# Food Security and the Federal Minimum Wage

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**Summary**

The U.S. federal minimum wage increased from $4.25 to $4.75 in October 1996 and from $4.75 to $5.15 in September 1997. We estimate the extent to which these increases improved the ability of households to be food secure - that is, to purchase for their members an adequate supply of nutritional and safe foods.

First, we show that the two increases significantly altered the hourly wage distribution of householders (principal person in a household). The shifts were greatest among household heads that are minority, single parents, and household heads with no more than a high school diploma.

Even after controlling for the link between the 1990s economic expansion and food security, the October 1996 and September 1997 increases in the federal minimum wage raised food security and reduced hunger, particularly in low-income households where householders had completed no more than a high school degree or were a single parent.

A variety of robustness checks supports these basic findings. In particular, we show that the increases in the minimum wage raised wages at and below the 15$^{th}$ percentile of the hourly wage distribution and did not have an adverse impact on the employment of household heads.

## I. Introduction

Prior to the late 1980s, the economics literature on the minimum wage focused on employment losses resulting from minimum wage increases, especially for the lowest-skilled workers.[1] Most studies before 1982 predicted that increases in the minimum wage would lead to large increases in unemployment. The evidence, however, typically found small rises in unemployment.[2] Studies after 1982 continued to find only modest job losses. These small job loss estimates led to a shift in research focus toward the distribution of benefits from minimum wage increases across the population and their effect on the overall wage distribution.

What is known about the direct effects on households of increases in the minimum wage? Numerous studies have examined the relationship between increases in the minimum wage and poverty. However, to our knowledge few studies have estimated the impact of increases in the federal minimum wage on direct measures of economic well-being, such as food security. Food security is the extent to which a household has enough financial resources to provide its members with adequate supplies of nutritional and safe foods, without resorting to emergency food. Hunger, an extreme form of food insecurity, is a physiological condition where household members experience an uneasy or painful sensation caused by the involuntary lack of food.

To date, most studies on food security in the United States have been descriptive in nature, finding that households whose members are low-wage workers, minorities, immigrants, or female heads tend to be more food insecure than middle-income U.S. households (Andrews, et al. 2000). A natural policy question arises: how do we raise the food security of households? One way to raise household food security is through minimum wage increases. However, it remains an open question as to how much an increase in the minimum wage translates into actual improvements in household food security.

In this study, we assess the link between minimum wage increases and food security by using data from the Current Population Survey (CPS), a monthly survey conducted by the U.S. Bureau of the Census as part of a joint effort with the U.S. Bureau of Labor Statistics to measure employment and unemployment in the United States. Once a year, a supplement to the CPS also collects data on food security and hunger.

We find that:

- Relative to the general population, food security rates are lower among households in which the householder has no more than a high school degree, is African American or Hispanic, or is a single-parent.
- Food security rates increased modestly after 1995, the first year in which the Current Population Survey administered the Food Security Supplement.
- Even after controlling for the link between the 1990s economic expansion and changes in food security, the October 1996 and September 1997 increases in the federal minimum wage raised food security and reduced hunger, particularly in low-income households where householders had completed no more than a high school degree or were a single parent.

## II. Literature

### A. Food Security

Numerous studies over the last decade have sought to develop and validate a methodological basis for measuring food security. From these studies, questionnaire-based surveys have emerged as the prevailing method for assigning food security status to households.[3] Concerns have sometimes arisen as to the seemingly simplistic and adhoc approach of questionnaire or survey-based formats for sorting households into food security categories. For example, depending on the nature of the

survey questions, it is quite plausible that a household well above the poverty line could still report food insecurity.

Extensive efforts have been made to assess the validity of the questionnaire-based approach.[4] One validation method is to assess the extent to which households that are predetermined to be food secure by alternative criteria are actually classified as secure by the survey in question. Another method is to use factor analysis to determine whether different theoretical components of food security exist in the actual response patterns to the survey questions. A third form of validation is to evaluate the consistency of response patterns across different demographic groups.

These validation procedures typically find a strong correlation between food security status, as classified by the survey, and food assistance program participation, actual nutrient intake, and weekly household food expenditures. Hamilton et al (1997) use the 1995 Current Population Survey supplement to show that the raw summation of affirmative responses of food insecurity is highly indicative of the severity of the behaviors experienced by the household.[5]

Borjas (2001) finds additional support for the validity of the questionnaire used in the CPS Food Security Supplement. He pools observations from the 1995 to 1999 files and shows that the usual weekly food expenditures of households classified as food insecure are approximately 20 percent lower than the food expenditures of households classified as food secure. Hence the validity of the questionnaire can be easily cross-checked by looking at weekly food expenditures of the household in question.

Moreover, Borjas finds that the correlation between food expenditure and food security status persists even after controlling for state-time fixed effects, country of origin, and other socioeconomic variables. Beyond research on evaluating the validity of the survey method, Borjas found that

households classified as food insecure tended to be lower-income adult households that were predominately African American, Latino, single parent, or female-headed.

Researchers have also identified various socioeconomic characteristics that are correlated with food security. Bickel et al (1999), Nord et al (1999a), and Andrews et al (2000) use the CPS Food Security Supplement to calculate the prevalence of food security in the United States as well as in states and for socio-demographic groups. African American households, Hispanic households, single-parent households, and households in poverty have lower food security rates than the general population.

The recent work of Bhattacharya, Currie and Haider (forthcoming) takes a different approach to assess the validity of questionnaire-based measures of food security. They use the standard poverty measure as a benchmark for evaluating the quality of the food insecurity questions in the National Health and Nutrition Examination Survey III (NHANES III). They argue that the validity test should not be how the survey questions correlate with other factors such as education or household structure, but rather whether the new food security measure better predicts nutritional outcomes than the traditional measure of poverty. They find that the food insecurity questions are correlated with the dietary outcomes of older household members, but "not consistently related to the diets of children."

Several studies have performed multivariate regression analysis of the sociodemographic determinants of food security. Rose et al (1998) estimate logit models and find that household income, household size, educational attainment, age, race, and home ownership are strongly correlated with the probability of food insufficiency. Their analysis uses data from the 1989 to 1991 Continuing Survey of Food Intake by Individuals (CSFII) and the 1992 Survey of Income and Program Participation (SIPP).

Others focus on describing the adverse physical and psychosocial consequences stemming from the absence of food security. Olson (1999) studies 204 Baltimore and Philadelphia school-age children and finds that a strong association exists between food insecurity, as measured by the Community Childhood Hunger Identification Project (CCHIP) survey, and the prevalence of psychosocial disorders in children, as documented by the Pediatric Symptom Checklist (PSC). The relationship remains after controlling for estimated family income and maternal educational attainment.

B. Minimum Wage

During the 1990s, research on the minimum wage has shifted away from estimating effects on employment (modest to none) to describing the beneficiaries of minimum wage hikes and the alteration of the wage distribution resulting from increases in the minimum wage. Much of that research has found that the chief beneficiaries of a minimum wage hike are adults, and not teenage workers from middle-class families. Card and Krueger (1995) find that more than 70 percent of workers affected by the 1990 increase were adults, who were predominately women and minorities; moreover, 30 percent of the beneficiaries were the only earner in their family. On average, minimum wage workers account for one-half of their family's total earnings. Compared to other workers, individuals whose wages are affected by an increase are three times more likely to live in poverty.

Recently, in an analysis of the potential impacts of increasing the federal minimum wage from $5.15 to $6.65 per hour, Bernstein and Chapman (2002) demonstrate that a link exists between increased quality of life and increases in the minimum wage for low-income households. The Bernstein and Chapman study finds that between 1938 and 1981, the federal government routinely increased the minimum wage to keep pace with cost of living increases. Between 1981 and 1997, the federal government increased the minimum wage three times, with none of the increases

matching the cost of living or ordinary wage increases. Given those policy decisions, the minimum wage is now valued at 19 percent less than it was in 1981. The Bernstein and Chapman study also shows that workers and families who would be most significantly impacted by a minimum wage increase are low-wage households, primarily those that are African-American, Latino, female, or single-parent.

Specifically, if the minimum wage were raised from $5.15 to $6.65 per hour, almost 68 percent of the beneficiaries would be adults and most of those (61 percent) of those adults would be women. African-Americans and Hispanics would make up 33 percent of the beneficiaries, far larger than their representation in the total workforce.[6]

For households headed by workers between the ages of 25 and 54, 59 percent of the gains from the proposed increase would go to the bottom 40 percent of the income distribution, and over three-fourths of the gains would go to the bottom 60 percent of these prime-age earner-headed households. Excluded are households with no earnings and households headed by older or younger persons (who tend to be less connected to the workforce).

To illustrate the impact that the 1990 and 1991 increases in the minimum wage from $3.35 to $4.25 per hour had on the wage distribution, Card and Krueger (1995) follow the 5$^{th}$ and 10$^{th}$ percentiles of wages between the first quarter of 1989 and the last quarter of 1991 in three groups of U.S. states: (1) 13 low-wage states (where the increase in the minimum wage had a high impact); (2) 22 medium-wage states; and (3) 16 high-wage states (where it had a low impact). The categories are based on the share of a state's working teenagers that earned between $3.35 and $4.25 per hour prior to the increase. They find that both the 5$^{th}$ and 10$^{th}$ percentiles of wages in the low-impact states drifted upward during the three-year sample period, but prior to the increases in the federal minimum wage. This timing suggests that the structure of wages in the low-impact states was largely

unaffected by the federal minimum wage hikes, implying that wages in the low-impact states provide a valid counterfactual for the wage growth in the medium and high impact states.

Card and Krueger find that the 1990 and 1991 federal minimum wage hikes increased the 5$^{th}$ percentile of wages in the lowest-wage (i.e., high-impact) states by 60 cents and raised the 10$^{th}$ percentile of wages in these states by 25 cents. To control for remaining factors that might be correlated with both wage growth and the share of workers affected by a minimum wage increase, Card and Krueger estimate state-level regressions which control for a variety of factors, finding again a strong positive correlation between changes in the 5$^{th}$ and 10$^{th}$ percentiles of wages and the fraction of workers who prior to the increase were earning between $3.35 and $4.24. Wage inequality, as measured by the difference between the 10$^{th}$ and 90$^{th}$ percentile wages, narrowed in states with a high fraction of workers who were affected by the minimum wage increases.

Finally, Card and Krueger show that the 10$^{th}$ percentile of family earnings increased as the percentage of workers affected by the minimum wage in the state increased and that poverty rates fell faster in high-impact states. Because of the estimate's lack of precision, they caution the reader that it is difficult to attribute the decline in poverty solely to the minimum wage. But they are confident that there is no evidence to suggest that poverty increased as a result of the 1990 and 1991 minimum wage hikes. The questions that now must be answered are the following: (1) How do these distributional and welfare changes translate into food security status? (2) Does food security increase, and is the increase largest in low-income households, including minority households, households in which the head has no more than a high school diploma, and single-parent households?

## III. Theoretical Framework

Our model of food security is based the theory of household production as developed in Gorman (1956), Lancaster (1966a, b) and Becker (1965). Rose et al (1998) is the most recent study on food security to utilize this model.[7] The approach relies on the assumption that households obtain utility from underlying goods that cannot be purchased in markets. Instead, households produce utility by using goods from market purchases and leisure time.[8]

In our setting, households combine store-bought foods and time spent shopping and preparing meals with the use of durable goods (e.g., refrigerators and microwaves) and human capital (e.g., nutrition knowledge and preparation skills) to create meals. Households receive utility from their preferences or tastes for different types of foods and from the health effects of the nutrients consumed.

More formally, households choose taste components, A, and nutrients, N, found in meals to maximize

1) $U = U(A, N, X, l), \quad subject\ to$

2) $N = n(F, L_F, K, D),\ and$

3) $P_F F + PX = V + w(T - L_F - l).$

The term $X$ denotes other goods and $l$ denotes leisure. Equation (2) represents the household's home production function, where $F$ denotes store-bought foods, $L_F$ is the labor time spent shopping for food and preparing meals, $K$ denotes capital goods, including human capital, and $D$ denotes the demographic characteristics of the household.[9]

Equation (3) is the household's constraint on income and time, where $P_F$ denotes the price of food, $P$ denotes prices of other goods, $w$ denotes the wage rate, $V$ denotes non-labor income, and $T$ denotes the total time available to the household members.[10]

For this optimization problem, the households' reduced-form nutrient demand equations take the following form:

4) $$N = n^*(P_F, P, V, w, K, D).$$

The demand for nutrients depends on the price of food, prices of other goods, non-labor income (e.g., food stamps), wages, capital goods, and demographic characteristics.

A household is categorized as food secure if the level of nutrients consumed exceeds some minimum level of nutrients. Let $I_h$ denote a food security indicator variable for the *hth* household that takes on the following values:

5) $$I_h = 1, \textit{ if } N_h > N_{h,\min}$$
$$I_h = 0, \textit{ otherwise},$$

where a household is food secure if the level of nutrients exceeds some threshold, which could either be a societal threshold (e.g., living wage) or a subjective threshold set by the individual household.

## IV. Econometric Models

### 1. Probit Models

Since we only observe the outcome of whether the household nutritional level exceeds a particular threshold, and not the actual nutritional level, we model food security for the *hth* household as an unobserved latent variable, $y^*$, such that

7) $$y_h^* = X_h\beta + \varepsilon_h.$$

The vector $X_h$ contains household-specific information such as the age, gender, race, educational attainment, industry, and occupation of the reference person in the household. The vector also contains household-level information on the number of individuals in the household, urban residency, and food stamp usage and amount. We assume that $\varepsilon$ has a standard normal distribution with mean zero and variance one. To operationalize (7), we write

8) $$y_h = 1, \; if \;\; N_h^* > N_{\min},$$
$$y_h = 0, \; if \; N_h^* \le N_{\min},$$

where $y_h$ denotes a dummy variable that equals 1 if the nutrition level of the *hth* household exceeds some minimum threshold and 0 if not. Given our assumption that the residual is distributed with mean zero and variance of 1, we estimate a probit model.

It is well known that the estimated coefficients for probit models can only be utilized to determine the direction of a variable's impact on the probability of food security. To estimate the impact that a change in a variable has on the probability of food security, we use the estimated coefficients from our probit equation and each household's vector of characteristics to construct an index ( $X_h\hat{\beta}$ ) for the each household. We then calculate each household's partial derivative, the change in the probability of food security with respect to a change in the *kth* variable, and compute the average of the partial derivatives over the *H* households. The resulting marginal effect of the *kth* explanatory variable on the probability of food security is

**9)** $$\overline{\frac{\partial P[y=1]}{\partial X_k}} = \frac{1}{H}\sum\nolimits_{h=1}^{H}\left(\frac{\partial P[y=1]}{\partial X_k}\right)_h = \frac{1}{H}\sum_{h=1}\phi(X\hat{\beta}_h)\hat{\beta}_k$$

where $\phi(\cdot)$ is the density function of the standard normal distribution.

2. Estimating the Impact of the Federal Minimum Wage Increases

Using the state-level approach in Card and Krueger (1995), we estimate a variety of specifications to identify the impact of the October 1st, 1996 and September 1st, 1997 increases in the federal minimum wage. We regress the change in a state's food security – that is, the change in the percentage of households classified as food secure within the state – on its share of working householders earning between $4.25 and 5.14 per hour. To control for changing macroeconomic conditions, we include the change in the state's employment-population ratio.

Formally, the model is written as

**10)** $$\Delta FS_{ij} = \alpha_0 + \alpha_1 \%Affected_{ij} + \alpha_2 \Delta EPOP_{ij} + \varepsilon_{ij},$$

where $\Delta FS_{ij}$ denotes the change in the *ith* state's food security at the *jth* income category from period *t*, a period before the increase in the minimum wage and *t+1*, a period after the increase in the minimum wage, $\%Affected_{ij}$ denotes the *ith* state's share of working householders earning between $4.25 and $5.14 per hour in the *jth* income category prior to the minimum wage increase, $\Delta EPOP_{ij}$ denotes the *ith* state's change in employment-population ratio of householders in the *jth* income category from period *t* to *t+1*, and $\varepsilon_{ij}$ denotes an error term. All specifications are estimated using weighted least squares, where the average of the state's resident population from 1995 to 1999 is used as the weight.

To identify the net impact of the minimum wage on food security, we perform two calculations. We first multiply our estimate of $\alpha_1$ by the share of affected workers in a "high" impact states. We then multiply our estimate of $\alpha_1$ by the share of affected workers in a "low" impact states. The difference measures the minimum wage's net impact on household food security.

## V. Data

The Current Population Survey (CPS) is a monthly survey of about 50,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics. The CPS is the primary source of information on the labor force characteristics of the U.S. population. Respondents are interviewed to obtain information about the employment status, earnings, and hours of work for each member of the household aged 15 years and older.

Our research utilizes the annual Food Security supplement to the CPS that was first collected in April 1995 by the U .S. Census Bureau and sponsored by the U.S. Department of Agriculture.

Subsequent supplements have been administered in September 1996, April 1997, August 1998, and April 1999 and later years.

The food security classification scheme is based on a standard conceptual framework developed by the Life Sciences Research Office (LSRO) of the Federation of American Societies for Experimental Biology. Underlying the LSRO framework is the following descriptive terminology:

***Food security*** – "Access…to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)."

***Food insecurity*** – "Limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."

***Hunger*** – "The uneasy or painful sensation caused by a lack of food. The recurrent and involuntary lack of access to food. Hunger may produce malnutrition over time…Hunger is a potential, although not necessary, consequence of food insecurity." (LSRO 1990).

Food insecurity and hunger can be thought of as a continuum in which hunger is manifested as the level of food insecurity worsens. The determination is based on behaviors that include "the experience of running out of food, without the money to buy more," "perceptions…that the food eaten by household members was inadequate in quality or quantity," "adjustments to normal food use, substituting fewer and cheaper foods than usual," and "instances of reduced food intake" (Bickel et al 2000).

The food security supplement classifies each household into a food security category by its pattern of responses to 18 questions. See Appendix 1 for a list of the questions. Each question asks the household to affirm or deny whether it has experienced a particular behavior in the last twelve months; each affirmation thus provides additional evidence of food insecurity or hunger in the household. The respondent's period of reference for reporting behaviors is, in every question, the twelve months immediately prior to the administration of the survey. Moreover, all questions

explicitly ask the household to report only those behaviors that result from financial resource constraints. Since some questions refer to children, households without children are asked only 10 of the 18 questions.

Given the presence or absence of children, the household is classified as "food secure," "food insecure without hunger," or "food insecure with hunger" based on the number of affirmative responses given by a designated household member's answers to the eighteen or subset of eighteen questions. For example, households with children are designated as "food secure" if they give fewer than three affirmative responses, as "food insecure without hunger" if they give between three and seven affirmative responses (inclusive), and as "food insecure with hunger" if they give eight or more such responses (Bickel et al 2000).

Recall that in our estimation of equation (10), which assesses the impact that increases in the minimum wage have on food security, we desire data from reference periods completely *before* and completely *after* the pair of minimum wage increases. Thus, we exclude the 1997 data from our analysis; our results would be biased if we included it. Figure 1 provides a timeline of the surveys and the increases in the minimum wage to illustrate this point. The survey was administered in April 1997, but the minimum wage was increased on October 1$^{st}$, 1996. Since respondents are asked to report their experiences from the previous 12 months, the effective date of the wage hike falls in the middle of the reference period for the 1997 interview. Note that even though the September 1$^{st}$, 1997 increase in the minimum wage occurs one month after the beginning of the reference period for the August 1998 survey, we do not exclude the 1998 data from our analysis and regard this data as falling in the post-increase period. To measure food security across these surveys, we use a variable (HRFS12C1) that has been adjusted to account for changes in the screening process used to determine whether an individual is asked the food security supplement.

The major sample restrictions are that each household must have complete information on the age, sex, race, ethnicity, and educational attainment of the reference householder, as well as information on household structure, number of household members, industry, occupation, and residency in metropolitan statistical areas. When we focus on estimating the food security-hourly wage relationship, our samples are further reduced, because hourly wages are only collected for the outgoing groups (4 and 8), which represent 20 percent of the CPS sample. Further, in 1998 and 1999, a food security test question was used in rotation group 8, leading to households with multiple children or adults being excluded during the computation of food security status. The Bureau of Census and Bureau of Labor Statistics adjust the sample weights of the remaining rotation groups to account for the reduction in sample. We also exclude households in which the reference person's (head of household) hourly wages are below $1.00 per hour.

We now present summary statistics. Table 1 reports nominal hourly wage distributions by demographic group for 1995 to 1999. In all panels, the share of householders with earnings below $5.14 per hour falls after 1996. For example, Panel A shows that in 1995 and 1996, 9.0 and 7.0 percent, respectively, of reference persons earned less than $5.15 per hour. This figure falls to 1.0 in 1999. The remaining panels show even larger shifts in the wage distributions of minorities, single parent households, and households where the head has no more than a high school degree.

Table 2 shows odds ratios for our food security of respondents in the 1995, 1996, and 1998, and 1999 samples. Some of the variation could be seasonal since the surveys are done in different months. Researchers have shown that food security is subject to a seasonal effect. We attempt to control for this effect in our estimation procedures.

The descriptive statistics are quite similar to past research. Since 1995, the odds of becoming food secure have increased, with the improvement occurring after 1996, with gains being due to the

increases in the minimum wage and the strengthening of the overall economy. The increases in the number of food secure households over this period are largest for those households most impacted by the minimum wage increases. African-American, Hispanic, and Native American households experience the largest increases. Growth in food security occurs at all levels of educational attainment, and the food security of single-parent households increases more than the food security of dual households. In all, the aggregate trends point to a modest increase in food security that might be due to the increase in the minimum wage; however, it is quite reasonable to think that the booming economy of the 1990s explains some of the increase in food security.[11]

Panel B of Table 2 provides a profile of households that are more likely to be experience hunger. Households in a state of hunger are more likely to be: (i) African-American and Hispanic households; (ii) households in which the reference person is without a high school diploma; and (iii) female-headed households.

## VI. Basic Results

Table 3 displays results from probit models that estimate the determinants of food security over the 1995 to 1999 period. Food security and hourly wages are modeled as a linear relation. The columns labeled "dP/dx" show the predicted marginal changes in the probability of food security with respect to a particular explanatory variable. The columns labeled "SE" show the standard errors for these predicted changes. A food security-wage gradient exists even after controlling for a host of characteristics. A one-dollar increase in the hourly wage is associated with a 0.9 percentage point increase in the proportion of households classified as food secure.[12]

In addition, Table 3 presents the food security-wage gradients of less-educated households, nonwhite households, and female-headed households. A one-dollar increase in the reference person's hourly wage has a larger impact if the reference person is African-American, Hispanic, a female head of household, or has no more than a high school diploma. The larger impacts are due to the fact that these groups have lower initial wages and that food security exhibits diminishing returns as a function of wages.

The coefficients on the race and ethnicity dummy variables in the table also show through examination of the columns labeled "All" that almost all of the odds that white households experience greater food security than African Americans and Hispanic households are explained by the measures included in the model. An education gradient exists, with high school dropouts having the lowest food security. Female-headed households have lower levels of food security than dual-headed households. The partial derivatives in the single-parents' probit model indicate that single parents with no more than a high school degree have food security rates that are 10.8 percentage points lower than those for college-educated single parents, all else equal.

Table 4 reports non-linear estimates of the hourly wage and food security relationship. Instead of specifying the hourly wage as a linear function, a vector of dummy variables, each of which represents a certain range for the wages earned by household heads, is used to describe the wage-food security relationship. The omitted category is the range of wages in excess of $15.37 per hour. As seen in Table 4, non-linearities do exist: the food security-wage relationship typically has a U-shape. As we move from less than $4.25 to $5.14 per hour, the food security gap between earners in the given wage interval and the highest wage earners expands, peaking at the $5.15 to $5.74 and $5.75 to $6.24 categories. From $6.25 to $15.37, the food security gap narrows. The pattern is well observed among all groups, except single parents. We speculate that households headed by workers

with wages below $4.25 have access to other forms of income. For example, they may receive support from social safety nets.

In sum, the estimates in Tables 3 and 4 reveal that demographic groups with the greatest disadvantages are the ones most likely to be beneficiaries of minimum wage increases, especially when these increases would raise the floor to a minimum of $6.25 per hour.

We turn now to an analysis of the effects of the 1996-97 minimum wage increases. Utilizing food security variation across the 50 states plus the District of Columbia and across the 14 household income categories to build aggregate food security statistics is not feasible because of the prohibitively small number of observations from the CPS that would fall in each of the state-income combinations. To solve this problem, we still allow food security to vary by state but also create three broad income categories: 1) less than $12,500, 2) $12,500 to $34,999, and 3) $35,000 or more. For each combination of state and household income category, we construct the change in food security (hunger) from the pooled years of 1995 and 1996 to the pooled years of 1998 and 1999, generating a dependent variable with 51*3 = 153 observations. The USDA highly recommends that the best approach to creating state-level measures of food security is to pool adjacent years. Our independent variable, an aggregate measure of the percent of household heads affected by the 1996-97 increases in the minimum wage, also varies across states and the three household income distribution categories. To control for changes in the state's macroeconomy, we add a second variable, the change in the state's employment-population ratio of household heads in each income category. Allowing for variation in the employment-population ratio by income enables us to control for state-specific fixed effects.

Table 5 shows the relationship between the change in food security (hunger) and the percent of household heads affected. Model (1) regresses the change in food security on the percent affected

and state dummy variables. Model (2) adds the change in the state's employment-population ratio. Model (3) controls for changes in the usage of food stamps.

Using Table 5, we see that the increase in the minimum wage raises the probability of reporting food security and lowers the probability of reporting hunger. For example, consider the coefficients on "% affected" in the food security and hunger equations from panel 1 (0.0951 and -0.0368, respectively). In a state such as California where 36.5 percent of households with income less than $12,500 are affected by the minimum wage increase, the preceding coefficients give rise to an increase in food security of 3.5 percentage points (0.365 * 0.0951) and a fall in hunger of 1.3 percentage points (0.365* -0.0368) between 1995/96 and 1998/99. Table 6 presents these estimates. If we assume that California households with incomes between $12,500 and $34,999 are fairly similar to households with incomes less than $12,500, the former can serve as a counter factual. The predicted change in food security for households with income between $12,500 and $34,999 is what we could expect to observe in the absence of a minimum wage increase. Table 6 reports that the predicted change in food security among California households with incomes between $12,500 and $34,999 is 0.9 percent. The difference between the two predicted changes in food security, 2.4 (3.5 – 0.9) represents among households with less than $12,500 of income the net food security impact of the increase in the minimum wage.

A state such as Rhode Island also provides a counter factual. Seven and one-half percent of households with income less than $12,500 are affected, which leads to a food security increase 0.7 percentage points and reduction in hunger 0.3 percentage points. The difference between California's predicted change in food security and Rhode Island's predicted change, 2.6 (3.5 - 0.7), represents among households with less than $12,500 of income the net food security impact of the increase in the minimum wage for these two states. The difference between the two predicted

changes in hunger, 1.0 (1.3 – 0.3), measures the net reduction in hunger attributable to the minimum wage increase for extremely low-income households. Panels A and B of Table 6 also present predicted changes for selected states, providing the reader with other potential counterfactuals.

The results for less-educated households indicate that even after controlling for changes in the macroeconomy and food stamp usage, the minimum wage increases have a significant impact on food security. A one-percentage point rise in the share of affected workers increases the 1995/96-1998/99 growth in food security by 8.6 percentage points. After controlling for changes in food stamp usage, the coefficient remains negative but is no longer precisely measured. Table 6 reports simulations for noncollege educated households. Using Rhode Island as the low impact state and California as the high impact state, the minimum wage generates a net increase of 2.5 percentage points in the food security of less-educated households with incomes less than $12,500. If California's $12,500 to $34,999 income households are used as the counterfactual or low impact group, the net impact is a 2.3 percentage point increase in food security.

The food security coefficients and hunger coefficients for nonwhites have the expected signs but are not statistically significant from zero due to the data limitations in creating more precise income category-state-year aggregates of food security and hunger. Single-parent households experience an increase in food security and reduction in hunger; all of the estimates are measured with a high level of precision. The estimated coefficients of 0.1529 and -0.0924 on "%Affected" in the (model 3) regression, translate into impacts for California single-parent households with incomes less than $12,500 of an 8.2 percent increase in food security and a 5.0 percentage point decline in hunger (Table 6). The predicted changes among California households with incomes between $12,500 and $34,999 are 1.0 and –0.6 percent, which yields a net increase of 7.2 percent in food security and a 4.4 percent decline in hunger. Pennsylvania single parent households serve as the best

low impact state. The predicted increase in food security among households with less than $12,500 in income is 1.5 percent. This leads to a net impact of 6.7 percent. The predicted decline in hunger for Pennsylvania's households with income between $12,500 to $34,999 is 0.8 percent, yielding a 4.1 percent decline in hunger.

## VII. Sensitivity Analysis

Our first robustness check estimates three state-level equations. The first regresses the change in a state's food security from 1995 to 1996 on its percent affected in 1996. The second regresses the change in food security from 1996 to 1998 on the percent affected in 1996. The third regresses the change in food security from 1998 to 1999 on the percent affected in 1996. Each equation includes the change in the state's 16 and over employment-population ratio. If the increases in the federal minimum wage had independent impacts on food security, then the percent affected coefficient in the 1996 to 1998 model should be positive, while the percent affected coefficients in the 1995 to 1996 and 1998 to 1999 models should be zero. Formally, the three equations are written as follows:

**11)** $$\Delta FS_{i,(1996-1995)} = \gamma_0^1 + \gamma_1^1 \%Affected_{i,1996} + \gamma_2^1 \Delta State\ EPOP_{i,(1996-1995)} + \Delta\varepsilon_{i,(1996-1995)},$$

**12)** $$\Delta FS_{i,(1998-1996)} = \gamma_0^2 + \gamma_1^2 \%Affected_{i,1996} + \gamma_2^2 \Delta State\ EPOP_{i,(1998-1996)} + \Delta\varepsilon_{i,(1998-1996)},$$

**13)** $$\Delta FS_{i,(1999-1998)} = \gamma_0^3 + \gamma_1^3 \%Affected_{i,1996} + \gamma_2^3 \Delta State\ EPOP_{i,(1999-1998)} + \Delta\varepsilon_{i,(1999-1998)}.$$

Equation (12) is similar to our models in Table 5, except that we only use the 1996 and 1998 CPS to build pre- and post-increase state aggregates. The coefficient on percent affected captures the relationship between a state's share of affected workers prior to the increases in the minimum wage and the state's change in food security from 1996 to 1998. The coefficient $\gamma_1^2$ is expected to be positive. Estimates of $\gamma_1^1$ and $\gamma_1^3$ are expected to be zero: the percent affected in 1996 should not be correlated with changes in food security in years in which the federal minimum wage was

unchanged. All models are estimated using weighted least squares, with state population used as the weight.

In addition to these estimates, we also present estimates of $\gamma_1$ from models that use state-level changes in householder employment-population ratios and state-level changes in the hourly wages of householders at a particular percentile of the wage distribution as the dependent variables. Estimates of $\gamma_1$ from these models will show that the increases in the minimum wage did not adversely impact the employment of household heads and helped to raise the wages of the lowest paid household heads.

The estimated coefficients for the food security models (11) through (13), which are presented in the bottom half of Table 7, must be interpreted with caution. The changes in state-level food security are based on annual changes. As mentioned earlier, the U.S. Department of Agriculture has shown that the most reliable state-level estimates of food security are only obtained by pooling years. So, we are not surprised that the coefficient estimates have little precision. However, we are encouraged by the magnitudes and signs of the coefficients. They are consistent with our basic results that the increases in the federal minimum wage in 1996 and 1997 raised food security. Although not measured with precision, the coefficient on the relationship between the change in food security from 1996 to 1998 and the percent affected is 0.028. The coefficients for the adjacent year changes are either zero or measured with little precision.

The top half of Table 7 presents some very important evidence on the employment effects of minimum wage increases. The estimates indicate that states with larger shares of affected household heads saw larger gains in employment-population ratios from 1996 to 1998. On the other hand, we cannot reject the hypothesis that the change in employment-population ratios from 1995 to 1996 or

from 1998 to 1999 are unrelated to the percent affected, suggesting that we have correctly specified our model.

Figures 2 – 4 present coefficients measuring the impact of percent affected on the change in hourly wage at a given percentile of the wage distribution. They too, reveal a pattern that suggests that the increases in the minimum wage had their greatest impact at the lower end of the wage distribution: the 5th, 10th and 15th percentiles.

Our second robustness check takes advantage of the fact that from 1995 to 1999 some states had minimum wages that exceeded the federal minimum wage. We use this variation to estimate four fixed effect models. The first and second models regress state-level food security and hunger rates on the logarithm of the higher of the two minimum wages. The third regresses a state's employment-population ratio of its household heads on the logarithm of the higher of the state and federal minimum wages. This model estimates whether the increases in the minimum wage had disemployment effects on household heads. The fourth model regresses a state's log hourly wage at a particular percentile (e.g., 5th, 10th, or 25th percentile) of the wage distribution on on the logarithm of the higher of the state and federal minimum wages. The latter model, estimated at a variety of percentiles, demonstrates the distributional impact that the minimum wage increases had on the wage structure of household heads. All models also control for the state's employment-population ratio (as published by the Bureau of Labor Statistics) and food stamp usage in the state. The coefficient on the logarithm of the minimum wage is equal to 100 times the impact of a one percent increase in the minimum wage on food security, hunger, the employment-population ratio, and log hourly wages, food security and hunger, controlling for changes in the macroeconomy.

Formally, the models are written as:

**14)** $EPOP_{it} = \beta_0 + \beta_1 \log[\max(state\ MW, federal\ MW)]_{it} + \beta_2 (state\ EPOP)_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$,

**15)** $FS_{it} = \beta_0 + \beta_1 \log[\max(state\ MW, federal\ MW)]_{it} + \beta_2 (state\ EPOP)_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$,

**16)** $H_{it} = \beta_0 + \beta_1 \log[\max(state\ MW, federal\ MW)]_{it} + \beta_2 (state\ EPOP)_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$,

**17)** $\log(W)_{ipt} = \beta_0 + \beta_1 \log[\max(state\ MW, federal\ MW)]_{it} + \beta_2 (state\ EPOP)_{it} + \alpha_i + \alpha_t + \varepsilon_{it}$,

where $MW_{it}$ denotes the minimum wage in state *i* at time *t*, $EPOP_{it}$ denotes the employment-population ratio of household heads in state *i* in year *t*, and $FS_{it}$ are defined as before, $H_{it}$ denotes the aggregate rate of hunger, $W_{ipt}$ denotes the wage at percentile *p*, and $\alpha_i$ and $\alpha_t$ are dummies for state and year, respectively.

Table 8 displays the results from estimation of (14) through (16). The estimates in Model A include all regressors except year dummy variables, and Model B adds year dummy variables. Comparison of Models A and B for the food security and hunger equations suggests that improvement in food security within states was more due to an upward trend over time and not to an increase in the minimum wage. As a reminder, the samples used to build the state-year aggregates are too small to generate precise estimates that can be used to describe changes over time in food security and hunger. The models without year dummy variables suggest that states with higher minimum wages consequently have higher employment-population ratios and higher food security, all else equal. The addition of the year dummy variables causes the coefficients to fall to zero. One interpretation of this finding is that changes in the minimum wage over time are not correlated with changes in food security. However, we attribute this result to our inability to construct the most reliable annual estimates of food security. Because of this data limitation, we recommend that the food security supplement be expanded such that reliable annual state-level estimates can be constructed. This would allow researchers to more readily explore the impact of state policies on food security and hunger.

Finally, Figure 5 displays the estimate of $\beta_1$ from estimation of equation (17) for various percentiles of the wage distribution. The figure clearly shows that higher minimum wages are associated with higher earned wages primarily at the lower end of the wage distribution ($20^{th}$ percentile and below). Minimum wage levels have negligible impacts on wages above the $20^{th}$-$25^{th}$ percentiles.

## VIII. Conclusion

Research on the economic impacts of increases in the federal minimum wage remains an active area of inquiry; however, the focus for many researchers has shifted from estimating dis-employment effects to estimating the broader impacts on economic welfare. First, researchers found that the profile of minimum wage workers had changed. Today, more "breadwinners" support their households on the minimum wage. Second, researchers found evidence that the four minimum wage increases in the 1990s had significant impacts on the wage distribution.

Did those changes lead to improvements in the welfare of low-wage households? More specifically, did the increases in the minimum wage translate into greater food security for low-wage households? To answer these questions we used data from the Food Security Supplements of the Current Population Survey. We compare the change in food security of low-income households within states heavily impacted by the minimum wage increases to the change in food security of low-income households within states not heavily impacted by the increases. We also compare the change in food security of low-income households within states heavily impacted by the minimum wage increases to the change in food security of households within highly impacted states, but to households that have slightly higher income.

We first establish that households headed by African-Americans, Hispanics, single parents, or persons with no more than a high school degree have food security rates that are lower than the

rate prevailing in the general population. We then show that food security rates have increased modestly since 1995, with the largest increases among the demographic groups that past researchers have found to benefit most from increases in the minimum wage.

Our preferred estimation strategy finds that increases in the minimum wage from $4.25 to $5.15 per hour had the greatest impact on increasing food security, especially among less-educated and single-parent households. Our sensitivity analysis does not reject these findings.

We arrive at a similar conclusion as Card and Krueger did when they examined the relationship between poverty and the 1990 and 1991 increases in the minimum wage. Estimates from our sensitivity analysis lack precision, making it more difficult to attribute food security increases from 1995 to 1999 solely to increases in the minimum wage. Yet, we remain confident that none of this evidence indicates that food security declined as a result of the 1996 and 1997 minimum wage hikes.

An additional caveat must be made about our findings. The modest ability of the increases in the minimum wage to raise food security should not be interpreted as a reason to conclude that the "minimum wage is poor social policy." We do not present a benefit-cost analysis, which would take into account all the impacts of the minimum wage in order to evaluate the previous statement. The minimum wage is one of many public policies which, when used in conjunction with each other, can significantly improve the food security of American households. Evidence demonstrates that those households most dependent on the minimum wage for income and most impacted by increases in the minimum wage are low-income households, primarily African-American, Latino, single-parent, female-headed, and less educated households.

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## Table 1: The Nominal Hourly Wage Distribution of Reference Persons, 1995 to 1999 (in Percent)

**Panel A: All Reference Persons**

| Year | Sample Size | Less than $4.25 | $4.25-$4.74 | $4.74-$5.14 | $5.15 to $5.74 | $5.75-$6.24 | $6.25-$6.64 | $6.65-$8.28 | $8.29-$15.37 | At Least $15.38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 3142 | 1% | 4% | 4% | 4% | 6% | 3% | 16% | 43% | 19% |
| 1996 | 3055 | 1% | 2% | 4% | 4% | 4% | 4% | 14% | 45% | 23% |
| 1998 | 1981 | 1% | 0% | 1% | 5% | 5% | 4% | 15% | 43% | 26% |
| 1999 | 1891 | 0% | 0% | 1% | 3% | 5% | 3% | 17% | 43% | 27% |

**Panel B: African American non-Hispanic Reference Persons**

| Year | Sample Size | Less than $4.25 | $4.25-$4.74 | $4.74-$5.14 | $5.15 to $5.74 | $5.75-$6.24 | $6.25-$6.64 | $6.65-$8.28 | $8.29-$15.37 | At Least $15.38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 366 | 1% | 7% | 8% | 5% | 8% | 3% | 21% | 36% | 12% |
| 1996 | 317 | 3% | 2% | 3% | 9% | 6% | 7% | 15% | 39% | 15% |
| 1998 | 257 | 0% | 0% | 0% | 7% | 6% | 6% | 18% | 44% | 19% |
| 1999 | 239 | 0% | 0% | 2% | 7% | 6% | 8% | 24% | 35% | 18% |

**Panel C: Hispanic Reference Persons**

| Year | Sample Size | Less than $4.25 | $4.25-$4.74 | $4.74-$5.14 | $5.15 to $5.74 | $5.75-$6.24 | $6.25-$6.64 | $6.65-$8.28 | $8.29-$15.37 | At Least $15.38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 213 | 2% | 9% | 6% | 6% | 13% | 6% | 16% | 31% | 11% |
| 1996 | 300 | 1% | 7% | 10% | 7% | 4% | 8% | 14% | 38% | 12% |
| 1998 | 200 | 1% | 0% | 3% | 5% | 7% | 7% | 20% | 43% | 15% |
| 1999 | 186 | 0% | 0% | 3% | 3% | 13% | 3% | 27% | 38% | 13% |

**Panel D: Single Parents**

| Year | Sample Size | Less than $4.25 | $4.25-$4.74 | $4.74-$5.14 | $5.15 to $5.74 | $5.75-$6.24 | $6.25-$6.64 | $6.65-$8.28 | $8.29-$15.37 | At Least $15.38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 566 | 3% | 8% | 7% | 5% | 7% | 4% | 20% | 35% | 10% |
| 1996 | 569 | 3% | 4% | 8% | 7% | 5% | 5% | 18% | 39% | 12% |
| 1998 | 381 | 1% | 0% | 0% | 7% | 5% | 6% | 20% | 44% | 16% |
| 1999 | 381 | 1% | 0% | 2% | 6% | 8% | 5% | 24% | 37% | 18% |

Notes: Authors' calculations from the 1995, 1996, 1998 and 1999 Current Population Survey Food Supplement. The earnings data on which these figures are based is only collected in the CPS's outgoing rotation groups (4 and 8), which represent 20 percent of the sample. In 1998 and 1999, as a result of a test question used in rotation group 8, households in this rotation group with multiple children or adults were excluded from the computation of food security. The other rotation groups were weighted to account for this drop in sample. The distributions have been weighted using the household sample weight, which is based on the nominal hourly wages of the household reference person. To be included in the sample, the household must have complete information for all of the following variables: household family income, structure, size, and urban residency status, as well as the reference person's hourly wage, gender, race/ethnicity, age, educational attainment, and industry and occupation of employment.

## Table 1 cont.: The Nominal Hourly Wage Distribution of Reference Persons, 1995 to 1999 (Percent)

**Panel E: High School Dropouts and Graduates**

| Year | Sample Size | Less than $4.25 | $4.25-$4.74 | $4.74-$5.14 | $5.15 to $5.74 | $5.75-$6.24 | $6.25-$6.64 | $6.65-$8.28 | $8.29-$15.37 | At Least $15.38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1995 | 2388 | 2% | 5% | 5% | 4% | 6% | 3% | 17% | 44% | 15% |
| 1996 | 2353 | 1% | 3% | 5% | 5% | 4% | 4% | 15% | 45% | 18% |
| 1998 | 1500 | 0% | 0% | 1% | 6% | 6% | 5% | 17% | 44% | 21% |
| 1999 | 1423 | 0% | 0% | 1% | 4% | 6% | 3% | 19% | 44% | 22% |

Notes: Authors' calculations from the 1995, 1996, 1998 and 1999 Current Population Survey Food Supplement. The earnings data on which these figures are based is only collected in the CPS's outgoing rotation groups (4 and 8), which represent 20 percent of the sample. In 1998 and 1999, as a result of a test question used in rotation group 8, households in this rotation group with multiple children or adults were excluded from the computation of food security. The other rotation groups were weighted to account for this drop in sample. The distributions have been weighted using the household sample weight, which is based on the nominal hourly wages of the household reference person. To be included in the sample, the household must have complete information for all of the following variables: household family income, structure, size, and urban residency status, as well as the reference person's hourly wage, gender, race/ethnicity, age, educational attainment, and industry and occupation of employment.

## Table 2: Odds Ratios for Food Security, 1995, 1996, 1998 and 1999

| | Panel A: Food Security | | | | Panel B: Hunger | | | |
|---|---|---|---|---|---|---|---|---|
| **Category** | **1995** | **1996** | **1998** | **1999** | **1995** | **1996** | **1998** | **1999** |
| All Householders | 9.55 | 9.04 | 9.20 | 10.95 | 0.04 | 0.04 | 0.03 | 0.03 |
| **Race and Ethnicity** | | | | | | | | |
| Non-Hispanic African American | 4.46 | 3.94 | 4.61 | 5.04 | 0.08 | 0.08 | 0.07 | 0.05 |
| Hispanic | 4.43 | 3.85 | 4.09 | 4.93 | 0.07 | 0.09 | 0.06 | 0.05 |
| Native American | 4.55 | 3.95 | 3.92 | 4.93 | 0.09 | 0.08 | 0.06 | 0.11 |
| Asian | 22.29 | 16.10 | 15.34 | 14.84 | 0.01 | 0.02 | 0.01 | 0.01 |
| Non-Hispanic White | 12.57 | 12.72 | 12.44 | 15.72 | 0.03 | 0.03 | 0.03 | 0.02 |
| **Household Structure** | | | | | | | | |
| Husband and Wife | 14.87 | 13.29 | 14.59 | 18.00 | 0.02 | 0.02 | 0.01 | 0.01 |
| Single Parent | 3.65 | 3.61 | 3.61 | 4.33 | 0.09 | 0.08 | 0.08 | 0.06 |
| Single Male | 7.01 | 7.22 | 6.78 | 7.71 | 0.05 | 0.04 | 0.05 | 0.03 |
| Single Mother | 3.12 | 3.01 | 3.01 | 3.67 | 0.10 | 0.10 | 0.08 | 0.07 |
| Individual Male | 9.60 | 9.79 | 10.48 | 10.90 | 0.05 | 0.05 | 0.04 | 0.03 |
| Individual Female | 9.39 | 9.08 | 8.94 | 11.54 | 0.05 | 0.05 | 0.05 | 0.04 |
| **Educational Attainment** | | | | | | | | |
| High School Dropout | 4.13 | 3.62 | 3.36 | 4.16 | 0.08 | 0.09 | 0.09 | 0.06 |
| High School Graduate | 6.89 | 6.43 | 6.42 | 7.70 | 0.05 | 0.05 | 0.05 | 0.04 |
| Associates Degree | 8.00 | 7.54 | 7.74 | 9.12 | 0.04 | 0.05 | 0.04 | 0.03 |
| Bachelors Degree | 10.95 | 10.40 | 11.27 | 13.40 | 0.03 | 0.04 | 0.02 | 0.02 |

Notes: Authors' weighted tabulations from the 1995, 1996, 1998, and 1999 Current Population Survey Food Supplements. To adjust for differences in the screener question across years, we use the HRFS12C1 variable. The reference period covers the previous twelve-month period. The household supplemental weight is used to generate the summary statistics because approximately 12 percent of the monthly sample declined to complete the Food Security Supplement. This weight generates statistics that represent the national civilian non-institutional population. The samples consist of households for which we have complete information for all of the following variables: household family income, structure, size, and urban residency status, as well as the reference person's gender, race/ethnicity, age, educational attainment, and industry and occupation of employment. The sample sizes for all householders range from 23,822 to 29,134. The remaining sample sizes are as follows: Non-Hispanic African-Americans: 2233 to 2529; Hispanics: 1771 to 2016; Non-Hispanic Whites: 18659 to 23759; Native Americans: 238 to 271; Asians: 758 to 804; Husband and Wife Households: 13056 to 17549; Single Parent: 3786 to 4213; Single Father: 989 to 1051; Individual Male: 3720 to 3966; High School Dropouts: 2261 to 3188; High School Graduates: 12046 to 14919; Associates Degree: 2099 to 2367; BA Degree: 7416 to 8660.

## Table 3: The Determinants of Household Food Security

| | All Household Heads | | Less Educated | | African American and Hispanic | | Single Parent | | Single Mother | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **dP/dX** | **SE** | **dP/dX** | **SE** | **dP/dX** | **SE** | **dP/dX** | **SE** | **dP/dX** | **SE** |
| Hourly Wage | 0.0088 | 0.0006 | 0.0118 | 0.0008 | 0.0147 | 0.0020 | 0.0152 | 0.0025 | 0.0167 | 0.0032 |
| Food Stamp Usage | -0.1243 | 0.0296 | -0.1192 | 0.0319 | -0.1525 | 0.0552 | -0.1369 | 0.0507 | -0.1407 | 0.0563 |
| Food Stamp Dollar Amount | 0.000001 | 0.0001 | 0.0000 | 0.0001 | 0.0001 | 0.0002 | -0.0002 | 0.0002 | -0.0002 | 0.0002 |
| Female | 0.0258 | 0.0091 | 0.0327 | 0.0114 | 0.0533 | 0.0296 | -0.0528 | 0.0232 | | |
| Hispanic | -0.0154 | 0.0089 | -0.0109 | 0.0102 | | | -0.0053 | 0.0287 | -0.0091 | 0.0368 |
| Non-Hispanic African American | -0.0124 | 0.0078 | -0.0108 | 0.0094 | 0.0026 | 0.0160 | -0.0026 | 0.0219 | -0.0111 | 0.0260 |
| Native American | -0.0102 | 0.0221 | -0.0211 | 0.0297 | | | 0.0160 | 0.0542 | -0.0028 | 0.0713 |
| Asian | 0.0198 | 0.0138 | 0.0308 | 0.0174 | | | 0.0877 | 0.0464 | 0.1227 | 0.0570 |
| Age | -0.0065 | 0.0012 | -0.0079 | 0.0015 | -0.0060 | 0.0038 | -0.0129 | 0.0043 | -0.0183 | 0.0053 |
| $Age^2$ | 0.0001 | 0.00001 | 0.0001 | 0.0000 | 0.0001 | 0.0000 | 0.0002 | 0.0001 | 0.0002 | 0.0001 |
| High School Dropout | -0.0556 | 0.0147 | -0.0202 | 0.0086 | -0.0173 | 0.0371 | -0.1083 | 0.0523 | -0.1252 | 0.0643 |
| High School Graduate | -0.0284 | 0.0085 | | | 0.0082 | 0.0326 | -0.0744 | 0.0359 | -0.1018 | 0.0430 |
| Associate Degree | -0.0194 | 0.0130 | | | 0.0353 | 0.0347 | -0.0611 | 0.0507 | -0.0973 | 0.0622 |
| Single Father | -0.0341 | 0.0142 | -0.0356 | 0.0166 | -0.0238 | 0.0328 | | | | |
| Single Mother | -0.1295 | 0.0165 | -0.1441 | 0.0198 | -0.1752 | 0.0395 | | | | |
| Individual Male | -0.0262 | 0.0102 | -0.0295 | 0.0125 | -0.0162 | 0.0290 | | | | |
| Individual Female | -0.0970 | 0.0172 | -0.1134 | 0.0219 | -0.1406 | 0.0505 | | | | |
| Other Type of Household | -0.0689 | 0.1228 | -0.1428 | 0.1773 | | | | | | |
| Number in Household | -0.0114 | 0.0020 | -0.0135 | 0.0025 | -0.0085 | 0.0053 | -0.0200 | 0.0072 | -0.0178 | 0.0091 |
| Suburb | -0.0027 | 0.0065 | -0.0083 | 0.0082 | -0.0182 | 0.0174 | 0.0041 | 0.0225 | 0.0016 | 0.0273 |
| Rural | 0.0046 | 0.0069 | 0.0086 | 0.0085 | -0.0039 | 0.0227 | 0.0096 | 0.0247 | 0.0118 | 0.0303 |
| Metro Residence Not Identified | 0.0065 | 0.0073 | 0.0088 | 0.0091 | -0.0024 | 0.0223 | 0.0346 | 0.0250 | 0.0121 | 0.0315 |
| Number of Household Heads | 12966 | | 9853 | | 2665 | | 2443 | | 1868 | |

Notes: Authors' calculations from the 1995, 1996, 1997, 1998 and 1999 Current Population Survey Food Supplements. To adjust for differences in the screener question across years, we use the HRFS12C1 variable. All models include year dummy variables. The samples consist of households for which we have complete information for all of the following variables: household family income, structure, size, and urban residency status, as well as the reference person's gender, race/ethnicity, age, educational attainment, and industry and occupation of employment. Variables for Blacks, Native Americans, and Asians refer to non-Hispanic members of the respective groups. Non-Hispanic Whites are omitted from the set of race and ethnicity variables included in the models; college graduates are omitted from the set of variables for educational attainment; and dual-headed households are omitted from the set of variables for household structure. "Monthly amount of food stamps" is measured in dollars and assumes a value of 0 for all non-recipients.

**Table 4: Hourly Wage's Impact on Household Food Security**
**(Nonlinear Wage Specification)**

| | All | | Less Educated | | Single Parents | | Black and Hispanic | |
|---|---|---|---|---|---|---|---|---|
| **Variable** | **dP/dx** | **SE** | **dP/dx** | **SE** | **dP/dx** | **SE** | **dP/dx** | **SE** |
| <$4.25 | -0.1720 | 0.0583 | -0.1800 | 0.0671 | -0.3850 | 0.1198 | -0.1619 | 0.1284 |
| 4.25 to 4.74 | -0.2389 | 0.0442 | -0.2924 | 0.0504 | -0.3757 | 0.0986 | -0.2837 | 0.0827 |
| 4.75 to 5.14 | -0.2149 | 0.0319 | -0.2561 | 0.0371 | -0.2595 | 0.0829 | -0.2574 | 0.0678 |
| 5.15 to 5.74 | -0.2971 | 0.0324 | -0.3268 | 0.0369 | -0.3400 | 0.0793 | -0.3299 | 0.0659 |
| 5.75 to 6.24 | -0.2424 | 0.0284 | -0.2693 | 0.0330 | -0.3354 | 0.0787 | -0.2520 | 0.0606 |
| 6.25 to 6.64 | -0.2359 | 0.0314 | -0.2590 | 0.0366 | -0.4086 | 0.0765 | -0.3245 | 0.0661 |
| 6.65 to 8.28 | -0.1710 | 0.0177 | -0.1834 | 0.0214 | -0.2984 | 0.0608 | -0.1999 | 0.0438 |
| 8.29 to 15.37 | -0.0809 | 0.0092 | -0.0902 | 0.0122 | -0.2191 | 0.0497 | -0.1156 | 0.0319 |
| > $15.37 | - | | - | | - | | - | |

Notes: Authors' calculations from the 1995, 1996, 1997, 1998 and 1999 Current Population Survey Food Supplement. To adjust for differences in the screener question across years, we use the HRFS12C1 variable. Coefficients are for a series of dummy variables that correspond to a portion of the hourly wage distribution. The omitted category is for respondents with hourly wages in excess of $15.37 per hour. The samples consist of households for which we have complete information for all of the following variables: household family income, structure, size, and urban residency status, as well as the reference person's gender, race/ethnicity, age, educational attainment, and industry and occupation of employment. Dummy variables for African-Americans, Native Americans, and Asians refer to non-Hispanic members of the respective groups. All models include year dummy variables and all control variables in Table 3 are included in these models.

**Table 5: The Impact of the Minimum Wage Increases on Food Security and Hunger**

| All Householders | Change in Food Security | | | Change in Hunger | | |
|---|---|---|---|---|---|---|
| **Variable** | **1** | **2** | **3** | **1** | **2** | **3** |
| %Affected | 0.0896[a] | 0.0905[a] | 0.0951[a] | -0.0546[a] | -0.0536[a] | -0.0368[b] |
| | (0.0215) | (0.0231) | (0.0250) | (0.0181) | (0.0194) | (0.0206) |
| Change in Householder EPOP | | -0.0111 | -0.0166 | | -0.0131 | -0.0333 |
| | | (0.1051) | (0.1061) | | (0.0885) | (0.0873) |
| Change in Food Stamp Usage | | | -0.0391 | | | -0.1429[a] |
| | | | (0.0795) | | | (0.0655) |
| Constant | 0.3924 | 0.3925 | 0.3940 | 0.3553 | 0.3555 | 0.3851 |
| **Less Educated** | | | | | | |
| %Affected | 0.0924[a] | 0.0881[a] | 0.0860[a] | -0.0452[a] | -0.0305[c] | -0.0164 |
| | (0.0245) | (0.0261) | (0.0275) | (0.0194) | (0.0203) | (0.0209) |
| Change in Householder EPOP | | 0.0526 | 0.0556 | | -0.1816[a] | -0.2015[a] |
| | | (0.1079) | (0.1091) | | (0.0838) | (0.0828) |
| Change in Food Stamp Usage | | | 0.0208 | | | -0.1392[a] |
| | | | (0.0845) | | | (0.0642) |
| Constant | 0.3657 | 0.3672 | 0.3676 | 0.3280 | 0.3581 | 0.3872 |
| **Nonwhite** | | | | | | |
| %Affected | 0.0658[c] | 0.0439 | 0.0491 | -0.0518[c] | -0.0344 | -0.0313 |
| | (0.0472) | (0.0472) | (0.0475) | (0.0345) | (0.0343) | (0.0346) |
| Change in Householder EPOP | | 0.2835[a] | 0.2604[a] | | -0.2251[a] | -0.2384[a] |
| | | (0.1266) | (0.1288) | | (0.0922) | (0.0940) |
| Change in Food Stamp Usage | | | -0.1034 | | | -0.0598 |
| | | | (0.1060) | | | (0.0773) |
| Constant | 0.4082 | 0.4394 | 0.4453 | 0.3806 | 0.4191 | 0.4229 |
| **Single Parents** | | | | | | |
| %Affected | 0.1171[a] | 0.1311[a] | 0.1529[a] | -0.0711[a] | -0.0761[a] | -0.0924[a] |
| | (0.0414) | (0.0451) | (0.0475) | (0.0319) | (0.0349) | (0.0368) |
| Change in Householder EPOP | | -0.1156 | -0.1339 | | 0.0408 | 0.0546 |
| | | (0.1466) | (0.1464) | | (0.1135) | (0.1134) |
| Change in Food Stamp Usage | | | -0.1396[c] | | | 0.1047[c] |
| | | | (0.0991) | | | (0.0767) |
| Constant | 0.4074 | 0.4112 | 0.4231 | 0.3261 | 0.3270 | 0.3398 |

Notes: Authors' calculations from the 1995, 1996, 1998 and 1999 Current Population Survey Food Supplements. The income category-state-year aggregates are based on micro data samples of households for which we have complete information for all of the following variables: household family income, structure, size, urban residency status, and food stamp usage, as well as the reference person's gender, race/ethnicity, age, educational attainment, and industry and occupation of employment. All models contain 153 observations. The regressions are estimated using weighted least squares where the weight is the state's population. All models include state dummy variables. "a" – Significant at the 1% level. "b" – Significant at the 5% level. "c"-Significant at the 10% level.

**Table 6: Predicted Impact of $1.50 Minimum Wage Increase by Household Income: All Householders in Selected States**

| Panel A: Food Security | | | | | | |
|---|---|---|---|---|---|---|
| | Less than $12,500 | | $12,500 to $34,999 | | $35,000 or more | |
| State | %Affected | Predicted Change | %Affected | Predicted Change | %Affected | Predicted Change |
| NY | 40.3% | 3.8% | 4.4% | 0.4% | 0.7% | 0.1% |
| TN | 39.4% | 3.7% | 8.1% | 0.8% | 3.2% | 0.3% |
| TX | 36.9% | 3.5% | 7.8% | 0.7% | 0.0% | 0.0% |
| CA | 36.5% | 3.5% | 9.1% | 0.9% | 1.7% | 0.2% |
| MD | 35.5% | 3.4% | 6.0% | 0.6% | 0.0% | 0.0% |
| OH | 32.6% | 3.1% | 5.3% | 0.5% | 2.4% | 0.2% |
| PA | 24.8% | 2.4% | 4.4% | 0.4% | 0.7% | 0.1% |
| AL | 24.2% | 2.3% | 10.2% | 1.0% | 0.0% | 0.0% |
| GA | 23.3% | 2.2% | 6.6% | 0.6% | 0.0% | 0.0% |
| MI | 22.7% | 2.2% | 2.0% | 0.2% | 0.0% | 0.0% |
| FL | 22.6% | 2.2% | 4.6% | 0.4% | 1.1% | 0.1% |
| NC | 19.8% | 1.9% | 8.1% | 0.8% | 1.8% | 0.2% |
| RI | 7.5% | 0.7% | 7.2% | 0.7% | 0.0% | 0.0% |
| Panel B: Hunger | | | | | | |
| NY | 40.3% | -1.5% | 4.4% | -0.2% | 0.7% | 0.0% |
| TN | 39.4% | -1.4% | 8.1% | -0.3% | 3.2% | -0.1% |
| TX | 36.9% | -1.4% | 7.8% | -0.3% | 0.0% | 0.0% |
| CA | 36.5% | -1.3% | 9.1% | -0.3% | 1.7% | -0.1% |
| MD | 35.5% | -1.3% | 6.0% | -0.2% | 0.0% | 0.0% |
| OH | 32.6% | -1.2% | 5.3% | -0.2% | 2.4% | -0.1% |
| PA | 24.8% | -0.9% | 4.4% | -0.2% | 0.7% | 0.0% |
| AL | 24.2% | -0.9% | 10.2% | -0.4% | 0.0% | 0.0% |
| GA | 23.3% | -0.9% | 6.6% | -0.2% | 0.0% | 0.0% |
| MI | 22.7% | -0.8% | 2.0% | -0.1% | 0.0% | 0.0% |
| FL | 22.6% | -0.8% | 4.6% | -0.2% | 1.1% | 0.0% |
| NC | 19.8% | -0.7% | 8.1% | -0.3% | 1.8% | -0.1% |
| RI | 7.5% | -0.3% | 7.2% | -0.3% | 0.0% | 0.0% |

Notes: Values represent the simulated impact of raising the federal minimum wage from $5.15 to $6.65. %Affected corresponds to the share of householders within the given state and income category whose hourly wages prior to the minimum wage increase are between $5.15 and $6.64. The column labeled "Predicted Change" reports the product of the %Affected and the corresponding estimated coefficient on %Affected from Table 5. For the food security simulation the coefficient is 0.0951 and for the hunger simulation the coefficient is -0.0368.

**Table 6 cont.: Predicted Impact of $1.50 Minimum Wage Increase by Household Income: Noncollege Householders in Selected States**

Panel A: Food Security

| | Less than $12,500 | | $12,500 to $34,999 | | $35,000 or more | |
|---|---|---|---|---|---|---|
| State | %Affected | Predicted Change | %Affected | Predicted Change | %Affected | Predicted Change |
| NY | 43.7% | 3.8% | 5.2% | 0.4% | 1.1% | 0.1% |
| TN | 39.4% | 3.4% | 6.3% | 0.5% | 4.3% | 0.4% |
| CA | 38.8% | 3.3% | 11.7% | 1.0% | 1.1% | 0.1% |
| MD | 38.7% | 3.3% | 6.8% | 0.6% | 0.0% | 0.0% |
| TX | 38.2% | 3.3% | 7.9% | 0.7% | 0.0% | 0.0% |
| OH | 33.8% | 2.9% | 6.3% | 0.5% | 3.2% | 0.3% |
| PA | 29.9% | 2.6% | 3.1% | 0.3% | 0.9% | 0.1% |
| MI | 26.0% | 2.2% | 2.4% | 0.2% | 0.0% | 0.0% |
| GA | 25.3% | 2.2% | 7.8% | 0.7% | 0.0% | 0.0% |
| AL | 24.2% | 2.1% | 12.5% | 1.1% | 0.0% | 0.0% |
| FL | 23.7% | 2.0% | 6.0% | 0.5% | 0.0% | 0.0% |
| NC | 20.2% | 1.7% | 9.5% | 0.8% | 2.4% | 0.2% |
| RI | 9.0% | 0.8% | 4.0% | 0.3% | 0.0% | 0.0% |

Notes: Values represent the simulated impact of raising the federal minimum wage from $5.15 to $6.65. %Affected corresponds to the share of householders within the given state and income category whose hourly wages prior to the minimum wage increase are between $5.15 and $6.64. The column labeled "Predicted Change" reports the product of the %Affected and the corresponding estimated coefficient on %Affected from Table 5. For the food security simulation the coefficient is 0.0860.

**Table 6 cont.: Predicted Impact of $1.50 Minimum Wage Increase by Household Income: Single-Parent Householders in Selected States**

| Panel A: Food Security | | | | | | |
|---|---|---|---|---|---|---|
| | Less than $12,500 | | $12,500 to $34,999 | | $35,000 or more | |
| State | %Affected | Predicted Change | %Affected | Predicted Change | %Affected | Predicted Change |
| OH | 59.4% | 9.1% | 3.0% | 0.5% | 9.4% | 1.4% |
| CA | 53.7% | 8.2% | 6.6% | 1.0% | 0.0% | 0.0% |
| MI | 43.6% | 6.7% | 4.9% | 0.7% | 0.0% | 0.0% |
| NY | 39.3% | 6.0% | 5.8% | 0.9% | 0.0% | 0.0% |
| FL | 35.5% | 5.4% | 11.3% | 1.7% | 0.0% | 0.0% |
| TN | 35.0% | 5.4% | 25.9% | 4.0% | 0.0% | 0.0% |
| AL | 34.2% | 5.2% | 14.4% | 2.2% | 0.0% | 0.0% |
| TX | 33.6% | 5.1% | 10.1% | 1.5% | 0.0% | 0.0% |
| MD | 20.2% | 3.1% | 16.4% | 2.5% | 0.0% | 0.0% |
| GA | 18.3% | 2.8% | 10.8% | 1.6% | 0.0% | 0.0% |
| RI | 15.4% | 2.3% | 0.0% | 0.0% | 0.0% | 0.0% |
| NC | 12.7% | 1.9% | 12.4% | 1.9% | 0.0% | 0.0% |
| PA | 9.8% | 1.5% | 8.5% | 1.3% | 0.0% | 0.0% |
| Panel B: Hunger | | | | | | |
| OH | 59.4% | -5.5% | 3.0% | -0.3% | 9.4% | -0.9% |
| CA | 53.7% | -5.0% | 6.6% | -0.6% | 0.0% | 0.0% |
| MI | 43.6% | -4.0% | 4.9% | -0.5% | 0.0% | 0.0% |
| NY | 39.3% | -3.6% | 5.8% | -0.5% | 0.0% | 0.0% |
| FL | 35.5% | -3.3% | 11.3% | -1.0% | 0.0% | 0.0% |
| TN | 35.0% | -3.2% | 25.9% | -2.4% | 0.0% | 0.0% |
| AL | 34.2% | -3.2% | 14.4% | -1.3% | 0.0% | 0.0% |
| TX | 33.6% | -3.1% | 10.1% | -0.9% | 0.0% | 0.0% |
| MD | 20.2% | -1.9% | 16.4% | -1.5% | 0.0% | 0.0% |
| GA | 18.3% | -1.7% | 10.8% | -1.0% | 0.0% | 0.0% |
| RI | 15.4% | -1.4% | 0.0% | 0.0% | 0.0% | 0.0% |
| NC | 12.7% | -1.2% | 12.4% | -1.1% | 0.0% | 0.0% |
| PA | 9.8% | -0.9% | 8.5% | -0.8% | 0.0% | 0.0% |

Notes: Values represent the simulated impact of raising the federal minimum wage from $5.15 to $6.65. %Affected corresponds to the share of householders within the given state and income category whose hourly wages prior to the minimum wage increase are between $5.15 and $6.64. The column labeled "Predicted Change" reports the product of the %Affected and the corresponding estimated coefficient on %Affected from Table 5. For the food security simulation the coefficient is 0.1529 and for the hunger simulation the coefficient is -0.0924.

**Table 7: Specification Tests for All Householders**

| **Change in EPOP** | **1996-1995** | **1998-1996** | **1999-1998** |
|---|---|---|---|
| %Affected in 1996 | 0.0028 | 0.0883[c] | 0.0553 |
| | (0.0470) | (0.0607) | (0.0717) |
| Change in State EPOP | 0.0047[a] | 0.0071[a] | -0.0017 |
| | (0.0017) | (0.0018) | (0.0030) |
| $R^2$ | 0.5474 | 0.3894 | 0.1604 |
| **Change in Food Security** | **1996-1995** | **1998-1996** | **1999-1998** |
| %Affected in 1996 | -0.0021 | 0.0285 | -0.0095 |
| | (0.0897) | (0.0804) | (0.0826) |
| Change in State EPOP | -0.0036 | 0.0008 | 0.0009 |
| | (0.0032) | (0.0024) | (0.0035) |
| $R^2$ | 0.2472 | 0.2914 | 0.3594 |

Notes: Authors' calculations from the 1995, 1996, 1998 and 1999 Current Population Survey Food Supplements. The income category-state-year aggregates are based on micro data samples of households for which we have complete information for all of the following variables: household family income, structure, size, urban residency status, and food stamp usage, as well as the reference person's gender, race/ethnicity, age, educational attainment, and industry and occupation of employment. All models contain 51 observations. The regressions are estimated using weighted least squares where the weight is the state's population. All models include dummy variables for census division. Controls for changes in food stamp usage do not change these results. "a" – Significant at the 1% level. "b" – Significant at the 5% level. "c"-Significant at the 10% level.

**Table 8: The Impact of the Minimum Wage on Employment, Food Security and Hunger**

| | **EPOP** | | **Food Security** | | **Hunger** | |
|---|---|---|---|---|---|---|
| **Variable** | **A** | **B** | **A** | **B** | **A** | **B** |
| Log(MW) | 0.0207 | -0.0027 | 0.0359[a] | -0.0049 | -0.0404[a] | -0.0087 |
| | (0.0094) | (0.0250) | (0.0129) | (0.0297) | (0.0076) | (0.0187) |
| State EPOP | 0.0040[a] | 0.0041[a] | -0.0011 | -0.0024[a] | 0.0012[b] | 0.0019[a] |
| | (0.0012) | (0.0012) | (0.0014) | (0.0012) | (0.0008) | (0.0007) |
| Food Stamp Usage | -0.2017[a] | -0.1758[a] | -0.1633[a] | -0.3229[a] | 0.1364[a] | 0.2173[a] |
| | (0.0677) | (0.0751) | (0.0949) | (0.0849) | (0.0559) | (0.0536) |
| $R^2$ | 0.6157 | 0.6258 | 0.7092 | 0.8049 | 0.5727 | 0.6707 |

Note: The estimates are the coefficients from state-year panels that regress employment-population ratio, food security, and hunger on a constant, the employment-population ratio, logarithm of the maximum of the state and federal minimum wages, and food stamp usage. Model A includes state dummy variables, and Model B includes both state and year dummy variables. The state-year aggregates are built from the micro data in the CPS Food Supplements: 1995, 1996, 1997, 1998 and 1999.

## Appendix 1: Survey Questions in the Current Population Survey Food Supplement

*Households are assigned a food security status based on their pattern of responses to the following questions*.

Now I'm going to read you several statements that people have made about their food situation. Please tell me whether the statement was often, sometimes, or never true in the last 12 months.

1. "I worried whether our food would run out before we got money to buy more."
2. "The food that we bought just didn't last, and we didn't have money to get more."
3. "We couldn't afford to eat balanced meals."
* 4. "We relied on only a few kinds of low-cost food to feed the children because we were running out of money to buy food."
* 5. "We couldn't feed the children a balanced meal because we couldn't afford that."
* 6. "The children were not eating enough because we just couldn't afford enough food."

Additional Questions:

7. In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
8. How often did this happen – almost every month, some months but not every month, or only one or two months?

9. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?

10. In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?

11. Sometimes people lost weight because they don't have enough to eat. In the last 12 months, did you lose weight because there wasn't enough food?

12. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?
13. How often did this happen – almost every month, some months but not every month, or in only one or two months?

* 14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food?

* 15. In the last 12 months, did any of the children ever skip meals because there wasn't enough money for food?
* 16. How often did this happen – almost every month, some months but not every month, or in only one or two months?

* 17. In the last 12 months, were the children ever hungry but you just couldn't afford more food?

* 18. In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?

* Denotes questions asked only of households with children
Source: Bickel et al (2000).

## ENDNOTES

[1] See, for example, Brown, Gilroy and Kohen (1982), Katz and Krueger (1992); Neumark and Wascher (1992); Card and Krueger (1995); Lang and Kahn (1998); Partridge and Partridge (1998); De Fraja (1998); Burkhauser et al (2000); and Zavodny (2000).

[2]A simple calculation can show that these estimates yield an increase in the income of low-wage workers. Suppose that each 10 percent increase in the minimum wage produced job losses of 1 percent for minimum wage workers. Using this estimate, a simple back-of-the-envelope calculation shows that with a 90 cent increase in the minimum wage, 98 percent of the 11 million workers between $4.25 and $5.15 get a raise and only 2 percent have to look for new jobs. Given the high turnover rates in these jobs, spells of unemployment should be quite short, Furthermore, the net gain for the economy will be even greater if effort is tied to wages, because productivity will improve.

[3] The Cornell Division of Nutritional Sciences developed one of the first surveys. Its questions were designed from actual experiences of hunger documented by working-age women in upstate New York. This survey became a precursor to the Current Population Survey (CPS) Food Security Supplement.

[4] See, for example, Kendall et al (1995, 1996), Frongillo et al (1997b), and Hamilton et al (1997).

[5] For illustration, suppose the survey questions are ordered from least severe to most severe. Hamilton et al conclude that if a household gives *n* affirmative responses (i.e. reports *n* types of behaviors related to food insecurity), then the affirmative responses can be presumed to have come from the *n least severe* questions (i.e. the first *n* questions) on the list. Thus, households that give *numerically* more affirmative responses can be presumed to have experienced *qualitatively* more severe behaviors relevant to food insecurity and hunger.

[6] An earlier study by Bernstein and Brocht (2000) found similar results. They show that 71 percent of the beneficiaries would be adults and 60 percent would be women. Even though blacks and Hispanics collectively make up 23 percent of the workforce, they would comprise 35 percent of the beneficiaries.

[7] See Deaton and Muellbauer (1980) for a detailed discussion of household production theory.

[8] Stigler and Becker (1977) have utilized this model to explain choices between goods in differing observable characteristics (e.g., quality), addiction, the existence of habits and customs, the effects of advertising on behavior, and fashions and fads.

[9] Production functions for other features of meals, such as taste, can be easily developed.

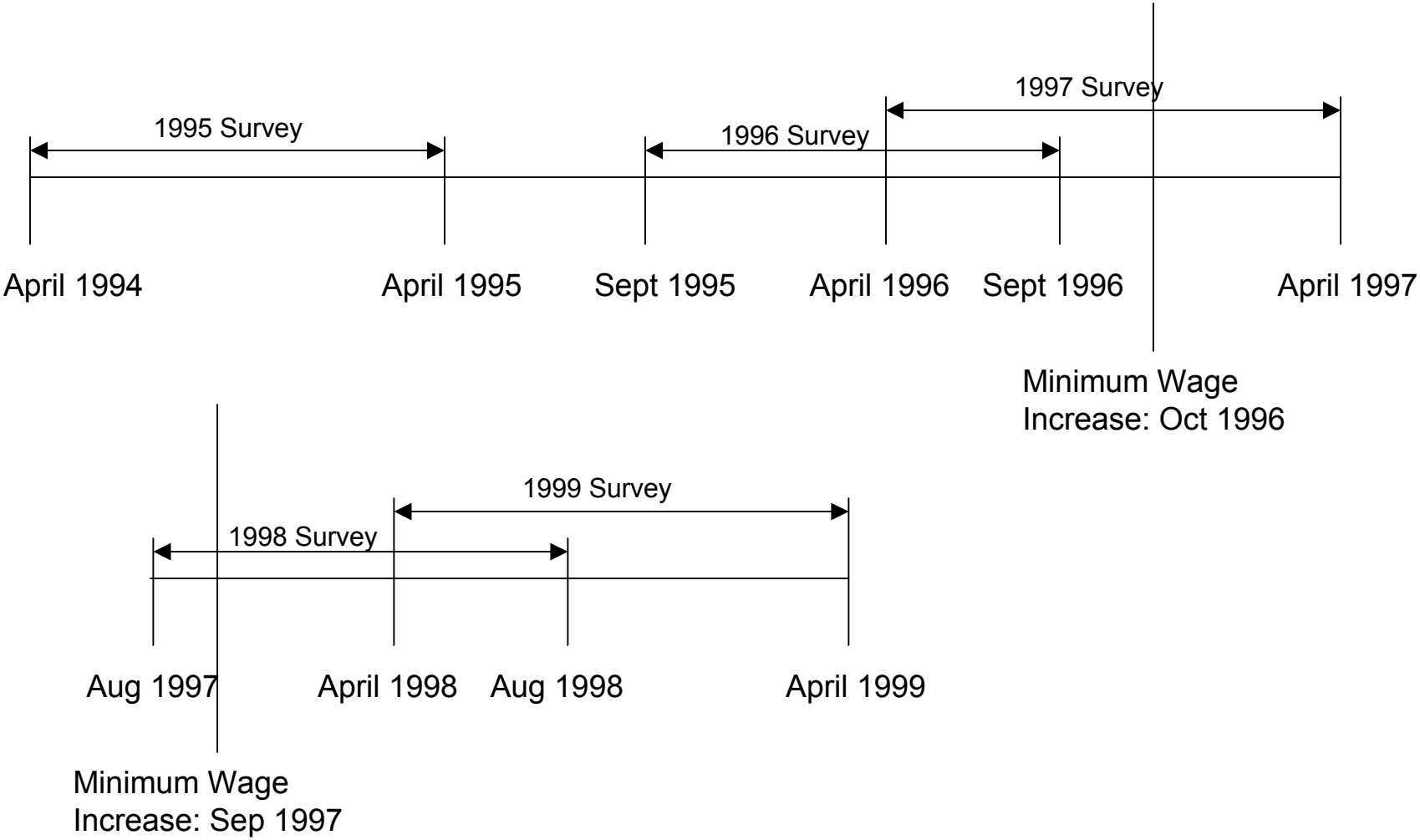
[10] Note that the time constraint has been incorporated into the budget constraint.

[11] A variety of studies has shown that individuals and families at the lowest part of the earnings and income scales experienced the largest benefits of the extremely tight labor markets of the 1990s. See, for example, Freeman and Rodgers (2000), Hines, Hoynes and Krueger (2002).

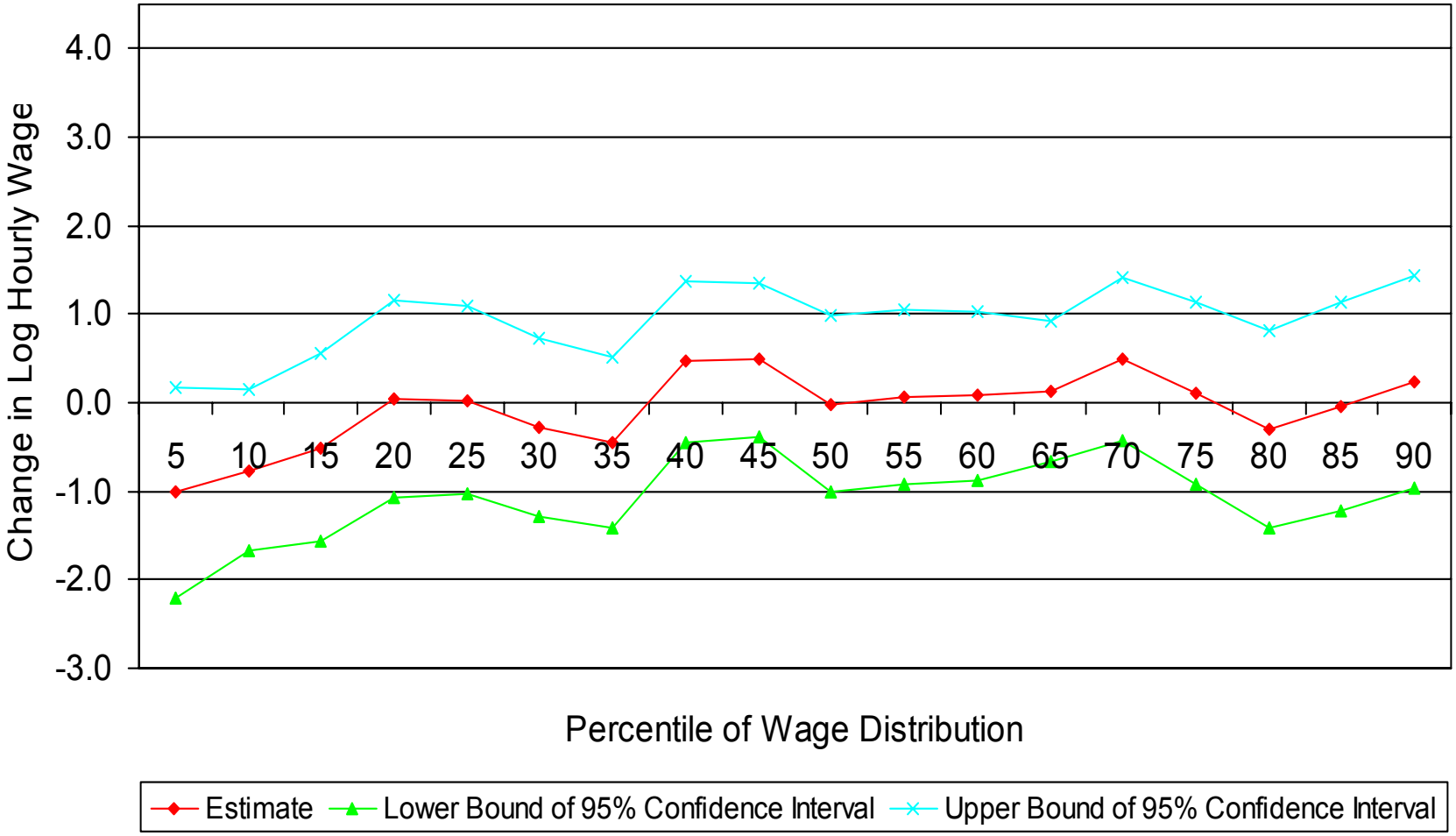
[12] The hourly wage coefficients can be used to construct estimates of the increase in food security due to an increase in the hourly wage from $5.15 to $6.65 per hour. Our calculation assumes that individuals earning from $5.15 to $6.64 are moved to the new statutory minimum of $6.65. Evaluated at the mean characteristics of workers in the $5.15 to $6.64 range, the increase in food security due to an increase in the hourly wage from $5.15 to $6.65 is 2.3 percent. Estimates for noncollege graduate household heads, single mothers, nonwhites and single parents are 2.9, 2.5, 3.2 and 2.8 percent. For all householders, the increase raises food security from 78.3 to 80.6 percent, for non-college educated householders, the increases raises food security from 78.8 to 81.7 percent, 76.9 to 79.5 percent for single mothers, 75.3 to 78.5 percent for

nonwhite householders, and 78.3 to 81.1 percent for single parents. The detailed calculations are available from the authors.

# Figure 1: Timeline of CPS Food Security Supplement and Increases in the Minimum Wage

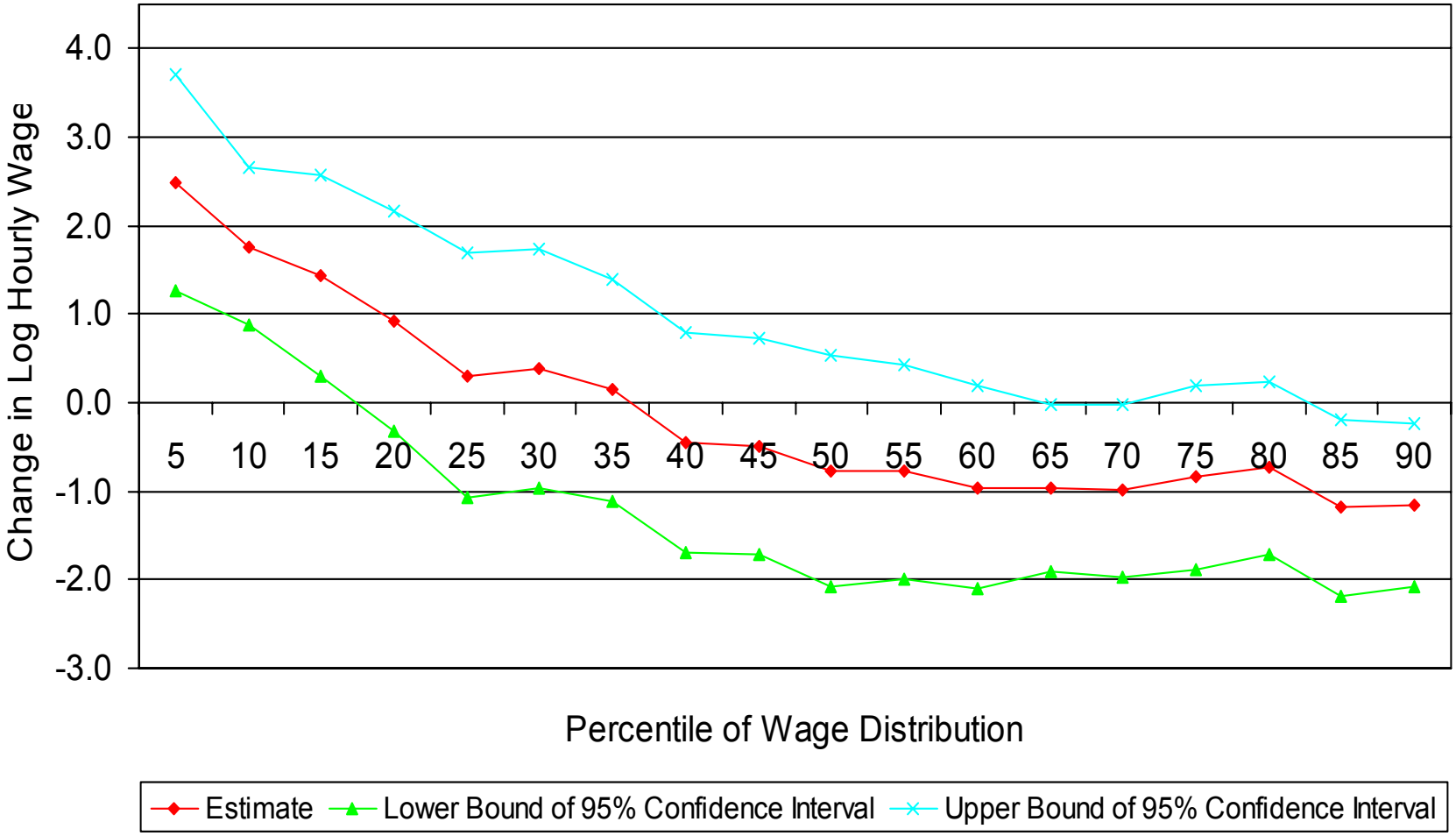


# Figure 2: Specification Test
# 1996-1995 Change in Log Hourly Wages



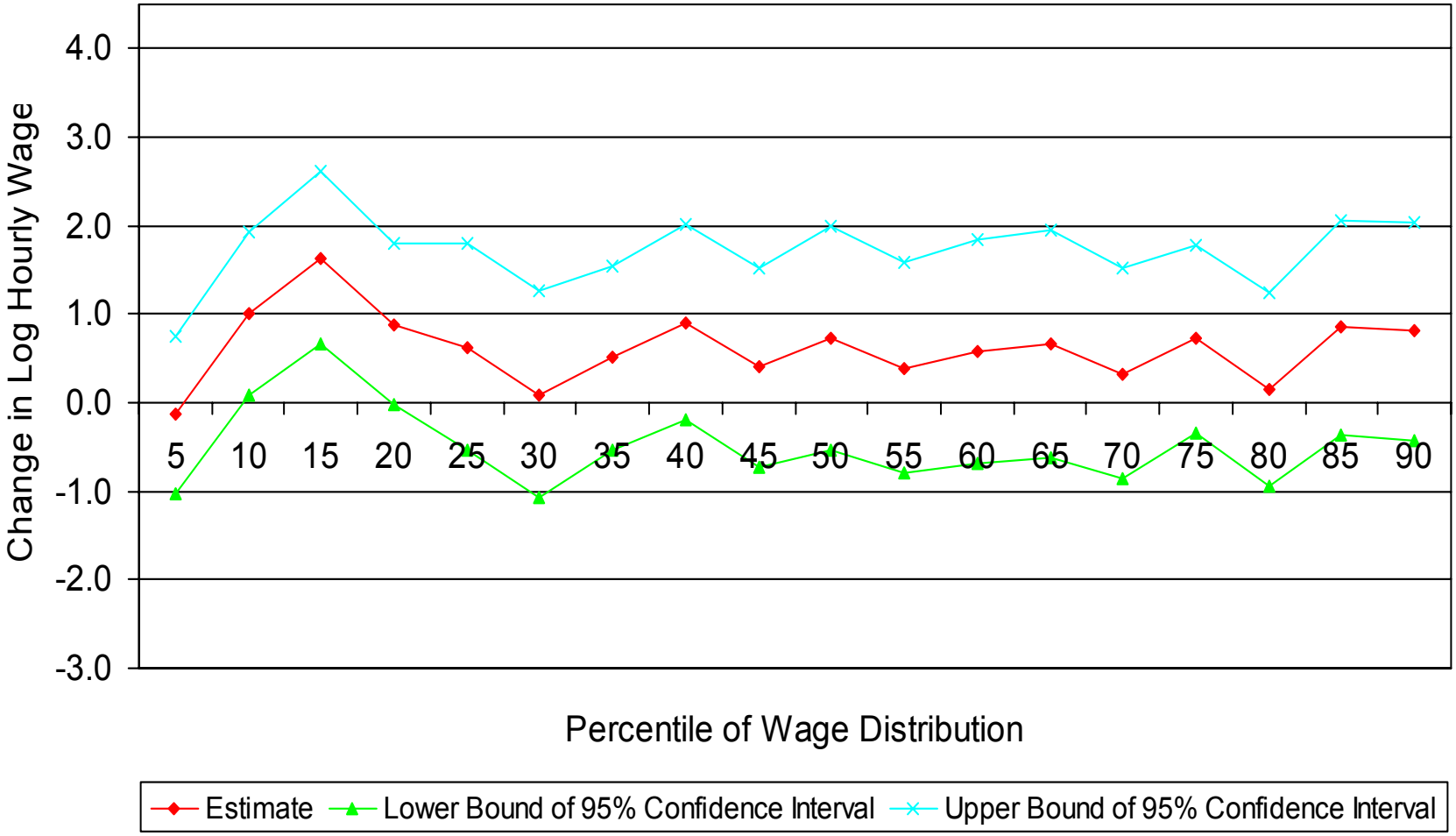

Notes: The vertical axis shows 100 times the impact of a 1 percentage point increase in the percent of workers affected by the 1996-97 minimum wage increase on the change in the log hourly wage rate between 1995 and 1996. See text for a detailed description of model.

# Figure 3: Specification Test
# 1998-1996 Change in Log Hourly Wages



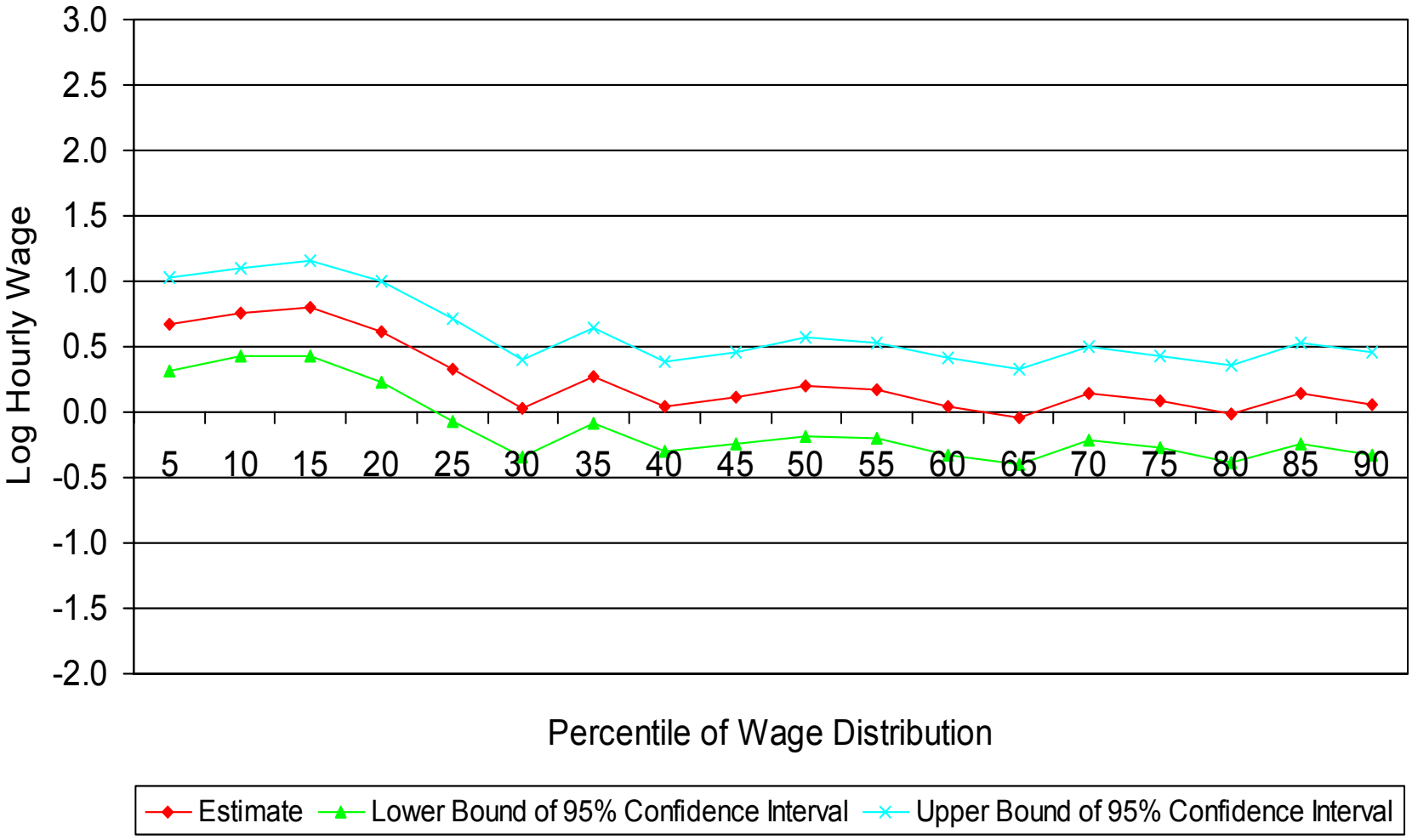

Notes: The vertical axis shows 100 times the impact of a 1 percentage point increase in the percent of workers affected by the 1996-97 minimum wage increase on the change in the log hourly wage rate between 1996 and 1998. See text for a detailed description of model.

# Figure 4: Specification Test
# 1999-1998 Change in Log Hourly Wages




Notes: The vertical axis shows 100 times the impact of a 1 percentage point increase in the percent of workers affected by the 1996-97 minimum wage increase on the change in the log hourly wage rate between 1998 and 1999. See text for a detailed description of model.

# Figure 5: The Impact of the Minimum Wage on Log Hourly Wages
## (Log of the Maximum of the State and Federal Minimum Wage Specification)




Notes: The estimate is the coefficient on the log of the maximum of the state and federal minimum wage in a state-year panel regression of log hourly wages on a constant, the aforementioned variable, the employment-population ratio, and food stamp usage. State and year dummy variables are included. The state-year aggregates are built from micro data in the CPS Food Supplements of 1995, 1996, 1997, 1998 and 1999.