Pennsylvania. However, the validity of the study was challenged because of the very specific sector analyzed (Cahuc & Zylberberg, 2004) and because of measurement errors (Neumark & Wascher, 1995).

A controversial point was whether lagged effects of minimum wage should be included. C. C. Brown et al. (1982, p. 496) suggested that lagged adjustments are not likely to occur. On the contrary, Neumark and Wascher (1994, p. 78) showed that results of previous research could be upward biased because they did not consider lagged effects of minimum wages.

Program Theory and Goal

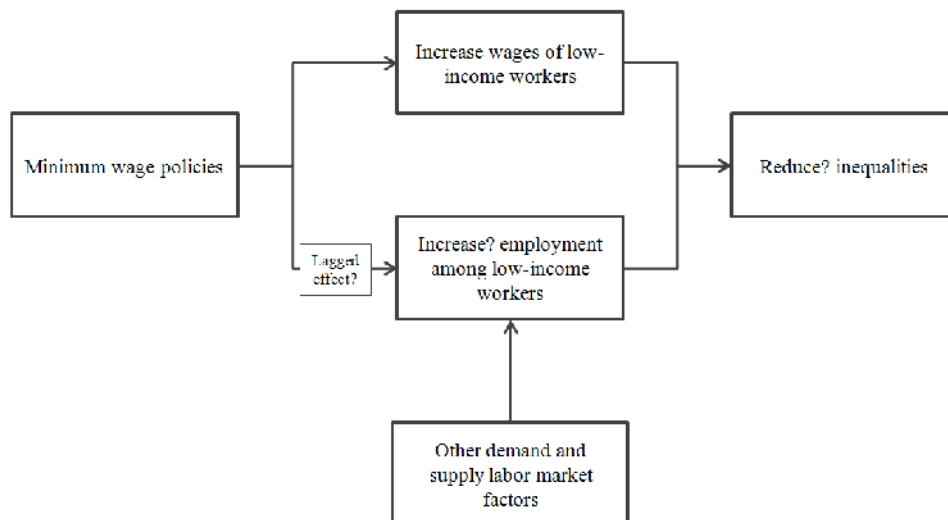
The main goal of minimum wage policies (input) is to reduce inequality (outcome) by taking low-income workers out of poverty. Minimum wage policies increase wages of low-income workers (output) and therefore it is expected that they generate a positive welfare effect. However, if minimum wage policies reduce the level of employment (negative impact) –as suggested by the simple competitive market model– the overall welfare effect can be negative because some workers with a reservation wage lower than the minimum wage are left out of the

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labor market. On the contrary, the monopsony model suggests that an increase in the minimum wage increases the wage of low-income workers while creating employment, thus driving to an overall increase of social welfare among low-income workers. The level of employment can also be affected by other demand and supply labor market changes. Figure 5 summarizes the program theory on which this evaluation is based.

This evaluation focuses on studying the effect of minimum wages (input) on employment (potential negative impact) by drawing upon time-series state-level data from 1977 to 2012. The main contribution of this study is that it is the first time-series analysis that relies on a long period of time. Previous research, particularly studies before the 1980's, analyzed periods no longer than 10 years.

Figure 5: Program theory of minimum wage policies



Source: Compiled by the author based on (C. C. Brown, Gilroy, & Kohen, 1982; Cahuc & Zylberberg, 2004; Neumark & Wascher, 1994)

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Method & Measures

Data

This study is based on time series state-level administrative data (50 states and District of Columbia) from 1977 to 2012 collected by the Department of Labor, the Department of Commerce, and the Census Bureau. The unit of analysis is the state and the size of the full sample is 1,836 (50 states and District of Columbia x 36 years). Eventually, the size of the analytic sample is 1,567 because 269 observations with a value of zero in the minimum wage (states in years without minimum wage policies) drop of the model by using a log-log model. There were no significant outliers in the analytic sample.

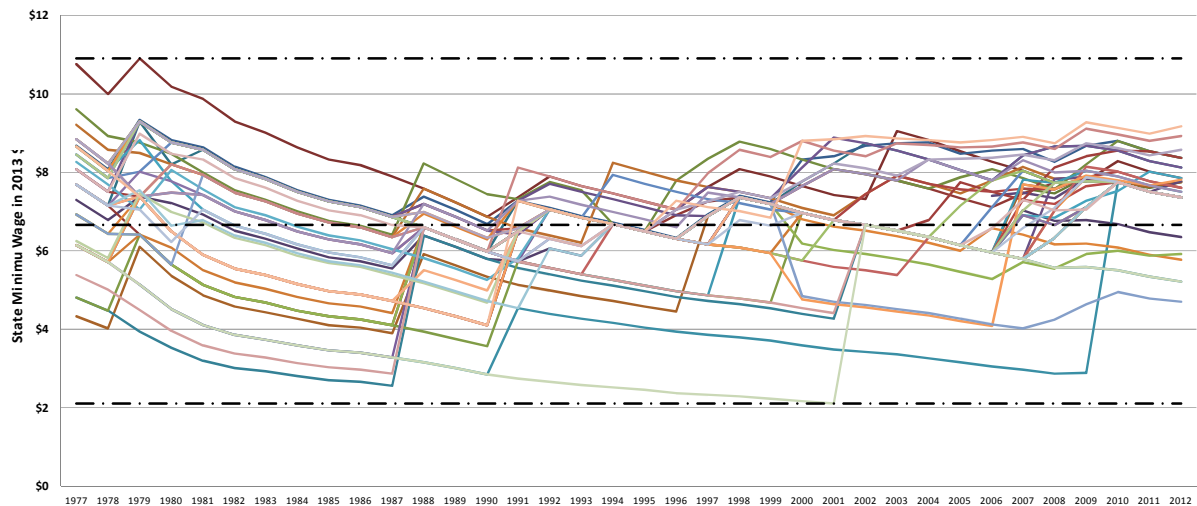
The study also includes a sensitivity analysis by using other state-level annual data of employment and labor force for young and female individuals between 2000 and 2012 (DOL, 2014c).

Measures

Predictor. The predictor variable is the annual state minimum wage in 2013 dollars. The Department of Labor (DOL, 2014a) provides state level minimum wage data in nominal dollars from 1977 to 2012. The nominal value was transformed into 2013 dollars by using the state Consumer Price Index (DOL, 2014b). When the minimum wage was reported as a range depending on the sector the value was estimated by using the average value of the minimum and maximum minimum wage. Figure 6 shows the evolution of state minimum wages in 2013 dollars in the analytic sample and its descriptive statistics.

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Figure 6: Evolution of state minimum wages in \$2013 in the analytic sample



Source: Compiled by the author based on (DOL, 2014a, 2014b)

Note: Observations: 1,567

Mean: 6.67; Standard deviation: 1.33

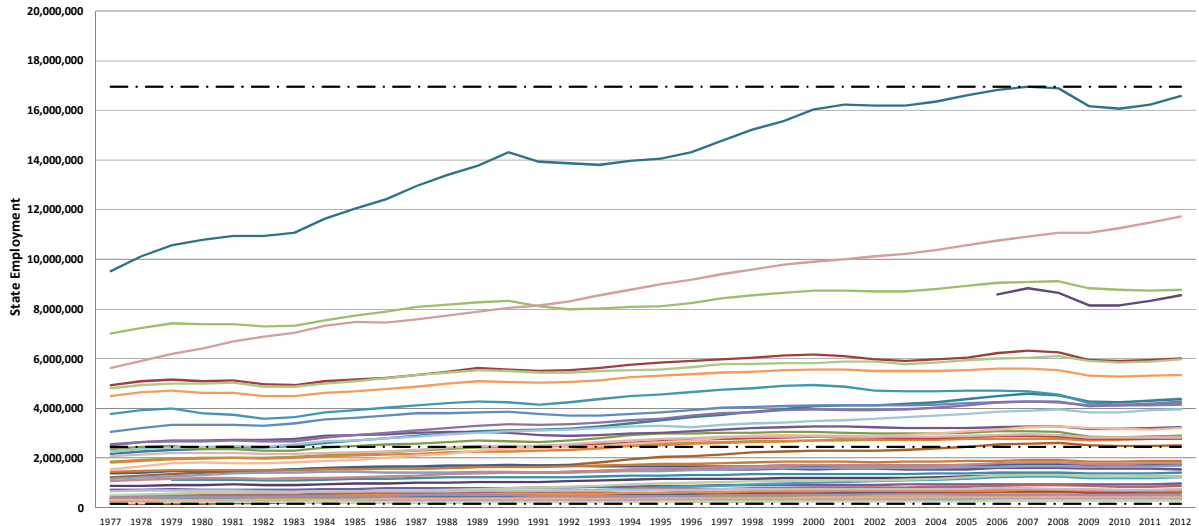
Five number summary: 2.1; 6.07; 6.77; 7.51; 10.91

Outcome. The outcome variable is the annual state employment. The Department of Labor (DOL, 2014d) provides data of annual averages of the employment status of the civilian non-institutionalized population by state from 1977 to 2012 that include the number of employees. Figure 7 shows the evolution of state employment in the analytic sample and its descriptive statistics.

The outcome of the log-log model (log of employment) follows a continuous quasi-normal distribution. The histogram is shown in Figure 8.

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Figure 7: Evolution of state employment in the analytic sample



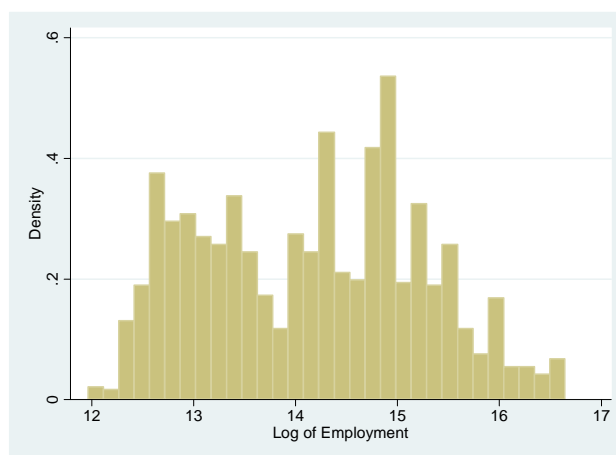
Source: Compiled by the author based on (DOL, 2014d)

Note: Observations: 1,567

Mean: 2,445,465; Standard deviation: 2,791,170

Five number summary: 156,649; 544,437; 1,544,124; 3,076,925; 16,960,730

Figure 8: Histogram of the log of state employment in the analytic sample



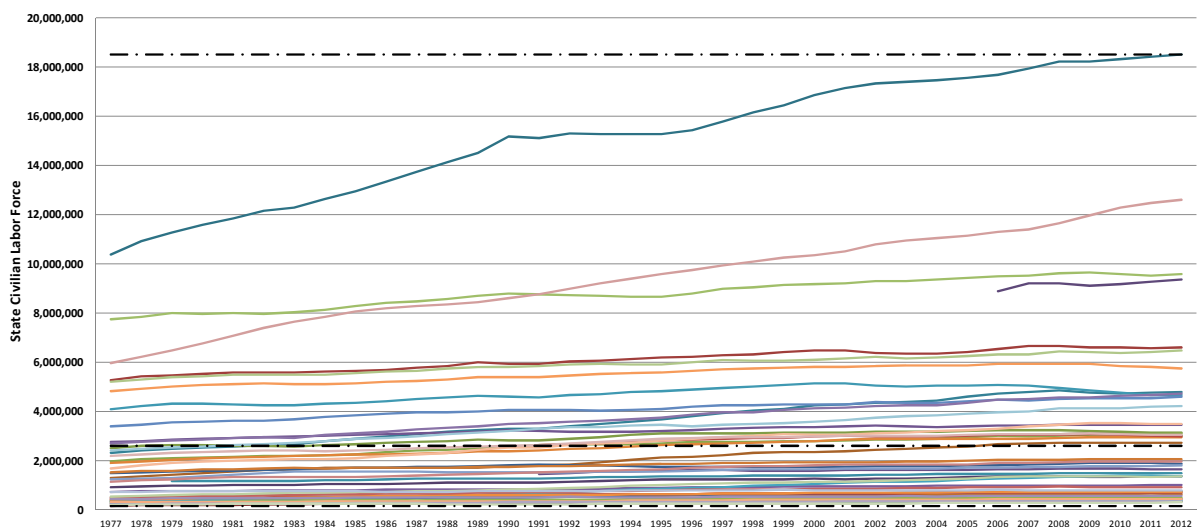
Source: Compiled by the author based on (DOL, 2014d)

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Control variables. The control variables are the annual state civilian labor force, to control for the supply of labor force, and the annual state Real DPG in 2005 dollars, to control for the demand of labor force.

The Department of Labor (DOL, 2014d) provides data of annual averages of the employment status of the civilian non-institutional population by state from 1977 to 2012 that includes the civilian labor force. Figure 9 shows the evolution of state civilian labor force in the analytic sample and its descriptive statistics.

Figure 9: Evolution of state civilian labor force in the analytic sample



Source: Compiled by the author based on (DOL, 2014d)

Note: Observations: 1,567

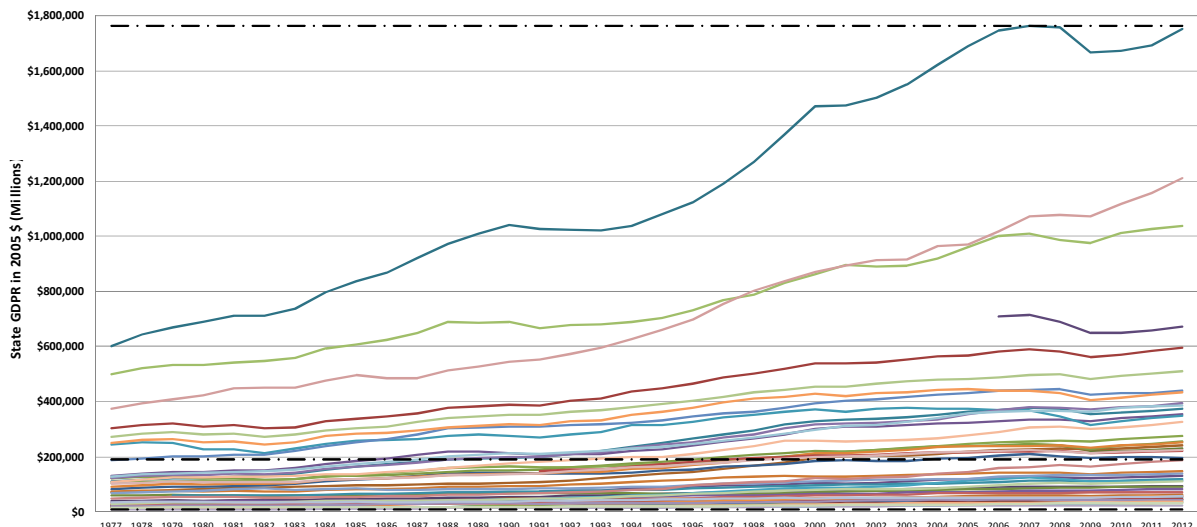
Mean: 2,445,465; Standard deviation: 2,791,170

Five number summary: 156,649; 544,437; 1,544,124; 3,076,925; 16,960,730

The Department of Commerce (DOC, 2014) provides data of annual Real GDP in 2005 dollars by state from 1977 to 2012. Figure 10 shows the evolution of state Real GDP in the analytic sample and its descriptive statistics.

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Figure 10: Evolution of state Real GDP in 2005\$ (millions) in the analytic sample



Source: Compiled by the author based on (DOL, 2014d)

Note: Observations: 1,567

Mean: 2.445.465; Standard deviation: 2,791,170

Five number summary: 156,649; 544,437; 1,544,124; 3,076,925; 16,960,730

Hypotheses

The research question is:

“What is the effect of the increase of minimum wages on employment?”

The hypothesis is:

Hypothesis: The minimum wage elasticity of employment is slightly positive (Katz & Krueger, 1992) or insignificant (Card, 1992; Card & Krueger, 1993).

The hypothesis is testing using a 2-tailed test because previous research has found positive and negative effects.

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Analytic Strategy

The evaluation follows a multiple comparison-group time-series quasi-experimental design. The analysis relies upon a single equation model of the type

$$E_{st} = f(MW_{st}, D_{st}, S_{st}, X_{st})$$

The dependent variable is a measure of labor force status, the independent variable is a measure of the minimum wage, D is a business cycle variable, S is a supply of labor force variable, and X are other set of potentially exogenous variables.

The outcomes (employment) for each group are measured from 1977 to 2012. Each group receives a different level of treatment defined by the value of its minimum wage. The analysis is performed using a log-log model as suggested by C. Brown et al. (1983), thus the estimate gives a simple to interpret employment elasticity of the minimum wage. Neumark and Wascher (1995) also considered elasticity to be the best indicator of the effect of minimum wages on unemployment rate. They estimated a elasticity of -0.24 in fast-food restaurants in New Jersey and Pennsylvania that was further used as a reference by other authors (Fox, 2006, p. 6).

The model controls for heterogeneous employment patterns of the states because they may be correlated with minimum wage policies (Allegretto, Dube, & Reich, 2010). These patterns involve factors of demand and supply of labor. Regarding the demand of labor, higher minimum wages are more likely to occur at times and places with (relatively) worse economic conditions (Dube, 2013). Those economic conditions are controlled by including one business-cycle variable (C. Brown et al., 1983, p. 7) namely the state GDP in real terms, that is likely to be associated to the demand of labor. By using the GDP in real terms the model only takes into account changes in the level of production, regardless of the inflation. Regarding the supply of labor, the model includes a control for the civilian population in the labor market in the state (C.

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Brown et al., 1983, p. 7). In using economic models of supply and demand it is expected that there will be a high correlation between the supply and demand variables. In fact, the VIF test of multicollinearity results in a high value of 13.51 and 13.44 for the demand and supply control variables respectively. Eventually, both variables were kept in the main model because their estimates can provide valuable information and the multicollinearity problem is expected to be offset by the high sample size. However a model with a compound control variable is included in the sensitivity analysis.

There may be other exogenous variables that affect the outcome and the treatment at the same time, thus biasing the results. To control for those unknown effects two statistical methods are used. Time invariant state-level effects are controlled by using a fixed effects estimator. It is very likely that these time invariant state-level factors exist because the Hausman test is significant. A dummy year variable is also included to control for average annual effects because in running a joint test of the dummy years, the null hypothesis that all years coefficients are jointly equal to zero was rejected ((Prob>F)<0.0001) and therefore time fixed effects is advised (Torres-Reyna, 2014, p. 31).

The equation of the model is:

$$\log(\text{employment}_{st}) = \alpha_0 + \alpha_1 * \log(\text{minimumwage}_{st}) + \alpha_2 * \log(D_{st}) + \alpha_3 * \log(S_{st}) + \alpha_t + \mu_{st} + \alpha_s$$

And using the Fixed effects estimator it becomes:

$$\log(\text{employment}_{st}) = \bar{\alpha}_0 + \alpha_1 * \log(\text{minimumwage}_{st}) + \alpha_2 * \log(\bar{D}_{st}) + \alpha_3 * \log(\bar{S}_{st}) + \alpha_t + \mu_{st}$$

α_1 is the average employment elasticity of the minimum wage.

A conventional p-value of 0.05 (2-tailed test) was used to determine if the results were statistically significant.

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A White's test and a Breusch-Pagan test of heteroskedasticity was performed to find conflicting results (*Prob. > chi2 < 0.0001 and Prob. > chi2 = 0.6060* respectively). To be conservative, the regressions were run using the robust option (clustering by state).

Sensitivity Analysis

The study performed two sets of sensitivity analysis. First, using different statistical methods and second, analyzing different segments of population and different periods of time.

To avoid the multicollinearity problem a model with a compound control variable of supply and demand was included in the sensitivity analysis. To avoid problems of simultaneity (the demand and supply functions go hand in hand), a model with Instrumental Variables (IV) was also used. The IV was built with the lagged minimum wage (one and two periods lagged).

Some other statistical estimators were ran: a simple OLS model, although the estimates are likely to be biased; a model with lagged independent variable because Neumark and Wascher (1994, p. 78) suggested that results of previous research could be upward biased because they did not consider lagged effects of minimum wages; a model without controls; and a model using a year trend instead of dummy years.

A sensitivity analysis using different periods of time and segments of population was also performed. Addison and Blackburn (1999) found that the effect was very different in the 1980's compared to the 1990's, suggesting that there might be dissipation through time of the effect of minimum wages on unemployment. The study analyzes 3 periods of time, namely, before 1990, from 1990 to 1999, and after 1999 to test whether the effect is changing through time. A deeper analysis was performed in the period after 1999. Previous research usually focused on segments of population that are more likely to be affected my minimum wages, namely youth and women (C. Brown et al., 1983; Stewart, 2004). Using state-level annual data of employment (outcome)

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and labor force (control for supply) for youth and women from 2000 to 2012 (DOL, 2014c) the base model was run on different segments, namely, youth 16 to 19 years old, youth 20 to 24 years old, youth 25 to 35 years old, women, youth women 16 to 19 years old, youth women 20 to 24 years old, and youth women 25 to 35 years old. Eventually, a model was included using as independent variable the type of minimum wage law in the state for each year, namely no law enacted, law mandating a minimum wage below the federal minimum wage, law mandating a minimum wage equal to the federal minimum wage, law mandating a minimum wage above the federal minimum wage, and law mandating a minimum wage above the federal minimum wage updated by CPI (DOL, 2014a).

Results

Using the fixed effects estimator this study found that the employment elasticity of minimum wage was negligible and statistically insignificant in the overall period. The estimate of the coefficient is -0.000579 (meaning that a 1% increase in the minimum wage yields to a marginal 0.000579% decrease in employment) and the result is not statistically significant. Similar statistically and practically insignificant results were found using an Instrumental Variable fixed effects estimator and using a compound control variable to avoid the multicollinearity problem. The models that are likely to be biased (POLS, Fixed Effects without controls, and Fixed Effects with year trend) provided statistically significant results (p-values between 0.1 and 0.01), with slightly higher values and opposite signs. The results of the regressions using different statistical methods are shown in table 1.

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Table 1: Results of the regression of the base model and models using different statistical methods

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	POLS	FE compound control	FE IV	FE lagged	FE no controls	FE year trend
log_minimumwagein2013dollars	-0.000579 (0.005096)	-0.008974 (0.004611)*	-0.008972 (0.018150)	-0.002105 (0.002689)		0.070857 (0.036908)*	-0.017146 (0.005333)***
log_civlaborforce	0.969957 (0.023688)***	1.006942 (0.006802)***		0.970124 (0.005428)***	0.970087 (0.024003)***		0.947622 (0.039862)***
log_gdprin2005dollars	0.022834 (0.018511)	-0.010585 (0.006593)		0.021282 (0.004119)***	0.021249 (0.018444)		0.073075 (0.031657)**
control_supply_demand			0.63071 (0.048252)***				
L.log_minimumwagein2013dollars					-0.001715 (0.005159)		
Constant	0.100564 (0.167117)	-0.030382 (0.028130)	14.258929 (0.044657)***	0.127765 (0.054036)**	0.128035 (0.180934)	13.730008 (0.077324)***	-0.106532 (0.260929)
Observations	1,567	1,567	1,567	1,521	1,521	1,567	1,567
R-squared	0.995	1.000	0.953		0.994	0.738	0.987
R-squared (adjusted)	0.995	1.000	0.952		0.994	0.732	0.987

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Compiled by the author

Regarding the sensitivity analysis on different segments of population and periods of time the results were quite different. The results are shown in table 2. When considering different periods of time, the results show that the elasticity is increasing over time. Before 1990 the elasticity is negative (-0.0107) and statistically significant at the 10% level, from 1990 to 1999 is practically and statistically insignificant, and after 1999 is positive (0.0103) and statistically significant at the 1% level. In a deeper analysis of the data from 2000 to 2012 the results showed that the elasticity is higher than on average for people between 16 and 19 years of age (0.034, statistically significant at the 5% level) and for people between 20 and 24 years of age (0.021, statistically significant at the 1% level). The result is statistically insignificant and much lower for older youths. The pattern is more relevant for women. Although the elasticity for women is

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only slightly positive (0.0106, statistically significant at the 1% level), it is much higher for women between 16 and 19 years of age (0.0502, statistically significant at the 1% level), and for women between 20 and 24 years of age (0.0298, statistically significant at the 1% level). The result is lower for women between 24 and 35 years of age (0.0124, statistically significant at the 10% level).

Table 2: Results of the regression of the base model and models on different segments of population and periods of time

VARIABLES	(1) FE	(8) FE before 1990	(9) FE between 1990 and 1999	(10) FE after 1999	(11) FE 16 to 19 after 1999	(12) FE 20 to 24 after 1999	(13) FE 25 to 34 after 1999	(14) FE Women after 1999	(15) FE Women 16 to 19 after 1999	(16) FE Women 20 to 24 after 1999	(17) FE Women 25 to 34 after 1999	(18) FE law
log_minimumwagein2013dollars	0.000579 (0.005096)	-0.010748 (0.005360)*	0.000616 (0.004210)	0.010315 (0.003568)***	0.034319 (0.013031)**	0.021323 (0.006553)***	0.007972 (0.005044)	0.010637 (0.003396)***	0.050222 (0.016707)***	0.029786 (0.007556)***	0.012359 (0.007071)*	
log_civilaborforce	0.969957 (0.023688)***	0.868812 (0.019566)***	0.910627 (0.040133)***	0.843532 (0.059488)***	0.188166 (0.045176)***	0.151076 (0.028686)***	0.123212 (0.019072)***	0.114603 (0.019508)***	0.142169 (0.047418)***	0.098071 (0.024195)***	0.119873 (0.018646)***	0.964704 (0.021982)***
log_gdprin2005dollars	0.022834 (0.018511)	0.151766 (0.019099)***	0.066828 (0.030597)**	0.153508 (0.027956)***	0.944558 (0.043200)***							
log_civilaborforce16to19years												
log_civilaborforce20to24years						1.014905 (0.019930)***						
log_civilaborforce25to34years							1.016338 (0.013810)***					
log_womencivilabor								0.918194 (0.026770)***				
log_womencivilabor16to19years									0.986914 (0.023370)***			
log_womencivilabor20to24years										1.014349 (0.017912)***		
log_womencivilabor25to34years											0.987770 (0.013627)***	
1.law												-0.002995 (0.003078)
2.law												-0.000389 (0.002872)
3.law												-0.001227 (0.004912)
4.law												-0.004842 (0.003279)
Constant	0.100564 (0.167117)	0.110407 (0.241664)	0.450319 (0.350033)	0.378660 (0.653120)	-2.164968 (0.590188)***	-1.959721 (0.329666)***	-1.594921 (0.196477)***	-0.862231 (0.186500)***	-1.839999 (0.581926)***	-1.336974 (0.262131)***	-1.408020 (0.208961)***	0.164946 (0.147755)
Observations	1,567	544	438	585	584	585	585	585	533	583	585	1,836
R-squared	0.995	0.986	0.989	0.957	0.950	0.948	0.975	0.966	0.961	0.938	0.962	0.995
R-squared (adjusted)	0.995	0.985	0.989	0.956	0.948	0.946	0.974	0.965	0.959	0.936	0.961	0.995

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Compiled by the author

The control variables are acting as expected. Despite the high correlation between the demand and supply control variables and due to the high number of observations of the sample, the results were statistically significant for the supply control variable (at the 1% level) and for most of the demand control variables (at the 1% and 5% level). The estimates of the civilian

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labor force are very close to 1 (in an efficient market the labor force should be close to the number of employees), and the estimates of the Real GDP is positive signed (a stronger economy is likely to yield higher employment). The results did not show any significant effect of the type of minimum wage state-law on employment.

Both R-squared and adjusted R-squared have values close to 1 in all the models analyzed, showing that the variables explain great part of the variation of the outcome. Both values are very close because the number of cases is very large.

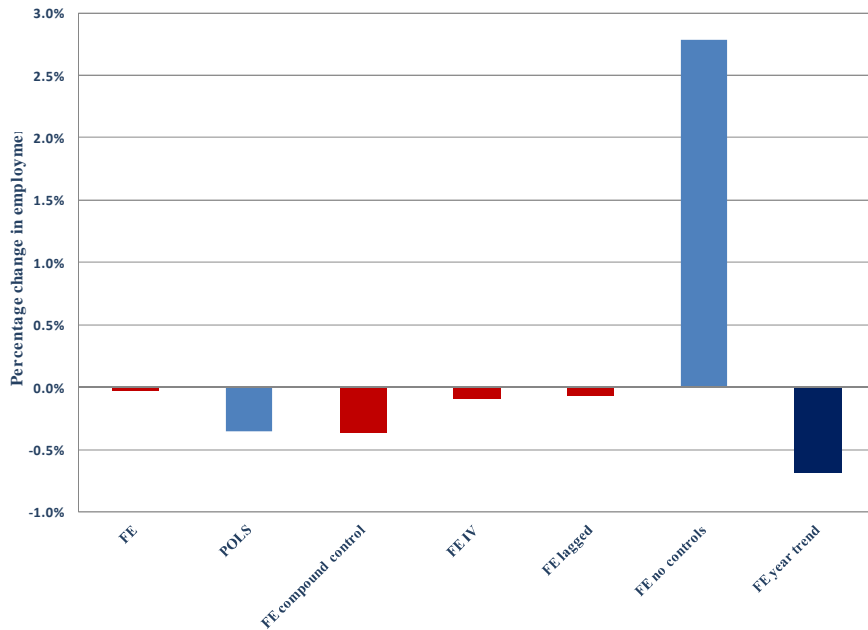
Discussion

The goal of this study is to understand how an increase in the minimum wage affects employment. To answer this question, the estimates of the coefficients of the employment elasticity of minimum wage were used to evaluate the effect of the change proposed by President Obama (2014, par. 50), namely a 39% increase in the minimum wage, from \$7.25 to \$10.10, on employment. The findings of the policy simulation are presented using two sets of results, those of the different statistical models and those of the models affecting different periods of time and different populations.

Using different statistical models the results suggest that the increase of minimum wages has very limited effect on unemployment as can be seen in figure 11. The more robust statistical models yield results statistically insignificant and close to zero. The Fixed Effect estimator suggests that the 39% increase in the minimum wage will suppose a negligible 0.02% decrease in employment. Only the likely biased Fixed Effects using a year trend yields a decrease slightly higher than 0.5% (still quite low). These results are in line with the emerging consensus in academy (EPI, 2006, p. 1).

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Figure 11: Estimation of the effect of the minimum wage increase proposed by President Obama on employment using different statistical methods



Source: Compiled by the author based on (Obama, 2014, par. 50)

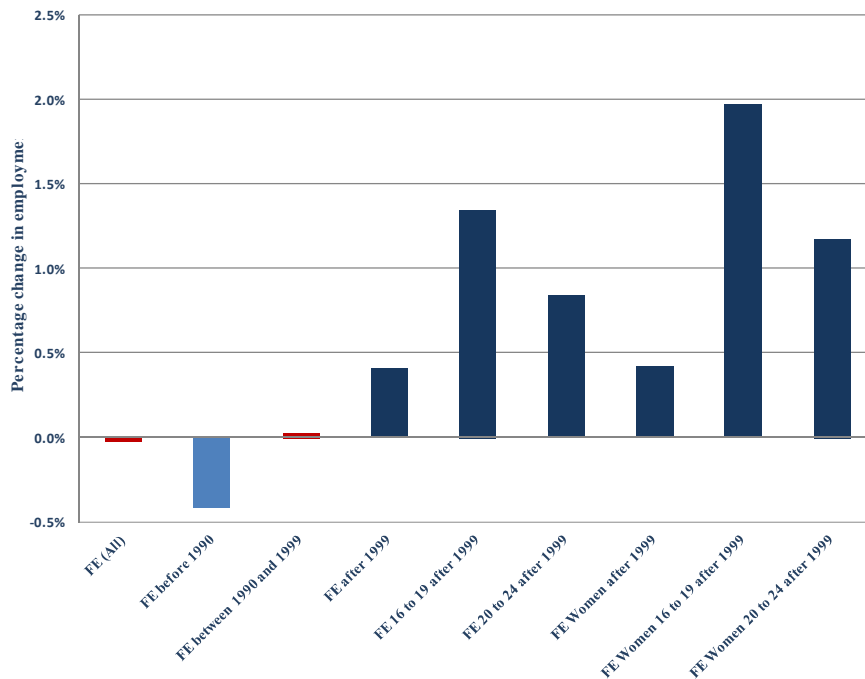
Note: Red columns are results statistically insignificant, light blue statistically significant at the 10% level, and dark blue, statistically significant at the 5% level of confidence used in this study.

Based on those results the conclusion is that there is no effect of minimum wages on the overall labor population during the period analyzed (1977-2012).

Other valuable findings arise when analyzing different segments of population and periods of time, as shown in figure 12.

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Figure 12: Estimation of the effect of the minimum wage increase proposed by President Obama on employment in different segments of population and periods of time



Source: Compiled by the author based on (Obama, 2014, par. 50)

Note: Red columns are results statistically insignificant, light blue statistically significant at the 10% level, and dark blue, statistically significant at the 5% level of confidence used in this study.

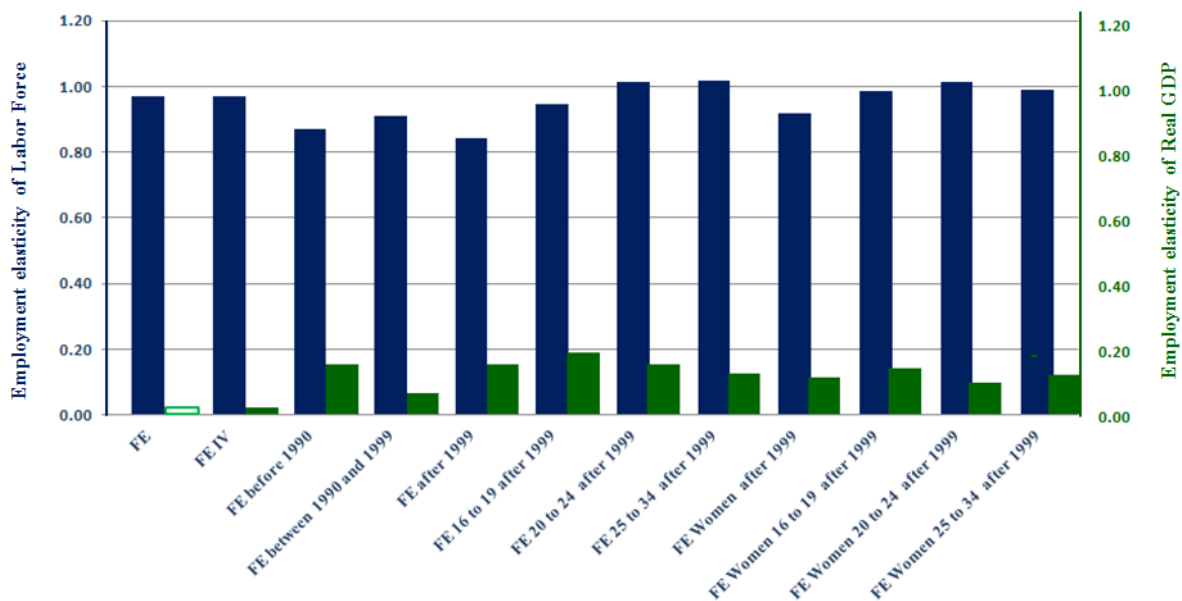
The findings suggest that the employment elasticity of minimum wage has changed substantially in recent years. The effect of the Obama proposal before 1990 would have reduced the employment by 0.5%, it would have no effect in the 1990s, and it would have increased the employment by 0.5% after 1999. These results are in line with the suggestions of Addison and Blackburn (1999) that found that the effect was very different in the 1980's compared to the 1990's. It seems that the increasing power of firms is turning an efficient low-income labor market before 1990 into a monopsony low-income labor market in the 2000s. In fact, there is strong evidence that current labor markets are far from competitive. Employers have significant power over their workers due, among other factors, to monopsony behaviors of firms

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(Ashenfelter et al., 2010), commuting costs (Manning, 2003), and search frictions (Dube, Lester, & Reich, 2011). The effect is especially significant for the sectors of population more affected by minimum wages, namely youth (1.3% increase) and particularly young women (2% increase). Although on average women display lower reservation wages than men, young women usually face the burden of taking care of the children, and thus they have higher reservation wages to make work pay (S. Brown, Roberts, & Taylor, 2011).

It is also worthy to analyze the effect of the control variables. The results are shown in figure 13.

Figure 13: Estimates of the coefficients of the control variables



Source: Compiled by the author

Note: The values shown in solid columns are statistically significant at the 5% level

The estimate of the employment elasticity of labor force is very close to 1 showing that the labor market in the US is quite efficient through the period analyzed. However, its value is slightly lower than on average after 1999, probably because it is capturing the effect of the 2007

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crisis. In that period it is also slightly lower for youth compared to older workers and slightly higher for women compared to all the workers. It may show that the market for youth is less efficient and for women is more efficient.

The estimate of the employment elasticity of Real GDP is always positive, as expected. In the period after 1999 its value is slightly higher for youths, showing that finding a job depends more heavily on the economic environment for young workers, particularly for men.

Limitations

Although the findings are consistent with previous research there are some important caveats that deserve consideration. Economic models of supply and demand are subject to unintended bias, due to simultaneity, omitted variables, or to incorrect functional models. The results strongly depend on the underlying assumptions and it is difficult to attribute causality to the variables because all the factors are closely intertwined. Although the analysis has controlled for supply and demand factors, state invariant effects, and average time effects, it is likely that the results are still affected by several of the above-mentioned problems. This is particularly relevant when considering long periods because the assumptions are likely to change over time. This fact is reflected in the study by getting more efficient results when analyzing shorter periods of time. In analyzing the statistics of the minimum wage yearly percentage change within the three analyzed periods, there are some differences that can be driving the results as can be seen in table 3 and in figure 14. Besides challenging the results, it makes particularly difficult to externalize the results to periods different to those considered in the analysis.

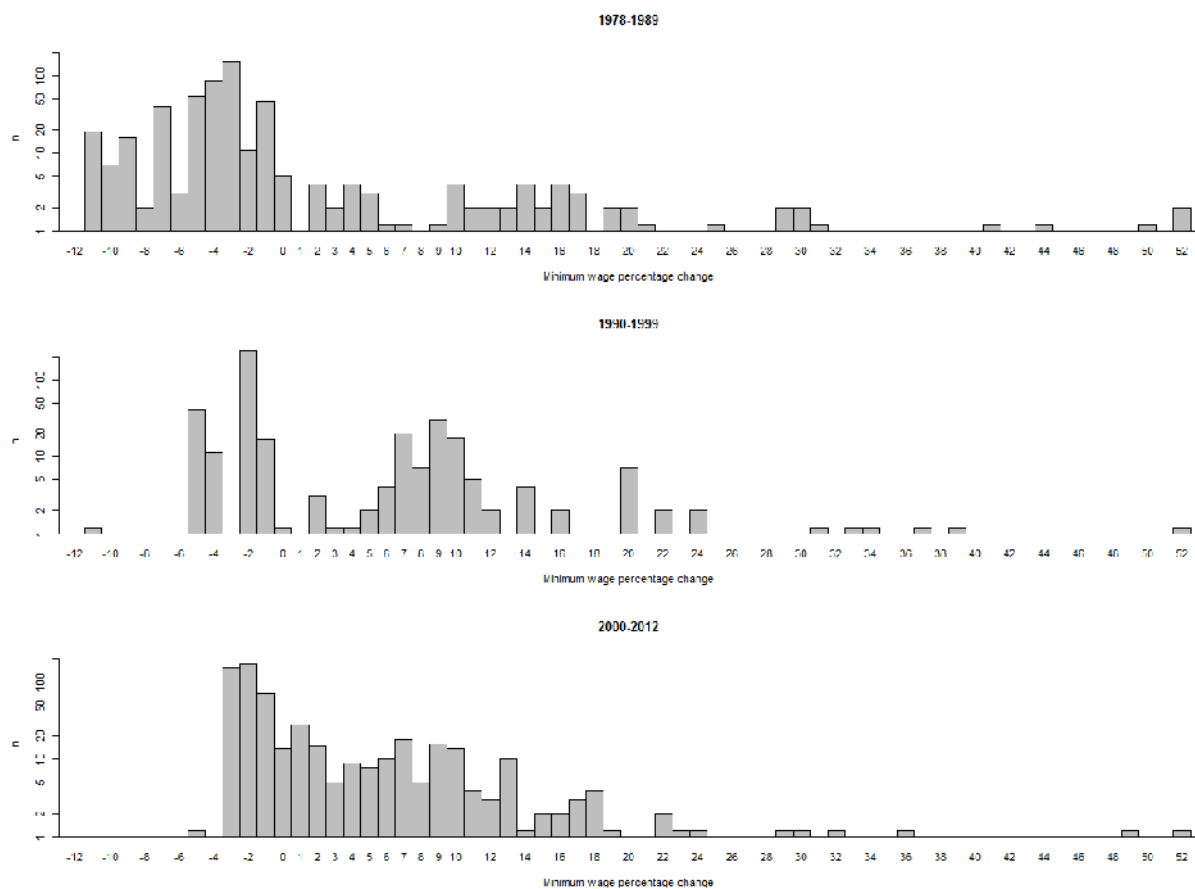
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Table 3: Statistics of the minimum wage yearly percentage change depending on the analyzed period

		Minimum Wage percentage change							
Statistics		observations	mean	stand. dev.	min	1Q	median	3Q	max
Period	1978-1989	502	-1.43	13.46	-11.89	-5.80	-3.52	-3.10	149.70
	1990-1999	436	1.74	10.58	-11.36	-2.91	-2.50	6.40	77.32
	2000-2012	583	1.30	13.82	-32.84	-3.06	-2.03	0.97	216.90

Source: Compiled by the author based on (DOL, 2014a, 2014b)

Figure 14: Distribution of the minimum wage yearly percentage change depending on the analyzed period



Source: Compiled by the author based on (DOL, 2014a, 2014b)

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Another consideration is that the study analyzes an average US employment elasticity of minimum wage while the elasticity may vary substantially among states and sectors. In fact, previous research usually focuses on specific sectors, such as the fast food industry. Although the study provides a comprehensive analysis of the average effect of minimum wages on employment, the results can be hard to apply to a specific state or a specific sector. Measurement error is another concern when working with state-level aggregated data, particularly in historical series. Comparing the state minimum wage data provided by the federal government (DOL, 2014a) to data provided by the state of California (California, 2014) there were some discrepancies. Although the differences are small, concerns arise when working with aggregated state-level data. Eventually, the study relies on state-level data, without taking into account interactions among neighbor states. States are not isolated entities and it is likely that there are spillover effects among the states that are not adequately captured by the model.

Conclusion

Minimum wage policies intend to improve the conditions of low-income workers that otherwise would be condemned to live into poverty. However, an intense partisan debate has led to the current stalemate of minimum wages. The industry and conservative groups oppose any increase in the minimum wage alleging that, in an efficient market, it would entail employers hiring fewer workers and therefore unemployment would worsen and inequalities would grow. The findings of the study suggest that although this might be the case before 1990, the labor market has likely become monopsony in the 2000s, making current labor markets far from competitive. The employment elasticity of minimum wage is shifting from negative before 1990 towards positive in the 2000s. In analyzing the employment elasticity of minimum wage after

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2000, its value is higher for youth, particularly for women. It suggests that current minimum wage policies not only endanger a minimum level income but also restrain the growth of the low-income job market, particularly for youth and more specifically young women, thus increasing the lingering high unemployment rates of young people. Updating current minimum wage policies to impose a floor to salaries closer to the market equilibrium point may offset the monopsony power of firms (Dube et al., 2011; Manning, 2003) and therefore can result not only in the improvement, but also in the growth of the low wage labor market.

Further research is required to understand why the trend is changing, how this trend affects to different economic sectors, and to determine the optimal minimum wage that could yield more efficient labor markets.

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