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Abstract

This paper investigates the effect that minimum wage policy has on enrollment in public assistance programs, specifically the Supplemental Nutritional Assistance Program, SNAP. If raising the minimum wage decreases enrollment in SNAP, this could uncover a method to reduce spending without eliminating programs. Using a time-demeaned model to account for fixed effects, I take advantage of the variation in the minimum wage in the 50 states between 1998 and 2014. I estimated that on average an increase in minimum wage in a prior year results in a decrease in SNAP participation by 3.95%.

Keywords

Minimum Wage, Public Assistance, Supplemental Nutritional Assistance Program, SNAP

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By Victoria Perez-Zetune

Abstract. This paper investigates the effect that minimum wage policy has on enrollment in public assistance programs, specifically the Supplemental Nutritional Assistance Program, SNAP. If raising the minimum wage decreases enrollment in SNAP, this could uncover a method to reduce spending without eliminating programs. Using a time-demeaned model to account for fixed effects, I take advantage of the variation in the minimum wage in the 50 states between 1998 and 2014. I estimated that on average an increase in minimum wage in a prior year results in a decrease in SNAP participation by 3.95%.

I. Introduction

Since 1939 the Fair Labor Standards Act established minimum wage policy to prevent erosion of consumer buying power by inflation and to ensure fair compensation for labor (Grossman). Proponents of raising the minimum wage argue that it reduces poverty and increases the standard of

living of low-income workers, while the opposition claims it has detrimental impacts on business, increases unemployment, and thus increases poverty. Various studies on the effect of minimum wage on unemployment have found either no impact or a small negative effect (Hoffman 2014; Sabia et al. 2012). An unexplored aspect of the consequences of a higher minimum wage is enrollment in public assistance programs, such as the Supplemental Nutritional Assistance Program, SNAP.

Previously named Food Stamps, SNAP is America's safety net to prevent hunger and improve nutritional intake. In 2012, more than 46 million low-income people were enrolled in SNAP on a monthly basis. A household must be at or below 130% of the poverty level according to federal

guidelines to qualify after deductions for monthly expenses including childcare, medical expenses, and housing (USDA). Evaluations of SNAP conclude that it successfully reduces poverty severity and improves health outcomes, and most full-time workers on minimum wage qualify for at least one public assistance program (Allegretto et al. 2013; Tiehen et al. 2012). The low minimum wage in the United States has a great societal cost. How does an increase in minimum wage affect enrollment in SNAP? Reich and West thus far is the only study to provide causal analysis of the minimum wage and SNAP enrollment, and they found that a 10% minimum wage increase reduces enrollment between 2.4 and 3.2% and overall program expenditure by 1.9% (Reich and West 2015). Establishing the relationship between the

minimum wage and public assistance enrollment contributes to the debate over raising the minimum wage.

The purpose of this paper is to establish further if a relationship between minimum wage and enrollment in SNAP exists. In the following section, I use a time-demeaned model to analyze the question, and the subsequent section will discuss the data collected. Section IV gives the evidence and results, and finally section V is the conclusion with a discussion of the findings and implication.

II. Modeling

Does an increase in minimum wage decrease enrollment in SNAP? Taking advantage of variation in minimum wage laws at a state level, I will examine changes in minimum wage over time and the corresponding impact on enrollment in SNAP.

This would result in a balanced panel dataset, since the construction would be samples from the population over various years with the same units appearing in each time period. If enrollment falls as minimum wage rises, this provides evidence that an increase in minimum wage lowers total enrollment. With panel data, it is necessary to control for time-constant unobserved features that could be correlated with the explanatory variables in the model. A fixed effect transformation eliminates time-constant characteristics specific to individual states, such as geography or more importantly the impact of unobservable cultural attitudes towards public assistance programs that could affect enrollment. As seen below, a model that varies over time and category, state in this case, can be averaged over time for each state. By subtracting

the original model from the averaged, the result is a time-demeaned equation that has eliminated the fixed effect, the unobserved time-constant characteristics denoted by a_i .

Original equation: $y_{it} = \beta_1 x_{it} + a_i + \mu_{it}$

Averaged equation over time: $\bar{y} = \beta_1 \bar{x}_i + a_i + \bar{\mu}_i$

Difference: $y_{it} - \bar{y} = \beta_1 (x_{it} - \bar{x}_i) + (a_i - a_i) + (\mu_{it} - \bar{\mu}_i)$

Time-demeaned: $\dot{y}_{it} = \beta_1 \dot{x}_{it} + \dot{\mu}_{it}$

Using a fixed effect transformation, I am not concerned with variation among states that do not depend on time. If a state has a change in minimum wage, a dummy variable will capture this to see if the impact of the rise in minimum wage had an effect on enrollment that year. I will add a lag of this minimum wage dummy variable because the impacts of policies typically do not have an immediate effect. Other necessary explanatory variables that I must include in my model are

variables that impact enrollment in SNAP that change over time, such as unemployment.

Qualification to participate in SNAP depends on household income and the number of individuals in a household. If unemployment were to rise, household income would fall and enrollment in public assistance programs would increase. Another variable is population growth since a higher population would lead to a greater likelihood for more people to qualify for SNAP. Race and ethnicity should also be included in the model to account for demographic changes over time in different states. Finally, a time variable is necessary to capture changes in enrollment that occur due to time. This would result in the following time-demeaning model:

$$\begin{aligned}
\log(enrollment_{it}) &= \beta_0 + \delta_0 min\ddot{w}age_{it} \\
&+ \delta_1 min\ddot{w}age_{i\ t-1} + \beta_1 un\ddot{e}m_{it} \\
&+ \beta_2 \log(\Delta p\ddot{o}p_{it}) + \beta_3 bl\ddot{a}ck_{it} \\
&+ \beta_4 year + \mu
\end{aligned}$$

With the time-demeaning variables, an ordinary least squares regression can be estimated. If the estimated coefficient of the minimum wage or the estimated coefficient lag of minimum wage is statistically different from zero, this is evidence that minimum wage policy does affect enrollment in SNAP. If the two estimated coefficients are negative, this would be evidence indicating that a rise in minimum wage causes a decrease in enrollment, holding unemployment, population growth, and the percent of blacks in the state constant. If this were to be the estimated result, the null hypothesis would fail to be rejected, and the fact that minimum wage increases lead to a lower

enrollment in SNAP would be accepted as a causal relationship. Finding this result would further the question if minimum wage changes lower expenditure of public assistance programs due to the decrease in enrollment.

On the contrary, if the estimated coefficient of the minimum wage and the estimated coefficient of its lag are both statistically insignificant, the null would be rejected and lead to the conclusion that increases in the minimum wage result in no impact on enrollment in SNAP assuming that unemployment, population growth, and the percent of blacks in the state are unchanged. Similarly, finding statistical significance but positive coefficient estimates of the minimum wage and the estimated coefficient lag of the minimum wage would also lead to rejection of the null hypothesis

and give evidence that the opposite is true. Positive coefficient estimates would imply that a rise in minimum wage increases enrollment in SNAP.

Using this model is best because the minimum wage and enrollment in SNAP change over time and different states have their own wage legislation. Thus, the relationship between minimum wage policy and enrollment in public assistance programs can be seen both over time and in the different states. With panel data, the standard ordinary least squares regression does not make sense since unobservable, constant characteristics exist that are state specific. When only using two time periods, differencing can be implemented to eliminate such characteristics, but SNAP and minimum wage policy have existed for various years and it is preferable to take advantage of all

available data. Limiting the model to two years could influence the estimated coefficients because it could be a year when enrollment was abnormally high or low due to the time period. Since more than two years are being observed, a time-demeaning model is best.

III. Data

An ideal data set for this model would have information for all years that both minimum wage policy was put into effect and food stamps were created. Minimum wage policy was created in 1938, but food stamps were not a national program until 1974. Furthermore, in 1977 President Carter established eligibility requirements in the Food Stamps Act, so the years of 1974 to 1977 should be grouped to create a dummy variable in order to account for criteria changes in enrollment (USDA

2014). With data spanning 1974 to present day from all 50 states, I would collect the minimum wage of each state annually. SNAP enrollment is given as a monthly estimate, but I would want to know whether or not each person in the United States benefited from SNAP annually. I would want the exact unemployment rate for each state, including discouraged workers who are not measured since unemployment only counts individuals actively seeking a job. Additionally, demographic parameters for each state would be preferred over estimates. I would want to use exact population growth and the racial and ethnic composition of each state. Racial composition would be the actual percentage of African Americans in the state, and ethnic composition would be the actual percentage of Hispanics in the state. Lastly, I ideally would

include average household size because qualification for SNAP is based on income of the household, and a larger household income size has a greater likelihood of qualifying. Average household size could change over time at varying rates in different states.

I was unable to find data spanning all of the desired years; I was limited to 1998 to 2014. The United States Department of Agriculture Food and Nutrition Service provided enrollment in SNAP for each state as the average monthly participation. The U.S. Department of Labor Wage and Hour Division published the minimum wage for each state, excluding farming employment, from 1968 until 2014. The minimum wage was given as a dollar value in normal terms. The Department of Labor also provided estimates for unemployment rate

between 2010 and 2014; prior years were found in statistical abstracts of the Census. Both the population growth and percent of the state population that is black were found in the Census or Current Population Survey. The black population was given as a percent of the total state population, but population growth I calculated by subtracting the current population with the prior years and taking the natural log. Below is a table with a summary of the data collected from 1998 to 2014 and used in the model. I manipulated enrollment of SNAP by taking the natural log in order to interpret the changes as percent changes in enrollment.

Figure 1: Data Summary Table

Variable	Mean	Std Dev	Min	Max
Enrollment	593169.7	683886.5	22485	4349634
Log(enrollment)	12.703	1.159	10.02	15.28
Min Wage	6.09	1.27	1.6	9.32
Min Wage dummy	.3129	.4639	0	1
Min Wage dummy lagged	.3133	.4641	0	1
Unemployment rate	5.818	2.012	2.2	13.5
Log(pop _{growth})	8.99	4.81	-12.438	13.749
Black percent of pop	9.919	9.477	0.177	37.505

The biggest limitation of my data was my inability to find accurate average household size per state and the Hispanic population. Average household size by state was only published for 2000 and 2010. The amount of missing information did not allow me to include this variable in the model. A similar collection issue arose with Hispanic population due to changes in the Census. Major

changes in categories of race and ethnicity occurred in 2008 and 2010 leaving inaccuracy in measurements due to phrasing changes (Cohn 2010). Also, historic data were only collected every decade so I had to begin my data set in 1998 when I would have liked to begin in 1974 with the national Food Stamps Act. Not being able to include the full time range and more importantly two explanatory variables that I believe are significant can cause omitted variable bias.

Another limitation of my data is that as I mentioned unemployment only captures individuals actively seeking a job. Unemployment excludes discouraged workers, people who are not looking for a job due to the belief that there are no jobs available. Furthermore, unemployment measures people who have job searched in the last month and

do not have employment therefore “marginally attached workers” are not considered. “Marginally attached workers” are those who have attempted to find a job in the last year but not the past month (Chapman and Ettlinger 2004). Unemployment does not account for hours worked, so part-time workers who desire full-time positions are uncouned.

Unemployment is a flawed measure in its ability to capture the economic situation of laborers accurately. Furthermore, Census data are collected through questionnaires mailed to households, and self-identification bias could occur for racial and ethnic categories. Also the data collected annually are estimates, not population parameters. Not having the ideal data, all desired variables, and the potential year span limits the validity and accuracy of my study.

IV. Evidence

Implementing a time-demeaning model with an ordinary least squares regression, the following model resulted in the estimation:

$$\begin{aligned} \log(enollment_{it}) &= \beta_0 + \delta_0 minwage_{it} + \delta_1 minwage_{it-1} \\ &\quad + \beta_1 unem_{it} + \beta_2 \log(\Delta pöp_{it}) \\ &\quad + \beta_3 black_{it} + \beta_4 year + \mu \end{aligned}$$

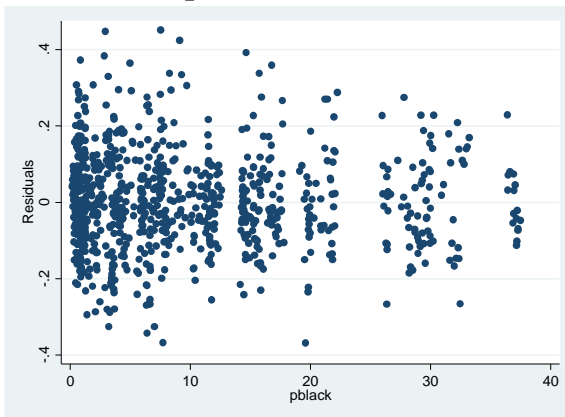
Figure 2: Coefficient estimate table

Variable	Coefficient Estimate
Min dummy	-.00794
Min lag dummy*	-.03948
Unem*	.04911
Log(Δpop)*	.00306
% Black	-.00095
Year*	.05977
Constant	-107.49
* Denotes statistical significance at a 1% level	

Surprised by the statistical insignificance of the coefficient estimate of *black* that had a p-value of .485, I plotted the residuals against *black* to

check if there was a pattern in the variance of the error term. When the variance in the error term is not constant, the problem of heteroskedasticity arises. Although heteroskedasticity does not impact the estimated coefficient value, statistical inference is not possible due to inaccurate p-values and t-statistics. The scatterplot below shows the graphical result, and the variance appears to converge.

Figure 3: Scatterplot



In order to correct the standard errors, I ran the regression using robust standard errors. Although

the robust standard errors decreased the p-value on the coefficient estimate of *black*, the coefficient estimate remained statistically insignificant at a 5% level. There were no changes to the statistical significance of any of the estimated coefficients when using robust standard errors.

Given the estimated coefficients, I find that my null hypothesis, that increasing the minimum wage decreases enrollment in the Supplemental Nutritional Assistance Program, is upheld. The coefficient estimate on the dummy variable that equals one when the state experienced a rise in the minimum wage that year is not statistically different from zero, but the lagged dummy variable of the minimum wage has a statistically significant coefficient estimate. The coefficient estimate on the lagged dummy variable of minimum wage has a p-

value of 0; therefore the coefficient estimate is statistically significant at a 99% confidence level. This provides very strong evidence that the minimum wage policy does effect enrollment in SNAP. On average, if in the prior year there is an increase in the minimum wage in a state, enrollment in SNAP decreases by 3.948%, holding unemployment, population growth, and the percent of the black population constant. This shows an increase in minimum wage results in a decrease in enrollment in SNAP, and lower enrollment in public assistance programs signify lower levels of spending without reducing program capacities or decreasing benefits.

The estimated model also found that on average when unemployment rises by one percentage point, enrollment in SNAP increases by

4.91% when other variables in the model are held constant. I expected the coefficient estimate of unemployment to be positive because higher levels of unemployment mean households have lower levels of income, and SNAP enrollment is based on household income. Holding everything included in the model constant, when population growth increases by 1%, enrollment in SNAP increases by 0.306% on average, which is very low in magnitude. Logically, this is also consistent because a larger population means that enrollment will rise due purely to the number of people in the state. Finally, I found that on average as an additional year passes, enrollment in SNAP increases by 5.977% holding other explanatory variables in the model constant.

V. Conclusion

I tested the hypothesis that increasing the minimum wage results in a decrease in enrollment of SNAP. Using panel data from 50 states from 1998 to 2014, I found that an increase in minimum wage in prior years results in an average decrease of SNAP participation by 3.948%. The model used to find this result was a time-demeaned equation with an ordinary least squares regression. Other explanatory variables in the model were the unemployment rate, population growth, the percent of blacks in the state, and time.

This research only begins to uncover causality between minimum wage policy and public assistance programs. Further research could either continue uncovering how the minimum wage impacts the Supplemental Nutritional Assistance

Program by evaluating expenditure or by attempting to find additional data with a larger year span to examine enrollment. Also, there are various public assistance programs that could be tested to attempt to establish causality between spending or participation and the minimum wage. Additionally, I did not evaluate increase in the minimum wage using specific monetary values since I used a dummy variable to capture if a state experienced a different minimum wage. Returning to this project, one could examine marginal impacts of a higher minimum wage.

Investigating the impact of the minimum wage on SNAP enrollment is important because establishing causality could impact our nation's attitude and policy. Furthermore, we could uncover

ways to reduce federal spending while continuing to provide a safety net for the most vulnerable.

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