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UNINTENDED CONSEQUENCES OF RAISING THE MINIMUM WAGE

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ABSTRACT

This paper examines common arguments for and against the minimum wage, results of studies on the employment effects of the minimum wage, and data comparing changes in the minimum wage to changes in unemployment rates for workers with varying educational attainments. It also examines data comparing changes in the minimum wage to changes in income inequality at both the national and state levels. Applying the results to New Jersey's likely upcoming minimum wage increase, I estimate that the unemployment rate for young workers without high school educations will rise by almost two percentage points while the unemployment rate for older workers without high school educations will rise by almost one percentage point.

JEL codes: J2, J3, J4

Keywords: minimum wage, labor, unemployment, inequality, equality, Gini, education

INTRODUCTION

The minimum wage tends to be an emotionally charged topic because both sides believe that they are arguing (at least in part) in defense of the poor. Each side then naturally assumes that the other side must be arguing in opposition to the poor. To promote civil discussion, it is important to recognize that both sides are truly interested in helping the poor. Once we realize that we share this common purpose, we can work together to examine honestly the arguments and evidence for and against the minimum wage.

The purposes of this paper are to examine arguments for and against minimum wage increases and to present new results by comparing employment for workers with differing educational attainments. I begin by looking at minimum wage workers: how many there are, how old they are, in what industries they work. I then list common arguments for and against the minimum wage and show evidence supporting and refuting these arguments. No discussion of the minimum wage is complete without reference to the famous study by economists David Card and Alan B. Krueger, showing that increases in the minimum wage result in more employment.[1] What is less widely noted is the fact that Card and Krueger do not actually measure employment. They measure managers' claims about employment changes that they had instituted or planned to institute. Therefore, no discussion of the minimum wage should be complete without reference to the study by economists David Neumark and William Wascher that attempts to replicate Card and Krueger's results. Neumark and Wascher, publishing in the same academic journal as Card and Krueger, replicate Card and Krueger's study but measure employment using actual payroll data. They find that employment did decline following New Jersey's minimum wage hike.[2] This is precisely what standard economic theory predicts should occur. Finally, I will examine some

1. David Card and Alan B. Krueger, "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *American Economic Review* 84, no. 4 (1994): 772–93.
2. David Neumark and William Wascher, "'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania': A Comment," *American Economic Review* 90, no. 5 (2000): 1362–96.

studies that offer compelling theoretical reasons why the minimum wage might not create unemployment.

To close, I will show additional evidence—at the national and state levels—of the relationship between the minimum wage and unemployment, and between the minimum wage and income inequality.

WHO EARNS THE MINIMUM WAGE?

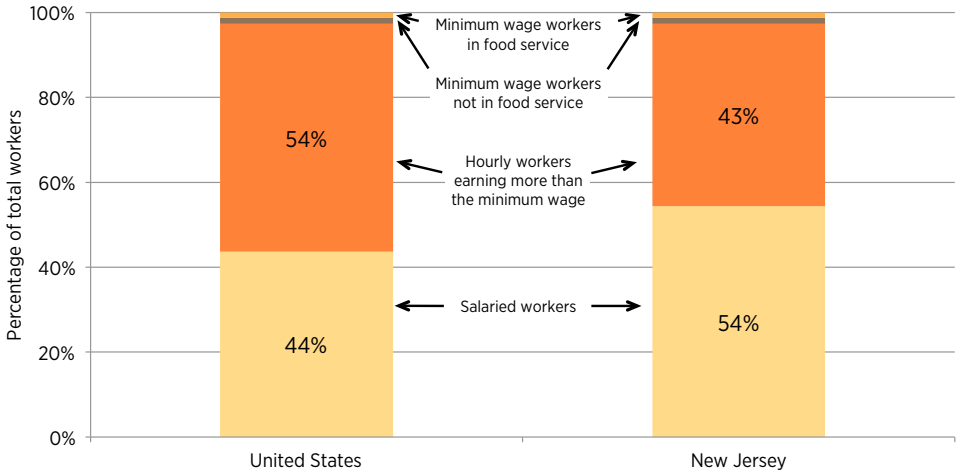
In 2012, there were 127.6 million full- and part-time workers in the United States. Of these, less than 3 percent earned at or below the minimum wage.[3] This statistic excludes workers who are paid under the table (and who may or may not earn less than the minimum wage after taxes are considered). It also excludes the self-employed, who may or may not earn less than the minimum wage, depending on the profitability of their businesses.[4] Slightly more than 1 percent of full- and part-time workers earn less than the minimum wage. However, legally employed workers in jobs that pay less than the minimum wage often earn tips, and, by federal law, employers are required to make up the difference if the tips do not bring their wage up to the minimum.[5] As these workers have an incentive not to report cash tips, it is possible that they make significantly more than the minimum wage. If all these subminimum wage workers actually earn more than the minimum wage, then minimum wage workers comprise 1.6 percent of the workforce. If all these subminimum wage workers actually earn the minimum wage, then minimum wage workers comprise 2.8 percent of the workforce. In sum, minimum wage workers constitute between 1.6 percent and 2.8 percent of all US workers. Of all minimum wage workers, 44 percent work in a single industry: food service and preparation. The next largest concentration, constituting 15 percent of minimum wage workers, is found in sales and sales-related jobs. See figure 1 for a comparison of nationwide wage statistics with those of New Jersey.

3. Bureau of Labor Statistics, US Department of Labor, *Characteristics of Minimum Wage Workers: 2012*, February 26, 2013, www.bls.gov/cps/minwage2012.pdf.

4. The employee's half of Social Security and Medicare taxes is 7.65 percent. The lowest marginal federal income tax rate is 10 percent. Assuming a state income tax rate of 3 percent and a local income tax rate of 1 percent, someone who earns $5.68 per hour and is underpaid under the table earns the same after-tax income as someone who earns $7.25 per hour and is paid above the table.

5. Federal law permits a subminimum wage for workers under 20 years of age during the first 90 consecutive days of employment.

FIGURE 1. BREAKDOWN OF US AND NEW JERSEY WORKERS



Note: Minimum wage workers constitute a small fraction of all US workers (2.7 percent in the United States and 2.6 percent in New Jersey). The plurality of minimum wage workers works in the food service industry. Nationally, 68 percent of hourly workers earning more than the minimum wage are full time (35 or more hours) versus 31 percent of minimum wage workers.

Sources: Bureau of Labor Statistics, US Department of Labor, Characteristics of Minimum Wage Workers: 2012, February 26, 2013, www.bls.gov/cps/minwage2012.pdf; Bureau of Labor Statistics, US Department of Labor, table 5, "Employees on Nonfarm Payrolls by State and Selected Industry Sector, Seasonally Adjusted," Economic News Release, last modified September 20, 2013, www.bls.gov/news.release/laus.t05.htm.

MISCONCEPTIONS ABOUT WAGES

There are some serious theoretical arguments for the minimum wage that deserve consideration. Unfortunately, the popular arguments that tend to appeal to non-economists are often based on misconceptions about wages and are too easily countered to receive serious consideration among economists. That said, even economists disagree about the effects of the minimum wage on employment and the living standards of those working in jobs that pay at or near minimum wage.

One bane of many microeconomists is the too-popular conception that the minimum wage is an effective policy tool for promoting social welfare.[6] The problem ultimately stems from the fact that a compelling sound bite can be stated in 10 seconds, while communicating the full truth and nuance requires significantly more words. Thus, "Vote for me and I'll increase the minimum wage and put more money

6. Joseph J. Sabia and Richard V. Burkhauser, "Minimum Wages and Poverty: Will a $9.50 Federal Minimum Wage Really Help the Working Poor?," *Southern Economic Journal* 76, no. 3: 592–623.

in workers' pockets" wins out over an explanation that normally requires an entire chapter in an undergraduate economics textbook.[7]

A common conceptual error in advocating for a minimum wage is to overemphasize the role of government and underemphasize the role of competition in setting wages. This conceptual error typically takes the form of believing that the minimum wage is what stands between the worker and the exploitative employer.[8] The idea is that, in seeking to reduce costs, profit-motivated employers would try to get away with paying their workers near-zero wages if they could. This argument is false on several counts. First, if employers really did exploit their workers by paying as little as possible, the workers would suffer from ill health, malnourishment, and inadequate hygiene; they would be unable to afford proper attire or transportation to and from work. Such workers would be of little use to the employer. Second, if an employer were able to pay workers an extremely low wage, or any wage that is below the prevailing level for workers with similar skills, then the employer's competitors would have an opportunity to steal the employer's workers by paying them slightly more. It is this dynamic—employers competing for workers—that is responsible for maintaining wages above zero, not the minimum wage.

How do we know this? If it were true that the minimum wage is the only thing preventing employers from paying their workers near-zero wages, then many workers would be earning exactly the minimum wage because there is no law requiring employers to pay more than the minimum. The fact that over 97 percent of workers earn above the minimum wage indicates that competition among employers plays a far more important role in buoying wages than does the minimum wage.

An apparently obvious truism is that raising the minimum wage raises workers' wages. This is, however, not necessarily true. It is true that the average wage *rate* rises when the minimum wage increases, but the average wage rate is a biased measure. People who are laid off due to an increase in the minimum wage (and consequently earn nothing) are excluded from the average wage rate calculations. The lost income of people whose hours are reduced is similarly excluded from the calculations. The result is that it is possible for total wages to fall even though the average wage rate rises.

Another common error is to confuse the *cost* of a worker and the *value* of a worker. Each worker represents some value to potential employers. That value is a function of work experience, education, skill, work ethic, physical stamina, and other factors particular to the worker. That value is also a function of the capital and technology with which the employer will match the worker. A worker who is

7. For a detailed discussion about the foundation for and effects of a minimum wage, see James D. Gwartney et al., *Economics: Private and Public Choice*, 10th ed. (Mason, OH: South-Western, 2003), 57–100 (chapter 3 and part of chapter 4).

8. Meteor Blades, "It's 100 Candles for the Minimum Wage," *Daily Kos* (blog), June 3, 2012, www.dailykos.com/story/2012/06/03/1096923/-It-s-100-candles-for-the-minimum-wage.

highly skilled in operating heavy construction equipment will provide less value to an employer who pairs the worker with a shovel than to an employer who pairs the worker with a backhoe.

The minimum wage does not set a lower bound on the value of the worker, but it does set a lower bound on the cost of the worker. If a worker who can produce $10 of value per hour for an employer costs the employer $9 per hour, then the employer will hire the worker and earn $1 profit for every hour the worker works. Imposing a $12 minimum wage doesn't increase the value of the worker, but it does increase the cost of the worker. If the employer pays the worker $12 an hour, the employer ends up incurring $2 in losses for every hour the worker works. Thus, the employer is better off not hiring the worker and foregoing the $10-per-hour value that the worker would bring in exchange for not incurring the $12-per-hour cost.

ECONOMIC ARGUMENTS FOR THE MINIMUM WAGE

Economists, both those in favor of and those opposed to the minimum wage, agree that employers have a profit incentive to lay off (or not hire in the first place) workers who cost more than the value they generate for the firm. To attract the attention of economists, any argument in support of the minimum wage cannot ignore this point of agreement. One such argument proposes that an increase in the minimum wage can increase the value minimum wage workers generate for the firm by as much as or more than it increases the cost of the minimum wage workers. Consequently, according to this argument, an increase in the minimum wage will not cause increased unemployment.

The efficiency wage theory of labor holds that higher real wages improve labor productivity by reducing worker turnover and the associated costs of hiring and training new workers, by reducing the incentive for workers to unionize, and by increasing the opportunity cost of being fired—thereby giving the worker incentive to be more productive.[9] Consequently, over at least some range, increasing the minimum wage can have no deleterious employment effects.[10] A related argument is that an increased minimum wage forces employers to increase training so as to improve worker productivity.[11]

An interesting argument for the minimum wage is that the use of a complicated patchwork of income subsidies for the poor has the effect of masking a job's true value. Rather than a worker earning a wage equal to the true value of his labor and

9. Janet L. Yellen, "Efficiency Wage Models of Unemployment," *American Economic Review* 74, no. 2 (1984): 200–205.

10. Andreas Georgiadis, "Efficiency Wages and the Economic Effects of the Minimum Wage: Evidence from a Low-Wage Labour Market," *Oxford Bulletin of Economics and Statistics*, published electronically July 5, 2012, doi: 10.1111/j.1468-0084.2012.00713.x.

11. "Raise the Floor?," *Free Exchange* (blog from *Economist*), November 27, 2012, www.economist.com/blogs/freeexchange/2012/11/labour-markets.

the consumer paying a price equal to the consumer's true value of the product, low-income supports (the Earned Income Tax Credit, housing subsidies, food stamps, etc.) reduce the need for higher wages, leading to lower product prices, the benefit of which is reduced by taxes needed to fund the low-income supports. Following this argument, raising the minimum wage moves us toward a one-step approach to addressing poverty wherein workers are paid and customers pay the true value of the workers' labor.

Along these lines, Neumark and Wascher find that the combination of the Earned Income Tax Credit and a higher minimum wage resulted in both increased wages and reduced unemployment among single women with children, though at the expense of less-skilled minority males and women without children.[12] David Lee and Emmanuel Saez find that, although it creates unemployment, the minimum wage can be used to redistribute income toward low-wage workers.[13]

George J. Stigler argues that an increase in the minimum wage could increase employment if the employer were a monopsonist—i.e., an employer who faces no competition in the labor market. A monopolist maximizes profit by restricting output and so driving up the product price by a greater amount (proportionally) than the value of the reduction in unit sales. Analogously, a monopsonist maximizes profit by restricting hiring and so driving down the wage rate by a greater amount (proportionally) than the value of the reduction in output due to the reduction in the labor force. In such a situation, Stigler argues, a minimum wage could both increase the number of workers the monopsonist hires and increase the wage rate the monopsonist pays.[14] It is noteworthy that the minimum wage, as such, isn't improving the labor market. Rather, the minimum wage is being employed to counteract a failure in the labor market that is the result of a lack of competition. It is competition (or, in this case, the minimum wage's simulation of the effects of competition) that improves the labor market.

Some recent empirical studies claim to have found no evidence that increases in the minimum wage result in increased unemployment. Arindrajit Dube, T. William Lester, and Michael Reich examine restaurant employment in counties on a border between states with different minimum wages and find no relationship between employment and the minimum wage.[15] However, Neumark and Wascher point out that Dube and his colleagues' analysis is not of employment among minimum wage workers, but of employment among restaurant workers. Consequently, Dube and

12. David Neumark and William Wascher, "Does a Higher Minimum Wage Enhance the Effectiveness of the Earned Income Tax Credit?," *Industrial Labor Relations Review* 64, no. 4 (2011): 712–46.
13. David Lee and Emmanuel Saez, "Optimal Minimum Wage Policy in Competitive Labor Markets," *Journal of Public Economics* 96, no. 9–10 (2012): 739–49.
14. George J. Stigler, "The Economics of Minimum Wage Legislation," *American Economic Review* 36, no. 3 (1946): 358–65.
15. Arindrajit Dube, T. William Lester, and Michael Reich, "Minimum Wage Effects across State Borders: Estimates Using Contiguous Counties," *Review of Economics and Statistics* 92, no. 4 (2010): 945–64.

his colleagues' results do not shed light on the effect of minimum wage hikes on low-skilled or inexperienced workers—the group traditional theory maintains will bear the brunt of the unemployment costs.[16]

In a paper with Dube and Reich, Sylvia A. Allegretto finds no relationship between changes in the minimum wage and changes in employment among teenagers.[17] Since teenagers are among the least skilled workers, this study is more relevant to the traditional question of the minimum wage than is the study by Dube, Lester, and Reich. However, as Neumark discusses in a paper with J. M. Ian Salas, Allegretto, Dube, and Reich's study overlooks the possibility of labor-labor substitution.[18] Specifically, it is possible employers respond to increases in the minimum wage by substituting better-skilled and more-experienced teenagers for lesser-skilled and less-experienced teenagers. If so, this labor-labor substitution is consistent with traditional minimum wage theory: the increase in the wage causes employers to lay off the least valuable workers. The fact that Allegretto, Dube, and Reich observe no change in employment among teenagers could be due to an influx of higher-skilled teenagers into the labor force offsetting the increase in unemployment among lower-skilled teenagers. Neumark and Wascher test this possibility by disaggregating teenagers into demographic groups. They find that increases in the minimum wage accompany increases in unemployment for male teenagers but not female teenagers, and increases in unemployment for black male and Hispanic male teenagers but not white male teenagers.[19] These results return us to the traditional theory—at least part of the wage gains due to increasing the minimum wage are paid for by increased unemployment among less advantaged workers.

In two separate studies, Allan Drazen, Kevin Lang, and Shulamit Kahn propose another explanation for why an increase in the minimum wage might not cause unemployment, but the explanation hinges on blurring the distinction between two different labor markets via imperfect information. According to their models, the quality of labor supplied to the market is a positive function of the wage rate. This is not an unreasonable assumption—all other things being equal, a higher-quality (i.e., higher-value) worker would have a higher opportunity cost of time, and so would require a higher wage. Therefore, an increase in the minimum wage alters the mix of workers by disproportionately increasing the high-quality labor offered for hire.

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16. Neumark and Wascher, "Does a Higher Minimum Wage Enhance the Effectiveness of the Earned Income Tax Credit?"

17. Sylvia A. Allegretto, Arindrajit Dube, and Michael Reich, "Do Minimum Wages Really Reduce Teen Employment? Accounting for Heterogeneity and Selectivity in State Panel Data," *Industrial Relations* 50, no. 2 (2011): 205–40.

18. David Neumark and J. M. Ian Salas, *Minimum Wages: Evaluating New Evidence on Employment Effects* (Washington, DC: Employment Policies Institute, January 2013), http://www.epionline.org/studies/Neumark-01-2013.pdf. Neumark and Salas also take issue with Allegretto and her colleagues' econometric treatment of state-specific trends in employment.

19. Neumark and Wascher, "Does a Higher Minimum Wage Enhance the Effectiveness of the Earned Income Tax Credit?"

Because employers do not have perfect information about the quality of the labor available, they behave as if the labor supply has increased in quality, which, probabilistically, it has. This improvement in the quality of labor increases the employers' demand for labor. Thus, it is possible that the equilibrium wage rate actually rises in response to the increase in the minimum wage. If the equilibrium wage rises by the same amount as the minimum wage increases, we would expect there to be no unemployment effects.[20]

Note, however, that this argument requires a blurring of the distinction between higher-quality and lower-quality labor. If employers could ascertain labor quality, there would actually be two labor markets—one for higher-quality labor and one for lower-quality labor—and the equilibrium wage for the higher-quality labor would be higher than the equilibrium wage for the lower-quality labor. The fact that, in this scenario, an increase in the minimum wage would have no unemployment effects is not due to a breakdown in the relationship between price floors and surpluses, but due to imperfect information.

COMMONSENSE ARGUMENTS AGAINST THE MINIMUM WAGE

A COMMON ARGUMENT against the minimum wage involves the adage that employment is a catch-22 problem: to get a job you need experience, but to get experience you need a job. Seen in this light, the minimum wage prevents some of the least skilled, least educated, and least experienced workers from participating in the labor market because it discourages employers from taking a chance by hiring them. In other words, workers compete for jobs on the basis of education, skill, experience, and price. Of these factors, the only one on which the lesser-educated, lesser-skilled, and lesser-experienced worker can compete is price. The minimum wage takes away even this last competitive factor. Milton Friedman once described the minimum wage as a requirement that "employers must discriminate against people who have low skills."[21]

When we think of the cost of an employee, we tend to think only of the wage. This is, however, not the whole cost and, in some cases, not even the largest part of the cost. Currently, employers are required to pay a payroll tax of 7.65 percent of employees' wages. Therefore, from the employer's perspective, a $1 increase in the minimum wage is actually a $1.08 increase. Moreover, employers provide benefits to employees—some voluntary, some mandated by the government. These benefits, often unseen by the employees, are real costs to the employers. For example, the

20. Allan Drazen, "Optimal Minimum Wage Legislation," *Economic Journal* 96 (1986): 774–84; Kevin Lang and Shulamit Kahn, "The Effect of Minimum-Wage Laws on the Distribution of Employment: Theory and Evidence," *Journal of Public Economics* 69, no. 1 (1998): 67–82.
21. Milton Friedman, interview by Richard D. Heffner, "Living within Our Means," *The Open Mind*, WPIX channel 11 (New York), December 7, 1975, http://www.thirteen.org/openmind/public-affairs/living-within-our-means/494/.

average American employer pays $21.50 per hour for labor and an additional $9.59 per hour in nonwage compensation, which includes paid leave ($2.18 per hour), insurance ($2.80 per hour), retirement contributions ($1.46 per hour), and other voluntary and legally required benefits ($3.15 per hour).[22] The additional $9.59 per hour in nonwage compensation does not include the costly interval between the time the employee begins working and the time the employee gains enough knowledge of the employer's systems and procedures to become fully productive. It also does not include the expense, in both time and money, of conducting the job search that resulted in the employee being hired.

Hiring a worker is not simply a matter of the employer paying an hourly wage and receiving an hour's worth of work. The transaction involves a significant upfront cost to the employer for advertising the position, interviewing, checking backgrounds, and training the employee, all costs that, if the employee is a poor hire, the employer will not recoup. The higher the minimum wage, the greater the risk that the employer takes in hiring a worker who may prove to be less capable, intelligent, dependable, or experienced than appeared in the job interview. Consequently, the higher the minimum wage is, the less likely the employer will be to take a chance on a risky hire—a candidate with fewer skills, less education, and less experience—and the more likely the employer is to opt for a safer hire—a candidate with more skills, more education, and more experience. The perverse implication is that the minimum wage encourages employers to avoid hiring the very workers the minimum wage is purportedly designed to help.

Another argument against the minimum wage is the truism that the money to pay for the increased wage must come from at least one of four places: higher prices for consumers, lower returns to investors, lower prices to suppliers, or a reduced workforce. I will look at each of these alternatives. First, if firms respond by raising their prices, then minimum wage workers will find themselves earning more dollars yet paying more for what they buy. In short, workers' purchasing power will increase less than the nominal increase in the minimum wage. Second, if firms respond by reducing returns to investors, then those firms could lose their investors to industries that are not as dependent on minimum wage workers. This is most problematic if the intent is to use the minimum wage to redistribute income from investors to minimum wage workers. Because firms employ minimum wage workers in different concentrations, the redistribution will apply more to some industries and less to others. For example, almost 20 percent of workers in the leisure and hospitality industry earn the minimum wage versus less than 1 percent in the construction industry.[23] Third, if firms pay lower prices to suppliers, then the whole quandary is

22. These are averages over all workers. Bureau of Labor Statistics, US Department of Labor, "Employer Costs for Employee Compensation—June 2013," Economic News Release, September 11, 2013, www.bls.gov/news.release/ecec.nr0.htm.
23. Bureau of Labor Statistics, *Characteristics of Minimum Wage Workers*.

merely pushed up the supply chain, with suppliers now having to fund the reduced prices via one or more of these four means.

The fourth possible response to increases in the minimum wage is to reduce the workforce. As the minimum wage rises, capital substitutes for labor become relatively cheaper. For example, years ago (and still, for those who live in New Jersey) gas stations employed people to pump gas. As the minimum wage rose relative to the cost of technology, gas stations replaced these workers with computers that allowed customers to pump gas and pay by themselves. Thus, increases in the minimum wage caused gas station attendants' jobs to disappear. A reasonable counterargument is that the falling cost of technology made this switch inevitable. Although this is true, the rising minimum wage not only made the transition occur sooner, it also gave entrepreneurs an added profit incentive to develop the technology more quickly.

The reduction in labor sometimes takes the form of increasing the workload of remaining workers and sometimes takes the form of pushing the workload onto the customer. Years ago, when customers ordered a Coke at McDonald's, they received a Coke. Today, they receive a cup and the cashier points to the Coke machine. McDonald's uses time and motion studies to determine how long it takes employees to perform various tasks in an attempt to identify bottlenecks in customer service.[24] Studies like this identified cup-filling as a significant time cost. Putting this task onto the customer allowed employers to serve the same number of customers per unit time while employing less labor.

Finally, one of the more principled arguments against the minimum wage is that, while usually portrayed as a restriction on employers, the minimum wage is equally a restriction on workers. Minimum wage law prohibits workers from selling their labor unless they can sell it for at least the dictated minimum. Other things being equal, a worker would rather receive more for his labor than less. But if the worker's option is to sell his labor for less than the minimum wage or not sell it at all, the choice should be the worker's to make, not the government's to dictate. Through the minimum wage, the state dictates what people may and may not do with their own labor.

EMPIRICAL ARGUMENTS FOR AND AGAINST THE MINIMUM WAGE

The most famous empirical study in favor of the minimum wage is Card and Krueger's 1994 study of New Jersey's minimum wage hike of 1992. Card and Krueger surveyed fast-food restaurants in New Jersey and eastern Pennsylvania to compare the number of employees before and after the minimum wage increased from $4.25 per hour to $5.05 per hour. They find that the increase in the minimum wage had

24. "Big Mac's Makeover," *Economist*, October 14, 2004, www.economist.com/node/3285898.

no negative effect on employment—in fact, it had a slightly positive effect. They do, however, find that prices at fast-food restaurants increased. This is consistent with the earlier truism that the increase in the minimum wage must be paid for from one of four sources, and if it isn't paid via a reduction in employment, then it could be paid via increased consumer prices. However, Card and Krueger find no evidence that the price increase was greater in stores that were affected more strongly by the minimum wage hike.[25]

Card and Krueger's finding of no decline, and a possible increase, in employment following the minimum wage hike is remarkable. If correct, their finding upends much of what classical economists thought they understood about labor markets. To draw an analogy, the finding would be akin, in physics, to finding evidence that gravity pushes instead of pulls. The implications of the finding would stretch far beyond a limited discussion of fast-food workers and minimum wages to suggesting some fundamental oversight in our understanding of how markets work.

One problem with Card and Krueger's study is the fact that the authors did not measure actual employment data, but rather surveyed store managers by telephone, asking whether the managers had hired or fired, or intended to hire or fire, workers following the increase in the minimum wage. A study by the Employment Policies Institute (EPI) examines Card and Krueger's data and finds numerous anomalies. For example, several fast-food establishments reported zero full-time workers before the minimum wage hike and 20 or more full-time workers after—a remarkable shift in employment. One establishment reported 30 full-time workers before the minimum wage increase, but none the following November. After reviewing Card and Krueger's survey data, EPI reviews the payroll data from the same establishments. While survey data measure the managers' recollections, estimates, or projections, payroll data measure the actual number of employees. Comparing Card and Krueger's telephone survey data to actual payroll records, the EPI study finds that one-third of the observations in Card and Krueger's study showed employment changes opposite to the direction indicated by the payroll data.[26]

Neumark and Wascher conducted a follow-up study in which they look at the same minimum wage hike and the same population of fast-food establishments in New Jersey and Pennsylvania. They attempted to duplicate Card and Krueger's results using actual payroll data from the same population of fast-food restaurants that Card and Krueger surveyed. Like the EPI study, Neumark and Wascher find that Card and Krueger's survey data vary markedly from payroll data, indicating severe measurement error in Card and Krueger's study. They also find, as classical

25. Card and Krueger, "Minimum Wages and Employment."
26. Employment Policies Institute, *The Crippling Flaws in the New Jersey Fast Food Study*, 2nd ed. (Washington, DC: Employment Policies Institute, April 1996), http://www.epionline.org/studies/epi_njfastfood_04-1996.pdf.

theory predicts, that the increase in the minimum wage in New Jersey led to a decline in employment in the fast-food industry.[27]

In another study, Laura Giuliano examines personnel records from a national retail employer's 700 stores before and after the federal minimum wage increases in August 1996 and August 1997. This study finds that the increase in the minimum wage had no significant effect on the stores' total employment. However, it also finds that the increase in the minimum wage altered the composition of the stores' workforce. It finds varying employment effects depending on whether the employees were teenagers or adults, the amount by which the their wages rose following the minimum wage increase, and the differences in wages between adults and teenagers. When both teenage and adult wages increased by the same amount, employment of teenagers fell.[28] The fall in teenage employment is consistent with classical theory: the increase in the minimum wage causes the employer to shift away from lower-quality workers.

Interestingly, Giuliano also finds that when adult wages did not rise but teenage wages did, employment of teenagers rose, albeit by a small amount.[29] Here, Giuliano finds the effect predicted by Drazen, Lang, and Kahn.[30] As the minimum wage rose, higher-quality teenagers entered the workforce and displaced the lower-quality teenagers. Giuliano finds that the new hires tended to be new labor market entrants: i.e., the increased minimum wage brought into the market higher-quality teenagers who had not been in the labor market previously. As a proxy for "quality," Giuliano uses the probability of the worker being fired, and by this metric, estimates that these new entrants were significantly more productive than other teenagers and approximately as productive as adults.[31] Again, this is consistent with classical theory's prediction that an increase in the minimum wage will result in unemployment among lower-quality workers. That Giuliano finds no change in unemployment among teenagers in general is due to the fact that the increased minimum wage enticed higher-quality workers into the labor market; these workers then replaced lower-quality workers. In addition, Giuliano finds that these new labor market entrants were predominantly teenagers from more affluent households.[32]

Recent studies find evidence that the minimum wage does not cause unemployment by employing econometric techniques not found in earlier research.[33]

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27. Neumark and Wascher, "'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania': A Comment."
28. Laura Giuliano, "Minimum Wage Effects on Employment, Substitution, and the Teenage Labor Supply: Evidence from Personnel Data," *Journal of Labor Economics* 31, no. 1 (2013): 155–94.
29. Ibid.
30. Drazen, "Optimal Minimum Wage Legislation"; Lang and Kahn, "Effect of Minimum-Wage Laws."
31. Giuliano, "Minimum Wage Effects."
32. Ibid.
33. Dube, Lester, and Reich, "Minimum Wage Effects"; Allegretto, Dube, and Reich, "Do Minimum Wages Really Reduce Teen Employment?"

However, Neumark, Salas, and Wascher demonstrate that these approaches are methodologically flawed and so do not produce more reliable results than earlier studies. They conclude that the preponderance of evidence suggests that the minimum wage results in a trade-off of higher wages for some in exchange for job losses for others.[34]

EMPIRICAL ANALYSIS OF THE MINIMUM WAGE AND UNEMPLOYMENT RATE

The goal of a controlled experiment is to allow the researcher to observe the relationship between a treatment and an outcome while holding constant all other factors that might affect the outcome. For example, if after holding all other factors constant, exposing a type of plant to a specific amount of radiation results in the plant's death, observers can conclude that that specific amount of radiation kills this type of plant.

In economics, researchers rarely are able to conduct controlled experiments, and so must rely on observational and statistical techniques to minimize and to filter out the influences of uncontrolled factors. One such approach is to limit the scope of the observations so as to capture movements in the relationship one is intending to examine while excluding, as much as possible, movements in extraneous factors. This is the approach Card and Krueger's and Neumark and Wascher's studies take when they examine the effect of a change in the minimum wage on a specific subset of the labor market in a specific geographic area over a specific time interval. In addition, both studies employ a difference-in-differences estimation in which outcomes are observed for two groups (Pennsylvania and New Jersey) at two points in time (before and after New Jersey's minimum wage hike), and one group (New Jersey) is exposed to a treatment (the minimum wage hike) at one of the points in time while the other is not.[35]

The difference-in-differences approach controls for systemic differences in the outcome that have nothing to do with the treatment. For example, if for reasons that have nothing to do with the minimum wage, Pennsylvania's unemployment rate is consistently lower than New Jersey's unemployment rate, the difference-in-differences approach will filter out this systemic difference. What the difference-in-differences approach cannot filter out are extraneous factors that both influence the outcome and, by coincidence, change at the same time that the treatment changes. For example, if New Jersey had increased its income tax at the same point

34. David Neumark, J. M. Ian Salas, and William Wascher, "Revisiting the Minimum Wage–Employment Debate: Throwing Out the Baby with the Bathwater?" (NBER Working Paper No. 18681, National Bureau of Economic Research, Cambridge, MA, January 2013), available at http://www.nber.org/papers/w18681.
35. Card and Krueger, "Minimum Wages and Employment"; Neumark and Wascher, "'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania': A Comment."

in time that it increased its minimum wage, the difference-in-differences approach would not have been able to isolate the effect on unemployment caused by the minimum wage hike from the effect on unemployment caused by the change in the income tax rate.

An alternate approach to difference-in-differences is to broaden the scope of the observations so as to capture both the movements in the relationship one is intending to examine and variations in extraneous factors. As long as the variations in extraneous factors are uncorrelated with changes in the treatment, expanding the scope of the observations allows movements in the extraneous factors to cancel themselves out over time, revealing only the effect of the changes in the treatment. For example, if the unemployment rate is influenced by climate (perhaps people who have a greater incidence of unemployment have an incentive to avoid states with inhospitable climates), then observers would expect—all other things being equal—that colder states would have lower unemployment rates and warmer states would have higher unemployment rates. This variation in unemployment due to climate introduces an extraneous factor that can complicate an analysis of the effect of changes in the minimum wage on unemployment.

By expanding the scope of the observations to include states with warm and cold climates, the positive unemployment effects from the warmer states will tend to cancel the negative unemployment effects from the colder states. A related approach is to include climate measurements explicitly in the model. By using regression analysis, the effects of such explicitly included factors can be filtered out, achieving the statistical equivalent of running a controlled experiment.[36]

I employ the latter approach here by comparing changes in the national unemployment rate over the period 1975–2012 to changes in the federal minimum wage. As of 2013, 18 states have minimum wages greater than the federal minimum wage.[37] When measuring dollars across time, the usual problem of inflation must be addressed so that dollars across periods have the same meaning. For this reason, researchers will examine the real minimum wage (the minimum wage adjusted for inflation).

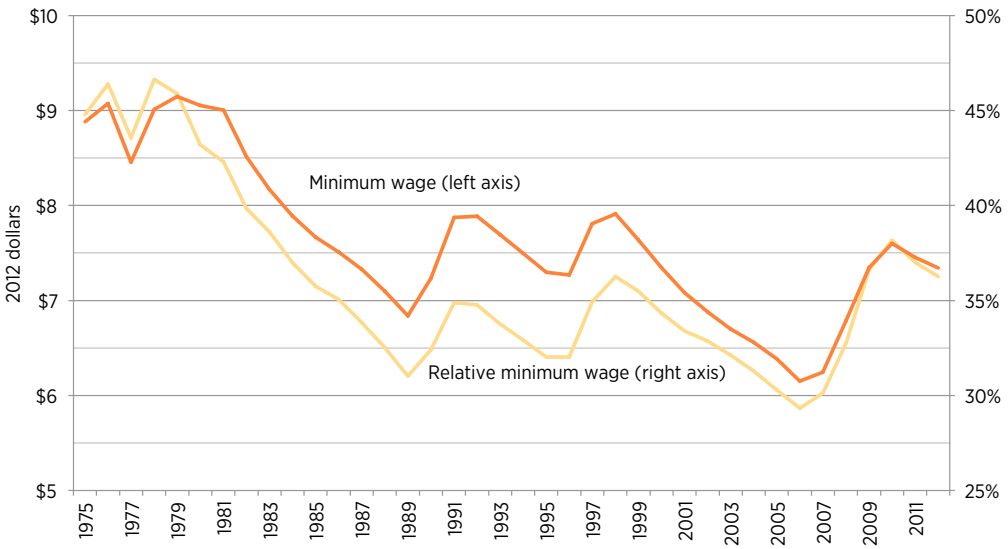
An additional problem arises when discussing price controls such as the minimum wage. Unto itself, the level of the price control doesn't matter. What matters is the

36. For various technical reasons, this technique does not achieve results that are as pristine as those achieved through a true controlled experiment, but for measuring statistical relationships (as opposed to deterministic relationships), the technique is frequently adequate.

37. Since the effective minimum wage in each state is the greater of the federal minimum wage and the state minimum wage, the relative minimum wage I calculate will be less than the wage that would result if I used a weighted average that reflected the higher minimums in the 18 states. Because of this, when a state minimum wage rises but the federal minimum wage does not, my dataset will show no change in the minimum wage. If the increase in the state minimum wage results in increased unemployment, my model will not pick up the relationship, as my dataset will show an increase in unemployment but no increase in the minimum wage.

level of the price control relative to the equilibrium price. For example, imposing a minimum wage of $10 per hour would have less of an effect if the equilibrium price of labor were $20 per hour than if the equilibrium price were $12 per hour, as the $10 is less "binding" when prices want to go all the way to $20 than when prices want to go only to $12. Expressing the minimum wage relative to the equilibrium wage both accounts for the degree to which the minimum wage is binding and adjusts for inflation (assuming the minimum wage and the equilibrium wage are both measured in nominal terms). Here I use the average hourly wage as a proxy for the equilibrium wage, and so the ratio of the minimum wage to the average hourly wage is a proxy for the degree to which the minimum wage is binding on the labor market. I call this ratio the *relative minimum wage*. The relative minimum wage is correlated with, but not identical to, the inflation-adjusted minimum wage. In fact, there are periods (1978–1979, 1991–1992, 1995–1996) in which the two measures move in opposite directions. These two measures are shown in figure 2.

FIGURE 2. THE INFLATION-ADJUSTED MINIMUM WAGE AND THE RELATIVE MINIMUM WAGE

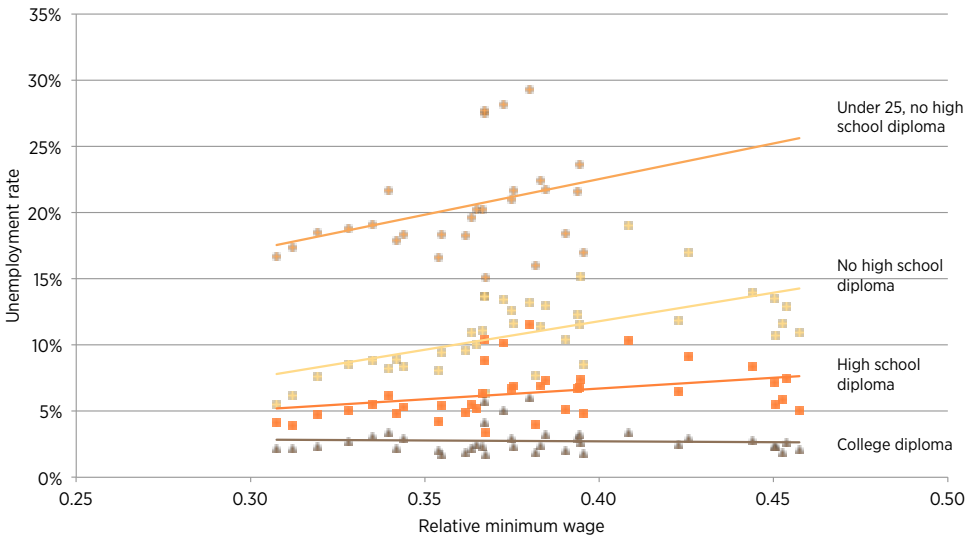


Sources: US Department of Labor, "History of Federal Minimum Wage Rates under the Fair Labor Standards Act, 1938–2009," accessed August 25, 2013, www.dol.gov/whd/minwage/chart.htm; Bureau of Labor Statistics, US Department of Labor, "Employment, Hours, and Earnings from the Current Employment Statistics Survey (National)," accessed August 25, 2013, data.bls.gov/timeseries/CES0500000008.

Figure 3 shows a comparison of the relative minimum wage to unemployment rates for demographic groups broken down by age and education, where "no high school diploma" means that the students did not complete high school. The data appear to show no relationship between the minimum wage and unemployment for college-educated workers, and a series of relationships that grow ever more

positive as we move down the worker-quality scale. Descriptive statistics for these data appear in table 1.

FIGURE 3. NATIONAL-LEVEL DATA FOR THE RELATIVE MINIMUM WAGE AND UNEMPLOYMENT, ACCORDING TO AGE AND EDUCATION



Note: Data are for nationwide unemployment rates, 1975–2012. Data for workers under 25 with no high school diploma are for 1985–2012.

TABLE 1. DESCRIPTIVE STATISTICS FOR UNEMPLOYMENT RATES AND THE RELATIVE MINIMUM WAGE

	Under 25, no high school diploma	No high school diploma	High school diploma	College	Relative minimum wage
Mean	0.205	0.110	0.064	0.027	0.381
Standard deviation	0.038	0.029	0.020	0.010	0.041

Source: Bureau of Labor Statistics, US Department of Labor, table A-4, "Employment Status of the Civilian Population 25 Years and Over by Educational Attainment," Economic News Release, accessed August 25, 2013, www.bls.gov/news.release/empsit.t04.htm.

Previous research has identified "peer effects" relating to the minimum wage wherein high school students form an impression of the likelihood of unemployment by observing people their age who have looked for jobs in the local job market.[38] By this argument, a student whose skills are not worth the increased minimum wage will not be employed and so the opportunity cost for the student to stay in

38. Richard Sutch, "The Unexpected Long-Run Impact of the Minimum Wage: An Educational Cascade" (NBER Working Paper No. 16355, National Bureau of Economic Research, Cambridge, MA, September 2010), http://www.nber.org/papers/w16355.pdf.

school is reduced, resulting in fewer students opting to leave high school for the job market. This creates a "ratchet effect" whereby younger students who observe older students opting to remain in school develop an impression of a higher unemployment rate among their peer group and so opt to remain in school as well. I will allow for this effect by measuring for the growth rate in the minimum wage from one year to the next in addition to the relative minimum wage.

Thus, my model has U_{et} from figure 3 as the dependent variable, where *e* denotes the level of education of the workers in year *t*. The key independent variable is W_t, the relative minimum wage from figure 3, which is the ratio of the minimum wage in year *t* to the average hourly wage in year *t*.[39] I also include interaction terms for W_t and the level of education of the workers. For the level of education I use D_{Ht}, which takes the value of 1 if the unemployment rate is for workers with high school diplomas, 0 otherwise, and D_{Nt}, which takes the value of 1 if the unemployment rate is for workers without high school diplomas, 0 otherwise. In the third equation, I add another interaction term, D_{Yt}, which has the value of 1 if the unemployment rate is for workers without high school diplomas who are 24 or younger, 0 otherwise. Since workers who are 24 or younger without high school diplomas constitute a subset of workers without high school diplomas, the coefficient on the interaction term D_{Nt} will pick up effects for workers 25 or older without high school diplomas, while the coefficient on the interaction term D_{Yt} will pick up the deviation from this effect for workers who are 24 or younger without high school diplomas. In short, when $D_{Nt} = 1$ and $D_{Yt} = 0$, we have workers who are 25 or older and without high school diplomas. When $D_{Nt} = 1$ and $D_{Yt} = 1$, we have workers who are 24 or younger and without high school diplomas. Finally, economic growth will obviously play a role in unemployment. I both include the percentage change in real GDP as a proxy for economic growth,[40] and estimate the pooled models:

$$U_{et} = \alpha + \left(\beta + \beta_H D_{Ht} + \beta_N D_{Nt}\right)W_t + \gamma S_t + \delta G_t + u_{et},\ \ u_{et} + \rho_1 u_{e,t-1} + \rho_2 u_{e,t-2} + \varepsilon_{et} \tag{1}$$

$$U_{et} = \alpha + \left(\beta + \beta_H D_{Ht} + \beta_N D_{Nt}\right)W_t + \delta G_t + u_{et},\ \ u_{et} + \rho_1 u_{e,t-1} + \rho_2 u_{e,t-2} + \varepsilon_{et} \tag{2}$$

$$U_{et} = \alpha + \left(\beta + \beta_H D_{Ht} + \beta_N D_{Nt} + \beta_Y D_{Yt}\right)W_t + \delta G_t + u_{et},\ \ u_{et} + \rho_1 u_{e,t-1} + \rho_2 u_{e,t-2} + \varepsilon_{et} \tag{3}$$

39. In years in which the minimum wage changes, I measure the minimum wage as the weighted average (based on the month in which the new wage took effect) of the two minimum wages.

40. Bureau of Labor Statistics, US Department of Labor, table 4.2, "Real Gross Domestic Product by Major Demand Category," last modified February 1, 2012, www.bls.gov/emp/ep_table_402.htm.

where ε is a white noise error over both dimensions and the variables are defined as follows:[41]

U_{et} Unemployment rate for workers with education e in year t.

W_t Ratio of the minimum wage in year t to the average hourly wage in year t (the "relative minimum wage").

D_{Ht} 1 if the unemployment rate is for workers with high school diplomas, 0 otherwise.

D_{Nt} 1 if the unemployment rate is for workers without high school diplomas, 0 otherwise.

D_{Yt} 1 if the unemployment rate is for workers without high school diplomas who are 24 or younger, 0 otherwise.

S_t Growth rate in the nominal minimum wage from year $t - 1$ to year t.

G_t Growth rate in real GDP from year $t - 1$ to year t.

The data reject the Wald test when a single slope dummy replaces the four education-and-age-specific slope dummies (p-value = 0.000). This indicates that the sensitivity of the unemployment rate to changes in the minimum wage is significantly different across the four education-and-age levels. The residuals are stationary,[42] serially uncorrelated,[43] and normally distributed.[44] Since residuals contain changes in the unemployment rate that the model cannot explain, failing any of these three tests would indicate the possibility that some additional factor that significantly affects the unemployment rate has been excluded from the model.

In all models in which it was included, the growth in the nominal wage rate showed no significant relationship with the unemployment rate. For comparison, model 2 shows the results from model 1 with the variable for the growth in the

41. Bureau of Labor Statistics, US Department of Labor, table A-4, "Employment Status of the Civilian Population 25 Years and Over by Educational Attainment," Economic News Release, accessed August 25, 2013, www.bls.gov/news.release/empsit.t04.htm; Bureau of Labor Statistics, "Real Gross Domestic Product."

42. The p-value for the Augmented Dickey-Fuller test is 0.000 for all three models. Nonstationary data can produce regression results that appear to be significant when, in fact, the data are unrelated.

43. The minimum p-value for the Q-statistics is 0.113 at a 14-period lag (model 1), 0.102 at a 14-period lag (model 2), and 0.059 at a 14-period lag (model 3). Serial correlation causes standard hypothesis tests to be invalid.

44. The p-values for the Jarque-Bera statistics are 0.455 (model 1), 0.590 (model 2), and 0.503 (model 3).

nominal minimum wage removed. Removing the variable improves all the residual test results.[45] Model 3 shows the results from model 2 with an additional classification added—workers who do not have a high school diploma and are also 24 years old or younger.

TABLE 2. THE RELATIONSHIP BETWEEN THE RELATIVE MINIMUM WAGE AND UNEMPLOYMENT

Regressor	Model 1 coefficient estimate (standard error)	Model 2 coefficient estimate (standard error)	Model 3 coefficient estimate (standard error)
W_t	0.129 (0.083)	0.080 (0.068)	0.084 (0.076)
$W_t DH_t$	0.096*** (0.020)	0.096*** (0.020)	0.097*** (0.030)
$W_t DN_t$	0.219*** (0.020)	0.219*** (0.020)	0.220*** (0.030)
$W_t DY_t$			0.501*** (0.034)
S_t	–0.026 (0.026)		
G_t	–0.099** (0.047)	–0.109** (0.046)	–0.100** (0.043)
AR(1)	1.120*** (0.094)	1.127*** (0.092)	1.242*** (0.082)
AR(2)	–0.452*** (0.097)	–0.474*** (0.095)	–0.488*** (0.088)
R^2	0.928	0.927	0.971
Durbin-Watson	2.056	2.076	2.022

Notes: Pooled Generalized Least Squares.
Models 1 and 2 include 108 observations (national data, 1975–2012, 3 education classifications). The data fail to reject the Wald test for valid parameter restrictions when a single constant replaces the education-and-age-specific intercept dummies (p-value = 0.938). The Durbin-Watson statistic shows no evidence of serial correlation in the residual.
Model 3 includes 134 observations (national data, 1985–2012, 4 education classifications). Unemployment data for workers under 25 without a high school diploma are only available back to 1985.
AR(1) and AR(2) are autocorrelation coefficients.
****Significant at 1 percent level. **Significant at 5 percent level. *Significant at 10 percent level.*

The coefficient on W_t represents the marginal impact of changes in the relative minimum wage on the unemployment rate among college-educated workers. The coefficient on $W_t D_{Ht}$ and $W_t D_{Nt}$ represent the marginal impact of changes in the relative minimum wage on workers with a high school diploma and workers 25

45. As a robustness check, I compared the results with those obtained from lagging all of the regressors one period. None of the results were qualitatively different. Most of the coefficient estimates changed by less than 5 percent. The two exceptions were the growth in real GDP (which increased in absolute value by 50 percent but retained its sign and significance) and the growth in the nominal minimum wage (which increased in absolute value by 100 percent and changed sign but remained statistically insignificant from zero).

or older without high school diplomas.[46] The coefficient on $W_t D_{Yt}$ represents the deviation in the marginal impact for workers 24 or younger without high school diplomas from the marginal impact for workers 25 or older without high school diplomas. To find the marginal impact of workers 24 or younger without high school diplomas, one would add the coefficient on $W_t D_{Nt}$ to the coefficient on $W_t D_{Yt}$.

It is interesting that, while changes in the relative minimum wage are unrelated to changes in the unemployment rate among college-educated workers, changes in the relative minimum wage are significantly and positively related to changes in unemployment among high school–educated workers, more significantly and more positively related to changes in unemployment among non-high school–educated workers, and still more significantly and more positively related to changes in unemployment among young non-high school–educated workers. This is consistent with the commonsense arguments against the minimum wage. The data indicate that, as the relative minimum wage rises, the workers with the least education and the fewest skills are the ones who suffer the worst increases in unemployment.

As a robustness check, below in table 3 are the results for model 3 when estimated via seemingly unrelated regression where the constant term, the coefficients on real GDP growth, and the autocorrelation coefficients are constrained to be equal across the four equations. The dependent variables in the four equations are the unemployment rates for each demographic group.

TABLE 3. SEEMINGLY UNRELATED REGRESSION ESTIMATION OF THE RELATIONSHIP BETWEEN THE RELATIVE MINIMUM WAGE AND UNEMPLOYMENT

Regressor	Young, no high school diploma coefficient (std error)	No high school diploma coefficient (std error)	High school diploma coefficient (std error)	College degree coefficient (std error)
Constant		–2.960*** (0.365)		
W_t	0.540*** (0.059)	0.276*** (0.058)	0.148*** (0.053)	0.048 (0.051)
G_t	–0.028 (0.132)	–0.171 (0.108)	–0.081 (0.065)	–0.027 (0.033)
AR(1)		1.083*** (0.091)		
AR(2)		–0.310*** (0.094)		
R^2	0.863	0.734	0.755	0.749

Notes: 134 observations (national data, 1985–2012, 4 equations).
AR(1) and AR(2) are autocorrelation coefficients.
****Significant at 1 percent level. **Significant at 5 percent level. *Significant at 10 percent level.*

46. Technically, these coefficients represent the *deviations* of these marginal impacts from the marginal impact for college-educated workers. But since the marginal impact for college-educated workers is (statistically) zero, these are approximately the same as marginal impacts themselves.

Compared to the results in models 1 through 3, the results in table 3 show a lesser, though significant, effect of the relative minimum wage on unemployment among young non-high school–educated workers and among non-high school–educated workers in general.

IMPLICATIONS

New Jersey may increase its minimum wage from $7.25 to $8.25 per hour in November 2013. As of 2012, the nationwide unemployment rate for 16- to 24-year-olds without a high school education was 27.7 percent, or 3.15 times the nationwide unemployment rate of 8.8 percent. As of June 2013, New Jersey's unemployment rate is 8.7 percent. Assuming the ratio holds for New Jersey, we can expect that, as of June 2013, New Jersey's unemployment rate for 16- to 24-year-olds without a high school education was 27.4 percent.[47] As of May 2012 (the last year for which data is available) the average hourly wage in New Jersey was $25.00.[48] Nationwide, average hourly earnings rose 1.9 percent from May 2012 to June 2013.[49] Assuming New Jersey's average hourly wage rose proportionally, the average hourly wage in New Jersey as of June 2013 was approximately $25.48.

Increasing the minimum wage from $7.25 to $8.25 increases the relative minimum wage from 0.285 to 0.324 (ignoring potential changes in the average hourly wage from June 2013 to November 2013) for an increase in the relative minimum wage of 0.039. By applying this change in the relative minimum wage to the regression estimates, one can expect the increase in the minimum wage to increase the unemployment rate among workers without a high school education by almost one percentage point for workers 25 or older, and over two percentage points for workers 24 or younger. This assumes that the workers remain in the workforce. The increase in the unemployment rate will be less as more workers opt to seek employment under the table and so disappear from the labor roles.

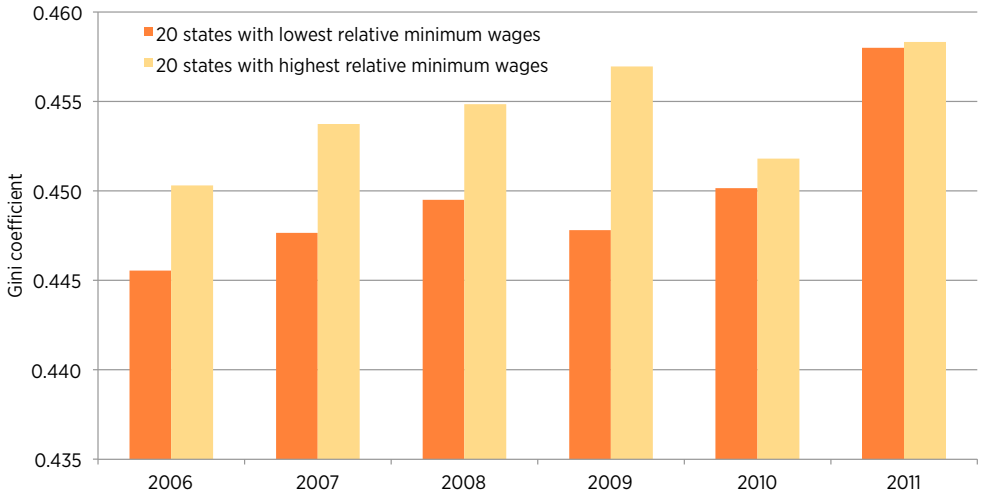
DOES A HIGHER MINIMUM WAGE REDUCE INCOME INEQUALITY?

One possible goal of the minimum wage is to reduce income inequality by raising the lowest wages.[50] In a cross-state study over the years 1960–2000, Thomas W. Volscho Jr. finds that states with higher minimum wages have less income inequality,

47. Data for unemployment by state and educational attainment is not readily available.
48. Bureau of Labor Statistics, US Department of Labor, "May 2012 State Occupational Employment and Wage Estimates: New Jersey," last modified March 29, 2013, www.bls.gov/oes/current/oes_nj.htm.
49. Bureau of Labor Statistics, US Department of Labor, table B-3, "Average Hourly and Weekly Earnings of All Employees on Private Nonfarm Payrolls by Industry Sector, Seasonally Adjusted," Economic News Release, accessed August 25, 2013, www.bls.gov/news.release/empsit.t19.htm.
50. Andy Stern and Carl Camden, "Why We Need to Raise the Minimum Wage," *Los Angeles Times*, March 10, 2013, articles.latimes.com/2013/mar/10/opinion/la-oe-stern-camden-why-we-should-raise-the-minimum-20130310.

provided the wage is set above some lower bound.[51] The results suggest that, since the minimum wage is not adjusted for inflation, inequality arises because inflation asymmetrically erodes the purchasing power of the incomes of minimum wage workers versus non-minimum wage workers. Volscho admits to the possibility that detrimental employment effects can accrue at higher levels, but that such effects did not manifest at the minimum wage levels observed in his dataset. Others have found relatively little impact of minimum wage on inequality.[52] John DiNardo, Nicole M. Fortin, and Thomas Lemieux look at US data from 1973 through 1992 and conclude that the decline in the real value of the minimum wage explains a significant portion of the growth in income inequality. They find that the effect is more pronounced in states with lower average wages.[53] A simple comparison of the states with the highest and lowest relative minimum wages, shown in figure 4, is revealing.

FIGURE 4. INCOME INEQUALITIES IN STATES WITH THE LOWEST AND HIGHEST RELATIVE MINIMUM WAGES



51. Thomas W. Volscho Jr., "Minimum Wages and Income Inequality in the American States, 1960–2000," *Research in Social Stratification and Mobility* 23 (2005): 343–68. Volscho estimates the lower bound in the data he examined to be $4.

52. John P. Formby, John A. Bishop, and Hoseong Kim, *What's Best at Reducing Poverty? An Examination of the 2007 Minimum Wage Increase* (Washington, DC: Employment Policies Institute, February 2010), http://www.epionline.org/studies/formby_02_2010.pdf.

53. John DiNardo, Nicole M. Fortin, and Thomas Lemieux, "Labor Market Institutions and the Distribution of Wages, 1972–1992: A Semiparametric Approach," *Econometrica* 64, no. 5 (1996): 1001–44.

In each year, from 2006 through 2011, the 20 states with the lowest relative minimum wages exhibited an average income inequality (as measured by the Gini coefficient) that was less than that of the 20 states with the highest relative minimum wages.[54] DiNardo, Fortin, and Lemieux argue that the Gini coefficient can be too gross a measure for examining changes in the minimum wage if most of the changes are concentrated at the far end of the income distribution.[55] Indeed, none of the differences in figure 4 is statistically significant. However, the fact that the differences all point in the same direction—more inequality among states with higher minimum wages—is telling. If the differences were equally probable, we would expect to observe half of the years showing more inequality in one direction and half of the years showing more inequality in the other direction. The odds of observing all six years showing more inequality in the same direction is less than 2 percent. Having said this, there is a significant endogeneity problem about whether the minimum wage causes, or is a response to, inequality that would need to be addressed before any conclusions can be drawn from this data.

Instead of the Gini coefficient, DiNardo, Fortin, and Lemieux measure the variance in wages within specific demographic groups and find, for the period 1979 through 1988, that increases in the inflation-adjusted minimum wage were associated with declines in income variation.[56] In a third approach, Neumark, Mark Schweitzer, and Wascher allow for differential effects of minimum wage changes on workers of differing wage levels. They find that increases in the minimum wage have a disproportionately negative effect on employment and earnings among low-wage workers versus higher-wage workers.[57]

A drawback to examining averages is that averages mask individual variation. A solution is to examine each year and each state individually when comparing the relative minimum wage to inequality. Following Volscho, I have modeled the Gini coefficient as a function of the relative minimum wage, the proportion of the population holding a high school diploma but not a college degree, the proportion of the population holding a college degree, and real median household income.[58]

$$G_{it} = \alpha_i + \beta W_{it} + \gamma H_{it} + \delta C_{it} + \theta M_{it} + \varepsilon_{it} \quad (4)$$

54. The minimum wage in each state is the higher of the federal and state minimum wages.
55. Ibid.
56. Ibid.
57. David Neumark, Mark Schweitzer, and William Wascher, "Minimum Wage Effects throughout the Wage Distribution," *Journal of Human Resources* 39, no. 2 (2004): 425–50.
58. Volscho used the nominal state minimum wage, not the relative minimum wage, and did not adjust for instances in which the federal minimum wage exceeded the state minimum wage. Volscho, "Minimum Wages and Income Inequality."

where ε is a white noise error over both dimensions and the variables are defined as follows:[59]

G_{it} Gini coefficient for state *i* in year *t*.

W_{it} Ratio of the minimum wage for state *i* in year *t* to the average hourly wage in year *t*.

H_{it} Proportion of residents of state *i* in year *t* who have a high school diploma, but not a college degree.

C_{it} Proportion of residents of state *i* in year *t* who have a college degree.

M_{it} Median household income (in 2011 dollars) for state *i* in year *t*.

The results show a significantly positive relationship between the relative minimum wage and income inequality, after filtering out the effects of education and median household income.[60]

TABLE 4. THE RELATIONSHIP BETWEEN THE RELATIVE MINIMUM WAGE AND STATE-LEVEL INCOME INEQUALITY

Regressor	Coefficient estimate (standard error)
W_{it}	0.075*** (0.020)
H_{it}	–0.448*** (0.021)
C_{it}	–0.089*** (0.025)
M_{it}	-1.48×10^{-6}*** (1.12×10^{-7})

Notes: Odinary Least Squares, 306 observations (state-level data, 2006–2011, 51 states). The District of Columbia is included as the 51st "state." Data on the proportion of the population completing high school and college only goes up to 2009. As the average of the annual growths of these measures is less than 1 percent for each state, I use the average of the growth rates from 2006 through 2009 to extrapolate measures for 2010 through 2012.
$R^2 = 0.773$, DW = 2.089.
****Significant at 1 percent level. **Significant at 5 percent level. *Significant at 10 percent level.*

59. American FactFinder, US Census Bureau, factfinder2.census.gov; US Department of Labor, "Changes in Basic Minimum Wages in Non-farm Employment Under State Law: Selected Years 1968 to 2013," last revised April 2013, www.dol.gov/whd/state/stateMinWageHis.htm; US Census Bureau, "Statistical Abstract of the US," www.census.gov/compendia/statab/cats/education/educational_attainment.html; State Median Income data, US Census Bureau, www.census.gov/hhes/www/income/data/statemedian/.
60. The residuals are (marginally) normally distributed (Jarque-Bera p-value = 0.059). The data fail to reject the Wald test for valid parameter restrictions when a single constant replaces 51 state-specific intercept dummies (p-value = 0.290). Failing these tests would indicate the possibility that additional factors that significantly affect the unemployment rate may have been excluded from the model.

As shown earlier, increasing New Jersey's minimum wage from $7.25 to $8.25 increases the state's relative minimum wage by 0.039. Applying our regression model estimates yields the following:

$$\Delta\hat{G}_{it} = \hat{\beta}\,\Delta W_{it} = (0.075)(0.039) = 0.003 \tag{5}$$

As of 2011, New Jersey's Gini income inequality index was 0.4694, making it the 34th out of 51 states for equitable incomes.[61] An increase of 0.003 would increase New Jersey's inequality index to 0.4724, dropping the state to 38th in the income equity list.

As a point of interest, we can examine the same relationship using national data:

$$G_t = \alpha + \beta W_t + \gamma H_t + \delta C_t + \theta M_t + u_t,\ u_t = \rho u_{t-1} + \varepsilon_t \tag{6}$$

where ε is a white noise error and the variables are defined as follows:

G_t Gini coefficient for the United States in year *t*.

W_t Ratio of the minimum wage for the United States in year *t* to the average hourly wage in year *t*.

H_t Proportion of residents of the United States in year *t* who have a high school diploma but not a college degree.

C_t Proportion of residents of the United States in year *t* who have a college degree.

M_t Median US household income (in 2011 dollars) in year *t*.

These results show no relationship between the minimum wage and income inequality. The results using state-level data may be more reliable because individual state-level effects can be observed that could otherwise be cancelled out due to the national-level aggregation.

61. American FactFinder, US Census Bureau, factfinder2.census.gov.

TABLE 5. THE RELATIONSHIP BETWEEN THE RELATIVE MINIMUM WAGE AND NATIONAL-LEVEL INCOME INEQUALITY

Regressor	Coefficient estimate (standard error)
W_t	−0.033 (0.043)
H_t	0.421*** (0.134)
C_t	0.389*** (0.050)
M_t	-9.37×10^{-8} (9.55×10^{-7})
AR(1)	0.507 (0.111)***

Notes: Generalized Least Squares, robust errors, 35 observations (national data, 1976–2010).
AR(1) is the autocorrelation coefficient.
$R^2 = 0.973$, DW = 1.907.
****Significant at 1 percent level. **Significant at 5 percent level. *Significant at 10 percent level.*

CONCLUSION

Conventional wisdom suggests some apparently compelling arguments about the benefits of a minimum wage. Such arguments, however, are based on a misconception that wages are levers that set value, rather than metrics that reflect value. Clearly, earning a higher wage is better for the employed worker than earning a lower wage. The important question is whether the trade-off—an increased likelihood of unemployment—offsets the increased wage.

After comparing historical changes in unemployment rates among workers of varied educational attainments to changes in the minimum wage, I estimate that the pending increase in New Jersey's minimum wage will increase unemployment among workers without a high school education (by approximately two percentage points), increase unemployment among workers without high school diplomas in general (by approximately one percentage point), and have no effect on unemployment among college-educated workers. I also find no evidence that increasing the minimum wage will improve income equality in New Jersey, and some preliminary evidence that increasing the minimum wage will result in more income inequality.