The impact of the minimum wage on DI participation

Author: Gary V. Engelhardt

Chestnut Hill, Mass.: Center for Retirement Research at Boston College, January 2020

CENTER *for* RETIREMENT RESEARCH *at* BOSTON COLLEGE

THE IMPACT OF THE MINIMUM WAGE ON DI PARTICIPATION

Gary V. Engelhardt

CRR WP 2020-6
January 2020

Center for Retirement Research at Boston College
Hovey House
140 Commonwealth Avenue
Chestnut Hill, MA 02467
Tel: 617-552-1762   Fax: 617-552-0191
https://crr.bc.edu

Gary V. Engelhardt is a professor of economics at Syracuse University. The research reported herein was derived in whole or in part from research activities performed pursuant to a grant from the U.S. Social Security Administration (SSA) funded as part of the Retirement and Disability Research Consortium. The opinions and conclusions expressed are solely those of the author and do not represent the opinions or policy of SSA, any agency of the federal government, Syracuse University, or Boston College. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of the contents of this report. Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply endorsement, recommendation or favoring by the United States Government or any agency thereof. The author would like to thank Jeff Kubik, Perry Singleton, Krieg Tidemann, and the work-in-progress seminar participants at SSA for helpful comments. All errors are his own.

About the Center for Retirement Research

The Center for Retirement Research at Boston College, part of a consortium that includes parallel centers at the National Bureau of Economic Research, the University of Michigan, and the University of Wisconsin-Madison, was established in 1998 through a grant from the U.S. Social Security Administration. The Center's mission is to produce first-class research and forge a strong link between the academic community and decision-makers in the public and private sectors around an issue of critical importance to the nation's future. To achieve this mission, the Center sponsors a wide variety of research projects, transmits new findings to a broad audience, trains new scholars, and broadens access to valuable data sources.

Center for Retirement Research at Boston College
Hovey House
140 Commonwealth Ave
Chestnut Hill, MA 02467
Tel: 617-552-1762 Fax: 617-552-0191
https://crr.bc.edu

Abstract

This report provides an empirical analysis of the impact of the minimum wage on DI claims and awards. It draws on data from the Social Security Administration's State Agencies Monthly Workload Dataset, from which a state-by-year panel of DI claims and awards is constructed for 2002-2017 and matched to data on the real effective minimum wage, the higher of the federal and state minimum wage in each state and year. Then two reduced-form estimation methodologies are employed. The first follows studies in the hourly wage-inequality literature and models log DI claims as a function of the bindingness of the minimum wage in the state hourly wage distribution. The second follows studies in the minimum wage disemployment literature and models log claims (in both levels and first-differences) as a function of a distributed lag of the minimum wage.

The paper found that:

- Across a wide variety of specifications that control for an array of factors deemed important in previous minimum wage studies, including state-level economic conditions such as unemployment and economic activity, the Great Recession, and the presence of linear state trends, both methodologies lead to the same primary finding: the minimum wage has had no net effect in the short run on DI claims and awards.
- The estimated elasticities of DI claims and awards to the minimum wage are both economically small and not statistically different from zero.

The policy implications of the findings are:

- Based on the estimates, any policy proposals to increase the minimum wage would be predicted to have no discernable impact on DI claims and awards.

Introduction

In the United States, Social Security Disability Insurance (DI) is designed to provide income support for those unable to work because of long-term, severe disability. Over the last three decades, both program expenditures and the number of beneficiaries have expanded considerably, which, in turn, has drawn the attention of policy makers and researchers. Indeed, at the end of 2018, there were approximately 8.5 million DI beneficiaries, and annual expenditures were $144 billion (Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, 2019). While well-documented changes in population age composition and patterns of disability are important contributing factors, there has been a long-standing interest in the impact of local labor-market conditions on DI participation and payments in general (Black et al. 2002), and the decline in labor-market opportunities, especially for low-skilled workers (Autor and Duggan, 2003). Since DI is not designed to protect workers against transitory income (e.g., business cycle) or permanent labor-demand shocks, evidence that DI participation and payments are counter-cyclical, while latent disability is not, is a key concern in analyzing program growth.

This report provides an empirical analysis of the impact of the minimum wage on DI claims, a topic that has gone unexplored in previous studies. In principle, the minimum wage affects the value of labor-market work relative to DI: higher minimum wages raise the opportunity cost of being on DI for those not truly long-term, severely disabled. Unlike other measures of outside opportunities, however, increases in the minimum wage cut both ways. They raise hourly wages (Lee, 1999; Autor et al., 2016), but may decrease employment/hours for low-skilled workers (Brown, 1999; Card and Krueger, 1994; Neumark et al., 2014). Therefore, unlike local labor-market studies based on booms and busts in resource prices (Black et al., 2002; Vachon, 2014; Charles et al., 2018), in which hourly wages and employment are expanding and contracting in unison, the net impact of raising the minimum wage on DI participation is theoretically ambiguous. Rather than focus on the separate programmatic channels through which the minimum wage might affect DI participation at a granular level, this report estimates an overall net effect of the minimum wage and provides an answer to the following question: As a first-order approximation, do changes in the minimum wage find their way in the short run into changes in DI claims and awards?

The empirical analysis draws on data from the Social Security Administration's State Agencies Monthly Workload (MOWL) Dataset, from which a state-by-time panel of DI claims is constructed for 2002-2017 and matched to state-by-time variation in the real effective minimum wage, defined as the higher of the federal and the highest state minimum wage prevailing in each state. Then two reduced-form estimation methodologies are employed. The first follows studies in the hourly wage-inequality literature (Lee, 1999; Autor et al., 2016) and models log DI claims as a function of the bindingness of the log minimum wage in the state hourly wage distribution. The second follows studies in the minimum wage disemployment literature (Allegretto et al., 2011; Meer and West, 2016) and models log claims (in both levels and first-differences) as a function of a distributed lag of the minimum wage.

Across a wide variety of specifications that control for an array of factors deemed important in previous minimum wage studies, including state-level economic conditions such as unemployment and economic activity, the Great Recession, and the presence of linear state trends, both estimation methodologies lead to the same primary finding: the minimum wage has had no net effect in the short run on DI claims and awards over the last two decades. The estimated elasticities of DI claims and awards to the minimum wage are both economically small and not statistically different from zero. Based on the estimates, any policy proposals to increase the minimum wage would be predicted to have no discernable impact on DI claims and awards.

The remainder of the report is organized as follows. Section 1 provides background on the DI program and describes the data sources. Section 2 gives basic time-series evidence on the relationship between claims, awards, and the minimum wage. Section 3 outlines the two econometric methodologies. The estimation results are discussed in context. The paper concludes with a brief summary and discussion of caveats.

1. Background on DI

SSA requires a five-month waiting period between the onset of a disability and eligibility for DI benefits. When a claim is made, there are two broad sets of requirements for benefits. The first are non-medical requirements, which are legal (citizenship, qualifying alien status) and financial (current and past earnings) in nature. For the latter, to qualify for DI benefits, an individual must have had a minimum number of quarters of coverage in the Social Security system and attained insured status. In 2019, $1,360 of earnings is required for one quarter of coverage. The minimum number of quarters of coverage for DI eligibility depends upon age at the time of disability. Conditional on being insured, an individual is deemed disabled if unable to engage in substantial gainful activity (SGA) due to a physical or mental impairment. SSA defines substantial gainful activity by a monthly amount of earnings. If one earns more than this amount, SSA presumes the individual to be not disabled. In 2019, the SGA limit is $1,220 per month for a non-blind individual. If SSA determines a claimant does not meet the non-medical requirements, then it will deny the claim.

If SSA determines a claimant meets the non-medical requirements, then the application for benefits is sent to a state agency and undergoes a medical determination by a disability claims examiner. There are 50 state agencies, plus agencies in the District of Columbia, Guam, the Virgin Islands, and Puerto Rico. In addition, there are expanded service team sites in Arkansas, Mississippi, Oklahoma, and Virginia, as well as federal claims centers, that process determinations from a variety of states to help smooth the SSA workload. The first time a claim is sent to a state agency, it is referred to as an "initial claim." SSA has a list of impairments that qualify for benefits; other conditions may qualify for benefits if a physician determines that the condition contributes to sufficient impairment. The impairment itself must last for at least a year or be expected to result in death. If the medical requirements are met, an award, also known as an allowance, is made, benefits for which are paid retroactively to the date of the onset of the disability. Like OASI benefits, DI payments themselves are based on past covered earnings, where the replacement rate is higher for low-earning (relative to high-earning) individuals.

State agencies process two other types of DI claims. First, if an initial claim is denied, it can be appealed, which is termed a reconsideration. The second is a continuing disability review (CDR), a medical review of an award previously made.

Closely related to the DI program is the Supplemental Security Income program, or SSI. SSI is a federal income transfer program administered by SSA and designed to supplement the income of the aged, blind, and disabled who have very low income and assets. Individuals can apply for and receive DI and SSI benefits at the same time. Such applicants are referred to as concurrent claims. Given the income and asset tests associated with SSI, concurrent claimants have enough work history to have attained insured status for DI, but very low earnings, so as to meet the income test for SSI. Therefore, concurrent claimants are comparatively low-skilled workers, more likely to be affected by changes in the minimum wage than the typical DI applicant.

Broadly speaking, holding employment, hours worked, and true disability status constant, increases in the hourly wage (from an increase in the minimum wage) can affect DI participation in the short run along a number of dimensions. First, an increase in the hourly wage increases the likelihood of attaining a quarter of coverage and, therefore, over time increases the likelihood an individual will be insured for DI benefits. Second, conditional on being insured, an increase in the hourly wage increases the likelihood that earnings exceed the SGA limit (for any given month) and, therefore, reduces the likelihood an insured individual is eligible for DI benefits. Third, conditional on being eligible, an increase in the hourly wage will increase earnings, decrease the replacement rate from DI, and, therefore, increase the opportunity cost of DI participation relative to the outside option of labor force participation. Allowing employment and hours to adjust along with hourly wage further complicates the potential impact on DI participation. In particular, if increases in the minimum wage reduce employment for low-skilled individuals—a point of considerable debate among labor economists—then DI participation becomes more attractive relative to labor force participation. Overall, the impact of a change in the hourly wage, such as that induced by a change in the minimum wage, is theoretically ambiguous.[1]

Empirically, DI participation appears in the short run to be strongly counter-cyclical with labor-market conditions. Figure 1 plots the time series of aggregate beneficiaries, measured in millions on the left-hand axis, and annual aggregate expenditures, measured in billions of constant (2016) dollars on the right-hand axis, for 2001-2017, the time period of analysis below. As depicted, there was substantial growth in the size of the program in the 2000s, then a plateau after the Great Recession. Since most individuals do not leave DI once awarded, changes in the number of beneficiaries (i.e., the stock) reflect changes in claims that generate an award (in-flow) and mortality (out-flow). As mortality changes only very slowly, the vast majority of the short-run variation in the number of beneficiaries is driven by variation in claims and allowances (i.e., awards), which, for the purposes of the empirical analysis below, are better direct measures of DI participation.

[1] If increases in the minimum wage translate into increases in OASDI covered earnings, then sustained exposure to the minimum wage over longer periods of time might raise career earnings (AIME), on which DI payments would be based. This type of long-run response is outside the scope of the current study.

The solid line in Figure 2 shows the aggregate annual national time series of initial DI claims over the same period from SSA's State Agencies Monthly Workload (MOWL) Dataset. The MOWL is a public-use dataset that contains monthly information about the processing of DI claims by state agencies, from October 2000, to the present. The series in the figure represents monthly initial DI claims by adults for 2001-2017 aggregated to the annual level from all fifty state agencies, the agencies in the District of Columbia, Guam, and Puerto Rico, the expanded service team sites in Arkansas, Mississippi, Oklahoma, and Virginia, as well as federal claims centers. Reconsiderations, continuing disability reviews, and all claims for child DI benefits are excluded. Initial claims rose during the recession in the early 2000s and then dramatically so in the Great Recession. The dashed lines in the figure depict the time series for the number of concurrent claims and allowances on all claims, respectively. Both show a similar counter-cyclical pattern. Finally, Figure 3 plots all claims (as an index), the solid line measured on the left-hand axis, versus the national unemployment rate, the dashed line measured on the right-hand axis. The two series track closely (Maestes et al., 2015) and reinforce that claims are highly counter-cyclical. These aggregate patterns are too large to be explained by counter-cyclical increases in true disability. Indeed, Ruhm (2000) and subsequent studies (Ruhm, 2003, 2004, 2005, 2007, 2015, 2016; van den Berg et al., 2017) have found that many objective measures of poor health are pro-, not counter-, cyclical.

The best evidence on the impact of labor-market conditions on DI comes from the influential study by Black et al. (2002). Counties in four coal-producing states (Ohio, Kentucky, West Virginia, and Pennsylvania) were geologically endowed with differing coal reserves. When world coal prices boomed in the 1970s, coal-rich counties experienced both rising hourly wages and employment, concentrated heavily among lower-skilled men, and declining DI participation and payments, from increased labor demand as coal production in these counties increased. The opposite occurred in the coal bust, when world coal prices declined in the 1980s. Using coal-poor counties, often contiguous with coal-rich counties, as controls, they estimated an elasticity of DI payments with respect to earnings (the product of the hourly wage and hours worked) of -0.3 using county-by-year panel data. Vachon (2014) applied the same methodology to examine the impact of the boom and bust in oil prices in the 2000s on DI participation and payments for counties in North Dakota, South Dakota, and Montana, which encompass the oil-rich Bakken Basin, the site of extensive fracking activity. She estimated an elasticity of DI payments with respect to earnings of -1 and an elasticity of DI participation (as measured by beneficiaries) with respect to earnings of -0.7. Finally, in a study using methodology very similar to Vachon (2014), but applied to counties in 11 oil-producing states (North Dakota, Montana, Wyoming, Utah, Colorado, Kansas, New Mexico, Mississippi, Louisiana, Texas, and Oklahoma) over a longer time period (1970-2011), Charles et al. (2018) estimated an elasticity of DI payments with respect to earnings of -0.3 and an elasticity of DI payments to employment of -0.7. Taken together, these three studies suggest that increases in local labor demand, which raise hourly wages and employment, have a sizable impact on DI participation and payments.

2. The Time-Series Relationship between the Minimum Wage and DI Claims

Unfortunately, the results of these studies are not necessarily directly applicable to the impact of the minimum wage on DI participation for two reasons. First, although an increase in the minimum wage raises the hourly wage (at the bottom of the hourly wage distribution), it decreases employment in perfectly competitive labor markets, the extent to which is a point of great debate in labor economics. Essentially, natural resource booms and busts represent shifts in labor demand, with the responding wage and employment effects reflecting the shape of the local labor supply curve. Increases in the minimum wage represent movements along (not shifts in) the labor demand curve. Second, due to the absence of county-level claims data, previous studies have focused primarily on DI payments, rather than claims. A change in the minimum wage today may affect the decision to claim, but will not affect the amount of benefits, given that benefit payments are a function of earnings histories unaffected by contemporaneous changes to the minimum wage. Vachon (2014) examined the participation response, where participation was measured at the county level as the (log) number of beneficiaries (relative to population). As most individuals do not leave DI once awarded, changes in the number of beneficiaries reflect changes in claims and mortality. Therefore, claims and allowances, the focal measures examined below, are better measures of DI participation than the number of beneficiaries used in prior studies.

As a point of departure, Figure 4 plots again the all-claims index from Figure 3, but now versus the aggregate national time series of the real value of the minimum wage (measured on the right-hand axis). The minimum wage series was constructed using the monthly CPS Merged Outgoing Rotation Group (MORG) data from 2001-2017 from the NBER. For each state and month, the higher of the applicable nominal state and federal minimum wage rates were assigned to each ORG respondent. [2] These minimum wages were then inflated into real 2016 dollars using the monthly all-items Consumer Price Index (CPI), and then the real wage data were weighted by the CPS sampling weight and collapsed into annual data. Therefore, the series in the figure represents the state-employment-weighted annual average national real minimum wage.

The variation in the real minimum wage is determined by three factors. First, there were increases in the federal minimum wage in 2007 ($5.85), 2008 ($6.55), and 2009 ($7.25). Second, there were changes in the states' minimum wages above the federal minimum. The bars in Figure 5 illustrate the number of states changing their minimum wage for each year from 2001-2017 and indicate that a substantial fraction of the variation in the minimum wage nationally comes from state-by-time variation in the minimum wage, which will be the source of identifying variation used in the estimation below. Finally, the annual real minimum wage series shows the proto-typical saw-toothed pattern, whereby increases in the nominal minimum wage are slowly eroded by inflation.

Overall, comparing the claims and real minimum wage series in Figure 4, there is little evidence that claims and the minimum wage are inversely correlated, as the previous studies focusing on natural resource booms would suggest. Indeed, the sample correlation coefficient is 0.58 (and 0.46 omitting the Great Recession years). Figures 6 and 7 parallel Figure 5. In particular, Figure 6 shows the time series for the aggregate annual number of DI allowances (awards), which has a sample correlation coefficient with the minimum wage of 0.28 (and 0.05 omitting the Great Recession years). Figure 7 shows the time series for the aggregate annual number of concurrent claims, which reflect better the type of low-skilled individuals likely affected by the minimum wage. The sample correlation coefficient between concurrent claims and the minimum wage of 0.22 (and 0.0003 omitting the Great Recession years). Overall, there is little evidence of a contemporaneous time-series relationship between the minimum wage and DI participation.

An important analytical issue with these simple graphical comparisons is that some of the variation in the minimum wage that identifies changes in the labor-market opportunities for workers, especially the low skilled, is purely time-series in nature. As has been well

[2] Some states have tiered minimum wages. The highest-tier minimum wage is selected as the state's "minimum wage" for the calculation of the effective minimum wage.

documented, there have been many secular changes to the demand and supply of labor in the 2001-2017 period, such as continued deunionization, increased automation, skill-biased technical change, international competition, outsourcing, and changes to other social insurance programs, all of which may be affecting DI independently from the minimum wage. Therefore, to better identify the impact of the minimum wage on DI participation, the analysis moves to a regression framework that exploits the considerable state-by-time variation in the minimum wage depicted in Figure 5.

3. Econometric Specifications and Results

The regression analysis uses two different methodologies that have been used in previous studies to identify the net impact of the minimum wage on DI. Here, "net impact" refers to the the average impact of the minimum wage, averaged across all the possible channels outlined above; there is no attempt to estimate the effect of the minimum wage on DI through individual channels. Consequently, the estimates presented below are summary measures of the effect of the minimum wage on DI claims and awards, and answer the question: "As a first-order approximation, do changes in the minimum wage find their way into changes in DI claims (at the state-year level of aggregation)?"

Method 1: Exploiting the Bindingness of the Minimum Wage

The first methodology is a regression framework similar to that in Lee (1999) and Autor et al. (2016) from the literature on effect of the minimum wage on the hourly wage distribution. In those studies, the hourly wage is modeled as a function of the bindingness of the minimum wage. Instead of the hourly wage as the focal outcome, here DI claims are the focal outcome. Specifically, let s and t index the state of residence and calendar year, respectively, in the following econometric specification:

$$\ln d_{st} = \alpha + \beta_1 (\ln w_{st}^{MW} - \ln w_{st}^{50}) + \beta_2 (\ln w_{st}^{MW} - \ln w_{st}^{50})^2 + \mathbf{X}_{st} + \psi_s + \tau_t + \psi_s \cdot t + u_{st}, \qquad (1)$$

where $\ln d$ is the natural logarithm of claims in state s in year t, and $\ln w^{50}$ represents the natural log of the median wage in state s in year t, while ψ and τ represent state and calendar-year effects, respectively, and $\psi \cdot t$ is a state-specific linear time trend. The focal explanatory variable is $(\ln w_{st}^{MW} - \ln w_{st}^{50})$, the difference for a given state and year between the log of the minimum wage and the log of the median wage. It enters as a quadratic to reflect that changes in the minimum wage should have a non-linear impact on DI in states where the minimum wage binds at a higher percentile of the hourly wage distribution. In this model, the elasticity of DI claims to the minimum wage is measured as

$$\beta_1 + 2\beta_2 (\ln w_{st}^{MW} - \ln w_{st}^{50}). \tag{2}$$

This will be negative if increases in the minimum wage (net of disemployment effects) lowers the value of the outside option of DI participation. Because DI claims, employment, and wages are jointly determined in labor-market equilibrium, the parameters in (1) are estimated via instrumental variable (IV) estimation. Following Autor et al. (2016), the three instruments are: (i) the log of the minimum wage, $\ln w_{st}^{MW}$; (ii) the square of the log of the minimum wage $(\ln w_{st}^{MW})^2$; and the interaction of the log minimum wage and the average log median wage for the state for 2001-2017, $\ln w_{st}^{MW} \times \overline{\ln w_{s}^{50}}$. In this framework, conditional on **X** (a set of controls for other factors changing across states over time that affect the outcomes), the key parameters, β_1 and β_2 are identified by exogenous variation across states and years in the minimum wage.

The sample is a state-year panel of DI claims and allowances for 2002-2017 for the 50 states and the District of Columbia, calculated from the MOWL data, for a total sample size of 816 observations. For the baseline specification, the dependent variable is the log of all DI claims in each state and year. All DI claims are the sum on concurrent and non-concurrent initial claims.[3] As in Figure 2, continuing disability reviews, reconsiderations, and child DI claims are excluded. Claims processed in Guam, Puerto Rico, the expanded service team sites in Arkansas, Mississippi, Oklahoma, and Virginia, and federal claims centers are excluded as well.[4]

[3] Non-concurrent claims are referred to as SSDI-only claims in the MOWL dataset.
[4] Technically, an individual's claim does not have to be processed by the agency in the state of residence, although the vast majority of claims are, so that there is not necessarily an exact mapping of the MOWL data to state minimum wage data. This study abstracts from any potential mismatch and follows others who have used the MOWL data to make state-year panel data on claims. As long as the instrument set, based on state-by-year variation in effective minimum wages is orthogonal to any mismatch of state of residence and state of processing, which seems plausible in this context, the IV estimates in Table 2 and the figures below will be consistent.

The real minimum wage is the effective (i.e., the higher of the state and federal) minimum wage prevailing in that state and year, and the median wage is calculated from the annual hourly wage distribution in the CPS ORG data. Table 1 shows the sample means and standard deviations for the variables used in all the specifications and samples below.

Column 1 of Table 2 shows the IV estimates of β_1 and β_2 in (1) when all initial claims is the dependent variable, for the baseline specification that omits other controls (**X**) and state-specific linear time trends ($\psi \cdot t$). Standard errors (in parentheses) are clustered at the state level.[5] Increases in the minimum wage decrease ID claims at an increasing (negative) rate.

To get a better sense of what these estimates imply, Figure 8 plots the estimated elasticities of DI claims with respect to the minimum wage from this specification. The horizontal solid gray line is a reference line for an elasticity of zero, implying changes in the minimum wage have no effect on DI claims. The horizontal long-dashed line is the IV estimated elasticity DI claims with respect to the minimum wage in (2), evaluated at the sample mean of the log difference between the state minimum and median wages, respectively,

$$\overline{(\ln w_{st}^{MW} - \ln w_{st}^{50})}:$$

$$\hat{\beta}_1^{IV} + 2\hat{\beta}_2^{IV}\overline{(\ln w_{st}^{MW} - \ln w_{st}^{50})},$$

where $\hat{\beta}_1^{IV}$ and $\hat{\beta}_2^{IV}$ are the IV estimates of β_1 and β_2 from column 1 of Table 2. This sample mean is -0.93, indicating that the sample average spread between the state effective minimum and the median state wages is 0.93 log points—the minimum wage is roughly 93% lower than the median wage. Evaluated at this sample mean value, this estimated elasticity is slightly negative, and, although confidence intervals are not shown for this estimated elasticity, it is not statistically different from zero at conventional levels of significance.

Of course, the sample mean of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$ is just one value at which the elasticity in (2) can be calculated. To show the sensitivity of the elasticity estimate to the choice of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$, the solid line in the figure shows the implied elasticity evaluated at different

[5] The partial F-statistic on the instrument set from the first-stage exceeds 50, indicating strong instruments.

percentiles of the sample distribution of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$. For example, when (2) is evaluated at the sample median of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$, which is the 50th percentile on the horizontal axis in the figure, the elasticity is slightly more negative (than when (2) is evaluated at the sample mean); the red short-dashed lines in the figure demarcate the associated 95% confidence interval. When the elasticity in (2) is evaluated at values of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$ that are high (percentiles) in the sample distribution, which means the spread between the median and minimum wage is comparatively small—these are low-wage states, such as Arkansas, Mississippi, West Virginia, South Dakota—the implied elasticity is negative. Conversely, when the elasticity in (2) is evaluated at values of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$ that are low (percentiles) in the sample distribution, which means the spread between the median and minimum wage is comparatively large—these are high-wage states, such as the District of Columbia, Virginia, Maryland, Connecticut, New Jersey—the implied elasticity is positive. At the 5% level of significance, however, the estimated elasticities are not different from zero for a broad range of values in the middle of the sample distribution of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$, which suggests the minimum wage has little net impact on DI claims.

Figures 9 and 10 illustrate three robustness checks. Figure 9 shows elasticity estimates including state-specific linear time trends ($\psi \cdot t$), the state unemployment rate, population, and real gross state product as time-varying controls (**X**). Column 2 of Table 2 shows the IV parameter estimates. Figure 10 uses the same specification as in Figure 9, but omits the Great Recession years (2007-2010). Column 3 of Table 2 shows the IV parameter estimates. The estimated elasticities in the figures are similar to those in Figure 8 and suggest the minimum wage has little net impact on DI claims.

Figure 11 is isomorphic to Figures 9, but has allowances on all initial DI claims as the outcome variable. The econometric model is

$$\ln a_{st} = \alpha + \beta_1 (\ln w_{st}^{MW} - \ln w_{st}^{50}) + \beta_2 (\ln w_{st}^{MW} - \ln w_{st}^{50})^2 + \mathbf{X}_{st} + \psi_s + \tau_t + \psi_s \cdot t + u_{st}, \qquad (3)$$

where a is the number of allowances in state s in year, and

$$\beta_1 + 2\beta_2 (\ln w_{st}^{MW} - \ln w_{st}^{50}) \qquad (4)$$

is the elasticity of the allowances with respect to the minimum wage. Column 4 of Table 2 shows the IV parameter estimates. The estimated elasticities of allowances with respect to the minimum wage shown in Figure 11 at both the sample mean and across the sample distribution of $(\ln w_{st}^{MW} - \ln w_{st}^{50})$ are economically close to and statistically not different from zero.

The analysis ends with Figures 12 and 13, which repeat the specifications as in Figures 9 and 11, but with concurrent claims and allowances, respectively, as the outcome variable. Concurrent claimants are individuals with enough work history to qualify for DI, but low enough earnings to also qualify for SSI. These individuals are more likely to be low-skilled workers subject (or near) to the minimum wage. Columns 5 and 6 of Table 2 show the respective IV parameter estimates, while Figures 12 and 13 illustrate the estimated elasticities. For both outcomes, there is no discernable relationship with the minimum wage.

Method 2: Distributed-Lag Approach

The second methodology is a regression framework similar to that in Meer and West (2016) and Allegretto et al. (2017) from the literature on effect of the minimum wage on employment. Those studies make the important point is that while hourly wage adjustments to changes in the minimum wage may occur contemporaneously, employment adjustments likely occur over time, which suggests a distributed-lag econometric specification for employment. In the context of DI claims, this might be particularly true given that there is a mandatory 5-month waiting period from the time of disability onset until a claim can be made. This suggests that specifications such as (1) based solely on contemporaneous changes might not pick up the full impact of changes in the minimum wage on DI claims.

Specifically, Meer and West (2016) adopted a reduced-form approach and modeled the log of annual employment in state s and year t as function of a distributed-lag of the log of the minimum wage. In the following specification, the log of annual DI claims substitutes for the log of employment as the outcome variable to yield

$$\ln d_{st} = \kappa + \sum_{r=-1}^{3} \delta_r \ln w_{st-r}^{MW} + \mathbf{X}_{st} + \psi_s + \tau_t + \psi_s \cdot t + u_{st}, \qquad (5)$$

where r indexes the lags (and leads) of the minimum wage. For example, $r = 0$ refers to the current period (year), so that δ_0 is the impact of a contemporaneous increase in the minimum wage (holding other lags and leads of the minimum wage constant); $r=1$ refers to the one-period lag, so that δ_1 is impact of a one-year-ago increase of the minimum wage, etc. At the annual frequency, Meer and West (2016) found minimum wage effects through a three years' lag. In recognition of this, (5) also employs three lags. The total elasticity of the minimum wage on claims is measured across all lags and is calculated as $\delta_0+\delta_1+\delta_2+\delta_3$. Finally, $r=-1$ refers to the one-period lead, so that δ_{-1} is impact of a one-year-ahead increase of the minimum wage, which, if minimum wage increases are not predictable, should in principle be zero.

As a point of departure, Table 3 shows estimated elasticities of DI claims to the minimum wage for a variety of specifications of (5) without any leads or lags. In column 1, the estimated elasticity is, $\hat{\delta}_0=0.057$, is economically small and not statistically different than zero at conventional levels of significance. Columns 2 and 3 expand to account for population, on the right- and left-hand sides of the model, respectively. Columns 4 adds controls for the state unemployment rate and gross state product per capita, and column 5 adds a state-specific linear time trend. Across all of the specifications shown, the results are similar: estimated elasticities that are economically small and not statistically different than zero

Next, Table 4 repeats the specifications in Table 3, but with one lead and three lags of the (log) minimum wage. Again, the results are similar: the estimated elasticities based on the sum of the contemporaneous and lagged coefficients (shown at the bottom of the table) are economically small and not statistically different than zero Tables 5 and 6 repeat the specifications in Tables 3 and 4, but using just (log) concurrent DI claims as the outcome. The estimated elasticities are larger and uniformly positive in Table 6, but not statistically different than zero. Finally, Table 7 shows estimates excluding the Great Recession years that again are very small.

Dube et al. (2010), Meer and West (2016), and Allegretto et al. (2017) are among a number of studies that have criticized the use of state-specific linear trends (along with state- and year-fixed effects, respectively) in specifications such as those in Tables 3-7, in which the dependent variable is in log levels. They have argued that the inclusion of such trends may attenuate estimates of disemployment effects of the minimum wage in state-year panel data, especially if the true effects on employment are on the growth rate (as opposed to level) of employment. Meer and West (2016), in particular, advocate for models in log first-differences, which are more robust to linear trends in this context. Therefore, as a final robustness check, Table 8 presents estimates in which both the DI claims and minimum wage variables are in log first-differences:

$$\ln d_{st} - \ln d_{st-1} = \kappa + \sum_{r=-1}^{3} \delta_r (\ln w_{st-r}^{MW} - \ln w_{st-r-1}^{MW}) + \mathbf{X}_{st} + \psi_s + \tau_t + \psi_s \cdot t + u_{st} . \qquad (6)$$

Hence, δ_0 now represents the impact of the contemporaneous annual growth rate of the minimum wage on the annual growth rate of DI claims and is still interpreted as the contemporaneous elasticity of DI claims to the minimum wage (holding lagged and lead effects constant). Similarly, the total elasticity of the minimum wage on claims is still measured across all lags and is calculated as $\delta_0 + \delta_1 + \delta_2 + \delta_3$. The parameter estimates for the same five variants of (6) as shown in the previous tables are given in Table 8. The estimated elasticities are now uniformly negative and not statistically different than zero. Estimates for DI and concurrent allowances (not shown) are similarly very small and not statistically different than zero

4. Summary and Caveats

This report provides an empirical analysis of the impact of the minimum wage on DI claims. In principle, the minimum wage affects the value of labor-market work relative to DI: higher minimum wages raise the opportunity cost of being on DI for workers who are not truly long-term, severely disabled. Unlike other measures of outside opportunities, however, increases in the minimum wage cut both ways. They raise hourly wages, but may decrease employment/hours for low-skilled workers. Therefore, unlike previous local labor-market studies, in which hourly wages and employment are expanding and contracting in unison, the net impact of raising the minimum wage on DI participation is theoretically ambiguous.

The analysis draws on data from the Social Security Administration's State Agencies Monthly Workload (MOWL) Dataset. A state-by-time panel of DI claims is constructed for 2002-2017 and matched to state-by-time variation in the real effective minimum wage, defined as the higher of the federal and the highest state minimum wage prevailing in each state. Then two reduced-form estimation methodologies are employed. The first follows studies in the hourly wage-inequality literature and models log DI claims as a function of the bindingness of the log minimum wage in the state hourly wage distribution. The second follows studies in the minimum wage disemployment literature and models log claims (in both levels and first-differences) as a function of a distributed lag of the minimum wage.

A useful way to summarize the empirical findings is the following. Tables 2-8 represent a total of 36 different regressions of DI claims or allowances on the minimum wage, using two different methodologies, with each specification employing varying controls for factors deemed important in previous minimum wage studies, including state-level economic conditions, such as unemployment and economic activity, the Great Recession, and the presence of linear state trends. In none of these specifications are there economically large and statistically significant effects. The point estimates themselves are just as likely to be positive as negative. The minimum wage has had no discernable net effect on DI claims and allowances over the last two decades, even for concurrent claimants, who are relatively more likely to seek employment in jobs at or near the minimum wage. Furthermore, although not shown, estimates using SSI claims as the outcome variable indicated no impact of the minimum wage on SSI participation. So, even for the low-skilled, changes in the minimum wage are not moving individuals on and off these federal programs.

These findings should be tempered by the following caveats. First, Allegretto et al. (2017) and Dube et al. (2010) provide other critiques of identification strategies in minimum wage research and stress the importance of local controls, advocating, in particular, the use of matched border counties in the estimation of minimum wage effects. Their arguments are compelling, but the absence of county-level claims data preclude a border approach in the current analysis. Second, this report makes no attempt to directly reconcile the findings on DI to estimates of disemployment effects in previous studies. This is a challenging undertaking, given the wide range of estimates in the literature, and is more appropriately a topic for further research.

References

Allegretto, Sylvia A., Arindrajit Dube, and Michael Reich. 2011. "Do Minimum Wages Really Reduce Teen Employment? Accounting for Heterogeneity and Selectivity in State Panel Data." *Industrial Relations* 50(2): 205-239.

Autor, David H. and Mark G. Duggan. 2003. "The Rise in Disability Rolls and the Decline in Unemployment." *Quarterly Journal of Economics* 118: 157-206.

Autor, David H., Alan Manning, and Christopher L. Smith. 2016. "The Contribution of the Minimum Wage to US Wage Inequality over Three Decades: A Reassessment." *American Economic Journal: Applied Economics* 8(1): 58-99.

Black, Dan, Kermit Daniel, and Seth Sanders. 2002. "The Impact of Economic Conditions on Participation in Disability Programs: Evidence from the Coal Boom and Bust." *American Economic Review* 92(1): 27-50.

Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds. 2019. *The 2019 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds* (Washington, D.C.: Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds).

Brown, Charles. 1999. "Minimum Wages, Employment, and the Distribution of Income." In *Handbook of Labor Economics*, *Vol. 3*, edited by Orley Ashenfelter and David Card, 2101-2163. Amsterdam: North-Holland.

Charles, Kerwin K., Yiming Li, and Melvin Stephens, Jr. 2018. "Disability Benefit Take-Up and Local Labor-Market Conditions." *Review of Economics and Statistics* 100(3): 416-423.

Dube, Arindrajit, T. William Lester, and Michael Reich. 2010. "Minimum Wage Effects Across State Borders: Estimates Using Contiguous Counties." *Review of Economics and Statistics* 92(4): 945-964.

Lee, David S. 1999. "Wage Inequality in the United States During the 1980s: Rising Dispersion or Falling Minimum Wage?" *Quarterly Journal of Economics* 114(3): 977-1023.

Maestes, Nicole, Kathleen J. Mullen, and Alexander Strand. 2015. "Disability Insurance and the Great Recession." *American Economic Review* 105(5): 177-182.

Meer, Jonathan and Jeremy West. 2016. "Effects of the Minimum Wage on Employment Dynamics." *Journal of Human Resources* 51: 500-522.

Neumark, David, Ian Salas, and William Wascher. 2014. "Revisiting the Minimum Wage-Employment Debate: Throwing Out the Baby with the Bathwater?" *Industrial and Labor Relations Review* 67: 608-648.

Ruhm, Christopher. 2000. “Are Recessions Good for Your Health?’ *Quarterly Journal of Economics* 115: 617-650.

Ruhm, Christopher. 2003. “Good Times Make You Sick.” *Journal of Health Economics* 24: 341-363.

Ruhm, Christopher. 2004. “Macroeconomic conditions, Health, and Mortality.” Working Paper No. 11007. Cambridge, MA: National Bureau of Economic Research.

Ruhm, Christopher. 2005. “Healthy Living in Hard Times.” *Journal of Health Economics* 24: 341-363.

Ruhm, Christopher. 2007. “A Healthy Economy Can Break Your Heart.” *Demography* 44: 829-848.

Ruhm, Christopher. 2015. “Recessions, Healthy No More?” *Journal of Health Economics* 42: 17-28.

Ruhm, Christopher. 2016. “Health Effects of Economic Crises.” *Health Economics* 25: 6-24.

Vachon, Mallory. 2014. “Local Labor-Market Conditions and the Federal Disability Insurance Program: New Evidence from the Bakken Oil Boom.” Mimeo. Syracuse, NY: Syracuse University.

van den Berg, Gerard, Ulf Gerdtham, Stephanie von Hinke, Maarten Lindeboom, Johannes Lissdaniels, Jan Sundquist, Kristin Sundquist. 2017. “Mortality and the Business Cycle: Evidence from Individual and Aggregated Data.” *Journal of Health Economics* 56: 61-70.

Table 1. Sample Means for Selected Variables (Standard Deviations in Parentheses)

	(1)	(2)	(3)	(4)
	Sample and Variable Measured in:			
	All Years		Omitting the Great Recession Years	
Explanatory Variable:	Levels	First-Differences	Levels	First-Differences
Log DI claims	9.899	0.007	9.898	-0.007
	(0.108)	(0.094)	(1.081)	(0.087)
Log real minimum wage	2.074	0.007	2.074	-0.004
	(0.109)	(0.048)	(0.119)	(0.036)
Log real median wage	3.010	0.003	3.010	0.003
	(0.140)	(0.031)	(0.141)	(0.031)
Log population aged 18-64	14.640	0.007	14.641	0.007
	(1.030)	(0.008)	(1.031)	(0.008)
Unemployment rate	5.909	-0.021	5.870	-0.336
	(1.995)	(1.104)	(1.924)	(0.656)
Real gross state product per capita	10.923	0.009	10.923	0.014
	(0.257)	(0.029)	(0.256)	(0.025)
Log concurrent claims	9.119	0.002	9.101	-0.013
	(1.099)	(0.115)	(1.097)	(0.111)
Log DI allowances	8.803	-0.003	8.796	-0.015
	(1.039)	(0.102)	(1.041)	(0.098)
Log concurrent allowances	7.695	-0.010	7.673	-0.024
	(1.057)	(0.125)	(1.057)	(0.122)
Sample Years	2002-2017	2002-2017	2002-2006, 2011-2017	2002-2006, 2011-2017

Note: Author's calculations.

Table 2. Selected Instrumental Variables Parameter Estimates of Impact of the Minimum Wage on DI Claims (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable:					
Explanatory Variable:	Log of DI claims	Log of DI claims	Log of DI claims	Log of DI allowances	Log of concurrent claims	Log of concurrent allowances
Log (real minimum wage-median wage)	-2.023**	-1.782	-1.813**	0.158	-1.750	-1.039
	(0.854)	(1.191)	(0.905)	(0.165)	(1.135)	(0.904)
Square of log (real minimum wage-median wage)	-1.061**	-0.927	-0.943**	0.078	-0.917	-0.521
	(0.448)	(0.621)	(0.454)	(0.086)	(0.587)	(0.461)
Log population aged 18-64		-0.248	-0.613	-0.224	-0.504	-2.127**
		(0.450)	(0.561)	(0.185)	(0.743)	(0.911)
Unemployment rate		0.014**	0.017**	-0.004*	0.014*	0.0007
		(0.005)	(0.008)	(0.002)	(0.008)	(0.007)
Log real gross state product per capita		-0.152	-0.145	0.130**	-0.328*	0.367
		(0.152)	(0.202)	(0.056)	(0.170)	(0.152)
Additional controls:						
State effects	Yes	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	Yes	No	No	Yes	Yes
Sample Years	2002-2017	2002-2017	2002-2006, 2011-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate IV regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 3. Estimated Impact of the Minimum Wage on DI Claims (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in Levels:				
Explanatory Variable in Levels:	Log of DI claims	Log of DI claims	Log of DI claims per capita	Log of DI claims	Log of DI claims
Log real minimum wage	0.057	0.016	-0.007	0.017	-0.015
	(0.109)	(0.087)	(0.090)	(0.083)	(0.067)
Log population aged 18-64		0.646**		0.654**	-0.282
		(0.245)		(0.252)	(0.490)
Unemployment rate				0.018**	0.013**
				(0.007)	(0.006)
Real gross state product per capita				-0.123	-0.165
				(0.116)	(0.169)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Sample Years	2002-2017	2002-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 4. Estimated Impact of the Minimum Wage on DI Claims with Distributed Lags of the Minimum Wage (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in Levels:				
Explanatory Variable in Levels:	Log of DI claims	Log of DI claims	Log of DI claims per capita	Log of DI claims	Log of DI claims
Log real minimum wage	-0.069	-0.070	-0.070	-0.068	-0.053
	(0.071)	(0.071)	(0.072)	(0.071)	(0.078)
1st lag of log real minimum wage	0.131	0.129*	0.128*	0.116	0.107
	(0.084)	(0.076)	(0.073)	(0.075)	(0.072)
2nd lag of log real minimum wage	-0.037	-0.053	-0.062	-0.054	-0.045
	(0.065)	(0.064)	(0.066)	(0.067)	(0.064)
3rd lag of log real minimum wage	-0.023	-0.035	-0.041	-0.062	-0.117
	(0.069)	(0.063)	(0.063)	(0.066)	(0.090)
1st lead of log of real minimum wage	0.059	0.019	-0.003	0.031	-0.050
	(0.095)	(0.084)	(0.089)	(0.075)	(0.106)
Log population aged 18-64		0.648**		0.658**	-0.279
		(0.243)		(0.251)	(0.511)
Unemployment rate				0.019**	0.014**
				(0.007)	(0.006)
Real gross state product per capita				-0.121	-0.159
				(0.117)	(0.171)
Sum of contemporaneous and lagged minimum wage effects	0.003 (0.144)	-0.028 (0.117)	-0.044 (0.109)	-0.068 (0.118)	-0.107 (0.129)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Years	2002-2017	2002-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 5. Estimated Impact of the Minimum Wage on Concurrent DI Claims (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in Levels:				
Explanatory Variable in Levels:	Log of concurrent claims	Log of concurrent claims	Log of concurrent claims per capita	Log of concurrent claims	Log of concurrent claims
Log real minimum wage	0.091	0.074	0.026	0.074	-0.003
	(0.155)	(0.135)	(0.142)	(0.127)	(0.090)
Log population aged 18-64		0.259		0.270	-0.542
		(0.363)		(0.365)	(0.817)
Unemployment rate				0.024**	0.013
				(0.012)	(0.010)
Real gross state product per capita				-0.198	-0.342*
				(0.152)	(0.194)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Sample Years	2002-2017	2002-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 6. Estimated Impact of the Minimum Wage on Concurrent DI Claims with Distributed Lags of the Minimum Wage (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in Levels:				
Explanatory Variable in Levels:	Log of concurrent claims	Log of concurrent claims	Log of concurrent claims per capita	Log of concurrent claims	Log of concurrent claims
Log real minimum wage	-0.015	-0.016	-0.016	-0.014	0.033
	(0.080)	(0.080)	(0.080)	(0.077)	(0.088)
1st lag of log real minimum wage	0.192*	0.192*	0.189*	0.174	0.155
	(0.114)	(0.111)	(0.103)	(0.109)	(0.097)
2nd lag of log real minimum wage	-0.096	-0.102	-0.120	-0.103	-0.073
	(0.088)	(0.087)	(0.090)	(0.088)	(0.084
3rd lag of log real minimum wage	0.097	0.092	0.078	0.056	0.028
	(0.103)	(0.097)	(0.087)	(0.100)	(0.108)
1st lead of log of real minimum wage	0.0007	-0.015	-0.061	-0.0009	-0.155
	(0.126)	(0.113)	(0.118)	(0.101)	(0.121)
Log population aged 18-64		0.256		0.269	-0.457
		(0.354)		(0.358)	(0.813)
Unemployment rate				0.023**	0.012
				(0.012)	(0.009)
Real gross state product per capita				-0.198	-0.355*
				(0.151)	(0.183)
Sum of contemporaneous and lagged minimum wage effects	0.177	0.165	0.131	0.113	0.143
	(0.196)	(0.180)	(0.167)	(0.179)	(0.179)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Years	2002-2017	2002-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 7. Estimated Impact of the Minimum Wage on DI Claims for Non-Recession Years, with Distributed Lags of the Minimum Wage (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in Levels:				
Explanatory Variable in Levels:	Log of DI claims	Log of DI claims	Log of DI claims per capita	Log of DI claims	Log of DI claims
Log real minimum wage	0.041	0.038	0.036	0.039	0.031
	(0.124)	(0.119)	(0.116)	(0.117)	(0.134)
1st lag of log real minimum wage	0.009	0.026	0.038	0.009	-0.028
	(0.123)	(0.113)	(0.112)	(0.111)	(0.137)
2nd lag of log real minimum wage	0.099	0.069	0.047	0.130	0.193
	(0.139)	(0.135)	(0.141)	(0.125)	(0.140)
3rd lag of log real minimum wage	-0.086	-0.094	-0.099	-0.174	-0.249**
	(0.111)	(0.098)	(0.095)	(0.115)	(0.120)
1st lead of log of real minimum wage	-0.014	-0.051	-0.078	-0.050	-0.106
	(0.082)	(0.084)	(0.086)	(0.072)	(0.108)
Log population aged 18-64		0.587**		0.608**	-0.376
		(0.249)		(0.257)	(0.557)
Unemployment rate				0.020**	0.013*
				(0.009)	(0.008)
Real gross state product per capita				-0.116	-0.172
				(0.123)	(0.211)
Sum of contemporaneous and lagged minimum wage effects	0.063	0.039	0.022	0.004	-0.053
	(0.144)	(0.164)	(0.156)	(0.159)	(0.149)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Years	2002-2006, 2011-2017	2002-2006, 2011-2017	2002-2006, 2011-2017	2002-2006, 2011-2017	2002-2006, 2011-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Table 8. Estimated Impact of the Minimum Wage on the Growth Rate of DI Claims, with Distributed Lags of the Minimum Wage (Standard Errors in Parentheses)

	(1)	(2)	(3)	(4)	(5)
	Dependent Variable in First-Differences:				
Explanatory Variable in First-Differences:	Log of DI claims	Log of DI claims	Log of DI claims per capita	Log of DI claims	Log of DI claims
Log real minimum wage	-0.081	-0.081	-0.083	-0.076	-0.073
	(0.067)	(0.080)	(0.067)	(0.067)	(0.074)
1st lag of log real minimum wage	0.151**	0.151**	0.151**	0.144*	0.148*
	(0.073)	(0.074)	(0.071)	(0.073)	(0.079)
2nd lag of log real minimum wage	-0.023	-0.023	-0.024	-0.026	-0.031
	(0.057)	(0.058)	(0.057)	(0.088)	(0.062)
3rd lag of log real minimum wage	-0.177**	-0.177**	-0.177**	-0.179**	-0.191**
	(0.072)	(0.072)	(0.074)	(0.073)	(0.077)
1st lead of log of real minimum wage	-0.0145	-0.012	-0.028	-0.010	-0.003
	(0.078)	(0.077)	(0.080)	(0.071)	(0.074)
Log population aged 18-64		-0.159		-0.086	-0.055
		(0.561)		(0.560)	(0.763)
Unemployment rate				0.008	0.007
				(0.004)	(0.004)
Real gross state product per capita				-0.221	-0.182
				(0.131)	(0.136)
Sum of contemporaneous and lagged minimum wage effects	-0.130	-0.130	-0.132	-0.137	-0.147
	(0.101)	(0.102)	(0.097)	(0.102)	(0.123)
Additional controls:					
State effects	Yes	Yes	Yes	Yes	Yes
Calendar-year effects	Yes	Yes	Yes	Yes	Yes
Linear state trends	No	No	No	No	Yes
Years	2002-2017	2002-2017	2002-2017	2002-2017	2002-2017

Note: Each column represents a separate OLS regression. Standard errors clustered at the state level. ** indicates an effect statistically different from zero at the 5% level of significance; * at the 10% level of significance.

Figure 1. Aggregate Annual DI Beneficiaries and Real Benefits Paid for 2001-2017

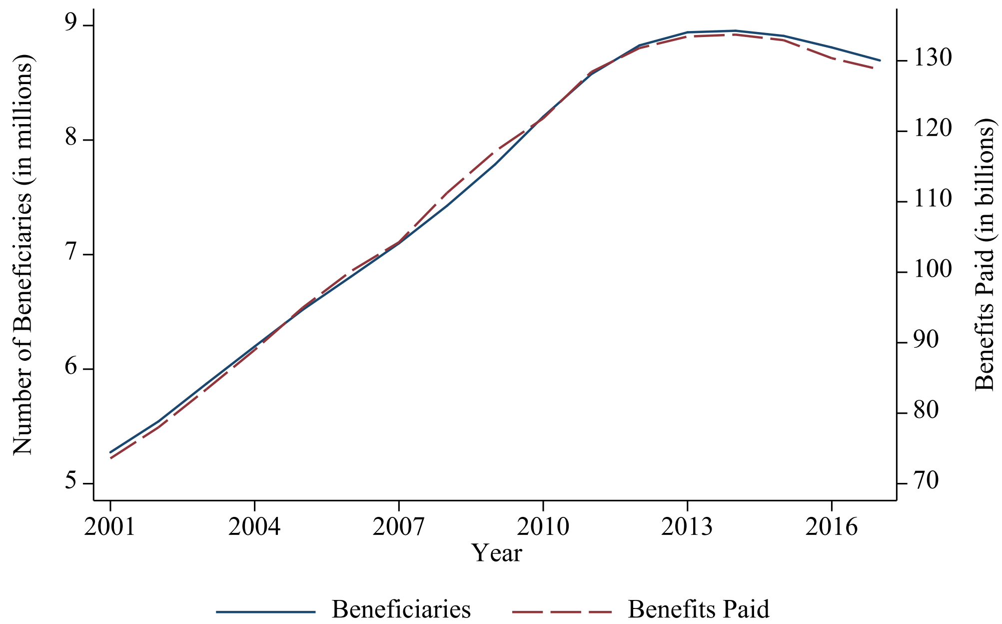


Figure 2. Aggregate Annual Disability Insurance Claims, Concurrent Claims, and Allowances for 2001-2017

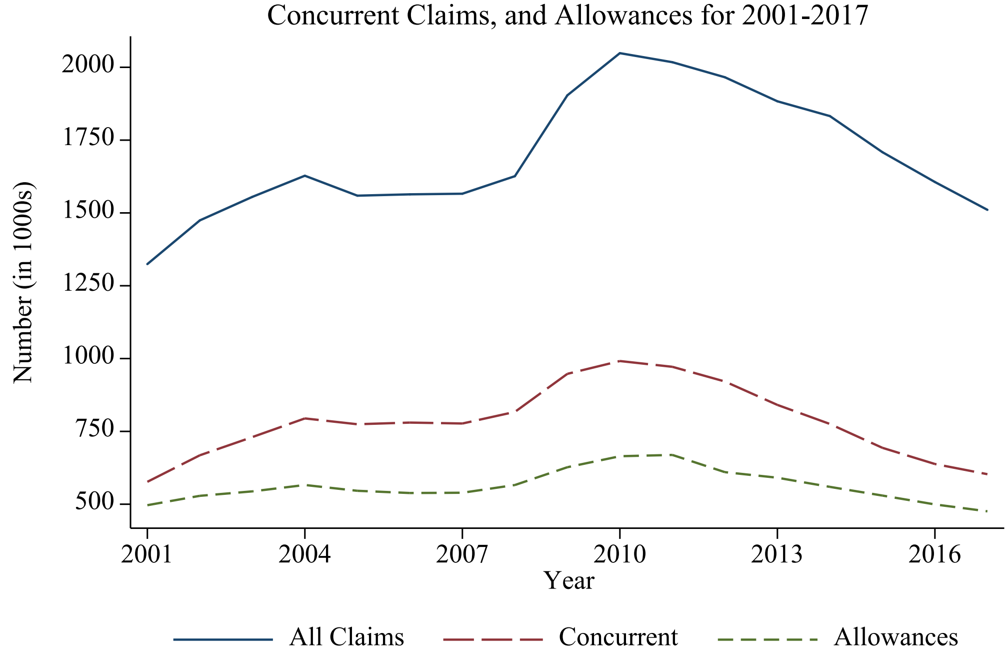


Figure 3. Aggregate Annual Disability Claims and the Unemployment Rate for 2001-2017

Figure 4. Aggregate Annual Disability Claims and the Real Minimum Wage for 2001-2017

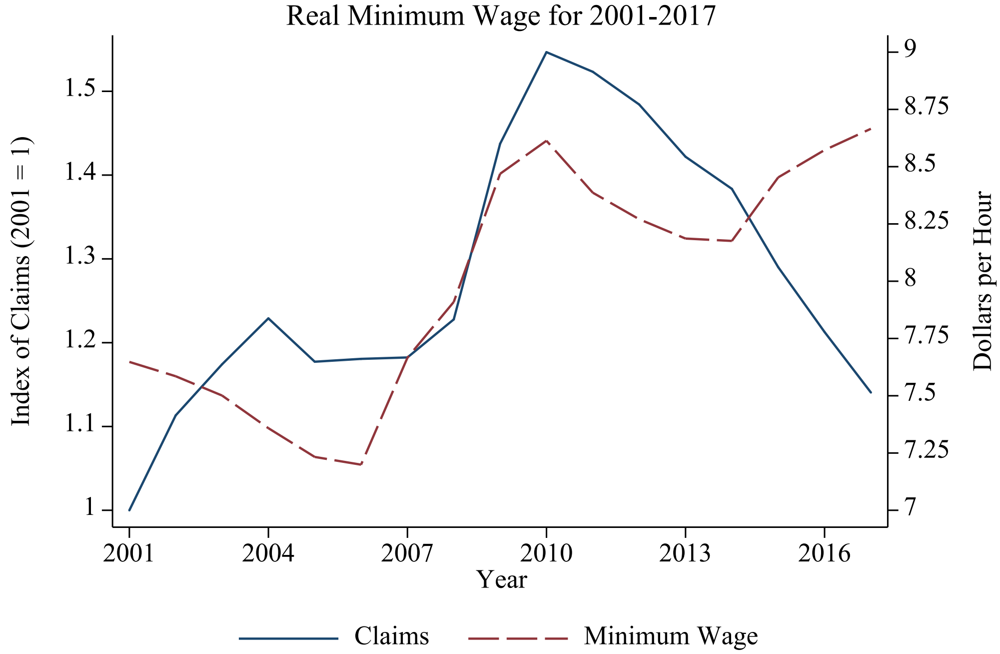


Figure 5. Annual Number of Minimum-Wage Changes at the State Level and the Real Minimum Wage for 2001-2017

Figure 6. Aggregate Annual Disability Allowances and the Real Minimum Wage for 2001-2017

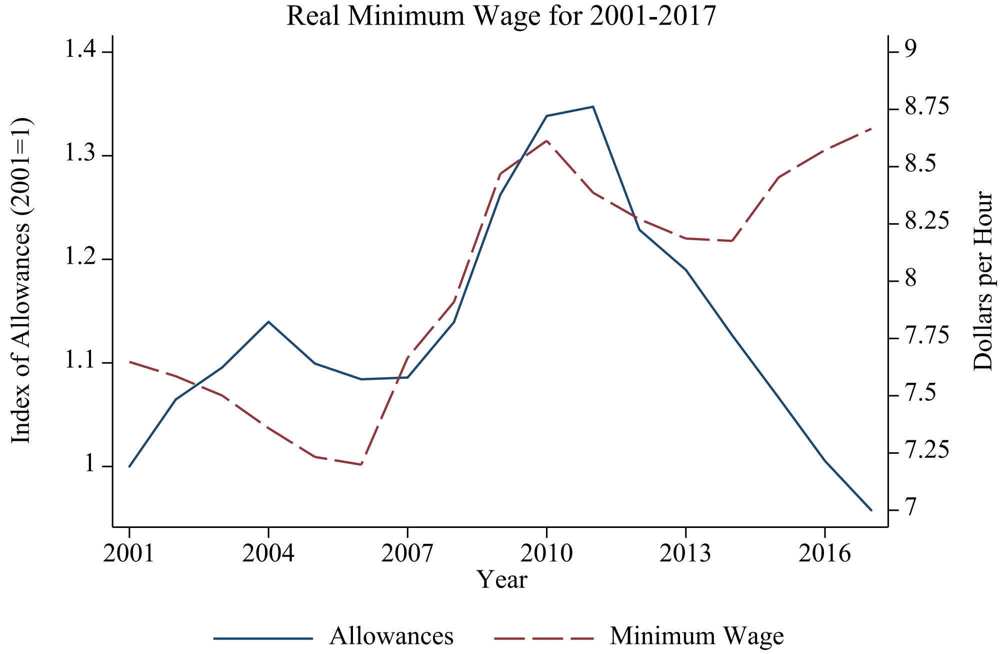


Figure 7. Aggregate Annual Concurrent Claims and the Real Minimum Wage for 2001-2017

Figure 8. Estimated Elasticities of DI Claims to the Minimum Wage for Baseline Specification for 2001-2017

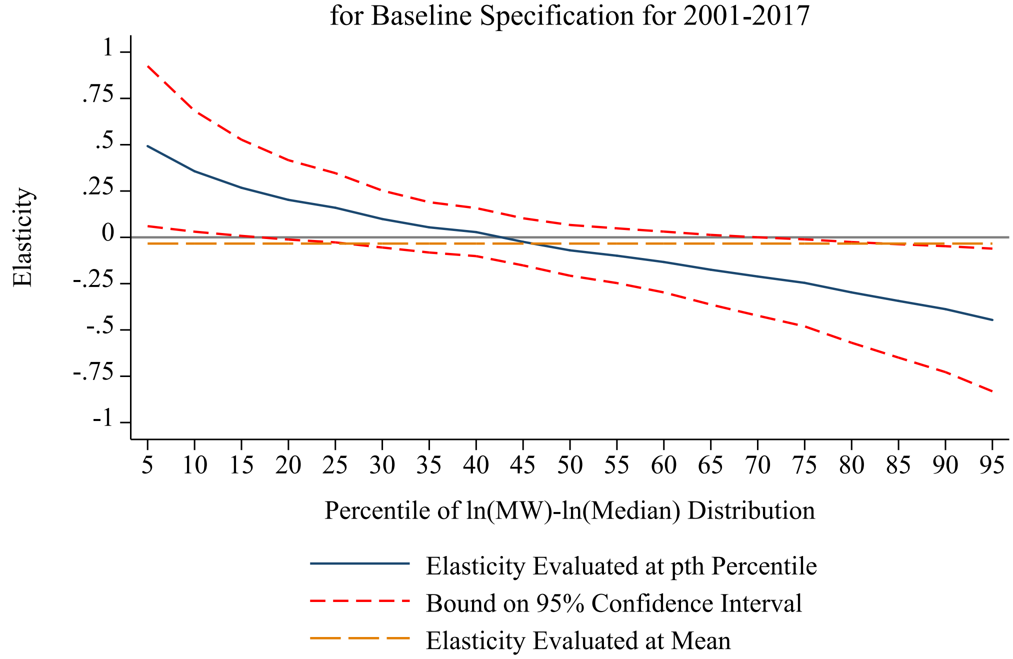


Figure 9. Estimated Elasticities of DI Claims to the Minimum Wage with Time-Varying Controls and State-Year Trends for 2001-2017

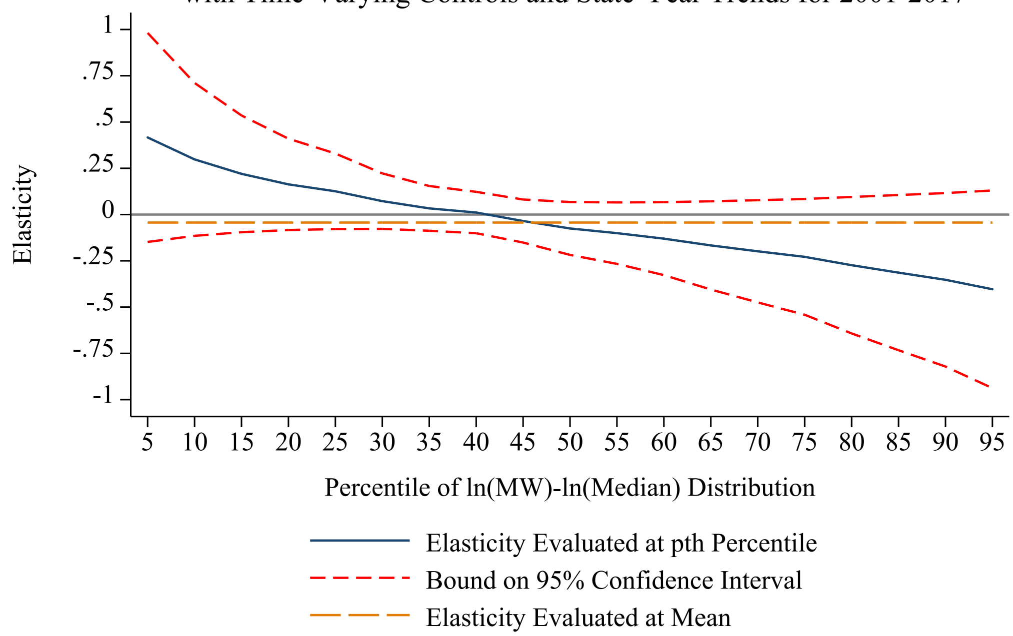


Figure 10. Estimated Elasticities of DI Claims to the Minimum Wage with Time-Varying Controls and State-Year Trends Omitting Recession

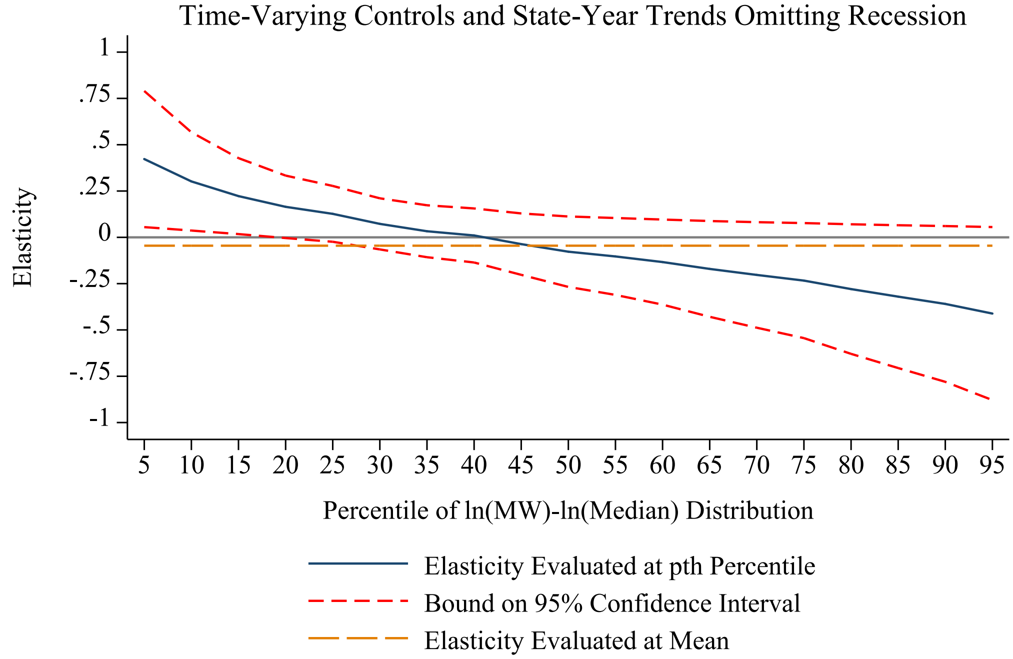


Figure 11. Estimated Elasticities of DI Allowances to the Minimum Wage with Time-Varying Controls and State-Year Trends for 2001-2017

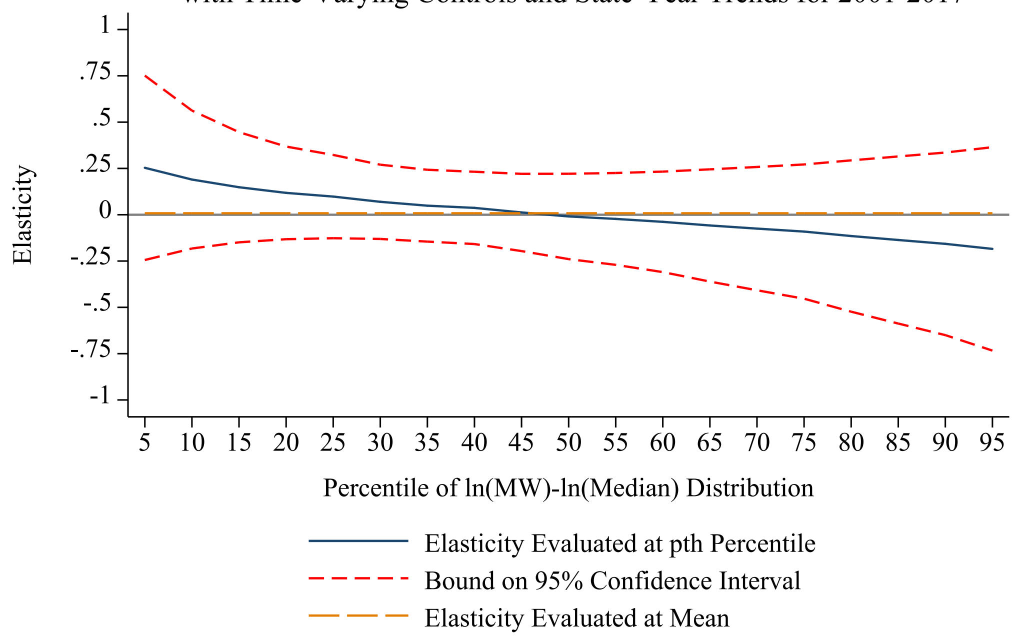


Figure 12. Estimated Elasticities of Concurrent Claims to the Minimum Wage with Time-Varying Controls and State-Year Trends

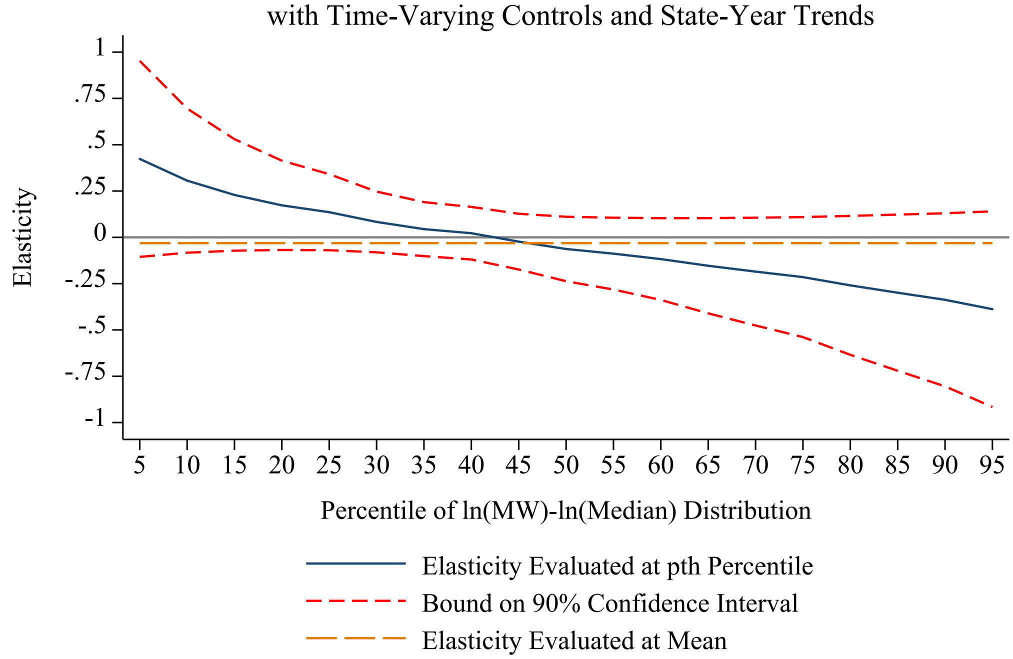
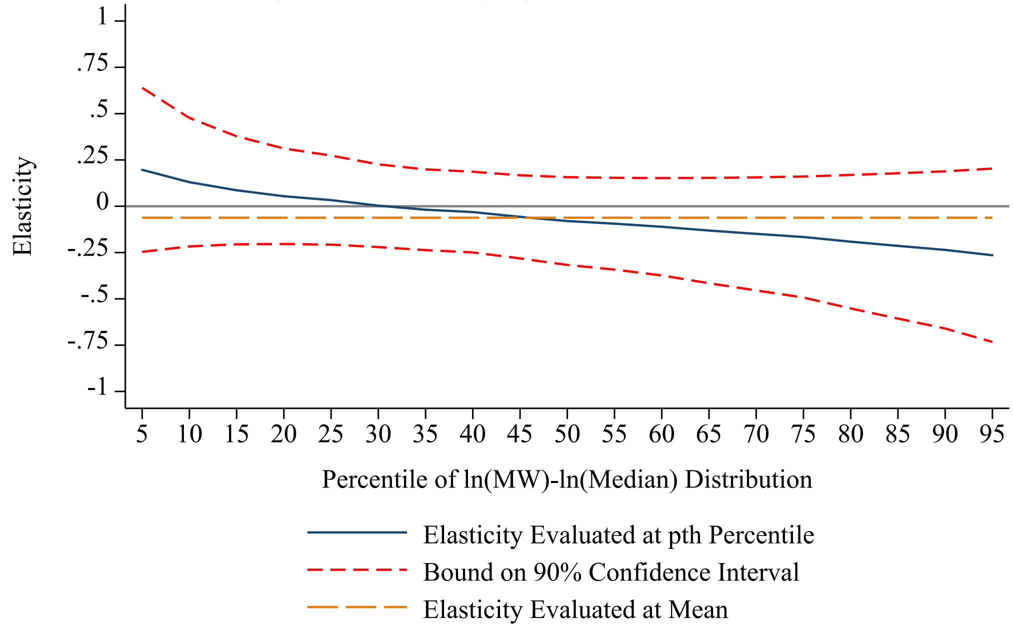


Figure 13. Estimated Elasticities of Concurrent Allowances to the Minimum Wage with Time-Varying Controls and State-Year Trends



RECENT WORKING PAPERS FROM THE CENTER FOR RETIREMENT RESEARCH AT BOSTON COLLEGE

Scheduling Uncertainty and Employment of Young Adults with Disabilities
Dara Lee Luca and Purvi Sevak, January 2020

Wages and the Value of Nonemployment
Simon Jäger, Benjamin Schoefer, Samuel Young, and Josef Zweimüller, January 2020

The Equilibrium and Spillover Effects of Early Retirement
Simon Jäger, Benjamin Schoefer, and Josef Zweimüller, January 2020

Measuring Racial/Ethnic Retirement Wealth Inequality
Wenliang Hou and Geoffrey T. Sanzenbacher, January 2020

A Study of Longitudinal Trajectories of Health and Job Demand on Retirement Age
Amal Harrati and David Rehkopf, January 2020

Participation and Leakages in Oregon's Auto-IRA
Laura D. Quinby, Wenliang Hou, Anek Belbase, and Geoffrey T. Sanzenbacher, November 2019

Why Are 401(k)/IRA Balances Substantially Below Potential?
Andrew G. Biggs, Alicia H. Munnell, and Anqi Chen, November 2019

How Best to Annuitize Defined Contribution Assets?
Alicia H. Munnell, Gal Wettstein, and Wenliang Hou, October 2019

How Do Older Workers Use Nontraditional Jobs?
Alicia H. Munnell, Geoffrey T. Sanzenbacher, and Abigail N. Walters, October 2019

Will More Workers Have Nontraditional Jobs as Globalization and Automation Spread?
Matthew S. Rutledge, Gal Wettstein, and Sara Ellen King, July 2019

Do States Adjust Medicaid Enrollment in Response to Capitation Rates? Evidence from the Medicare Part D Clawback
Laura D. Quinby and Gal Wettstein, June 2019

The Effect of Medicare Part D on Evergreening, Generic Entry, and Drug Prices
Geoffrey T. Sanzenbacher and Gal Wettstein, May 2019

Is the Drop in Fertility Due to The Great Recession or a Permanent Change?
Alicia H. Munnell, Anqi Chen, and Geoffrey T. Sanzenbacher, March 2019

All working papers are available on the Center for Retirement Research website (https://crr.bc.edu) and can be requested by e-mail (crr@bc.edu) or phone (617-552-1762).