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Why Did the Target Efficiency of the Minimum Wage Increase in Recent Years?

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Abstract

I estimate the change in the target efficiency of the federal minimum wage from 1999 to 2013, and I identify the labor market changes that contributed to the change in target efficiency. I find that the target efficiency of the minimum wage improved over this time period. Most of the improvement occurred in pre-recession years, due primarily to reduced income among near-poor minimum wage workers of all ages. Decreased teen employment, increased teen wages (relative to the minimum wage), and increased employment among poor, low-skilled 20-29 year-olds also contributed. The remainder of the improvement in target efficiency occurred following the onset of the recession, largely due to a stagnation in wages among poor, low-wage workers relative to the wages of non-poor, low-wage workers.

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1 Introduction

Whether or not the minimum wage reduces income inequality is an unsettled question in the literature (e.g. Dube, 2013; Burkhauser and Sabia, 2007; Neumark et al., 2005; Addison and Blackburn, 1999; Card and Krueger, 1995). However, the fact that the minimum wage is an *inefficient* form of income redistribution is unquestioned. Indeed, even Card and Krueger, whose work on employment effects of the minimum wage is frequently cited by minimum wage advocates, acknowledge that, "the minimum wage is evidently a 'blunt instrument' for redistributing income to the poorest families" (Card and Krueger, 1995). A primary reason for the inefficiency of the minimum wage in redistributing income to the poor is that the vast majority of low-wage workers are not poor, a fact first documented by Gramlich (1976) and confirmed in a number of later studies (e.g. Dube 2013; Burkhauser and Sabia 2007, 2010; Horrigan and Mincy 1993; Burkhauser and Finegan 1989; Johnson and Browning 1983).

In recent years, at least two labor-market trends have emerged which, in theory, may have improved the target efficiency of the minimum wage.[1,2] First, since the 1990s the teen employment rate has fallen precipitously. In 1999 42% of teens aged 16-19 were employed. By 2013 this figure had fallen to 24%.[3] Since teens make up a significant share of minimum wage workers, and a larger share of non-poor minimum wage workers, a reduction in teen employment could improve the target

[1] I say "at least" two labor-market trends because these are the labor-market trends that provide the motivation for this study, but there may be others. Indeed, one purpose of this study is to determine the age-specific labor-market changes that may have contributed to the change in target efficiency over this time period.
[2] The minimum wage is considered more target efficient if a greater share of the benefits derived from an increase in the minimum wage accrue to poor workers. This definition is based on arguments commonly made in support of the minimum wage. Consider, for example, a statement made by Senator Edward Kennedy in an effort to raise the federal minimum wage: "the minimum wage was one of the first – and is still one of the best – anti-poverty programs that we have" (quoted in Neumark, 2008).
[3] Estimated using data from the March Current Population Survey. See appendix I for a time series of employment-to-population ratios across the age distribution from 1999 to 2013.

efficiency of the minimum wage.[4] Second, since the onset of the Great Recession in 2007, median family income has fallen by about 8%.[5] If non-poor workers earning minimum wages experienced a decline in income, they may have been pushed into poverty, thus increasing the target efficiency of the minimum wage.

My objective in this study is twofold. First, I determine how the target efficiency of the federal minimum wage changed from 1999 through 2013. Target efficiency is established by simulating the same real increase in the federal minimum wage in each year from 1999 to 2013, then determining the share of benefits accruing to poor and non-poor families. I simulate a $2.85 increase (in 2013 dollars) in the federal minimum wage, consistent with recent proposals by Senate Democrats.[6] Target efficiency improves over this period if a greater share of benefits goes to families with incomes below the federal poverty line.

Second, I identify the age-specific labor-market changes that drove any change in target efficiency, and I quantify the importance of each age group's contribution to the improvement in target efficiency. Target efficiency will improve if the average annual benefit received by poor minimum wage workers increases relative to the average annual benefit received by non-poor workers, and/or the share of minimum-wage workers in poor families increases. If the former occurred, I determine whether the increase in average annual benefit was due to increased hours worked by poor minimum wage workers relative to non-poor minimum wage workers, increased weeks worked, or a larger wage increase. If the share of minimum wage workers in poor families increased, I identify the age-specific labor market changes that contributed to this increase. I then

[4] Using data from the March Current Population Survey, in 1999 29.0% of low-wage workers (those earning less than ½ the median wage) were teens aged 16-19. Only 10.1% of these workers were poor.
[5] This represents the change in median family income from March 2007 to March 2012 as calculated using historical income tables provided by the U.S. Census Bureau: http://www.census.gov/hhes/www/income/data/historical/families/
[6] In March of 2013 Senate Democrats proposed Senate bill S.460, requesting an increase in the federal minimum wage to $10.10/hour in three increments over a two year period.

determine which of these age-specific labor market changes were more impactful in driving the increase in the share of minimum wage workers in poverty by decomposing the increase into the portions contributed by each age group.

I find that the target efficiency of the federal minimum wage improved from 1999 to 2013. Using data from the March Current Population Survey (CPS) Outgoing Rotation Group (ORG) files, I find that in 1999-2001 15.33% of minimum wage benefits went to families with incomes below the federal poverty line.[7] By 2011-2013, this figure had risen to 18.76%, a 3.43 percentage point (22.37%) increase. I find that most of this improvement (2.20 percentage points) occurred in the years prior to the onset of the Great Recession (from 1999-2001 to 2005-2007), due entirely to an increase in the share of minimum wage workers in poor families. The balance of the improvement in target efficiency occurred in the years since the onset of the Great Recession (2005-2007 to 2011-2013), due primarily to an increase in the average benefit received by poor minimum wage workers relative to non-poor workers.

The increase in the share of minimum wage workers in poor families during pre-recession years (1999-2001 to 2005-2007) was primarily due to decreased family income among near-poor minimum wage workers of all ages. Decreased teen employment, and increased teen wages (relative to the minimum wage), and increased employment among poor, low-skilled 20-29 year-olds also contributed. The increase in the mean annual benefit for minimum wage workers in poor families relative to the mean annual benefit for minimum wage workers in non-poor families during recession and post-recession years (2005-2007 to 2011-2013) was due to a stagnation in wages among poor low-wage workers relative to the wages of non-poor low-wage workers. This wage stagnation caused poor workers to experience a larger wage increase when the simulated minimum wage hike was imposed, thus increasing their annual benefit relative to non-poor workers.

[7] 3-year moving averages are used throughout this study in order to reduce noise in the estimates.

2 Literature Review

Neumark and Wascher (2008) provide a thorough review of the literature concerned with minimum wage target efficiency. The first of these was conducted by Gramlich (1976). Gramlich simulated an increase in the 1973 federal minimum wage, assuming no effect on employment or hours worked. He found that only about half of the total benefits would flow to workers with family incomes below the median. Since the Gramlich (1976) study, a number of other papers have conducted similar simulation-type analyses of the target efficiency of the minimum wage (e.g., Johnson and Browning 1983; Burkhauser and Finegan 1989; Horrigan and Mincy 1993; Burkhauser and Sabia 2007, 2010). Several of these newer studies attempt to improve upon the Gramlich approach by accounting for employment effects and other relevant parameters in their simulation models. However, none of these studies allows for the possibility that employment effects might vary across the income distribution, or for possible labor supply responses by other household members (which might also vary across the income distribution). Since an analysis of the target efficiency of the minimum wage relies on identifying differential impacts across the income distribution, it is not clear that these more complicated models provide additional insight on target efficiency. Because of this, the simulation conducted in this study follows the more simple Gramlich approach.[8]

[8] Two studies by Burkhauser and Sabia (2007, 2010) represent the most recent papers in this vein of research. The 2007 paper finds a slight decline in target efficiency from 1995 to 2003, and the 2010 paper finds a substantial decline from 2007 to 2008. It is not obvious why the findings in the Burkhauser and Sabia (2010) study differ so much from the results in my study. In a recent review of Burkhauser and Sabia, Arindrajit Dube (see http://arindube.com/2014/01/22/the-poverty-of-minimum-wage-facts/) noted that they use the household, instead of the family, as the unit for calculating poverty status instead. I choose to use the family, following the approach taken by the U.S. Census Bureau. This could account for some of the difference between our estimates. However, this does not explain why the drop in target efficiency is so dramatic from one year to the next in their study: in 2007 they estimate that 15.5% of the benefits will accrue to poor workers versus 10.5% in 2008. They do not provide standard errors with their estimates so it is possible that the dramatic swing is simply due to sampling variation. In my study I attempt to overcome this by using three-year moving averages in all estimates.

This study contributes to the literature in several important ways. First, I update estimates of minimum wage target efficiency through 2013. In particular, I estimate how the minimum wage target efficiency changed during the period just before the Great Recession, and during the period following the onset of the Great Recession. Second, and more importantly, I present a methodology whereby I am able to 1) identify the age-specific labor-market changes which contributed to any change in target efficiency, and 2) determine the relative importance of these labor-market changes in terms of their impact on target efficiency through a decomposition technique. While my desire to identify the impact of declining teen employment on minimum wage target efficiency motivated me to conduct the analysis using age groups, the methodology could be applied to groups defined by race, sex, or any other mutually exclusive and exhaustive subdivisions of low-wage workers.

This study also provides a link between the minimum wage literature and the wage inequality literature. As documented by Autor (2013), the U.S. labor market has undergone a polarization of wages and job opportunities over the past two decades. In particular, Autor shows that a decline in middle-wage, middle-skill jobs has been accompanied by growth in both high-skill, high-wage jobs and traditionally low-skill, low-wage jobs. Smith (2011) presents evidence suggesting that this occupational polarization in the U.S. adult labor market has resulted in increased competition for jobs that teens traditionally hold, thus pushing them out of the labor market.[9] I advance this vein of research by examining the impact that the decline in teen employment has had on minimum wage target efficiency.

Finally, this study contributes to the income inequality literature by shedding light on a previously unidentified trend of reduced income among families in lower income quantiles during the years of economic expansion prior to the Great Recession. Evidence of declining income among

[9] Smith does not attribute the decline in teen employment solely to the phenomenon of wage and employment polarization, but he does present evidence suggesting that it is an important contributor to the decline.

poor families is an important counterpart to work on income inequality by Saez (2007), which shows growth in income for individuals at the top of the income distribution.[10]

3 Data

Data are drawn from the March CPS ORG files for the years 1999-2013. Observations are included for individuals aged 16-64 who are determined to be directly affected by an increase in the federal minimum wage.[11] A directly-affected (DA) worker is one whose hourly wage falls in a specified range, as described in the following section. I attempt to construct straight-time wages[12] for all workers. Where possible I use reported hourly wages. For non-hourly workers, I estimate hourly wages from usual weekly earnings and usual weekly hours worked.[13] Each worker's family is assigned to an income-to-needs category. Income-to-needs (ITN) is defined as the ratio of total family income to the family-size adjusted poverty level. I use the CPS definition of a family, which is a group of two or more persons (one of whom is the householder) residing together and related by birth, marriage, or adoption. I use poverty thresholds that are published each year by the U.S. Census Bureau.[14]

Target efficiency is established by simulating a $2.85 increase (in 2013 dollars) in the federal minimum wage, then determining the annual share of benefits which flows to each segment of the

[10] While Saez' work on rising income for those at the top of the income distribution is widely known and recognized, I am not aware of any work documenting the decline in income for families near the poverty line during pre-recession years.

[11] I follow the recent minimum-wage simulation literature in defining the "working-age" population as those individuals between 16 and 64 years of age (see Burkhauser and Sabia 2010)

[12] A straight time wage is an hourly wages that does not include overtime, tips, or commissions.

[13] Reported hourly wages do not include overtime, tips, or commissions while weekly earnings do. This means that estimated hourly wages for non-hourly workers will, on average, be higher than the straight-time wage. 11.1% of the estimation sample has estimated hourly wages. In one specification I only include workers with reported hourly wages. The distribution of directly-affected workers across the income distribution does change somewhat, with slightly more workers in poverty. However, percentage point *change* from 1999 to 2013 in the share of MW benefits accruing to poor worker is nearly identical so the analysis presented in this study does not change substantially. The results from this alternate specification are available upon request.

[14] The Census Bureau poverty measure is the subject of much criticism. Several experimental poverty measures have been developed to address these criticisms (Short 2011; Ruggles 1990). Additional research could determine target efficiency using one of these experimental measures of poverty.

income-to-needs distribution. The annual benefit for a worker is calculated as the product of the wage change (the difference between the worker's current wage and the new minimum wage), by the number of hours worked per week, by the number of weeks worked per year. The hourly wage and hours worked per week are both measured at the time of interview. The weeks worked per year is reported for the previous calendar year. It is assumed that the number of weeks worked in the previous year does not change in the interview year.

During the time period covered by this study, many states adopted minimum wages that exceeded the federal level. In order to ensure a consistent sample across years, I only include observations from states that are bound by a $2.85 increase (in 2013 dollars) in the federal minimum wage in each year from 1999 to 2013. I do not require that a state be *fully* bound by the simulated $2.85 increase in the federal minimum wage, only that the prevailing minimum wage in the state (the higher of the state or federal minimum wage) be less than the federal level plus $2.85 in each year. There are only two states that are excluded from this group: Washington and Oregon. This means that those states that are included in the estimation sample whose prevailing minimum wage exceeds the federal level will experience an increase in the minimum wage that is less than $2.85.

There are a number of individuals for whom I am able to determine an hourly wage but who do not report the number of weeks worked in the past year, and/or the usual number of hours worked per week. In particular, younger workers who report working at the time of the survey may not have been in the labor force during the previous year and therefore do not report weeks worked in the past year. I weight individuals using the earnings weight, which I adjust to account for the possibility that certain types of individuals have a lower probability of reporting weeks and/or hours worked and thus are less likely to be included in the estimation sample. I use a probit regression that includes age, race, sex, and state of residence to estimate the probability of reporting weeks and hours worked, and divide the earnings weight of individuals in the final estimation sample by this probit estimate.

The adjusted weight is an estimate of the inverse of the probability of being in the final estimation sample.[15]

4 Minimum Wage Target Efficiency from 1999 to 2013

In this section I simulate a $2.85 increase (in 2013 dollars) in the federal minimum wage in each year from 1999 to 2013. The purpose of this simulation is to determine how the annual monetary benefits generated by a minimum wage increase would be distributed across the family income-to-needs distribution. The simulation conducted here is highly stylized, relying on a number of simplifying assumptions. First, I assume that an increase in the minimum wage does not affect employment, hours, or weeks worked. Since much of the empirical minimum wage literature suggests disemployment effects when the minimum wage goes up, the simulation presented here represents an upper bound to the total benefits generated. However, as long as employment effects do not vary across the income distribution, the assumption of no employment effects will not impact a calculation of the distribution of benefits across the income distribution.[16]

Second, I assume that an increase in the federal MW affects only the wages of those workers earning between $.05 less than the current minimum wage and the new minimum wage. In other words, if the current MW is $7.25 and the new MW is $10.10, only those workers earning between $7.20 and $10.10 are assumed to experience a wage increase. Throughout this study I refer to workers earning in this wage range as directly-affected workers. I assume that those earning below the lower bound are employed in an uncovered sector. For workers earning just above the new minimum, research suggests the likelihood of some small positive spillovers (e.g. Grossman (1983),

[15] Of those workers for whom I can ascertain an hourly wage, 15.5% do not report hours and/or weeks worked. In one specification I do not adjust the earnings weights and the results are essentially unchanged. These results are available upon request.

[16] While an economic argument could be made as to why employment effect might vary across the income distribution, I am aware of no formal arguments in the literature. Furthermore, to my knowledge, there is no existing empirical study of the before-and-after variety testing for a difference in employment effects across the income distribution.

Card and Krueger (1995), Manning (2003), and Neumark et al. (2004)). In this regard, then, the estimates presented here may understate the total benefits derived from an increased MW. However, as long as workers earning just above the minimum wage are distributed across the income distribution similarly to workers earning in the directly-affected wage range, this assumption will not bias the estimation of the distribution of benefits across the income distribution.

Third, I assume no effect on the earnings, employment, or income of family members of directly affected workers. In the absence of employment losses or hours reductions among MW earners, economic theory predicts that an increase in the MW will induce other family members to reduce their earnings due to the income effect. At the same time, the higher MW may incentivize non-working family members to enter the labor force due to the substitution effect. The impact of a higher MW on the income of other family members depends on which of these effects dominates. Of course, if I allow for the possibility of negative effects on the employment and hours of directly affected workers, the earnings of MW workers may go down, and the income effect could incentivize increased earnings among family members. As before, so long as these two effects are the same for the family members of minimum wage workers throughout the income distribution, the assumption of no effect on other family member's earnings choices will not impact the distribution of minimum wage benefits.

To summarize, this simulation produces an estimate of the distribution of annual benefits across the family income-to-needs distribution assuming that: 1) the increase in the MW only impacts the wages of the directly-affected workers, 2) there is no impact on the employment, hours, or weeks worked of these workers, and 3) there is no effect on the earnings or income of the family members of the directly-affected workers. These simplifying assumptions will not bias the estimates as long it can be assumed that these effects, if accounted for in the simulation, would not vary across the income distribution.

I perform the simulation in two steps. First, I calculate the annual benefit received by each directly-affected worker as the product of his wage increase, his usual weekly hours, and his weeks worked in the past year. Second, I determine the distribution of benefits across the income-to-needs (ITN) distribution by dividing workers into four categories based on their ITN level, (ITN<1 defined as poor, 1≤ITN<2 defined as near-poor, 2≤ITN<3 defined as middle-income, and 3≤ITN defined as high-income) then identifying the share of the total benefits flowing to each ITN group. The results are presented using 3-year moving averages for the years 1999 to 2013 in Figure 1.[17] The share of benefits accruing to directly-affected workers in poor and near-poor families increased by 3.4 and 2.7 percentage points respectively. For directly-affected workers in middle-income and high-income families, the share of benefits fell by 1.9 and 4.2 percentage points respectively.

Since the share of benefits accruing to each segment of the ITN distribution is a function of the mean benefit per worker in each ITN segment, and the share of workers in each segment, I now identify which of these variables is driving the change in minimum wage target efficiency. An improvement in target efficiency will occur if the mean benefit per worker for workers in poor families rises relative to the mean benefit per worker for workers in non-poor families, or if the share of directly-affected workers in poor families increases.

Mean Benefit

In Figure 2 I present a time series of the mean benefit for directly-affected workers in poor and non-poor families. In 1999-2001 the mean benefit for poor and non-poor directly-affected workers is nearly identical. From 1999-2001 to 2005-2007 the mean benefit for poor workers fell somewhat relative to the mean benefit for non-poor workers, though the change is not statistically

[17] The table of values used to construct this figure, as well as the tables used to construct all subsequent figures, is included in Appendix II.

significant. From 2005-2007 to 2011-2013 the mean benefit for poor workers rose relative to the mean benefit for non-poor workers though, again, the change is not statistically significant.

Distribution of Directly-Affected Workers Across the Income-to-Needs Distribution

The distribution of directly-affected workers across the family income-to-needs distribution from 1999-2001 to 2011-2013 is presented in Figure 3. From 1999-2001 to 2005-2007 the share of directly-affected workers in poor families rose substantially, from 15.44% to 18.36% (2.92 percentage point increase). However, there is essentially no change in the share of directly-affected workers in poverty from 2005-2007 to 2011-2013. Combining these results with the mean-benefit results suggests that the improvement in minimum wage target efficiency from 1999-2001 to 2005-2007 was entirely due to an increase in the share of directly-affected workers in poor families while the increase in target efficiency from 2005-2007 to 2011-2013 was primarily due[18] to the increase in the mean benefit received by poor workers relative to the mean benefit received by non-poor workers.

5 Analysis of the Labor-Market Trends Driving the Increase in Minimum Wage Target Efficiency

In this section I identify the labor-market changes that drove the improvement in minimum wage target efficiency. More specifically, I identify the labor-market changes that drove the increase in the share of directly-affected workers in poverty between 1999-2001 and 2005-2007, and the labor-market changes that drove the increase in the mean benefit received by poor workers relative to the mean benefit received by non-poor workers between 2005-2007 and 2011-2013.

[18] I say "primarily due" to the increase in the mean benefit received by poor workers, because the share of directly-affected workers in poverty did actually increase very slightly over this period (by .09 percentage points). This suggests that 1.11 of the 1.20 percentage point increase in target efficiency between 2005-2007 and 2011-2013 was due to the increase in mean benefit received by poor workers relative to non-poor workers.

As indicated in the introduction, one motivation for performing this analysis is to determine the impact that declining teen employment had on the improvement in target efficiency. More important, however, is the policy relevance of this analysis. As previously noted, one criticism of the minimum wage is that it does not do a very good job of targeting the poor. While the improvement in target efficiency over this time period was modest, it is important to identify, and continually monitor the labor-market trends that led to this improvement as it could provide a rationale for increased reliance on the minimum wage as a means of combating poverty in the future.

5.1 Analysis of the Labor-Market Changes That Caused the Increase in the Mean Benefit Received by Poor Directly-Affected Workers, 2005-2007 to 2011-2013

I begin with an analysis of the labor-market changes during the time period from 2005-2007 to 2011-2013 because it is more straightforward. Having established that the 1.2 percentage point improvement in minimum wage target efficiency between 2005-2007 and 2011-2013 was primarily due to an increase in the mean benefit received by directly-affected workers in poor families relative to the mean benefit received by directly-affected workers in non-poor families, I now determine the labor-market changes which led to this increase. Recall that the annual benefit derived from an increase in the minimum wage for a directly-affected worker is calculated as the product of his wage increase, by his usual hours worked per week, by his weeks worked in the past year. In this section I identify which of these variables are driving the increase in the mean benefit to poor workers (relative to non-poor workers) over this time period.

In Figures 4-6 I present time-series of the mean wage increase, mean weekly hours worked, and mean weeks worked for directly-affected workers from 2005-2007 to 2011-2013. The mean wage increase for poor workers rose relative to the mean wage increase for non-poor workers, the mean weekly hours worked for poor workers fell relative to the mean weekly hours worked for non-

poor workers, and the mean weeks worked for poor workers did not change relative to the mean weeks worked for non-poor workers. This implies that the increase in the mean benefit for poor workers relative to non-poor workers from 2005-2007 to 2011-2013 was driven entirely by the rise in the mean wage increase for poor workers relative to non-poor workers. In fact, the reduction in hours for poor workers relative to non-poor workers actually worked in the other direction. Moreover, this suggests that the increase in minimum wage target efficiency from 2005-2007 to 2011-2013 was due to a stagnation in wages for poor directly-affected workers relative to non-poor directly-affected workers.

5.2 Analysis of the Labor-Market Changes That Caused the Increase in The Share of Directly-Affected Workers in Poverty, 1999-2001 to 2005- 2007

Having established that the 2.2 percentage point improvement in minimum wage target efficiency from 1999-2001 to 2005-2007 was driven entirely by an increase in the share of directly-affected workers in poor families, I now determine the labor-market changes that led to this increase. Since one motivation for this study is to determine the impact of the decline in teen employment on minimum wage target efficiency, I identify the age-specific labor-market changes that led to the increase in the share of directly-affected workers in poor families (as opposed to labor-market changes for groups defined by sex, or race for example).[19] After identifying these labor-market changes, I determine the relative importance of each age group to the increase in the share of directly-affected workers in poor families by decomposing the total increase into the shares contributed by each age group. If a particular age group contributed more to the increase in the share of directly-affected workers in poverty, I infer that the labor-market changes for that age group were more important to the improvement in target efficiency.

[19] While the analysis presented in this section focuses on identifying labor-market changes for groups defined by age, the methodology could be applied to any other mutually exclusive and exhaustive subdivision of directly-affected workers (eg. race, sex, etc.).

5.2.1 Identifying the Age-Specific Labor-Market Changes that Caused the Improvement in Target Efficiency

I begin by dividing directly-affected workers into three age categories: 16-19, 20-29, and 30-64 year-olds. Age groups are thus defined so that individuals still likely to live with their parents are in the youngest group, college and early-career aged individuals are in the second age group, and mature workers are included in the third group. For each age group there are three labor market changes that may have affected the share of directly-affected workers in poverty: wage changes, employment changes, and income changes. These changes are illustrated in Figure 7 where I plot workers in 1999 according to their wage and income-to-needs. The lower horizontal line in Figure 7 marks the federal minimum wage level in 1999 and the upper horizontal line marks the level the minimum wage would be following the minimum wage increase. Workers between these two lines are the directly-affected workers. The vertical line marks the poverty line, and the numbered arrows indicate flows of workers.

Increased wages (relative to the MW) among directly-affected workers are represented by arrows 1 and 1'. Increased wages (relative to the MW) decrease the share of the working-age population who are directly-affected workers, and increase the share of directly-affected workers in poverty if the outflow of non-poor workers (represented by arrow 1') exceeds the outflow of poor workers (represented by arrow 1). Decreased wages among workers earning just above the directly-affected wage range are represented by arrows 2 and 2'. Decreased wages (relative to the MW) increase the share of the working-age population who are directly-affected workers, and increase the share of directly-affected workers in poverty if the inflow of poor workers (represented by arrow 2) exceeds the inflow of non-poor workers. Decreased employment is represented by arrows 3 and 3'. Decreased employment reduces the share of the working-age population who are directly-affected workers, and increases the share of directly-affected workers in poverty if the outflow of non-poor

workers (represented by arrow 3') exceeds the outflow of poor workers. Increased employment among low-skilled individuals is represented by arrows 4 and 4'. Increased employment increases the share of the working-age population who are directly-affected workers, and increases the share of directly-affected workers in poverty if the inflow of poor workers (represented by arrow 4) exceeds the inflow of non-poor workers. And lastly, reduced income among near-poor directly-affected workers is represented by arrow 5. Reduced income does not change the share of the working-age population who are directly-affected workers, but it does increase the share of directly-affected workers in poverty.

I now turn to the data to determine which of these labor-market changes were likely to have caused the increase in the share of directly-affected workers in poverty. I look at labor-market changes for low-skilled individuals in each age group from 1999-2001 to 2005-2007 and assume that directly-affected workers within each age group were influenced by similar trends.[20] I use quantity of education as a proxy for skill level and examine changes in employment and wages (relative to the MW) for individuals with less than a 12th grade education.[21] While quantity of education is not a perfect skill proxy, it is the best option available in the CPS and it has been used for this purpose in other studies (Levy, 1992; Statz, 2001). I pool poor and non-poor individuals together, making the assumption that labor-market changes do not vary across the income distribution. I make this assumption because when, in a separate specification, I identify trends for poor and non-poor workers separately, the conclusions I reach do not differ from the conclusions reached using the

[20] I also assume that individuals earning just above the directly-affected wage range are influenced by the same trends. This allows me to ignore the possibility of, for example, increasing wages among directly-affected workers combined with decreasing wages among workers earning just above the directly-affected wage range. This assumption seems reasonable since the two groups of workers are quite similar in skill level.

[21] I do not apply an education restriction to the 16-19 age group since nearly all workers in this age group are low-skilled by virtue of their age.

pooled trends.[22] Since the conclusions do not change, and since the analysis is more straightforward using pooled trends, I proceed using the pooled trends. In order to determine income changes, I look at how the income level at the income quantile associated with the poverty line for each age group in 1999-2001 changed over this time period.

Wage Changes

In order to identify changes in wages (relative to the minimum wage), I calculate the average wage-to-minimum wage ratio for low-skilled workers in each age group from 1999-2001 to 2005-2007.[23] The wage-to-minimum wage ratio for each worker is the ratio of his wage to the prevailing MW. The results are presented in Figure 8. The wage-to-minimum wage ratio rose for every age group.[24]

Since it is assumed that wage changes do not vary across the income distribution, the impact that each change will have on the share of directly-affected workers in poverty depends on the share of each age group among poor directly-affected workers relative to the share of each age group among non-poor directly-affected workers. The age distribution in poor and non-poor groups of directly-affected workers in 1999-2001 is provided in Table 1. Since the share of *non-poor* directly-affected workers who were teens was larger than the share of *poor* directly-affected workers who were teens, the outflow of non-poor teens caused by the increase in wages (relative to the MW)

[22] Wages (relative to the MW) increase more for non-poor teen workers relative to poor teen workers. Wages (relative to the MW) increase more for poor 20-29 year-old workers relative to non-poor 20-29 year-old workers. Employment falls more sharply for non-poor teens than poor teens. Employment rises somewhat more for poor 20-29 year-olds relative to non-poor 20-29 year-olds. These differences only serve to reinforce the conclusions reached using the pooled samples. These results are available upon request.

[23] The sample is limited to workers whose wage level is at least ½ the minimum wage and no greater than 10 times the minimum wage. There are a number of instances of low-education workers with extremely high wages. In these cases education is clearly an inappropriate proxy for skills.

[24] While it is not evident from looking at Figure 8, for the 20-29 and 30-64 age groups the rise in the wage-to-MW ratio was caused by a rising real mean wage combined with a drop in the real mean MW. For the 16-19 age group, the real mean wage actually fell, but the real mean MW fell even more, resulting in an increase in the wage-to-MW ratio.

would have exceeded the outflow of poor teens, thus increasing the share of directly-affected workers in poverty. In contrast, since the share of non-poor workers who were in the 20-29 age group was smaller than the share of poor workers who were in the 20-29 age group, the outflow of poor 20-29 year-old directly-affected workers would have exceeded the outflow of non-poor 20-29 year-old workers, thus decreasing the share of directly-affected workers in poverty. And since the share of poor directly-affected workers who were in the 30-64 age group was essentially the same as the share of non-poor directly-affected workers who were in the 30-64 age group, the wage change for this age group did not affect the share of directly-affected workers in poverty.

Employment Changes

In Figure 9 I present time series of employment-to-population ratios for low-skilled workers in each age group from 1999-2001 to 2005-2007. Employment fell for the 16-19 age group, rose slightly for the 20-29 age group, and fell slightly for the 30-64 age group.

Since, as indicated in Table 1, the share of non-poor directly-affected workers who were teens was larger than the share of poor directly-affected workers who were teens, the decreased employment would have caused an outflow of non-poor workers that exceeded the outflow of poor workers, thus increasing the share of directly-affected workers in poverty. Since the share of poor directly-affected workers who were in the 20-29 age group exceeded the share of non-poor directly-affected workers who were 20-29 year-olds, the employment increase would have caused an inflow of poor workers that exceeded the inflow of non-poor workers, thus increasing the share of directly-affected workers in poverty. And finally, since the share of poor directly-affected workers who were in the 30-64 age group was essentially the same as the share of directly-affected workers who were in the 30-64 age group, the employment change for this age group did not affect the share of directly-affected workers in poverty.

Income Changes

In order to establish income changes, I determine the conditional income quantile at the poverty line for each age group of directly-affected workers in 1999-2001.[25] I then determine the income level at this quantile in each period through 2005-2007. The time-series is displayed graphically in Figure 10. For teens the family income level fell slightly (by $366), though the decline was not significant. For the 20-29 and 60-64 year-olds near the poverty line, family income fell by $1,440 in both cases.[26] Each of these income changes increased the share of directly-affected workers in poverty.

Summary

In summary, the labor-market changes working in favor of an increase in the share of directly-affected workers in poverty were: increased teen wages (relative to the MW), decreased teen employment, increased employment among poor, low-skilled 20-29 year-olds, and decreased income for near-poor directly-affected workers of all ages.

5.2.2 The Relative Importance of Each Age Group in Driving the Increase in the Share of Directly-Affected Workers in Poverty

Having identified the age-specific labor-market changes that worked in favor of an increase in the share of directly-affected workers in poverty, I now present evidence on the relative importance of each age group to the improvement in minimum wage target efficiency. If I can separate out the portion of the increase in the share of directly-affected workers in poverty that was caused by each age group, I will have a sense of the relative importance of each age group's labor-market changes to the improvement in target efficiency.

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[25] Family income quantiles are determined conditional on age.

[26] Unless rank is preserved, distributional changes do not necessarily translate to changes for individuals within the distribution. Because of this, the distributional changes presented here are suggestive, and not conclusive.

I accomplish this task by isolating the impact that the change in the share of the working-age population in each poor and non-poor age group of directly-affected workers had on the share of directly-affected workers in poor families. The change in the share of the working-age population in each age × ITN group of directly-affected workers is the direct result of the cumulative impact of the labor-market changes described in the previous section. The change in the share of the working-age population in each age × ITN group of directly-affected workers is presented in Table 2.[27]

This process is summarized in Equation 1:

Equation 1.

$$pov\_share^{2} - pov\_share^{1} = \sum_{i=1}^{3}\sum_{j=1}^{2}(pov\_share_{i,j}^{2*} - pov\_share^{1}) \cdot W_{i,j}$$

The variable pov_share represents the share of directly-affected workers in poor families. The numerical superscript represents the time period. The letter *i* specifies an age group and the letter *j* specifies an income-to-needs group. The variable $pov\_share_{i,j}^{2*}$ indicates what the share of directly-affected workers in poverty in period 2 would be if the share of the working-age population in age group *i*, ITN group *j* is allowed to change while holding the other age × ITN groups at their period 1 levels. The difference between $pov\_share_{i,j}^{2*}$ and pov_share^{1} represents the change in the share of directly-affected workers in poverty caused by the change in the share of the working-age population who are directly-affected workers in age group *i*, ITN group *j*.

One problem with the method just described is that this one-group-at-a-time approach fails to account for the fact that the size of the population of directly-affected workers is quite different when

[27] Changes are computed using the following equation:
$\Delta e_{i,j} = \frac{\Delta Share_{DA} \cdot Share_{i,j}^{2} - Share_{i,j}^{1}}{Share_{i,j}^{1}}$, where $\Delta Share_{DA}$ represents the change in the share of the working-age population who were directly-affected workers between 1999-2001 and 2005-2007. $Share_{i,j}$ represents the share of directly-affected workers in age group *i*, income-to-needs group *j*. The numerical superscript represents the time period, where 1=1999-2001 and 2=2005-2007.

the groups change simultaneously from when they change one at a time. The impact that any one change has on the share of directly-affected workers in poverty is dependent on the size of the directly-affected worker population (eg. doubling the number of poor teen directly-affected workers from 2 to 4 when the total population of directly-affected workers is 20 will have a smaller impact on the share of directly-affected workers in poverty than it will if the total population of directly-affected workers is 10). I can account for this by simply multiplying $pov\_share_{i,j}^{2*} - pov\_share^{1}$ by the ratio of the population of directly-affected workers when age group *i*, ITN group *j* changes in isolation, to the population of directly-affected workers when all age × ITN groups change simultaneously. This population ratio is represented by $W_{i,j}$. With the inclusion of $W_{i,j}$, the sum of the *(i,j)* elements on the right-hand side of Equation 1 will exactly equal the total change in the share of directly-affected workers in poor families.[28]

The results of this decomposition are presented in Table 3. Column 1 lists each age × ITN group. Column 2 lists the percent change in the share of the working-age population in each age × ITN group between 1999-2001 and 2005-2007. Column 3 lists the change in the share of directly-affected workers in poor families that results from isolating each age × ITN group-specific change of column 2. Each cell of column 3 represents an (*i,j*) element of the right-hand-side of Equation 1. The sum of the changes in column 3 should, therefore, exactly equal the change in the share of directly-affected workers in poor families over this time period. This sum is shown in row 10 (Net Δ).[29]

Of the 2.91 percentage point increase in the share of directly-affected workers in poor families, the 16-19 age group contributed 1.30 percentage points, the 20-29 age group contributed .17

[28] A more detailed explanation of the need for the $W_{i,j}$ correction factor, along with a simple example to illustrate, is included in Appendix III.

[29] As anticipated, the value in row 10 is nearly identical to the 2.92 percentage point increase in the share of directly-affected workers in poor families between 1999-2001 and 2005-2007, as calculated in the simulation exercise. See Table A4 for comparison.

percentage points, and the 30-64 age group contributed 1.45 percentage points. Since the contribution made by the 30-64 age group accounts for nearly 50% of the increase in the share of directly-affected workers in poverty, and since the contribution made by 30-64 year-olds is entirely due to decreased income among near-poor workers, this implies that decreased income was the labor market change that most contributed to the increase in the share of directly-affected workers in poor families. The contribution made by the 16-19 age group accounts for 45% of the increase in the share of directly-affected workers in poverty, due to a combination of increased wages (relative to the minimum wage), decreased employment, and decreased income among near-poor workers. The 20-29 age group contributed the final 5% of the increase in the share of directly-affected workers in poverty, due to a combination of increased employment and decreased income.

6 Conclusion

In this study I show that the target efficiency of the minimum wage improved between 1999 and 2013. In 1999-2001, 15.3% of the minimum wage benefits went to workers in poor families. By 2011-2013 this figure had risen to 18.8%. Nearly two-thirds of the improvement in target efficiency occurred during pre-recession years (1999-2001 to 2005-2007), and the balance of the improvement occurred since the onset of the Great Recession. The improvement in target efficiency during pre-recession years was entirely due to an increase in the share of minimum wage workers in poor families. Decreased income among near-poor minimum wage workers drove the majority of the increase in the share of minimum wage workers in poverty. Reduced teen employment, increased teen wages (relative to the minimum wage), and increased employment among poor low-skilled 20-29 year-olds also contributed.

The remainder of the improvement in target efficiency occurred during recessionary and post-recessionary years (2005-2007 to 2011-2013), primarily due to an increase in the mean annual

benefit received by poor minimum wage workers relative to the mean annual benefit received by non-poor minimum wage workers. The increase in benefit received by poor workers relative to the benefit received by non-poor workers was due to a stagnation in wages for poor directly-affected workers relative to the wages of non-poor directly-affected workers. This wage stagnation caused the simulated minimum wage hike to provide a larger wage increase to poor workers than non-poor workers, thus providing poor workers with a relatively larger annual benefit.

With one exception, the labor-market changes that led to an improvement in minimum wage target efficiency over the past 15 years are each representative of trends of increased income inequality as well as employment and wage polarization in the U.S. Decreased income during pre-recessionary years among near-poor families is the counterpart to the well-documented increase in income for those at the top of the income distribution (Saez 2007). Decreased employment among teen workers is likely the result, at least in part, of wage and employment polarization wherein middle-skill, middle-wage jobs have disappeared and teens have been required to compete for employment with higher-skilled workers (Smith, 2011; Autor, 2013). Wage stagnation among low-skilled poor workers relative to the wages of low-skilled non-poor workers is yet another sign of increasing inequality. Increased teen wages (relative to the MW) is the result of the real value of the minimum wage falling faster than real wages. The one exception is the increase in employment among poor, low-skilled 20-29 year-olds. And in this instance the increase appears to be slight, contributing very little to the improvement in target efficiency.

With all of these economic forces working in a direction that should improve the target efficiency of the minimum wage, it improved by a modest 3.43 percentage points over the past 15 years. Those who favor the minimum wage as a means to combat poverty might view the results of this study as an indication that the minimum wage is better positioned than at any other point in the past few decades to do so. Those opposed to the minimum wage might view the results of this study

as an indication that, even with all of these economic trends working to improve the target efficiency of the minimum wage, it continues to do a bad job of targeting the poor.

In his 1976 study on the target efficiency of the minimum wage, Gramlich concluded that, "The generally loose correlation between wages and family incomes implies that minimum wages will never have strong redistributive effects." While the results of my study do not comment directly on the distributional consequences of the minimum wage, the fact that the minimum wage continues to be such an *inefficient* form of income redistribution should certainly give policymakers pause as they consider its merit as a tool in combating poverty. At the same time, continued monitoring of the trends I find is important because they could lead to a stronger rationale for the minimum wage in the future.

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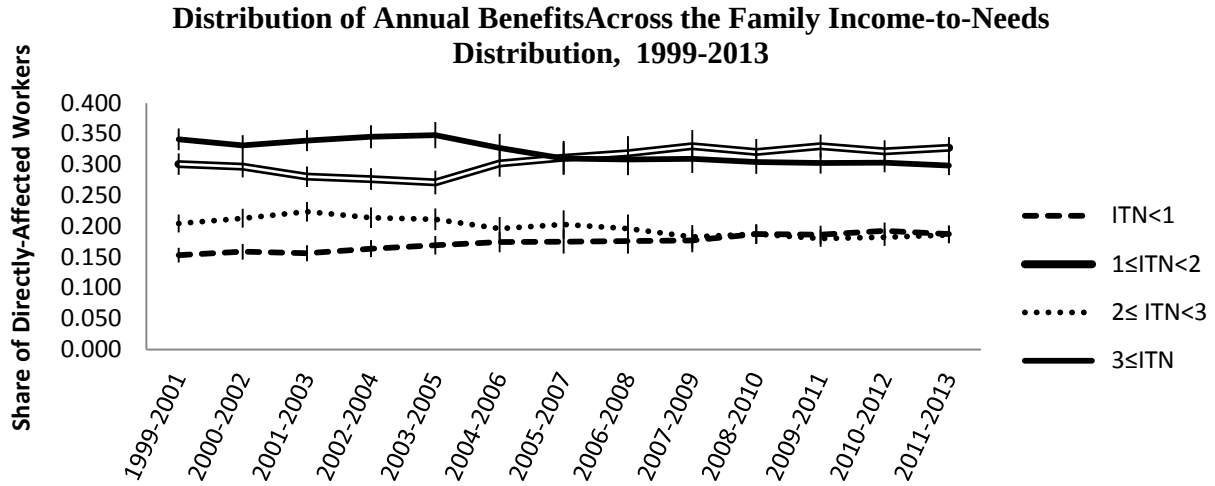
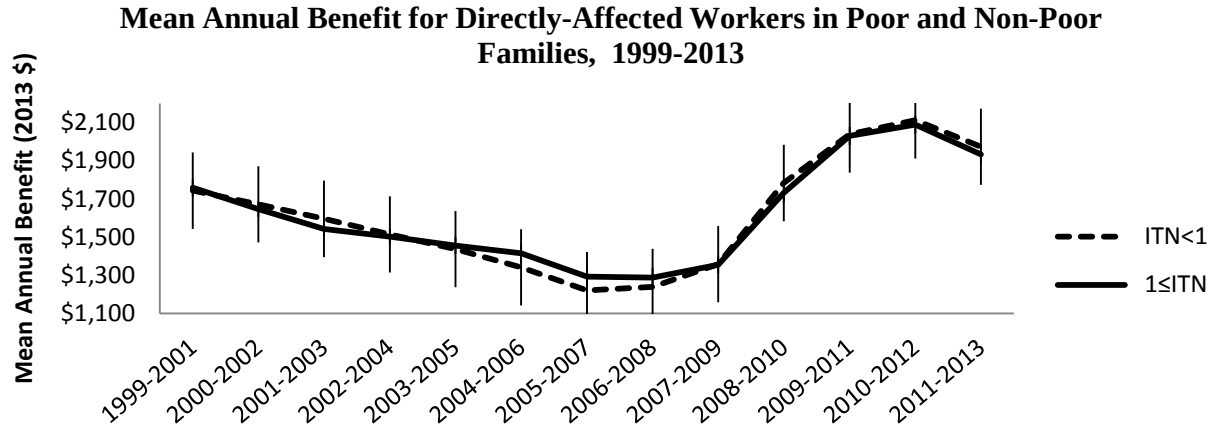
Figure 1.



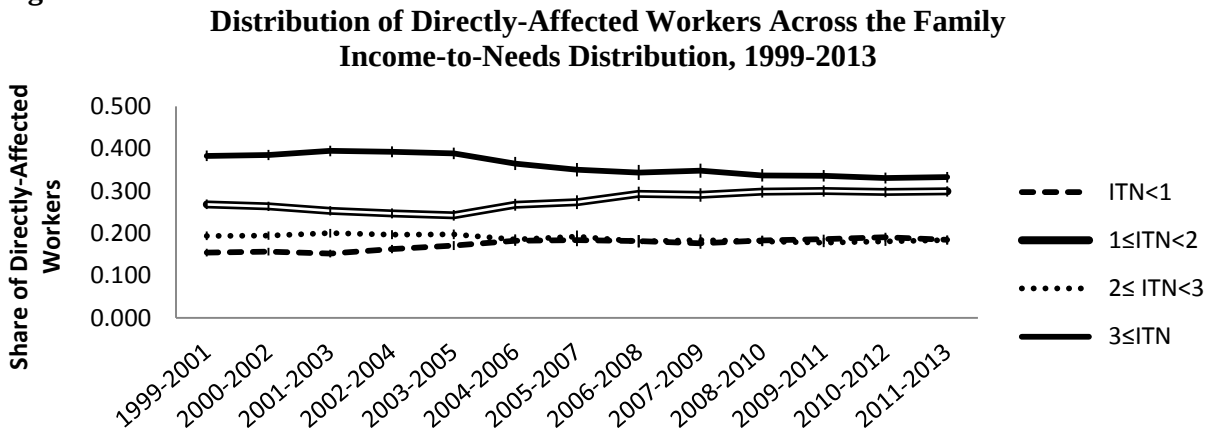
Notes: Distribution of annual benefits across the family income-to-needs distribution for workers who are directly affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage. Based on 3-year moving averages. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A2.

Figure 2.



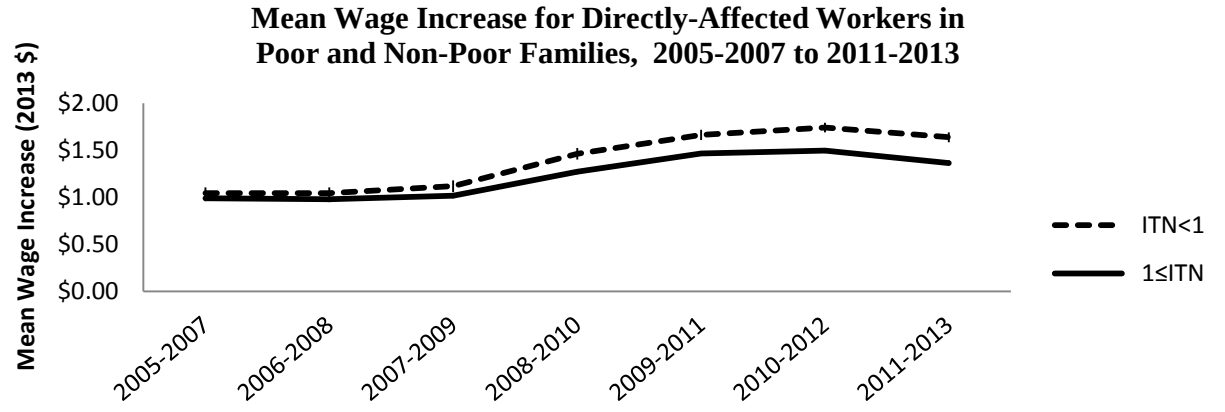
Notes: Mean annual benefit for workers in poor and non-poor families who are directly-affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage. Based on 3-year moving averages. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. The annual benefit for an individual is the product of his wage increase by his usual weekly hours worked by his weeks worked in the previous year. The benefit amount is reported in 2013 dollars. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A3.

Figure 3.



Notes: Distribution of workers who are directly-affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage across the family income-to-needs distribution. Based on 3-year moving shares. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A4.

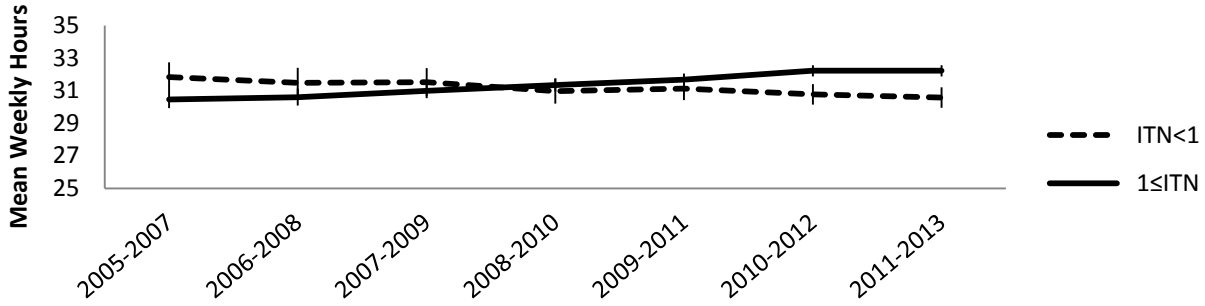
Figure 4.



Notes: Mean wage increase for workers in poor and non-poor families who are directly-affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. The wage increase for an individual is calculated as the difference between his wage and the new minimum wage. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A5.

Figure 5.

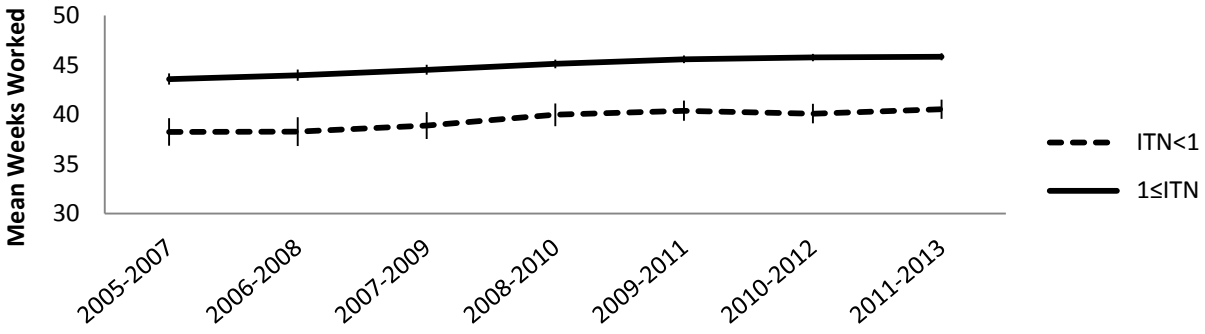
Mean Weekly Hours Worked for Directly-Affected Workers in Poor and Non-Poor Families, 2005-2007 to 2011-2013



Notes: Mean weekly hours worked for workers in poor and non-poor families who are directly-affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A6.

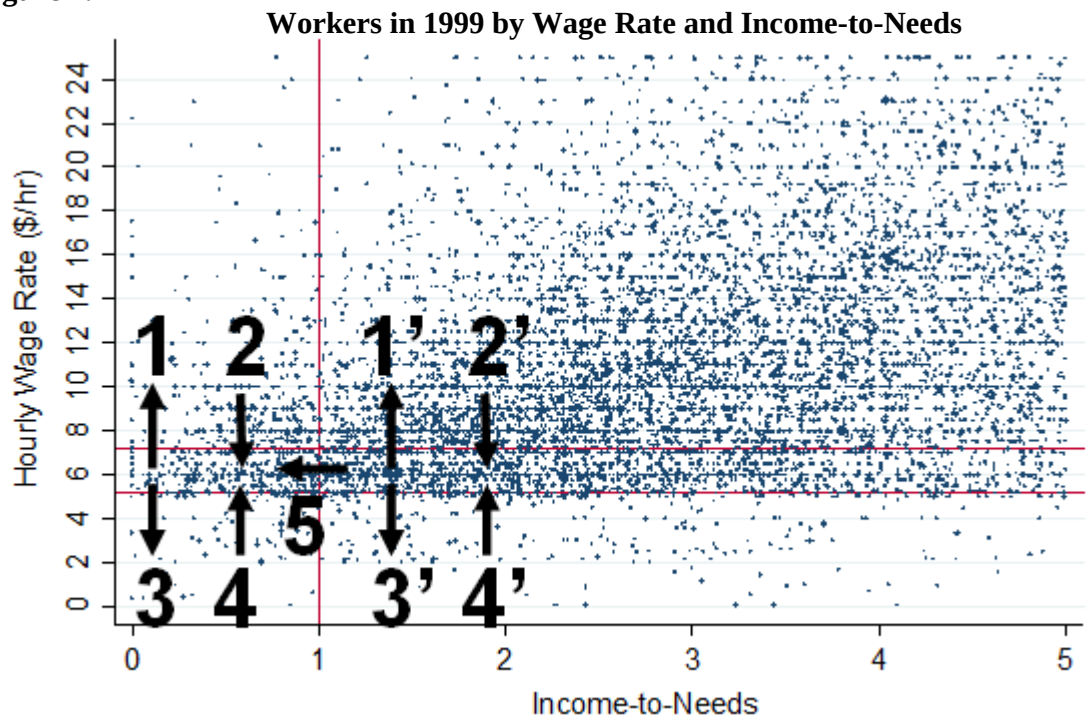
Figure 6.

Mean Weeks Worked per Year for Directly-Affected Workers in Poor and Non-Poor Families, 2005-2007 to 2011-2013



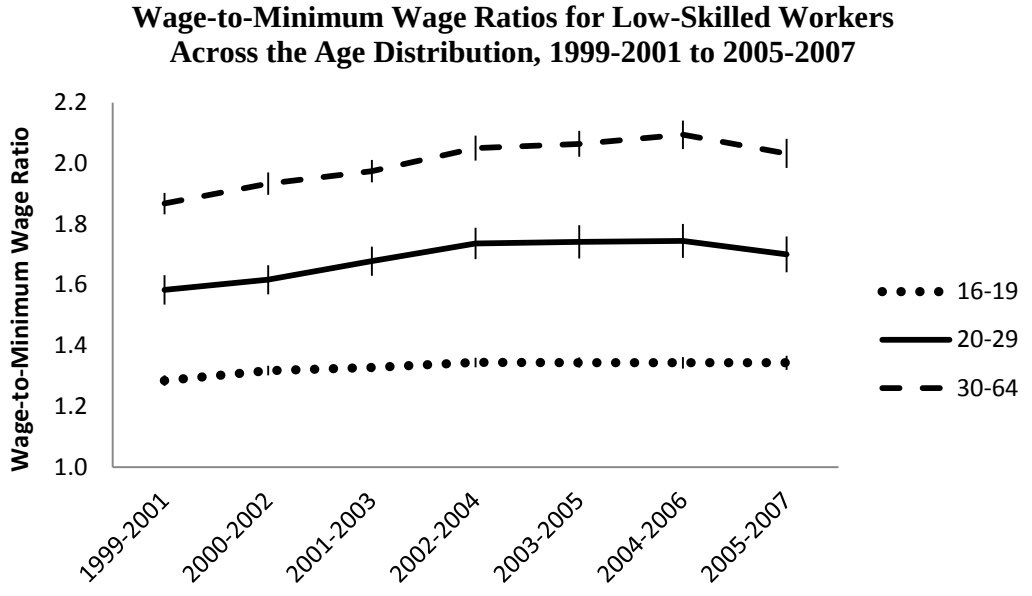
Notes: Mean weeks worked per year for workers in poor and non-poor families who are directly-affected by a simulated $2.85 increase (in 2013 dollars) in the federal minimum wage. Directly-affected workers are defined as those workers earning between $.05 less than the prevailing minimum wage (the higher of the state or federal minimum wage) and the new minimum wage. Data are drawn from the outgoing rotation group March CPS ASEC files. Observations are drawn from all states except Oregon and Washington. Observations are weighted using a modified CPS earnings weight. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A7.

Figure 7.



Notes: Scatter-plot of workers in 1999 according to their income-to-needs and hourly wage rate. Data drawn from the outgoing rotation group March CPS file.

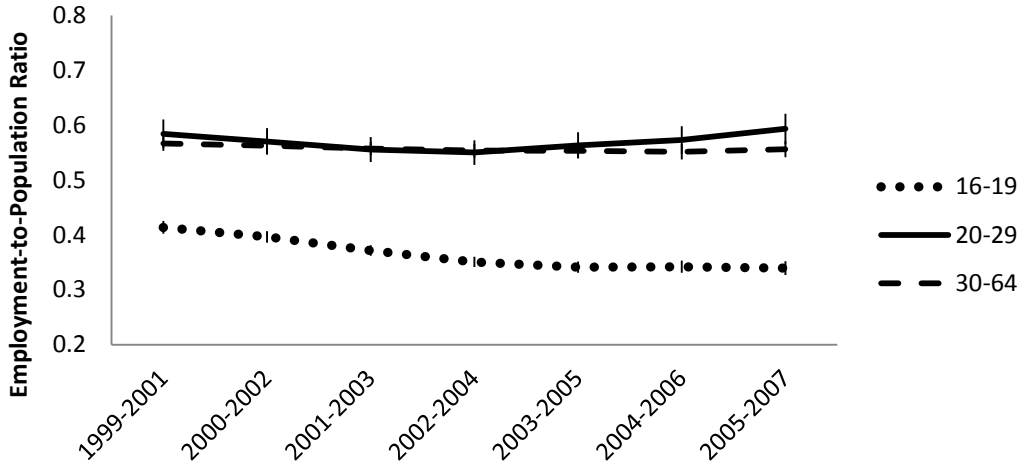
Figure 8.



Notes: Data are drawn from the outgoing rotation group March CPS ASEC files. Less than 12 years of education is used as a proxy for low skills. Only individuals whose wage level is between 1/2 and 10 times the minimum wage are included. Observations are weighted using CPS earnings weights. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A8.

Figure 9.

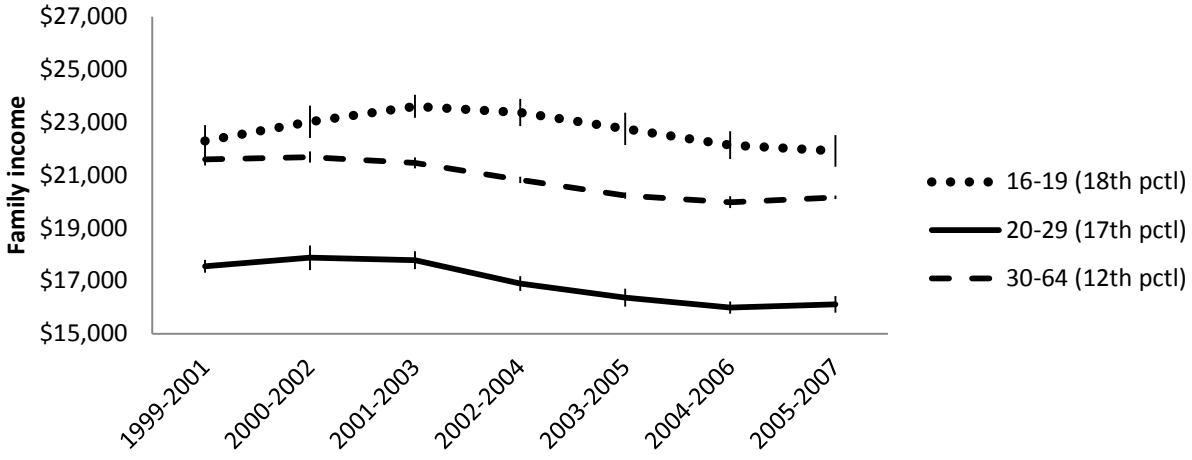
Employment-to-Population Ratios for Non-Poor, Low-Skilled Workers Across the Age Distribution, 1999-2001 to 2005-2007



Notes: Data are drawn from the outgoing rotation group March CPS ASEC files. Less than 12 years of education is used as a proxy for low skills. Observations are weighted using CPS earnings weights. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A9.

Figure 10.

Family Income Level at Particular Income Quantiles Across the Age Distribution, 1999-2001 to 2005-2007



Notes: Data are drawn from the outgoing rotation group, March CPS files. The selected quantile for each age group represents the income quantile (conditional on age) at the poverty line for each age group of directly-affected workers. Observations are weighted using march supplement weights. Standard errors are bootstrapped. Error bars indicate 95% confidence intervals. The table of values used to construct this figure is presented in the appendix, Table A10.

Table 1.

Change in the Share of the Working-Age Population in Age × Income-to-Needs Groups of Directly-Affected Workers, 1999-2001 to 2005-2007

	ITN<1	1≤ITN
	(1)	(2)
Ages 16-19	-29.1%	-41.1%
20-29	-27.9%	-37.7%
30-64	-31.2%	-47.4%

Notes: Calculations use March CPS data.

Table 2.

Age Distribution of Directly-Affected Workers in Poor and Non-Poor Families in 1999-2001

Ages	ITN<1	ITN≥1	Difference, (3)-(2)
(1)	(2)	(3)	(4)
16-19	0.163	0.258	0.095***
	(0.012)	(0.006)	(0.014)
20-29	0.373	0.296	-0.076***
	(0.016)	(0.007)	(0.017)
30-64	0.464	0.445	-0.019
	(0.017)	(0.007)	(0.018)

Notes: March CPS ORG files. Observations weighted using a modified earnings weight. Based on a three year average of the years 1999 through 2001. ***Significant at 1% level, **5% level, and *10% level.

Table 3.

The Effect of Changes in the Share of the Working-Age Population in each Age × Income-to-Needs Group of Directly-Affected Workers on the Share of Directly-Affected Workers in Poor Families, 1999-2001 to 2005-2007

Age × Income-to-Needs Directly-Affected Worker Groups			Change in the Share of the Working-Age Population, 1999-2001 to 2005-2007	Δ in Share of Poor (ITN<1) Directly-Affected Workers	
	(1)		(2)	(3)	
(1)	Ages 16-19 ×	ITN<1	-29.1%		-0.010
(2)		ITN>=1	-41.1%		0.023
(3)				16-19 Net Δ:	0.0130
(4)	Ages 20-29 ×	ITN<1	-27.9%		-0.023
(5)		ITN>=1	-37.7%		0.025
(6)				20-29 Net Δ:	0.0017
(7)	Ages 30-64 ×	ITN<1	-31.2%		-0.032
(8)		ITN>=1	-47.4%		0.047
(9)				30-64 Net Δ:	0.0145
(10)				Total Net Δ:	0.0291

Notes: Data are drawn from March CPS ASEC outgoing rotation group files. Observations are weighted using modified earnings weights.

Appendix I. Time Series of Employment-to-Population Ratios by Age, 1999 to 2013

See Table A1.

Appendix II. Tables that were used to construct figures in the paper.

Figure	Corresponding Data Table
1	A2
2	A3
3	A4
4	A5
5	A6
6	A7
8	A8
9	A9
10	A10

Appendix III. Explanation of the $W_{i,j}$ Adjustment Factor

$W_{i,j}$ is the ratio of the population of directly-affected workers when the share of the working-age population in age group *i*, ITN group *j* changes in isolation to the population of directly-affected workers when all age × ITN groups change simultaneously. It adjusts $pov\_share_{i,j}^{2*} - pov\_share^{1}$ to accurately reflect the impact that the change in the working-age population in age group *i*, ITN group *j* has on the share of directly-affected workers in poverty given the size of the population of directly-affected workers when all age × ITN groups change simultaneously. I can illustrate the need for $W_{i,j}$ with a simple example.

In the actual decomposition there are three age groups of poor directly-affected workers and three age groups of non-poor directly-affected workers. For illustration purposes, suppose there are only two groups: poor workers and non-poor workers. In period 1 there are 30 poor workers, and 60 non-poor workers. In period 2 the number of poor workers increases to 40 and the number of non-

poor workers falls to 15. The distribution of workers across the income distribution in periods 1 and 2 is summarized in Table A11.

The question is asked, of the 39.4 percentage point increase between periods 1 and 2 in the share of workers in poverty, how much can be attributed to the increase in the number of poor workers, and how much can be attributed to the decrease in the number of non-poor workers? One way to determine this might be to change the number of poor workers, holding the number of non-poor workers fixed at the period 1 level, and see how the distribution changes. Any change in the share of workers in poverty can be attributed to the change in the number of poor workers. The results of this process are presented in columns 1-6 of Table A12. In Table A12, instead of period 1 (P1) and period 2 (P2), I have P1 and $P2_1$* to indicate that only the number of poor workers have been changed between the two periods. Next, change the number of non-poor workers, holding the number of poor workers fixed at the period 1 level, and see how the distribution changes. Any change in the share of workers in poverty can be attributed to the change in the number of non-poor workers. The results of this process are presented in columns 1-6 of Table A13.

Now, if this exercise worked as intended then row 1, column 6 of Table A12 plus row 1, column 6 of Table A13 should exactly equal row 1, column 6 of Table A11. In fact, the sum of these two cells is close, but slightly larger (.40 compared to .394). The reason for the difference is that calculating the distributional change one group at a time fails to account for the fact that the total population of directly-affected workers is different than what it would be if the number of workers in both groups changed simultaneously. When the two groups change simultaneously the population of workers in P2 is 55. When I only change the number of poor workers, the population of workers in $P2_1$* is 100. When I only change the number of non-poor workers, the population of workers in $P2_2$* is 45. I can account for this by simply multiplying the change in the share of workers between P1 and $P2_1$* by the ratio of the population of workers in $P2_1$* to the population of workers in P2 ($\frac{100}{55}$ in

this example), and by multiplying the change in the share of workers between P1 and $P2_2$* by the ratio of the population of workers in $P2_2$*to the population of workers in P2 ($\frac{45}{55}$ in this example). These population ratios are equivalent to the $W_{i,j}$ adjustment factor. The adjusted changes in shares are presented in column 7 of Tables 12 and 13. With the inclusion of the adjustment factor, row 1, column 7 of Table A12 plus row 1, column 7 of Table A13 exactly equals row 1, column 6 of Table A11.

Table A1.

U.S. Employment-to-Population Ratios, 1999 to 2013

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	%Δ 1999 to 2013
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Ages 16-18	0.368	0.375	0.366	0.331	0.308	0.297	0.301	0.300	0.288	0.269	0.231	0.198	0.187	0.191	0.183	-51.2%
19-24	0.685	0.686	0.675	0.639	0.630	0.629	0.635	0.644	0.656	0.634	0.600	0.566	0.579	0.579	0.569	-17.1%
25-34	0.806	0.816	0.800	0.781	0.771	0.771	0.766	0.778	0.789	0.788	0.745	0.732	0.735	0.741	0.747	-8.5%
35-44	0.826	0.822	0.825	0.808	0.799	0.798	0.806	0.804	0.810	0.807	0.770	0.760	0.769	0.773	0.769	-6.4%
45-54	0.803	0.812	0.803	0.792	0.789	0.786	0.788	0.792	0.794	0.788	0.757	0.746	0.745	0.748	0.752	-7.4%
55-64	0.583	0.585	0.589	0.593	0.599	0.603	0.607	0.620	0.621	0.627	0.608	0.611	0.606	0.606	0.616	5.3%
65+	0.123	0.132	0.130	0.131	0.138	0.143	0.144	0.148	0.160	0.161	0.161	0.162	0.171	0.177	0.179	35.6%
Overall empl-to-pop:	0.640	0.645	0.652	0.636	0.630	0.628	0.631	0.636	0.630	0.624	0.594	0.582	0.583	0.583	0.583	-9.6%
Number of Observations:	91,569	92,310	131,972	132,437	133,941	131,183	131,911	131,469	103,424	103,702	105,040	105,718	104,013	103,453	102,996	-

Notes: Data are drawn from March CPS files. Observations are weighted using the CPS final weights. Individuals are counted as employed if they report working full-time, part-time, or with a job (but not at work) in the week prior to the survey.

Table A2. Distribution of Annual Benefits Across the Family Income-to-Needs Distribution from a Simulated $2.85 Increase in the Federal Minimum Wage

	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 1999-2001 to 2011-2013
Income-to-Needs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ITN<1	0.153	0.159	0.156	0.164	0.169	0.174	0.175	0.176	0.177	0.187	0.187	0.193	0.188	0.034
	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.011)	(0.010)	(0.008)	(0.007)	(0.007)	(0.007)	(0.009)
1≤ITN<2	0.301	0.297	0.281	0.277	0.271	0.302	0.311	0.319	0.330	0.321	0.330	0.322	0.328	0.027
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.014)	(0.014)	(0.013)	(0.011)	(0.010)	(0.009)	(0.009)	(0.013)
2≤ ITN<3	0.205	0.213	0.224	0.214	0.211	0.196	0.203	0.196	0.183	0.187	0.181	0.182	0.186	-0.019
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.012)	(0.012)	(0.010)	(0.008)	(0.007)	(0.007)	(0.007)	(0.011)
3≤ITN	0.341	0.331	0.339	0.345	0.348	0.327	0.310	0.309	0.310	0.304	0.303	0.303	0.299	-0.042
	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.013)	(0.013)	(0.012)	(0.010)	(0.009)	(0.008)	(0.008)	(0.012)
Observations:	5,803	6,030	6,078	5,420	4,608	3,850	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A3. Mean Annual Benefit for Directly-Affected Workers in Poor and Non-Poor Families from a Simulated $2.85 Increase in the Federal Minimum Wage

	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 1999-2001 to 2011-2013
Income-to-Needs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ITN<1	$1,744	$1,672	$1,596	$1,515	$1,437	$1,342	$1,222	$1,240	$1,359	$1,784	$2,039	$2,112	$1,974	$230
	(49)	(48)	(48)	(47)	(46)	(46)	(51)	(54)	(54)	(54)	(51)	(20)	(48)	(69)
1≤ITN	$1,760	$1,646	$1,543	$1,502	$1,456	$1,415	$1,293	$1,287	$1,356	$1,732	$2,030	$2,090	$1,933	$174
	(22)	(21)	(20)	(21)	(23)	(25)	(27)	(27)	(25)	(25)	(25)	(25)	(24)	(33)
Observations:	5,803	6,030	6,078	5,420	4,608	3,850	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A4.

Distribution of Directly-Affected Workers
Across the Family Income-to-Needs Distribution

	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 1999-2001 to 2011-2013
Income-to-Needs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ITN<1	0.1544	0.1568	0.1520	0.1627	0.1712	0.1822	0.1836	0.1818	0.1767	0.1829	0.1859	0.1908	0.1845	0.030
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.007)
1≤ITN<2	0.2686	0.2637	0.2530	0.2473	0.2424	0.2674	0.2736	0.2934	0.2908	0.2985	0.3000	0.2974	0.2991	0.030
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.009)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.008)
2≤ ITN<3	0.1940	0.1945	0.2003	0.1971	0.1974	0.1855	0.1927	0.1811	0.1843	0.1810	0.1781	0.1811	0.1839	-0.010
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)
3≤ITN	0.3830	0.3851	0.3947	0.3929	0.3890	0.3649	0.3502	0.3437	0.3481	0.3370	0.3360	0.3307	0.3326	-0.050
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)	(0.006)	(0.008)
Observations:	5,803	6,030	6,078	5,420	4,608	3,850	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A5.

Mean Wage Increase for Directly-Affected Workers in Poor and Non-Poor Families
from a Simulated $2.85 Increase in the Federal Minimum Wage

	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 2005-2007 to 2011-2013
Income-t	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITN<1	$1.04	$1.04	$1.12	$1.46	$1.66	$1.74	$1.64	$0.60
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
1≤ITN	$0.99	$0.98	$1.02	$1.27	$1.46	$1.50	$1.37	$0.38
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Observa	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A6.

Mean Weekly Hours Worked for Directly-Affected Workers in Poor and Non-Poor Families from a Simulated $2.85 Increase in the Federal Minimum Wage

	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 2005-2007 to 2011-2013
Income-t	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITN<1	31.83	31.48	31.53	30.97	31.12	30.78	30.58	-1.25
	(0.46)	(0.47)	(0.44)	(0.39)	(0.36)	(0.32)	(0.32)	(0.56)
1≤ITN	30.46	30.60	31.00	31.35	31.67	32.22	32.22	1.76
	(0.26)	(0.26)	(0.24)	(0.21)	(0.19)	(0.18)	(0.18)	(0.32)
Observa	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A7.

Mean Weeks Worked per Year for Directly-Affected Workers in Poor and Non-Poor Families from a Simulated $2.85 Increase in the Federal Minimum Wage

	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	Δ 2005-2007 to 2011-2013
Income-t	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITN<1	38.24	38.28	38.89	39.99	40.39	40.10	40.53	2.29
	(0.71)	(0.73)	(0.69)	(0.58)	(0.53)	(0.50)	(0.49)	(0.87)
1≤ITN	43.58	43.97	44.52	45.12	45.58	45.76	45.84	2.26
	(0.29)	(0.29)	(0.26)	(0.22)	(0.20)	(0.19)	(0.18)	(0.34)
Observa	2,928	2,721	3,138	4,009	4,683	5,158	5,441	

Table A8.

Wage-to-Minimum Wage Ratios for Low-Skilled Workers Across the Age Distribution

Ages	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	Δ1999-2001 to 2005-2007
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
16-19	1.285	1.318	1.328	1.345	1.344	1.344	1.343	0.058
	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.012)	(0.015)
20-29	1.584	1.617	1.678	1.736	1.742	1.745	1.700	0.117
	(0.025)	(0.025)	(0.024)	(0.026)	(0.028)	(0.028)	(0.030)	(0.039)
30-64	1.868	1.934	1.975	2.050	2.064	2.094	2.033	0.165
	(0.018)	(0.019)	(0.019)	(0.021)	(0.022)	(0.024)	(0.024)	(0.030)

Table A9.

Employment-to-Population Ratios for Low-Skilled Workers Across the Age Distribution

Ages	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	Δ1999-2001 to 2005-2007
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
16-19	0.414	0.397	0.372	0.351	0.341	0.342	0.340	-0.074
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.009)
20-29	0.584	0.570	0.556	0.550	0.563	0.573	0.593	0.009
	(0.013)	(0.012)	(0.012)	(0.011)	(0.012)	(0.013)	(0.014)	(0.019)
30-64	0.567	0.563	0.557	0.554	0.553	0.552	0.556	-0.011
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.010)

Table A10.

Income at Particular Income Quantiles Across the Age Distribution

		Income Level at the Column 2 Income Quantile							
Age	Income Quantile	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	Δ1999-2001 to 2005-2007
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
16-19	18	22,288	23,018	23,608	23,370	22,755	22,140	21,922	-366
		(306)	(312)	(223)	(261)	(311)	(268)	(306)	(433)
20-29	17	17,550	17,874	17,780	16,900	16,363	15,990	16,109	-1441
		(123)	(238)	(171)	(141)	(174)	(118)	(159)	(201)
30-64	12	21,600	21,688	21,463	20,820	20,230	19,975	20,160	-1440
		(117)	(106)	(103)	(63)	(63)	(114)	(35)	(122)

Table A11.

Group	Number of Workers P1	Number of Workers P2	Share of Workers P1	Share of Workers P2	Δ in Share, P2-P1
(1)	(2)	(3)	(4)	(5)	(6)
poor	30	40	0.3333	0.7273	0.3939
non-poor	60	15	0.6667	0.2727	-0.3939

Table A12.

Group	Number of Workers P1	Number of Workers $P2_1$*	Share of Workers P1	Share of Workers $P2_1$*	Δ in Share, $P2_1$*-P1	Adjusted Δ in Share, ($P2_1$*-P1)*(100/55)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
poor	30	40	0.3333	0.4000	0.0667	0.1212
non-poor	60	60	0.6667	0.6000	-0.0667	-0.1212

Table A13.

Group	Number of Workers P1	Number of Workers $P2_2$*	Share of Workers P1	Share of Workers $P2_2$*	Δ in Share, $P2_2$*-P1	Adjusted Δ in Share, ($P2_2$*-P1)*(45/55)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
poor	30	30	0.3333	0.6667	0.3333	0.2727
non-poor	60	15	0.6667	0.3333	-0.3333	-0.2727