Title
The Effects of Minimum Wages on Food Stamp Enrollment and Expenditures

Authors
Reich, Michael
West, Rachel

Publication Date
2015-06-01

IRLE
Institute for Research on Labor and Employment

IRLE WORKING PAPER
#112-15
June 2015

The Effects of Minimum Wages on Food Stamp Enrollment and Expenditures

Michael Reich and Rachel West

Cite as: Michael Reich and Rachel West. (2015). "The Effects of Minimum Wages on Food Stamp Enrollment and Expenditures". IRLE Working Paper No. 112-15. http://irle.berkeley.edu/workingpapers/112-15.pdf

Berkeley
UNIVERSITY OF CALIFORNIA

Title: The Effects of Minimum Wages on Food Stamp Enrollment and Expenditures

Authors: Michael Reich and Rachel West

Affiliations:

Reich: Department of Economics and Institute for Research on Labor and Employment, University of California, Berkeley

West: Center for American Progress, Washington, DC

Mailing Address: 2521 Channing Way, Berkeley, California, 94720-5555

Phone Numbers:

West: (651) 247-6985

Reich: (510) 643-7079

Acknowledgments

We are grateful to Sylvia Allegretto, Carl Nadler, Arindrajit Dube, Zachary Goldman, Ben Olinsky, Jesse Rothstein, Daniel Thompson, and Ben Zipperer, as well as two anonymous referees, for their valuable suggestions and assistance. Funds to support this research were provided by the University of California, Berkeley and the Center for American Progress.

The Effects of Minimum Wages on Food Stamp Enrollment and Expenditures

Abstract

We provide the first analysis of how minimum wage policy affects enrollments and expenditures in the Supplemental Nutrition Assistance Program (SNAP). Exploiting state and federal-level variation in minimum-wage policy between 1990 and 2012, and incorporating local controls in our specifications, we find that a 10 percent minimum wage increase reduces SNAP enrollment between 2.4 and 3.2 percent, and reduces program expenditures an estimated 1.9 percent. If the federal minimum wage were increased from $7.25 to $10.10, enrollment would fall between 7.5 and 8.7 percent (3.1 to 3.6 million persons) relative to 2012 levels, and annual expenditures would decrease 6 percent ($4.6 billion).

1. Introduction

Although the effects of minimum wages on employment have been much studied, the effects on public aid spending have not. How does minimum wage policy affect enrollments and expenditures on means-tested public assistance programs? In this study we address this question for the case of the Supplemental Nutrition Assistance Program, or SNAP, formerly known as the Food Stamp program.

By definition, government spending on a means-tested program should decline as average earnings increase, insofar as benefit levels fall with increased earnings and insofar as the earnings increase makes some individuals ineligible for any benefits. Both of these conditions are satisfied in the case of the effect of minimum wages on SNAP benefits. SNAP benefits decline 30 cents for every $1 increase in gross family earnings and phase out entirely at about the federal poverty level (U.S. Department of Agriculture 2013). Although only 13 percent of SNAP recipients in 2011 were employed (Rosenbaum 2013), low-wage workers are disproportionately enrolled in SNAP. A minimum wage increase that lifts many families out of poverty should therefore reduce public expenditure on this program.

But the relationship may be more complex. If, for example, a minimum wage increase reduces employment, thereby adding to the number of unemployed, the number of SNAP recipients could increase. Even if employment does not fall, the quantitative effect of minimum wages on SNAP enrollment and spending is still not self-evident. For example, if many SNAP recipients have earnings that already bring them close to becoming ineligible for the program, or if many minimum wage workers belong to families with incomes that are above the federal poverty level, a minimum wage increase may have a very small effect on SNAP expenditures. Similarly, SNAP recipients who are unemployed, disabled, or retired will not be affected by a minimum wage increase. Identifying the sign and magnitude of the effect requires a causal analysis.

The possibility that a higher minimum wage may lead to increased or reduced public spending has great relevance to the public and to policymakers. This study presents the first empirical analysis of the effects of minimum wage policy on SNAP participation and expenditures. We conduct this analysis by exploiting more than two decades of variation in binding state and federal minimum wage changes in a causal econometric framework. We also contribute to the growing literature that demonstrates the importance of using local controls to identify the causal effects of minimum wages on a variety of outcomes.

We find that a 10 percent increase in the minimum wage reduces SNAP enrollment between 2.4 and 3.2 percent and reduces program expenditures an estimated 1.9 percent. Taking into account each state's 2014 minimum wage level, we apply these results to the case of a federal minimum wage increase from $7.25 to $10.10 per hour, indexed in subsequent years to the consumer price increase.[1] The adoption of a $10.10 federal minimum wage in 2014 would reduce SNAP enrollments between 7.5 and 8.7 percent (3.1 to 3.6 million persons). The total anticipated annual decrease in program expenditures is nearly $4.6 billion, or about 6 percent of current SNAP program expenditures. An indexed federal minimum wage would increase at the same rate as SNAP benefit and eligibility levels, which are also indexed to the CPI. Consequently, the savings over 10 years, in 2014 dollars, would be 10 times the one-year savings, for a total of approximately $46 billion.

Some of the reduction in SNAP program enrollment and expenditures would occur among workers making less than $10.10 per hour—those whose pay would be directly increased by the minimum wage law. Another part of the reduction would occur among workers currently earning slightly above $10.10, who would also receive pay increases.[2] Our analysis uncovers the aggregate effect on all recipients from a wage increase, regardless of their starting pay.

Our paper proceeds as follows: Section 2 discusses the related research literature. Section 3 provides background information on the federal minimum wage, state minimum wages, and the SNAP program. Section 4 describes our methods and data. Section 5 provides our main results, including a simulation of the effects of a federal minimum wage increase to $10.10. Section 6 concludes.

2. Related Research

Although a large number of studies have examined the impact of minimum wage increases on earnings and employment, the impact of such minimum wage policies on public assistance enrollments and expenditures remains an under-explored subject in the economic literature.[3] Substantial literatures examine the importance of SNAP as a safety net program (Bitler and Hoynes 2013), the effects of SNAP on poverty and health outcomes (Smeeding et al. 2013) and how business cycle movements and policy changes affect the level of SNAP spending (Mulligan 2012; Ganong and Liebman 2013). None of these literatures examines the relation of SNAP to minimum wage policy.

Only a few studies discuss the relation between the minimum wage and government transfer spending, much less attempt to identify the causal effect of one upon the other. Page, Spetz, and Millar (2005) find positive effects of minimum wage increases on welfare caseloads. As they state, however, their results vary considerably with different sample periods and assumptions about state trends. Allegretto et al. (2013b) show that low-wage workers, in general, and fast-food workers in particular, are much more likely to be SNAP recipients than are other workers. Cooper (2014) simulates the effect of a minimum wage increase on transfer payments, but does not examine the dynamic supply and demand responses that are captured by a causal analysis.

Several studies have examined the relationship between the minimum wage and the Earned Income Tax Credit, or EITC. Neumark and Wascher (2011) find that a higher minimum wage increases EITC benefits for families in deep poverty, while reducing EITC benefits for some sub-groups. Lee and Saez (2012) argue that the minimum wage and EITC are complementary policies, not substitutes. The Congressional Budget Office (CBO 2014) argues that a minimum wage increase will not have a substantial effect on EITC spending, while Leigh (2010), Rothstein (2010) and Kasy (2014) each find that the positive effect of the EITC on labor supply lowers wages of low-skilled recipients and non-recipients. While these studies are of interest, the EITC is quite different from SNAP: The EITC has a substantial phase-in period in which benefits increase. It also has a long phase-out period, which extends up to an annual income of about $48,000 for a family of four, quite a bit above the reach of the minimum wage.

Research by Arindrajit Dube (2013) on the causal effect of the minimum wage on family poverty represents the study most related to ours. Dube finds that increasing the federal minimum wage to $10.10 would raise about 4.6 million non-elderly Americans above the federal poverty level. In contrast, when CBO uses a simple simulation method to address the same question, they find that raising the federal minimum wage to $10.10 would raise 900,000 people above the federal poverty level.[4] The difference between these two estimates highlights the limitations of the simulation approach and the importance of undertaking a causal analysis. Moreover, since eligibility and benefit levels for programs such as SNAP and Medicaid are tied to the federal poverty level, Dube's findings have direct implications for our study.

Our methods in this paper are also closely related to other recent econometric papers in the minimum wage literature that find that local controls are necessary to identify causal effects. These studies cover minimum wage effects on employment levels (Dube, Lester and Reich 2010; Allegretto, Dube and Reich 2011), employer flows (Aaronson et al. 2013), employment flows (Dube, Lester and Reich 2014), and enrollment in Medicaid (West and Reich 2014) and in other public aid programs (Zipperer 2014).[5] Each of these papers, as well as ours, finds that the traditional two-way state and year fixed-effects specification used by Neumark and Wascher fails pre-trend falsification tests, while a specification that adds local controls does not.[6]

3. Background

We begin this section with a discussion of the evolution of federal and state minimum wages, with special attention to their non-random pattern. We then describe the main parameters of the SNAP program and the degree to which SNAP policies have changed, both nationally and differentially by states. Here we pay special attention to whether heterogeneous policy changes pose a challenge to our identification strategy.

3.1 Federal and State Minimum Wages

The federal minimum wage was last increased in July of 2009 in only the third legislated action since 1980. In response to the subsequent approximately 30 percent decline of real federal minimum wages, many states have passed legislation fixing the minimum wage at a higher level than the federal minimum. However, as the maps in Figure 1 show, while states in every region of the United States have adopted higher minimum wages, these states are not distributed randomly by geography. As shown in Allegretto et al. (2013a), these states vary systematically from the other states by a number of characteristics that affect low-wage employment trends, but which are not related to minimum wage policy.

The non-random pattern of minimum wage adoption has important implications for obtaining unbiased estimates of minimum wages on employment. In particular, national panel studies that use state and time fixed effect models—such as Neumark and Wascher (1992)—spuriously estimate negative employment effects. As tests for pre-existing employment trends show, low-wage employment was already declining two years before minimum wage increases were implemented (Allegretto et al. 2013a). This pre-trend disappears when we include controls for heterogeneity among states and over time. For this reason, we conduct similar pre-trend tests for our SNAP outcomes and we follow Allegretto et al. (2013a) and use model specifications that include local comparisons.

3.2 The Supplemental Nutrition Assistance Program

Benefits under the SNAP program are entirely federally funded. The SNAP program is administered by the U.S. Department of Agriculture, together with state agencies, which share the administration costs. In 2012, SNAP benefits averaging $133 per month reached 46.6 million people, about one-seventh of the U.S. population (CBO 2012; Smeeding et al. 2013). In fiscal year 2014, SNAP's monthly benefits were capped at $189 for a single individual, $497 for a family of three, and $750 for a family of five (U.S. Department of Agriculture 2013).[7]

The proportion of the SNAP recipients in the U.S. population rose from 8 percent in 1990 to 10.5 percent in 1994, then fell to 6 percent in 2001 and rose to 9 percent by 2007. SNAP enrollment levels then rose sharply with the onset of the Great Recession, to 15 percent in 2011 (Ganong and Liebman 2013, figure 1). SNAP spending also climbed, from $46 billion in 2007 to $74.6 billion in 2012. According to CBO (2012) and Ganong and Liebman (2013), changes in SNAP enrollments and spending since 1990 are primarily the result of cyclical economic conditions, notably changes in unemployment and changes in per capita income and secondarily the result of changes in federally-mandated SNAP policies.[8] The 2009 American Recovery and Reinvestment Act temporarily increased SNAP spending. For example, maximum SNAP benefits increased by 13.6 percent; these higher benefit levels expired on November 1, 2013.

Take-up rates among eligible SNAP recipients have averaged about 70 percent in recent years, with much lower take-up among elderly households (CBO 2012). The take-up rate increases in more difficult economic times. It also increased when SNAP debit cards replaced actual food stamps, easing transactions and reducing stigma issues. Take-up is especially high among those most needy.

To be eligible for SNAP, a household must meet three tests: its gross income must be less than 130 percent of FPL; its net income (gross income less certain deductions, including a 20 percent earned-income deduction, and some costs for shelter, child care, child support and medical expenses) must be under 100 percent of FPL; and its assets—not including retirement accounts and home—must be under $2,000. In recent years, about 85 percent of households receiving benefits have incomes below the federal poverty level; 49 percent have dependent children; 16 percent are age 60 or older; 20 percent are disabled; and 30 percent report some earned income (CBO 2012).

SNAP recipients make up a diverse population. Children account for 45 percent of all recipients, 8 percent are elderly, 11 percent are non-elderly but disabled, and 4 percent are caregivers for young children or a disabled family member. Among the remaining 32 percent of SNAP recipients, 11 percent are employed and nearly 20 percent are not (Rosenbaum 2013). Our analysis in this paper focuses on this 32 percent of all SNAP recipients.

A household of three people with a single wage-earner working 40 hours per week at $10 per hour would receive a monthly SNAP benefit of $198, equivalent to a 12 percent earnings supplement (Rosenbaum 2013). Using the gross income test, SNAP benefits are reduced by 30 cents per dollar received and phase out entirely at gross monthly household incomes of 130 percent of the federal poverty level: $1,245 for a single individual, $2,116 for a family of three, and $2,987 for a family of five. However, to determine benefits SNAP also uses the net monthly income concept. Since 20 percent of earnings are deducted to obtain net income, one would expect that SNAP benefits in effect fall by 24 percent of each increased dollar of earnings. According to Rosenbaum (2013), however, other factors, such as the importance of shelter costs, also come into play; consequently, the reduction in benefits varies between 24 and 36 percent of an additional dollar of earnings.

3.3 Time and State Heterogeneity in SNAP Policies

SNAP policies varied during our sample period. Many of the changes were relatively minor and some were effectively national in scope. Nonetheless, a potential threat to our identification strategy arises if these policy changes are correlated with state and federal minimum wage changes. If they are, we might attribute to minimum wage changes effects that are actually the results of SNAP policy changes. As we discuss in the next section, our statistical approach includes controls for year fixed effects and state-specific linear time trends. This strategy will absorb some of the variation in SNAP policy that might otherwise confound our estimates. But are such controls sufficient to account for SNAP policy changes? We discuss this issue here by first considering changes in SNAP policy over time that were either national in scope or effectively national because they were adopted more or less simultaneously and uniformly by most states. We then discuss changes that differed among states.[9]

As Ganong and Liebman (2013) recount, important national-level changes in SNAP occurred during our sample period. In the 1990s, the single most important national-level change was the 1996 bill creating the Temporary Assistance to Needy Families (TANF) program. This law eliminated SNAP eligibility for some legal immigrants, limited the time length of eligibility for able-bodied childless adults, and reduced maximum benefits. The creation and then implementation of TANF thus coincided with the 1996-97 federal minimum wage increases. Moreover, a liberalization of the federal Earned Income Tax Credit (EITC) occurred in the same period, which likely reduced SNAP enrollments. Beginning in 2001, some of the 1996 restrictions were relaxed with the administrative modernization of SNAP, which simplified the enrollment process and lifted take-up rates. Additional liberalizations occurred in October 2008 with the American Farm Bill (Mulligan 2012, p. 56) and again in early 2009 with ARRA—the American Recovery and Reinvestment Act (Ganong and Liebman 2013). After the onset of the Great Recession, many states adopted technical policy changes that in effect further liberalized access to SNAP benefits. One such change lengthened the time that able-bodied adults without dependents could remain on SNAP, especially in states with elevated unemployment rates—which at the time covered almost all states. More recently, the elevated maximum benefit levels associated with ARRA have expired; legislation passed in early 2014 will reduce SNAP funding by $8 billion over the subsequent decade.

To some extent, the 1996 shift to TANF and the liberalizations of the 2000s affected states differently, in both intensity and at differing times, as we discuss in the next paragraph. However, a substantial portion of these policy changes also affected state SNAP programs simultaneously and uniformly. These impacts therefore also constitute national-level policy changes.[10] The year fixed effects controls in our estimation model will account for these changes.

In addition to policy changes that were either enacted nationally or adopted more or less simultaneously by most states, state governments have also made a variety of differing SNAP policy choices. To examine these, we rely here on Ganong and Liebman's (2013) extensive discussion of these changes as well as information on the SNAP website. Like Ganong and Liebman, we divide our discussion into three periods: 1990-2000, 2001–2007, and 2007-2012.

1990-2000: As we mentioned above, the 1996 act creating TANF also affected SNAP. However, changes at the state level began somewhat earlier. By 1996, 37 states were given waivers for the program that preceded TANF, Aid to Families with Dependent Children program. These waivers permitted reductions in cash assistance programs that spurred labor force participation—particularly among single parents, reducing this group's eligibility for SNAP benefits. After TANF's enactment in 1996, states also used the latitude available to them and differentially implemented TANF time limits on cash assistance, which also increased employment and reduced participation in SNAP (Ganong and Liebman 2013). However, while the intensity of welfare reform and its effects on SNAP eligibility varied among states, the changes in intensity occurred gradually throughout this decade and the next. Consequently, they are likely to be captured by the state-specific linear time trends that we include in our estimating models.

2001-2007: Beginning in 2001, states were allowed waivers to simplify SNAP program rules and administration. For example, states could obtain waivers to establish initial eligibility and recertification through telephone interviews or through online applications, instead of through face-to-face interviews. By 2007, 22 states were allowed to use telephone interviews and 20 were allowed to accept online applications (Ganong and Liebman 2013). Using a model that includes state and year fixed effects, Ganong and Liebman exploit policy differences among states in the period 2001 to 2007 to estimate the effects of these policy changes on SNAP take-up and enrollment. Their results are mixed: only two of eight changes are significant statistically.[11] It is not clear, therefore, that state policy changes in this era had statistically measurable effects on SNAP enrollment.

2007-2012: Ganong and Liebman identify only one important SNAP policy change in this period that was introduced at different times in different states. The SNAP program refers to this change as BBCE--Broad Based Categorical Eligibility (see also Trippe and Gilhooly 2010). According to our examination of the USDA's SNAP Policy Database (www.ers.usda.gov/data-products/snap-policy-database), BBCE was already in place in seven states in 2007.[12] It was subsequently expanded to 38 states in 2010. BBCE liberalized the gross income test, increased asset limits in 5 states and eliminated the asset limit test in 28 states (GAO 2012, Table 1).

The state by state variations in the introduction of BBCE poses a potential threat to our identification strategy to the extent that BBCE introduction was more likely in states that were also increasing their minimum wages. To address this point we examined the minimum wage status and time patterns of BBCE adoption. We begin with the minimum wage status of the seven "early adopters"—states with BBCE in 2007 or earlier—and the minimum wage status of the nine "late refusers"—states that had not adopted BBCE by 2011. We identified these states using the SNAP Policy Database and checked them with GAO (2012), Figure 6.[13] Five of the seven early adopters and all nine of the late refusers had minimum wages equal to the federal minimum; that is, these states did not have higher minimum wages. About half of the 34 states that added BBCE between 2008 and 2011 had a higher than federal minimum wage; the other half did not. Moreover, according to GAO (2012), in 2010 BBCE liberalizations increased SNAP enrollment by only 2.6 percent. The overall BBCE pattern and the small share of SNAP enrollment accounted for by BBCE thus suggest that BBCE adoption will not confound our estimates.

More generally, it appears that potentially confounding state SNAP policy differences were either small in magnitude or that they will be absorbed by the linear state trends that we include in the models we discuss below.

4. Data and Methods

As previously mentioned, we exploit variation in minimum wages by state and time to examine their causal effects on SNAP enrollments and expenditures. To do so, we use family-level data from 1990 through 2012 drawn from the March CPS (the Annual Social and Economic Supplement of the Current Population Survey).[14] We merge these data—which include information on SNAP enrollment—with state-level data on minimum wages, SNAP administrative expenditures as reported by the U.S. Bureau of Economic Analysis, population, unemployment rates, and state median income levels. (Descriptive statistics are shown in Table 1.) To control for time-varying heterogeneity among states, our specifications include controls for state linear trends and effects by Census division and time. We estimate effects at two levels: allowing for family variation and allowing only for state-level variation. We also employ a set of standard demographic controls, such as family size and composition and race and ethnic composition.

This econometric design is intended to ensure that our analysis precludes a spurious correlation between minimum wages and SNAP activity—for example, the tendency of more economically vibrant states to implement higher minimum wages. The desirable "pre-existing similarities" between states that we discuss above inform our choice of control variables in a statistical setting. More precisely, in our multiple regression models, we use median family income, the unemployment rate, the employment-to-population ratio, and regional and time identifiers to construct an appropriate group of peers for each state on the eve of a policy change. By ensuring similarity along these dimensions, we maximize the likelihood that SNAP activity in the "treatment" and "control" states would have comparable outcomes in the absence of a minimum wage policy change. Thus, when an individual state in our panel changes its minimum wage policy, we can isolate the portion of variation in SNAP activity attributable to the new minimum wage.

4.1 Data Description

We examine the empirical relationship between minimum-wage policy and food stamp activity at two levels of aggregation: the family level and the state level. As noted above, family level data are drawn from the March CPS.[15] The March CPS comprises responses from the residents of 50,000 to 60,000 dwelling places surveyed per year and contains detailed information on the residents' employment and income, including income from transfer payments. The sample for our analysis comprises more than 1.28 million family units during the period from 1990 to 2012 (inclusive). Survey weights allow us to analyze SNAP participation in a manner that is representative of the U.S. population at large. As Table 1 reports, over all the years in our sample, 9.1 percent of families reported food stamp receipt in the weighted March CPS sample. The enrollment rate was at a low of 6 percent in the year 2000. In 2012, the most recent year in our panel, 13.3 percent of families reported participating in SNAP at some point during the survey year.

A number of studies (notably Meyer et al. 2009 and Smeeding et al. 2013) find that the Current Population Survey underestimates both the number of SNAP enrollees and the value of their benefits. Smeeding et al., for example, find that CPS-reported enrollment equals 69.7 percent of the number in SNAP administrative data and that the value of CPS-reported benefits equal only 53.4 percent of administrative totals. This under-reporting has increased over time: The ratio of reported benefits to administrative benefits fell from 0.731 in 1990 to 0.539 in 2007 (Meyer et al. 2009).[16] Lower reporting rates in recent years, when minimum wage increases have tended to be larger and more frequent, could pose a threat to our identifying strategy. The allowance we make for state-level linear time trends mitigates this concern.[17] Moreover, undercounting is not an issue when we use administrative spending data.

Our first empirical strategy focuses solely on SNAP enrollment using family-level data. This approach identifies the effects of low-wage labor policy on the external margin—that is, the effect of the minimum wage on the likelihood that a family participates in the SNAP program at all—as opposed to the internal margin, or how much SNAP funding the family would receive.

Our second empirical framework uses state-level data. That is, we aggregate the March CPS data to obtain a single data point for each state/year back to 1990, representing the mean of the outcome for the state. The state-level estimation serves as a robustness check on the family-level results for SNAP participation.

Using aggregated data allows us to estimate directly the causal effect of minimum wage changes on SNAP spending. Looking at the effect on SNAP spending is not possible at the family level: response rates to a question in the March CPS on the on cash-equivalent value of food stamps for SNAP recipients are extremely low. When it is reported, the information may be unreliable—perhaps because recipients are unaware of the exact monthly cash-equivalent value of benefits they receive. Fortunately, the Bureau of Economic Analysis publishes aggregate SNAP spending at the state level in its National Income and Product Account, or NIPA, tables. Thus, while we are unable to observe the heterogeneity in the cash value of SNAP for families in each state, we are able to calculate average SNAP spending per resident in each state per year.[18]

Supporting covariates include the annual unemployment and employment data from the Bureau of Labor Statistics (BLS) and state-level population series from the inter-decennial census releases. We use the higher of federal and state minimum wage levels, which are available from the BLS's Wages and Hours Division. For state minimum wage changes enacted at other times than the first day of the year, we use an average value for the year.

4.2 Family-level Model Specifications

We first examine the effect of the minimum wage on participation in the food stamp program. For family i residing in state s in year t, we estimate an equation of the following form:

$$Y_{\text{ist}} = \alpha + \beta_1 \log(MW_{st}) + \beta_2 X_{\text{st}} + \beta_3 Z_{\text{i}} + \gamma_{\text{s}} + \phi_{\text{dt}} + \delta_s * t + \varepsilon_{\text{ist}} \quad (1)$$

Y_{ist} is a binary variable that is set equal to 1 if at least one member of family i received food stamps during the survey year. X_{st} is a set of state-level characteristics, including annual averages of the unemployment rate, the employment-to-population ratio, and the natural log of median family income. Z_i is a vector of family attributes, including indicators for the race/ethnicity and marital status of the family head, size of the family, the presence of children, and the presence of an adult male. State fixed effects are captured by γ_s. To control for time-varying heterogeneity, our preferred model specification also includes year fixed effects that vary by Census division (ϕ_{dt}) and state-level linear time trends ($\delta_s * t$). We discuss and justify the inclusion of these last two terms below. We also compare the results from our preferred specification with less saturated specifications.

The effect of interest, which is captured by β_1, is the expected change in the probability of receiving SNAP benefits with respect to a change in the (log of the) binding minimum wage in state s during year t. We estimate the parameters using linear regression, producing a linear probability model. We report robust standard errors, clustered at the state level. Details of the model selection process are covered in below.

4.3 State-level Model Specifications

The state-level models are similarly specified. For state s in year t, we assume that:

$$Y_{st} = \alpha + \beta_1 log(MW_{st}) + \beta_2 X_{st} + \gamma_s + \phi_{dt} + \delta_s * t + \varepsilon_{ist} \quad (2)$$

In this model, Y_{st} is now either the SNAP enrollment rate in state s during year t, or the natural logarithm of per capita SNAP expenditures in state s during year t. X_{st} is once again a set of state-level characteristics, including the same state-level covariates as in the family regressions (annual average unemployment rate, employment-to-population ratio, natural log of median family income), with the addition of family level characteristics averaged across the state (average family size and the shares of population constituted by each of five racial/ethnic groups). State fixed effects are represented by γ_s. As above, our preferred model specification includes year fixed effects that vary by Census division (ϕ_{dt}) and state-level linear time trends ($\delta_s * t$), as elaborated below. The effect of interest is captured by β_1.

We estimate both state-level models (enrollment and expenditures) using ordinary least squares regression. Thus, the interpretation of the coefficient is no longer that of a change in probability, as in the binary outcome models described above. Rather, for the state-level SNAP enrollment model, β_1 represents the expected change (in percentage points) in the state's SNAP enrollment rate that is due to a 1 percent change in the minimum wage. For the SNAP expenditures model, β_1 represents the elasticity of SNAP spending with respect to the minimum wage—that is, the percentage change in state expenditures expected to result from a 1 percent change in that state's minimum wage.

4.4 Model Estimation

We begin estimation with a set of simple unconditional models: regression of SNAP activity (enrollment or expenditures) on only the log of the minimum wage, as shown in the first columns of Table 2, Table 3, and Table 4. As displayed in subsequent columns of each of these tables, we then add covariates sequentially to these models. We first add simple controls for differences across geography and over time, in the form of state and year fixed effects (column 2)—the choice of which is described further below. We next include a vector of family-level controls (column 3), and finally a set of state-level covariates (the unemployment rate, log of median-family income, and the employment-to-population ratio) (column 4).

As expected, the simple unconditional models in column 1 indicate that the relationship between the minimum wage and SNAP enrollment, if one exists, is a more complex one, influenced by other factors. In the unconditional family-level model (column 1 of Table 2), the coefficient on the variable of interest—the log of the minimum wage—is small in magnitude and not statistically different from zero; in the state-level expenditure model (column 1 of Table 4), the minimum-wage coefficient displays an elasticity greater far greater than unity. Controlling only for heterogeneity across states and time, the effect of the minimum wage variable is not statistically different from zero (column 2 of Tables 2-4). Once we account for the influence of family-level characteristics and state-level economic and labor-market conditions on SNAP activity in the two subsequent columns, the effect of the minimum wage becomes somewhat precisely estimated in all but the state-level expenditure equation.

Next, we control for unobserved geographic- and time-varying characteristics by using two alternative specifications suggested by recent minimum-wage research. As noted above, our preliminary controlled estimates of the minimum wage effect in columns 2-4 of Tables 2-4 include only independent state-specific fixed effects and year-specific fixed effects. This specification implicitly assumes that families in any state constitute an equally good statistical control group for those in any randomly chosen state, after accounting for various characteristics (median income and unemployment rate, among others). Similarly, simple time fixed effects assume that families surveyed in any year can credibly serve as a control group for families surveyed in every other year of the sample (1990 through 2012). In other words, this specification assumes that a state's immediate neighbor provides no better a counterfactual for the effect of a minimum-wage change than does a state farther away, even across the country.

We relax this restrictive specification sequentially in two steps. In column 5 of Tables 2-4, we replace simple year fixed effects with fixed effects for each Census division/year combination. By using division-year effects, we remove the restriction implying that families in each state are equally good statistical controls for all other families. Rather, we allow for the possibility that the trajectory of SNAP participation in similar geographic regions (for example, the South or the Northeast) may be more similar to one another than the trajectory of SNAP participation farther away.

Finally, in column 6 of Tables 2-4, we add state-specific linear time trends to the previous specification. Thus, this specification is the most rigorous model specification, in that it allows for heterogeneity along three dimensions. That is, this specification allows each state to have its own time-varying trends, rather than imposing the restriction that states evolve identically over the 22 years in the sample.

Comparing across columns 4-6 of Tables 2-4—all of which include the full sets of family- and state-level control variables—we see that for both the enrollment models, the effect sizes are smallest for specification 1 (column 4), largest for specification 2 (column 5), and intermediate between these two in specification 3 (column 6). In the family-level enrollment model (Table 2), the standard error of the minimum-wage coefficient is smaller than in the other two specifications. Standard errors on the other variables are much smaller in specifications 2 and 3 than in specification 1.

A concern with specifications 2 and 3 is that trend controls, such as state linear trends, may incorrectly absorb some of the delayed impact of a minimum wage (Wolfers 2006). However, when we exclude state linear trends but do include division-specific time effects, the results are essentially the same, indicating that the issue raised by Wolfers does not affect our results. Another concern is that more saturated models, such as specification 3, use less of the statistical variation, which could reduce the statistical power of the results. However, the standard errors for our more saturated models are not higher—and are lower in some cases—than for the less saturated models. Overall, this evidence supports our use of the saturated model as the preferred model specification.

The last columns in each of Tables 2-4, which include the full set of relevant control variables, are the preferred models. The estimated enrollment regressions at both the family and state levels in these models show large and statistically significant coefficients. The estimated minimum wage effect in the expenditures regressions—for which we have only state-level data—is also large and statistically significant (Table 4).

The coefficient of the log minimum wage is somewhat higher (-0.042, as in Table 2, column 6) in the family-level enrollment analysis than the coefficient in the state-level enrollment analysis (-0.031, as reported in Table 3, column 6). The difference between these two coefficients is almost entirely attributable to the fact that the state-level regression is not weighted by each state's population.[19] This is deliberate: By not weighting the state-level models, we obtain a treatment effect (that is to say, the effect of a minimum wage change) representative of the average state rather than the average person. The treatment effect then corresponds to the level at which policy occurs —whether because a new minimum-wage increase is enacted by state government, or because federal legislation affects different states to varying degrees depending upon their initial wage floors.

If, instead, our primary interest were the impact of a minimum wage change on the average individual, we would designate the state population, as analytic weights, and obtain a coefficient better suited for such inference. Furthermore, the coefficient should be closer in magnitude to the estimate from the family-level regression. Indeed, when we run a population-weighted analysis at the state level, the estimated minimum-wage coefficient increases in magnitude from -0.031 to -0.044, and becomes more precisely estimated. This estimate is very close to the family-level estimate of -0.042.

4.5 Pre-trend Falsification Check

As noted above, recent minimum wage research highlights a common flaw in previous studies: failure to verify that the outcome variable is free of pre-existing trends (see, for instance, Allegretto et al. [2013a]). If, for example, SNAP activity was already trending down in states that raised their minimum wages before these changes came into effect, our regression analysis could (mistakenly) attribute that reduction to the minimum wage. We check for such pre-trends by introducing variables that represent the prior year's value, or lead, of the minimum wage. If the model estimates the minimum wage to have an effect on the outcome variable before the wage change went into effect, this suggests that an unobserved factor, rather than the minimum wage change itself, caused the change in SNAP activity.

We test for pre-trends by including a one-year lead in all three specifications discussed above. The results are reported in Table 5. We find that the lead terms are small and positive and not statistically significant, indicating that the concurrent minimum wage—not the wage level in prior periods—is driving the observed changes in SNAP outcomes. The coefficient (standard error) on the lead term in our preferred family-level enrollment regression is 0.011 and not significant (column 3), while the coefficient and standard error of the contemporaneous minimum wage remains the same as in the previous tables. In the state-level preferred enrollment regression, the coefficient of the lead term is again small, 0.07, and it is not significant (column 6). We obtain similarly small and insignificant coefficients on the leading term in the weighted state regression, discussed above (not shown). The corresponding coefficient on the lead term in the state-level expenditure regression is 0.16 and is not significant (column 9). The positive point estimates on these lead terms results not only rule out distorting negative pre-trends, but also suggest that our main results may underestimate the true effects.

5. Results

5.1 Estimated Minimum Wage Effects on SNAP Enrollment and Expenditures

Table 6 shows the estimated parameter of interest—the coefficient of the minimum wage—for the preferred model of each type. Coefficients on the minimum wage variable are not directly comparable across models because all four models have a different functional form. To understand and compare these estimates, we compute the change in SNAP activity predicted for a particular wage scenario. The final two columns in Table 6 answer the question: What would be the expected change in SNAP activity in response to a 10 percent increase in the minimum wage? The answer to this question varies with the value of the input parameters. In Table 6, we calculate the percentage decrease in enrollment or expenditures predicted for the average state with a minimum wage of $7.25 in 2014. The state-level SNAP expenditure model, which is a constant-elasticity model, conveys elasticity information directly for the change in expenditures per capita in the state.

According to this model, a 10 percent increase in the minimum wage would result in a 1.9 percent reduction in SNAP expenditures.[20] The two enrollment models are somewhat more precisely estimated than the expenditure model. The state-level enrollment model finds that a 10 percent minimum wage increase in a low-wage state is associated with a 2.35 percent decrease in SNAP enrollment in that state. The family-level linear probability model predicts a somewhat greater elasticity for low minimum wage states: an increase of 10 percent in the federal minimum would result in a 3.17 percent decline in SNAP enrollment.[21] As discussed in the previous section, population-weighted estimates from the state-level enrollment model predict enrollment reductions that are slightly larger still. We treat this range of elasticity estimates as an upper and lower bound on enrollment impacts. In practice, the lower-magnitude estimate can be interpreted as the expected response in the "average state" to a minimum-wage increase, and the higher-magnitude estimate as the expected response of among marginally eligible individuals to a minimum-wage increase.

5.2 Interactions between SNAP and Medicaid

Safety net programs are often administered through joint local offices and state eligibility for one program might interact with eligibility for another (See, for example, Schmidt et al. 2013 and Dorn et al. 2013.) To test whether such interactions affect our results, we also include among our control variables two measures of state-level Medicaid income eligibility thresholds. These measures are proxies for variation across states and time in Medicaid program generosity toward low-income workers and families. Since Medicaid is the single largest budget item for most states, these generosity variables may also be representative of broader changes in states' policy environments.

The eligibility cut-offs—one of which is for employed parents of dependent children, and the other for jobless parents of dependent children—are only available after 2001, and thus somewhat restrict the range of our sample. Nonetheless, including these variables in the regression specifications does not appreciably affect the magnitude of the variable of interest (the log of the minimum wage) or of the other main state-level control variables. The Medicaid controls themselves are of trivial magnitude and are imprecisely estimated. The final regression estimates we display (Tables 2-4) do not include these policy controls.[22]

5.3 Predicted Impacts of a $10.10 Minimum Wage

What would be the predicted change for the SNAP program if the federal minimum were raised to $10.10 in a single step beginning in 2014? An increase to $10.10, if enacted at the start of 2014, would have represented a 39.3 percent wage increase in a $7.25 minimum wage state, an increase of 26.3 percent in states, such as California, that had a minimum wage of $8, and an 8.4 percent increase in Washington State, which had the highest state minimum wage in the nation--$9.32 (Wages and Hours Division 2014). The increase to $10.10 would be outside the sample range of our data in levels, but not as a percent of the median wage. The increase would raise the ratio of the federal minimum wage to the median full-time wage from about 38 percent to 50 percent. This increase is well within historical experience: In the 1950s to the 1970s, this ratio varied between 45 and 55 percent. Moreover, the 39.3 percent increase in the federal minimum wage is comparable to the 40.8 percent federal increase in 2007-2009.

Our calculations account for the fact that 21 states maintained higher minimum wages than $7.25 at the beginning of 2014. The impact on SNAP activity will be lower in high minimum wage states. We calculate state by state the percentage wage change that would result from a $10.10 minimum wage and apply the parameters from each of the three models above to compute the expected decrease in SNAP activity for each state. In this exercise, we use states' current (2014) minimum wage levels and assume as a baseline the 2012 levels of SNAP enrollment and expenditure (2012 is the most recent year for which SNAP data were available). For each state, we apply estimated elasticities to 2012 SNAP enrollment and expenditures, respectively.[23]

We estimate that slightly more than 56 percent of the decrease in expenditures and about 59 percent of the decrease in enrollment would occur in states with minimum wages of $7.25 in 2014. In 2012, these states were home to 46 percent of the American population and accounted for a roughly equivalent percentage of total national SNAP expenditures.

Table 7 summarizes the predicted declines in SNAP activity for the nation as a whole that would result from the direct and indirect effects of the minimum wage increase. Enrollment would fall between 3.1 million persons and 3.6 million persons, representing 7.5 percent to 8.7 percent of current enrollment. The anticipated reduction in program expenditures would be nearly $4.6 billion, or 6.1 percent of program expenditures.

There are, of course, other possibilities for minimum wage legislation. Table 8 shows the expected SNAP changes for the United States under a variety of wage scenarios, calculated using the state-level models. If states were not able to set their minimum wages independently, such that all states were constrained by the federal minimum of $7.25, SNAP would be received by about 514,000 more people across the United States, at an additional program cost of nearly three-quarters of a billion dollars. In contrast, the effects of a higher minimum wage proposal—a federal wage floor of $11 per hour—would decrease enrollment in SNAP by more than 10 percent and decrease program costs by 8.3 percent.

6. Conclusion

An extensive body of literature examines employment effects of the minimum wage. A much smaller set of studies examines how the minimum wage affects poverty, and only a handful of papers examine the effects of the minimum wage on the EITC. Our analysis is the first to examine the effects of the minimum wage on SNAP.

Our findings indicate that increased earnings from minimum wage changes do reduce SNAP enrollments and expenditures. We estimate that increasing the federal minimum wage to $10.10 (and indexing it to the CPI) would save taxpayers nearly $4.6 billion per year, equivalent to 6.1 percent of SNAP expenditures in 2012, the last year for which data are available. Over a 10-year period, the estimated savings amount to nearly $46 billion. Using the Congressional Budget Office's calculations of how much the total wage bill would increase with a minimum wage increase to $10.10 our findings imply that the decline in overall SNAP spending equals about 15 percent of the total resulting increase in wages. The amount and distribution of this offset are of considerable interest. Minimum wage beneficiaries who come from working families already well above the poverty line would not see any offset, while those who are currently considerably below the poverty line will see larger offsets.

Our paper contains several limitations. First, the findings do not take fully into account possible interactions among SNAP, the EITC, and Medicaid. The eligibility cutoffs among these programs are quite different, suggesting that such interactions may be minor. Nonetheless, the joint effects can only be determined by further research using a causal model. Second, it would be useful to know the distribution of SNAP reductions along the wage distribution. These items constitute an agenda for further research.

References

Aaronson, Daniel, Eric French and Isaac Sorkin. 2013. "Firm Dynamics and the Minimum Wage: A Putty-Clay Approach." Discussion Paper No. 2013-26. Research Department, Federal Reserve Bank of Chicago. www.chicagofed.org/webpages/publications/working_papers/2013/wp_26.cfm.

Allegretto, Sylvia, Arindrajit Dube and Michael Reich. 2011. "Do Minimum Wages Really Reduce Teen Enrollment? Accounting for Heterogeneity and Selectivity in State Panel Data." *Industrial Relations* 50, 2: 205-240.

Allegretto, Sylvia, Arindrajit Dube, Michael Reich and Ben Zipperer. 2013a. "Credible Research Designs for Minimum Wage Studies." Working Paper 148-13. University of California, Berkeley. Institute for Research on Labor and Employment.

Allegretto, Sylvia, Marc Doussard, Dave Graham-Squire, Ken Jacobs, Dan Thompson and Jeremy Thompson. 2013b. "Fast Food, Poverty Wages: The Public Cost of Low-Wage Jobs in the Fast-Food Industry." University of California, Berkeley, Center for Labor Research and Education.

Bitler, Marianne and Hilary Hoynes. 2013. "The More Things Change, the More They Stay the Same: The Safety Net, Living Arrangements, and Poverty in the Great Recession." Working Paper 19449. Cambridge, MA: National Bureau of Economic Research.

Congressional Budget Office. 2012. "The Supplemental Nutrition Assistance Program." Washington, D.C.

Congressional Budget Office. 2014. "The Effect of a Minimum-Wage Increase on Employment and Family Income." Washington, DC.

Cooper, David. 2014. "Raising the Federal Minimum Wage to $10.10 Would Save Safety Net Programs Billions and Help Ensure Businesses Are Doing Their Fair Share." Issue Brief # 387. Washington, DC: Economic Policy Institute. http://www.epi.org/publication/safety-net-savings-from-raising-minimum-wage/

Dube, Arindrajit. 2013. "Minimum Wages and the Distribution of Family Income." Unpublished working paper. https://dl.dropboxusercontent.com/u/15038936/Dube_MinimumWagesFamilyIncomes.pdf.

Dube, Arindrajit. 2014. "The Poverty of Minimum Wage 'Facts'." Arindrajit Dube Blog. January 22. arindube.com/2014/01/22/the-poverty-of-minimum-wage-facts/

Dube, Arindrajit, William Lester and Michael Reich. 2010. "Minimum Wage Effects Across State Borders: Estimates from Contiguous Counties." *Review of Economics and Statistics* 92, 4: 945-64.

Dube, Arindrajit, William Lester and Michael Reich. 2014. "Minimum Wage Shocks, Employment Flows and Labor Market Frictions." Revise and resubmit, *Journal of Labor Economics.*

Ganong, Peter and Jeffrey Liebman. 2013. "The Decline, Rebound, and Further Rise in SNAP Enrollment: Disentangling Business Cycle Fluctuations and Policy Changes." NBER Working Paper 19363.

General Accounting Office (GAO). 2012. "Supplemental Nutrition Assistance Program: Improved Oversight of Eligibility Expansions Needed." Report GAO-12-670. gao.gov/assets/600/593070.pdf

Kasy, Maximilian 2014. "Who Wins, Who Loses? Tools for Distributional Policy Evaluation." Economics Department Working Paper, Harvard University. scholar.harvard.edu/files/kasy/files/whowinswholoses.pdf

Lee, David, and Emmanuel Saez. 2012. "Optimal Minimum Wage Policy in Competitive Labor Markets." *Journal of Public Economics* 96, 9: 739–49.

Leigh, Andrew 2010. "Who Benefits from the Earned Income Tax Credit? Incidence among Recipients, Coworkers and Firms." *The BE Journal of Economic Analysis and Policy* 10.

Meyer, Bruce, Wallace Mok and James Sullivan. 2009. "The Under-Reporting of Transfers in Household Surveys: Its Nature and Consequences." Cambridge, MA: NBER Working Paper 15181.

Mulligan, Casey. 2012. *The Redistribution Recession: How Labor Market Distortions Contracted the Economy.* New York: Oxford University Press.

Neumark, David, and William Wascher. 1992. "Employment Effects of Minimum and Subminimum Wages: Panel Data on State Minimum Wage Laws." *Industrial and Labor Relations Review* 46, 1: 55–81.

Neumark, David, and William Wascher. 2011. "Does a Higher Minimum Wage Enhance the Effectiveness of the Earned Income Tax Credit?" *Industrial and Labor Relations Review* 64, 4: 712–46.

Neumark, David, Ian Salas and William Wascher. 2014. "Revisiting the Minimum Wage and Employment Debate: Throwing out the Baby with the Bathwater?" *Industrial and Labor Relations Review* 67(Supplement): 608-48.

Page, Marianne, Joanne Spetz, and Jane Millar. 2005. "Does the Minimum Wage Affect Welfare Caseloads?" *Journal of Policy Analysis and Management* 24, 2: 273–95.

Rosenbaum, Dorothy. 2013. "The Relationship between SNAP and Work Among Low-Income Households." Washington, DC: Center on Budget Policies and Priorities. http://www.cbpp.org/files/1-29-13fa.pdf

Rothstein, Jesse. 2010. "Is the EITC as Good as an NIT? Conditional Cash Transfers and Tax Incidence." *American Economic Journal: Economic Policy* 2, 1: 177–208.

Schmidt, Lucie, Lara Shore-Sheppard and Tara Watson. 2013**.** "The Effect of Safety Net Programs on Food Insecurity," NBER Working Paper 19558.

Smeeding, Timothy, Dean Jolliffe and Laura Tiehen. 2013. "The Effect of SNAP on Poverty." Discussion Paper DP2013-06. University of Kentucky. Center for Poverty Research.

Trippe, Carole and Jessica Gillooly 2010. "Non–Cash Categorical Eligibility for SNAP: State Policies and the Number and Characteristics of SNAP Households Categorically Eligible Through Those Policies: Final Memo." Washington, DC: Mathematica Policy Research. http://www.mathematica-mpr.com/~/media/publications/PDFs/nutrition/non-cash_snap.pdf

U.S. Department of Agriculture. 2013. "Supplemental Nutrition Assistance Program (SNAP)," http://www.fns.usda.gov/snap/eligibility (last accessed February 2014).

Wage and Hours Division. 2014. "Minimum Wage Laws in the States – January 1, 2014." U.S. Department of Labor (February).

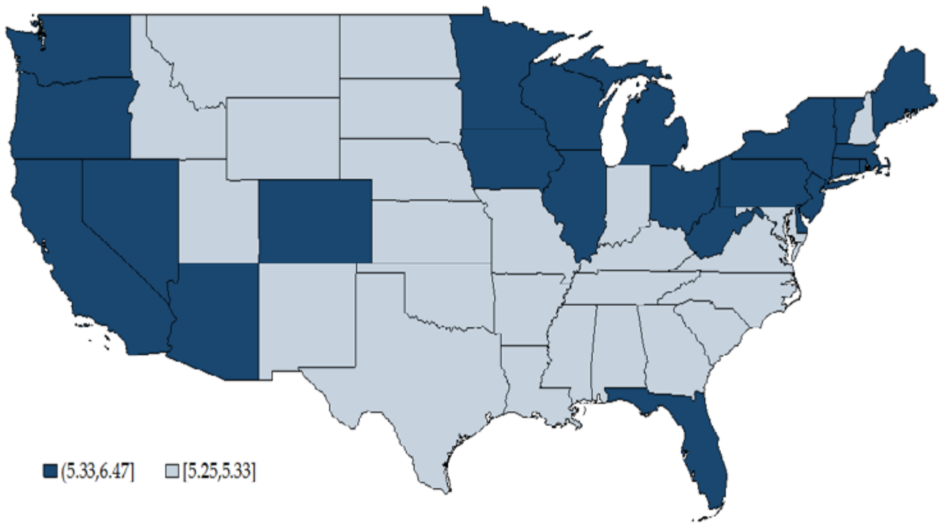
West, Rachel and Michael Reich. 2014. "A Win-Win for Working Families and State Budgets: Pairing Medicaid Expansion with a $10.10 Minimum Wage." Washington, DC: Center for American Progress, www.americanprogress.org/issues/poverty/report/2014/10/16/97672/a-win-win-for-working-families-and-state-budgets.

Wolfers, Justin. 2006. "Did Unilateral Divorce Laws Raise Divorce Rates? A Reconciliation and New Results." *American Economic Review* 96, 5: 1802-20.

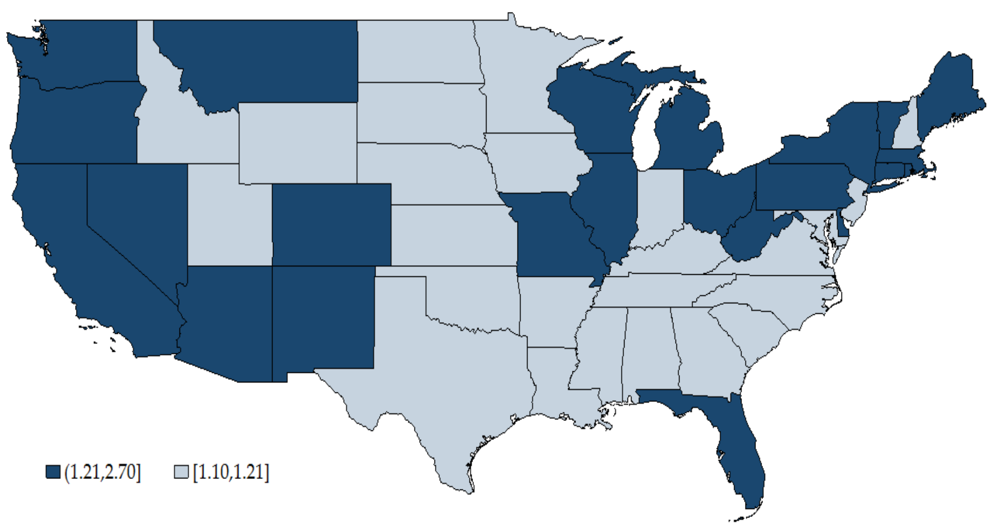
Zipperer, Ben. 2014. "Essays on the Minimum Wage." Unpublished Ph. D. Dissertation. Department of Economics, University of Massachusetts, Amherst.

Figure 1 High versus low minimum wage states during 1990–2012: Means and variances

A. Minimum wage means



B. Minimum wage variances



Note: State means and variances calculated using annual state minimum wage data over 1990–2012. The shading on the maps partitions the states into above- and below-median values.

Source: Sylvia Allegretto et al. 2013. “Credible Research Designs for Minimum Wage Studies.” Working Paper 148-13: University of California, Berkeley, Institute for Research on Labor and Employment.

Table 1

Descriptive Statistics

Average across states	1990 to 2012		2012 only	
	Mean	Standard Deviation	Mean	Standard Deviation
SNAP enrollment rate	9.1%	3.6%	13.5%	3.7%
SNAP expenditures (thousands)	$585,970	$832,255	$1,467,863	$1,620,768
State minimum wage	$5.50	$1.20	$7.51	$0.45
Federal minimum wage	$5.33	$1.05	$7.25	-
Unemployment rate	5.7%	1.9%	7.3%	1.7%
Median family income	$49,250	$11,374	$60,853	$8,985
Employment to population ratio	70.3%	4.9%	67.0%	5.0%

Average values across 50 states and Washington, D.C. All states are equally weighted. As noted above, we count as a family unit any individual residing on his or her own; two or more persons residing together who do not belong to a family in the March CPS sample are constructed as one family in our analysis.

Table 2

SNAP Enrollment: Family-Level, Linear Probability Model

	(1)	(2)	(3)	(4)	(5)	(6)
Log Minimum Wage	0.017	-0.032	-0.036*	-0.028*	-0.049***	-0.042***
	(0.014)	(0.020)	(0.021)	(0.014)	(0.017)	(0.009)
Unemployment Rate (/100)				0.275*	0.297***	0.280***
				(0.161)	(0.076)	(0.082)
Log Median Income				-0.077***	-0.055***	-0.039***
				(0.014)	(0.012)	(0.011)
Employment to Population Ratio				-0.238***	-0.250***	-0.239***
				(0.054)	(0.04)	(0.038)
N	1,242,022	1,242,022	1,242,022	1,242,022	1,242,022	1,242,022
State FE		Y	Y	Y	Y	Y
Year FE		Y	Y	Y		
Census division x year FE					Y	Y
State-specific linear trends						Y
Family-level controls*			Y	Y	Y	Y

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

Robust standard errors in parentheses. Observations clustered at the state level. All regressions include a constant term. Estimation includes CPS probability weights. Outcome variable is binary (equal to 1 if family is enrolled in SNAP). Annual data from March CPS (1990-2012) for all states except Alaska and Hawaii, plus Washington, DC. Family-level controls include family size, race and marital status of the family head, presence of children, and presence of an adult male.

Table 3

SNAP Enrollment: State-Level, Linear Regression

	(1)	(2)	(3)	(4)	(5)	(6)
Log Minimum Wage	0.031***	-0.007	-0.003	-0.019**	-0.035***	-0.031**
	(0.005)	(0.010)	(0.009)	(0.009)	(0.012)	(0.012)
Unemployment Rate (/100)			0.715***	0.401***	0.370***	0.339***
			(0.060)	(0.063)	(0.077)	(0.083)
Log Median Income				-0.081***	-0.073***	-0.061***
				(0.011)	(0.013)	(0.013)
Employment to Population Ratio				-0.183***	-0.222***	-0.248***
				(0.039)	(0.039)	(0.038)
N	1,127	1,127	1,127	1,127	1,127	1,127
State FE		Y	Y	Y	Y	Y
Year FE		Y	Y	Y		
Census division x year FE					Y	Y
State-specific linear trends						Y
Family controls*			Y	Y	Y	Y

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

Robust standard errors in parentheses. All regressions include a constant term (not shown). Annual data from BEA NIPA tables (1990-2012) for all states except Alaska and Hawaii, plus Washington, DC. Family controls include the share of households with children and the racial composition of the population.

Table 4

SNAP Expenditures: State-Level, Linear Regression

	(1)	(2)	(3)	(4)	(5)	(6)
Log Minimum Wage	1.567***	-0.097	-0.062	-0.121	-0.203**	-0.190*
	(0.064)	(0.082)	(0.073)	(0.075)	(0.103)	(0.103)
Unemployment Rate (/100)			5.833***	5.292***	5.152***	4.313***
			(0.408)	(0.464)	(0.576)	(0.628)
Log Median Income				-0.437***	-0.417***	-0.294***
				(0.080)	(0.086)	(0.078)
Employment to Population Ratio				-0.040	-0.220	0.244
				(0.261)	(0.26)	(0.24)
N	1,127	1,127	1,127	1,127	1,127	1,127
State FE		Y	Y	Y	Y	Y
Year FE		Y	Y	Y		
Census division x year FE					Y	Y
State-specific linear trends						Y
Family controls*			Y	Y	Y	Y

* p<0.1, ** p<0.05, *** p<0.01
Robust standard errors in parentheses. All regressions include a constant term (not shown). Outcome variable is the natural log of state SNAP expenditures per capita, 1990-2012. Annual data from March CPS (1990-2012) for all states except Alaska and Hawaii, plus Washington, DC. Family controls include the share of households with children and the racial composition of the population.

Table 5

Pre-trends Test on Leading Coefficients

	SNAP Enrollment (Family-Level)			SNAP Enrollment (State-Level)			SNAP Expenditures (State-Level)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Log minimum wage	-0.028*	-0.049***	-0.042***	-0.029**	-0.030*	-0.027*	-0.189	-0.282**	-0.281**
	(0.015)	(0.018)	(0.009)	(0.014)	(0.017)	(0.016)	(0.122)	(0.136)	(0.119)
One-year lead of log minimum wage	0.011	0.012	0.011	0.018	-0.002	0.007	0.117	0.145	0.161
	(0.017)	(0.024)	-0.022	(0.014)	(0.018)	(0.017)	(0.124)	(0.133)	(0.11)
N	1,242,022	1,242,022	1,242,022	1,078	1,078	1,078	1,078	1,078	1,078
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y			Y			Y		
Division x year FE		Y	Y		Y	Y		Y	Y
State-specific linear trends			Y			Y			Y

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

Estimation includes all states except Alaska and Hawaii, plus Washington, DC. All regressions include the following state-level covariates: unemployment rate, median income, and employment to population ratio. Family-level regressions include additional controls for family size, race and marital status of the family head, presence of children, and presence of an adult male. State-level regressions include the share of households with children and the racial composition of the state population.

Table 6

Comparison of national SNAP predictions for a 10 percent increase in the federal minimum wage

Model	Level	Regression Type	Predicted Outcome		Coefficient of Log(Minimum Wage)	Effect of a 10% Increase in the Minimum Wage on: (a)	
			Variable	Form of Variable	*(Standard Error)*	Total Enrollment	Total Expenditures
1	Family	Linear Probability	Enrollment	binary (enrolled=1)	-0.042*** (0.008)	-3.17%	NA
(2)	State	Linear Regression (OLS)	Enrollment	state enrollment rate (%)	-0.031*** (0.012)	-2.35%	NA
(3)			Expenditures	log(state expenditures per capita)	-0.190* (0.103)	NA	-1.90%

* p<0.1, ** p<0.05, ***p<0.01
Predicted changes are calculated for the average state with a minimum wage of $7.25 in 2014.

Table 7

Comparison of national SNAP predictions under a $10.10 minimum wage

Model	Enrollment (persons)			Expenditures (millions of dollars)		
	Current (2012)	Predicted	Change	Current (2012)	Predicted	Change
Family Enrollment (Linear Probability)	41,866,195	38,243,051	-3,623,144	$74,861	$68,332	-$6,529
State Enrollment (OLS)		38,745,435	-3,120,759		$69,244	-$5,617
State Expenditures (OLS)		39,304,135	-2,562,060		$70,305	-$4,556

Calculations use 2014 state minimum wages and the most recent SNAP data from 2012. They assume that per-enrollee expenditures remain constant.

Table 8

Summary of SNAP participation and expenditures under wage scenarios

If all states had minimum wages of:	Enrollment (persons)		Expenditures (millions of dollars)	
	Predicted	Change	Predicted	Change
Recent Levels (2012)	41,866,195		$74,861	
$7.25	42,380,520	514,326	$75,604	$743
$8.00	41,423,919	-442,276	$74,209	-$652
$9.00	40,148,451	-1,717,744	$72,350	-$2,511
$10.00	38,872,982	-2,993,212	$70,490	-$4,371
$10.10	38,745,435	-3,120,759	$70,305	-$4,556
$11.00	37,597,514	-4,268,681	$68,631	-$6,230

Calculations use state-level enrollment model coefficient.

Endnotes

[1] For this analysis, we model the effect of adopting a $10.10 federal wage floor in 2014. We do not consider an increase in the sub-minimum wage of tipped workers. The so-called tipped minimum wage has not increased since 1991. Raising this wage would increase the estimated SNAP savings by an unknown—but likely substantial—amount.

[2] The Congressional Budget Office estimates that workers currently earning between $10.10 and $11.50 per hour would see their wages rise if the federal minimum wage increased to $10.10 (CBO 2014).

[3] The effects of minimum wages on employment continue to be debated. See, for example, Dube, Lester and Reich (2010), Neumark, Salas and Wascher (2014), and Allegretto et al. (2013a).

[4] As Dube explains, the simulation approach underestimate stems from a number of unwarranted assumptions, including the range of actual wage increases and the accuracy of wage data in the Current Population Survey (Dube 2014). An econometric approach, such as this study develops, does not require these assumptions.

[5] Zipperer (2014, chapter 3) examines the effects of minimum wages on enrollment in a panoply of public aid programs. In personal communication, Zipperer reports that his methods and results for CPS-based family-level enrollments are similar to ours, but not identical. We go beyond Zipperer in using state-level comparisons and administrative data to estimate minimum wage effects upon program expenditures as well as enrollments.

[6] For more on this issue, see Allegretto et al. (2013) and Neumark et al. (2014).

[7] In many states, one-stop offices administer SNAP, TANF, Medicaid, and other public assistance programs. It therefore seems likely that interactions exist among these programs as well as others, such as Unemployment Insurance. Below we examine the interaction between TANF and SNAP and discuss the role of unemployment in determining SNAP enrollments. We are not aware of any studies that link Medicaid receipt with SNAP receipt. We address the effects of minimum wages on Medicaid receipt in a separate paper (West and Reich 2014).

[8] Mulligan (2012) argues that changes in SNAP policy prior to and during the Great Recession made SNAP benefits more attractive relative to supplying labor. Ganong and Liebman (2013) respond that the timing of SNAP policy and enrollments changes represented responses to the recession. CBO (2012) estimates that about two-thirds of the changes in SNAP expenditure are associated with changes in the number of recipients and one-third with changes in the benefits received when recipients' incomes change.

[9] The Department of Agriculture (see note 12) maintains a database that tallies the adoption of policy differences by state and year. However, the database does not separate the policies that affect non-elderly, non-disabled households differently from the entire SNAP universe, limiting its usefulness for statistical analysis in this paper.

[10] The salience of recession-based policy changes suggests including a control for recession years in our statistical estimates. In personal communication, Zipperer reports that he does include such a control and finds even stronger effects of minimum wages on reducing SNAP enrollments.

[11] In Ganong and Liebman, Appendix Table 2, only two of eight policy changes significantly affect SNAP take-up rates or enrollment. As they note in footnote 24: "An extensive literature estimates the effect of state SNAP policies on enrollment rates. Most papers find insignificant effects for most policies." Ganong and Liebman do find that an index that weights each of these eight policies equally does yield statistically significant results. They do not, however, justify their weights and many other policy changes are not included in it. Given the difficulties involved, we do not use the database to construct a quantitative index of state policies.

[12] U.S. Department of Agriculture, SNAP Policy Database, www.ers.usda.gov/data-products/snap-policy-database.

[13] The seven early adopters are AZ, ME, MN, OR, TX, WA, and WI. The nine late refusers are AK, AR, IN, MI, SD, TN, UT, VA, and WY.

[14] In order to more fully capture the number and characteristics of SNAP recipients, we depart somewhat from the Census Bureau's definition of a family unit, which is "two people or more (one of whom is the householder) related by birth, marriage, or adoption and residing together." U.S. Bureau of the Census, "Current Population Survey Definitions: Family," available at http://www.census.gov/cps/about/cpsdef.html (last accessed February 2014). First, unlike the Census Bureau, we count as a family unit any individual residing on his or her own. We do so because single individuals can—and do—receive SNAP benefits. Excluding them, would fail to make the analysis reflective of the population at large. Second, two or more persons in the March CPS sample residing together also constitute a family unit in our analysis, even if not identified as such according to the Census definition. Our definition therefore includes partners who may not be married legally but are a family in all other senses of the word. We include these persons as a family unit on the presumption that more often than not, resources are shared across members of the same dwelling even if these members are not genetically related, such as is likely the case with cohabitating partners.

[15] Three data sets include information about both income and participation in the food stamp program (Meyer et al. 2009). The Survey of Income and Program Participation, or SIPP, which is conducted in intermittent years, has the advantage of following the same individuals over a period of time. In other words, it is a longitudinal data set. It also has the advantage of containing monthly data. However, the sample size of the SIPP is not sufficient for analyzing variations in state-level minimum wages. The sample size of the Panel Study of Income Dynamics (PSID) is also too small for our analysis. The March CPS has the advantage of a much larger sample size, and it is conducted annually without any breaks in time. It has the disadvantage of being a cross-sectional data set, so we cannot follow the same individuals over more than one year. On net, the March CPS is much more suitable for our study.

[16] Meyer et al. 2009 report that similar under-reporting is present across four other household datasets and nine other transfer programs. Nonresponse rates for earnings have also increased in the CPS.

[17] Response rates have fallen at a steady pace, indicating that state-specific linear time trend controls will absorb different under-reporting rates by state. Under-reporting is not an issue when we use administrative data.

[18] At the state level, BEA data are identical to USDA's administrative reports.

[19] A small amount of the difference between the family- and state-level models may also be attributable to the more minimal set of demographic control variables in the state-level model. However, controlling for the average of all demographic variables that enter the family-level model does not alter the state-level estimated effect to within four significant decimal places.

[20] This result is similar to Dube's result for poverty reduction (Dube 2013).

[21] Strictly, the family level linear probability model predicts the percentage-point decrease in the probability that an individual family will receive SNAP payments. When applied to a large number of families, however, we can interpret the coefficient as a decrease in the mean of enrollment—that is, a decrease in the enrollment rate—by applying the law of iterated expectations.

[22] SNAP may also interact in important ways with the Unemployment Insurance program. However, state and time-based variations in the UI program correlate with state unemployment rates, which we include as a control. On the other hand, SNAP benefits are available to unemployed workers who are not eligible for unemployment insurance or whose benefits have run out. These are issues for further research.

[23] We generate expenditure predictions from the enrollment models—and, conversely, generate enrollment predictions from the expenditure model—by assuming that expenditures per enrolled family remains the same before and after the minimum wage change. We are thus assuming that average treatment effects over the past twenty years would be pertinent to an increase in the minimum to $10.10 in 2014. In practice, this is likely to yield a conservative estimate—that is, to underestimate the decrease in SNAP activity. Average SNAP benefits per family will also decrease as many families that remain eligible for SNAP experience income gains.