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Working Paper **6536**

NBER WORKING PAPER SERIES

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Working Paper 6536
http://www.nber.org/papers/w6536

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 1998

We thank Rebecca Blank, Harry Holzer, Sanders Korenman, Walter Oi, and Dan Sichel for helpful comments. The views expressed are those of the authors only, and do not necessarily reflect those of the Federal Reserve Board, the Federal Reserve Bank of Cleveland, their staffs or the National Bureau of Economic Research. This research was carried out when Neumark was a Visiting Scholar at the Federal Reserve Bank of Cleveland.

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NBER Working Paper No. 6536
April 1998
JEL Nos. J18, I3, J23, D31

ABSTRACT

The primary goal of a national minimum wage floor is to raise the incomes of poor or near-poor families with members in the work force. However, estimates of employment effects of minimum wages tell us relatively little about whether minimum wages are likely to achieve this goal; even if the disemployment effects of minimum wages are modest, minimum wage increases could result in net income losses for poor and low-income families.

In this paper, we present evidence on the effects of minimum wages on family incomes from matched March CPS surveys. Using non-parametric estimates of the distributions of family income relative to needs in states and years with an without minimum wage increases, we examine the effects of minimum wages on this distribution, and on the distribution of the changes in income that families experience. Although minimum wages do increase the incomes of some poor families, the evidence indicates that the overall effects are to increase the proportion of families that are poor and near-poor, and to decrease the proportion of families with incomes between 1.5 and 3 times the poverty level.

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I. Introduction

One of the most compelling rationales for a higher national minimum wage floor is to raise the incomes of poor or near-poor families with members in the work force. This general point is often missed in academic debates over the merits of a higher minimum wage which, in contrast to these oft-stated distributional goals, have tended to focus on the employment effects of minimum wages--especially among teenagers or young adults. However, while negative employment effects represent a cost of minimum wages, such costs do not necessarily imply that minimum wages constitute bad social policy. In particular, the employment losses associated with a higher minimum wage may be more than offset by positive effects on low-income families, especially if minimum wages are a significant factor in helping to move families out of poverty. As Gramlich (1976) puts it: "Minimum wages do, of course, distort relative prices, and hence compromise economic efficiency, but so do all other attempts to redistribute income through the tax-and-transfer system. The important question is not whether minimum wages distort, but whether the benefits of any income redistribution they bring about are in some political sense sufficient to outweigh the efficiency costs" (p. 410). Our goal in this paper is to provide information with which to assess this tradeoff.

This is not to argue that research on employment effects of minimum wages is irrelevant. But such research may be more important as a test of the theory of labor demand and as a method of learning how employers and individuals adjust to exogenous wage increases, than as a method of assessing the wisdom of the policy. In addition, we do not mean to suggest that the short-run effects of minimum wages on the incomes of poor families should be the sole criterion for evaluating such policies. Other studies have found evidence suggesting, for example, that minimum wage increases reduce school enrollment rates and training (Neumark and Wascher, 1996a; Hashimoto, 1982), factors that might offset the benefits of shorter-run effects of minimum wages on family incomes by reducing longer-run earnings or earnings growth. Nonetheless, our perception is that potential near-term increases in the incomes of poor and low-income families provide the main motivation for raising the minimum wage, making it important to assess the evidence on whether minimum wage increases achieve this goal.

In this regard, there are two questions that must be addressed. First, there is the question of how minimum wages affect the total earnings of the low-wage workforce--that is, do the wage gains received by employed workers more than offset the lost earnings suffered by those who lose or cannot find jobs?[1] Second, there is the question of how minimum wages affect workers in different parts of the family income distribution. Because many (roughly speaking, a large minority of) minimum wage workers are in relatively affluent families (Gramlich, 1976; Card and Krueger, 1995; Burkhauser, et al., 1996), which workers gain and which workers lose will have an important influence on the effects of minimum wages on the distribution of family incomes.

In this paper, we present non-parametric density estimates of the effects of minimum wage increases on the distribution of family incomes relative to needs. Specifically, we use matched March CPS data on families to study both the distribution of family incomes and the distribution of changes in family incomes (relative to needs). In a nutshell, our empirical strategy is to compute difference-in-difference estimates of the effects of minimum wages on the family income distribution, by comparing changes in this distribution over time in states in which minimum wages did and did not increase.[2]

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[1]DiNardo, et al. (1996) examine the effects of minimum wages on the distribution of wages of employed workers, but do not address the overall effects on the incomes of low-wage workers (including any disemployment effects).

[2]Most of the well-known papers on this topic, including Gramlich (1976), Johnson and Browning (1983), Burkhauser and Finegan (1989), and Horrigan and Mincy (1993), do not study the actual

The evidence on both the distribution of family income and changes in incomes experienced by families indicates that the overall effects of increases in the minimum wage are to increase the proportion of families that are poor and near-poor, and to decrease the proportion of families with incomes between 1.5 and 3 times the poverty level. This evidence sends a strong message that reductions in the proportions of families that are poor or near-poor should not be counted among the potential benefits of minimum wages.

II. Distributional Effects of the Minimum Wage

Low-Wage Workers

If minimum wages are to raise the incomes of poor families, they must first redistribute earnings toward low-wage *workers*. Estimated employment elasticities from minimum wage studies in the -0.1 to -0.2 range for teenagers and young adults are sometimes interpreted as evidence of such a redistribution, using the following logic: An elasticity of -0.1 indicates that a ten-percent increase in the minimum wage reduces the employment rate of teenagers and young adults by 1 percent, meaning that 99 percent of them receive a ten-percent raise, while one percent of them lose their job.[3] Someone making this calculation would then conclude that the higher minimum wage leads to an 8.9 percent increase in income for this particular group of low-wage workers (99×.1 - 1). If it is further assumed that roughly similar magnitudes apply to other (i.e.,

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consequences of minimum wage increases for family incomes, but rather look at simulations based on assumptions about employment effects, etc. A few recent studies have presented more limited "before and after" analyses of the effects on minimum wage on family incomes. These include: Addison and Blackburn (1996), who conduct a state-level analysis of the effects of minimum wages on the poverty rate for subsets of the population, using data from 1983 to 1991; Card and Krueger (1995), who estimated similar effects using a more limited data set exploiting the 1990 and 1991 federal increases in the minimum; and Connolly and Segal (1997).

[3]Of course, if one's view of the evidence on employment effects is that minimum wages have no disemployment effects, then minimum wages almost certainly raise the incomes of the poor. For reviews of the competing evidence, see Card and Krueger (1995) and Neumark and Wascher (1996b).

older) low-wage workers, then the implication is that minimum wages raise the incomes of low-wage workers. Indeed, Freeman (1996) asserts that since the estimated elasticity for minimum wage workers is far smaller than -1, it would appear that "at some level little of the cost of the minimum is borne by low-wage workers" (p. 642).

This argument is flawed for two reasons. First, the -0.1 to -0.2 elasticities used to reach this conclusion are taken from studies of the employment effects of minimum wages for entire age groups and are not equivalent to--as some have asserted--the elasticity of demand for minimum wage workers. An estimate of the effect of a minimum wage increase on total employment in any particular age group is really the effect on the low-wage individuals in the group for whom the new minimum wage raises wages, averaged over all workers in this age category; as higher-wage workers are for the most part unaffected by changes in the minimum wage, the aggregate elasticity will understate the employment effect on low-wage workers. Second, the calculation overstates the additional income that low-wage workers are likely to get from a minimum wage increase, because not all workers affected by the minimum wage change receive the full amount of the increase (in particular, those who were earning between the old and new minimum wage). Thus, the more relevant measure for assessing the effect of the minimum wage on the earnings of low-wage workers is the ratio of the employment decline among low-wage workers to the wage increase among this group, a ratio requiring an adjustment to both the numerator and the denominator of the conventional employment elasticity.

To illustrate this point, consider the full implementation of the 1996-1997 minimum wage increase to $5.15 per hour, a 21.2 percent increase in the minimum wage. As shown in Table 1, data from the 1995 CPS indicate that 6.2 percent of workers aged 16 to 24 were paid exactly the old minimum wage in that year and another 15.1 percent were paid between the old and new minimums, so that a total of 21.3 percent of the youth work force is directly affected by the minimum wage increase. Assuming that everyone in these categories who retains a job sees their new wage rise to exactly $5.15 per hour as a result of the increase in the minimum, the average wage increase received by a worker in this affected group will be 10.8 percent. Suppose further that all of the job loss resulting from the minimum wage increase occurs among these affected workers. Then using an elasticity of -0.1 for the age group as a whole, we can calculate the demand elasticity for young minimum wage workers as:

$$(-.1/.213)/(10.8/21.2) = -.92 \ .$$

Dividing -.1 by .213 can be interpreted as adjusting the numerator of the conventional elasticity to obtain the percentage employment decline among affected workers. Dividing by (10.8/21.2) corrects the percentage wage increase in the denominator of the conventional elasticity to reflect the fact that the average wage increase for affected workers is smaller than the minimum wage increase itself.

If we instead use this elasticity, the calculation of the distributive effects of an increase in the minimum wage yields a quite different answer--a ten-percent increase in the minimum wage results in a decline in income for low-wage young workers of 0.1 percent, as 90.8 percent get a ten-percent raise, and 9.2 percent lose their job ($90.8 \times .1 - 9.2 \times 1$). Thus, when we adjust the estimates obtained from studies of the employment effects of minimum wages to get closer to the elasticity of demand for minimum wage workers, it is not out of the question that the latter elasticity is in fact near -1. We emphasize, though, that we raise this as a possibility rather than as an empirical claim. The calculation just described is based on the assumptions that all of the job loss occurs among minimum wage workers and that the only effects on wages are to top off workers to the new minimum wage; these assumptions make the contrast between our calculation and the -0.1 "elasticity" especially strong. For example, if we assume that only 80 percent of the job loss occurs among minimum wage workers, then a ten-percent increase in the minimum results in a 1.9 percent increase in income for low-wage workers (versus a decline of 0.1 percent according to the calculation above). In addition, if workers with wages above the new minimum also see their wages rise in response to a minimum wage increase--reflecting, for example, shifts in demand toward workers initially earning above the new minimum, or maintenance of wage differentials between workers (Grossman, 1983)--income gains for relatively low-wage workers (including those slightly above the minimum wage) would be larger.[4] On the other hand, using a larger disemployment effect (e.g., an "elasticity" of -0.2, which we also regard as a plausible estimate) results in stronger negative effects on incomes of low-wage workers; in this case, retaining the assumption that 80 percent of the job loss occurs among minimum wage workers, a 6.2 percent decrease in income for these workers would occur in response to a ten-percent increase in the minimum wage. Along the same lines, if minimum wage increases also lead to hours reductions among low-wage workers (see, e.g., Hungerford, 1996), then such increases would also reduce incomes of low-wage workers in ways not reflected in estimated employment effects of minimum wages.

Regardless of the exact assumptions used, as long as the job loss is concentrated among low-wage workers, or the average wage increase resulting from a minimum wage hike is smaller than the minimum wage hike itself, the standard elasticity of employment with respect to the minimum wage will overstate the income gains that low-wage workers would receive as a consequence of a minimum wage hike. The evidence we ultimately present describes the effects of minimum wages on family incomes, which is our main purpose. Our point in this section is

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[4]In addition, we have assumed that the wages of workers earning below the new minimum are unaffected. If these are waiters and waitresses reporting hourly wages, their wages might be expected to rise unless (as with the most recent federal minimum wage legislation) the tip credit is expanded. On the other hand, if these are workers in the uncovered sector, their wages would be expected to fall.

simply to show that the conclusion that moderate disemployment effects imply large income gains for low-wage workers is not necessarily correct.

Low-Income Families

The second issue that needs to be addressed in assessing the effects of minimum wages on family incomes is the relationship between low-wage workers and low-income *families*. That is, even if minimum wages increase the incomes of low-wage workers generally, the effects on the family income distribution are ambiguous because many low-wage workers are not in low-income families. Burkhauser, et al. (1996) report, for example, that while one-third of workers affected by the 1990 increase in the federal minimum wage were in poor or near-poor families (defined as those with family incomes up to 1.5 times the poverty line based on their family's size), roughly another one-third were in families with incomes exceeding three times the poverty line. Similarly, the impact of minimum wage increases on family incomes will be influenced by the location in the family income distribution of those minimum wage workers who get the largest raises, and--more importantly perhaps--the location of those who become disemployed.

Table 2 presents some illustrative calculations showing the interactions between the concentration of employment losses among low-wage workers and the distribution of minimum wage workers throughout the income-to-needs distribution. These calculations are based on the elasticities discussed above, information on the distribution of minimum wage workers and minimum wage income from Burkhauser, at al. (1996), and information on the distribution of families by income-to-needs from the CPS for our sample period.

Column (2) provides an approximate representation across income-to-needs categories of workers who were likely to be affected by the 1990 and 1991 two-step increase in the minimum wage--which occurred in roughly the middle of our sample period--using the distribution of workers earning less than $4.25 per hour in March of 1990 (recall that the minimum wage was increased from $3.35 to $4.25 in two steps beginning in April 1990). A comparison with column (3), which shows the distribution of families by income-to-needs ratio in our sample, reveals that minimum wage workers are overrepresented among families with income-to-needs below 3, although many (32.8 percent) of affected workers are in the 46.1 percent of families with higher income-to-needs. Column (4) reports the share of minimum wage income earned by families in each income-to-needs category in 1990. This share is lower (19.3 percent) for those below the poverty line than the share of affected workers (22 percent), probably because of lower hours worked by minimum wage workers in poor families, as column (6) shows. Column (4) provides a hint of the extent to which a minimum wage increase is likely to benefit poor and near-poor families. In particular, 26.3 percent of families are in these two categories, and they earn 34.1 percent of minimum wage income. Thus, minimum wages do go somewhat disproportionately to the poorest families, although the difference does not strike us as particularly great.

Next, we explore the implications of using an appropriate elasticity to calculate the effects of minimum wage increases on income-to-needs of low-income families, simulating the federal increases to $5.15 in 1996-1997. Since Table 1 suggests that minimum wage workers would, on average, receive a 10.8 percent increase by having their wage moved to the new minimum, we assume an average initial wage of $4.65, as reported in column (5). As discussed above, we then use an employment elasticity for affected (i.e., minimum wage) workers of -.92, in Panel A; this assumes that all of the job loss occurs among minimum wage workers. This elasticity, coupled with the wage increase induced by the minimum wage hike, leads to roughly a 10-percent employment decline among affected workers.

The gains from minimum wage increases accrue from the higher wages of workers who remain employed, while the losses stem from employment declines. Columns (9)-(12) provide information on these effects. Column (9) reports the average hourly income gain per worker stemming from the wage increase; this is calculated for the proportion of workers expected to remain employed, and is weighted by the relative hours worked by minimum wage workers in each group. Column (10) instead reports the average income gain per family. Because, for example, the share of affected workers in poor families is higher than the share of such families, the entry in the first row of this column is larger than in column (9). Columns (11) and (12) report similar calculations, but this time for the average hourly income loss from the employment decline. Note that the loss is sharpest for near-poor families (with income-to-needs between 1 and 1.5), because minimum wage work is disproportionately concentrated in this group.

Finally, column (13) reports the net effect on hourly income per family. The figures reveal that with the assumptions built into the calculations in Panel A, minimum wages are largely a wash, having essentially no net effect on earnings in any income-to-needs category. Of course, with a smaller elasticity in column (7), which we do not rule out, the entries in column (13) would be positive. Alternatively, if we maintain the assumptions used in Panel A but start with a minimum wage employment elasticity of -.2 (Panel B), there would be sizable declines in earnings of low-income families in response to a minimum wage increase.

Again, these illustrative calculations are not intended as empirical estimates, but are meant to show that it is perhaps as plausible that minimum wages reduce income among low-income families as that they increase income. Indeed, there are a number of additional unknowns that further complicate any predictions regarding the overall effects of minimum wages on family incomes. For example, in Table 1 we assume that the employment elasticity for affected workers is the same throughout the distribution of income-to-needs. In fact, however, we know virtually nothing about where in the family income distribution any employment (or hours) loss occurs, and it could be more or less concentrated among the lowest-income families. On the other hand, the consequences of job loss among such families may be less severe, since government transfers may make up some of the lost income. Similarly, the impact of minimum wage increases on family incomes will be influenced by the location in the family income distribution of those minimum wage workers who get the largest raises. Finally, as noted by Addison and Blackburn (1996), changes in the minimum wage may induce labor supply responses by other family members or may lead to changes in family living arrangements, both of which could affect family income.

Our main point, however, is that despite the modest employment effects estimated from standard minimum wage studies, the direction (and magnitude) of the effects of minimum wages on family incomes is an empirical issue, and thus it is an open question whether minimum wages tend to help poor and low-income families. Indeed, even if minimum wages result in an increase in the *share* of income going toward low-income families, the effects on real incomes of the poor could be negative if minimum wages lower total national income. As a consequence, the focus of our empirical analysis is on changes in family income relative to the poverty line, rather than on changes in families' relative positions in the income-to-needs distribution, or on changes in income inequality.

III. The Data

The data we use come primarily from matched March CPS annual demographic files from 1986 through 1995. Matching the files provides two years of data on matched families, which allows us to observe transitions into and out of poverty, or between other parts of the income distribution.[5] For each family, we extracted information on the amount and composition of family

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[5]Welch (1993) discusses matching observations across CPS surveys.

income, family size, and the family's state of residence.[6] We take a broad approach that does not distinguish among families based, for example, on whether family size changed, someone retired, or there was any earned income. Instead, we treat the family as the unit of observation and infer the total effect of minimum wage changes through any of these channels. Obviously the type of analysis we carry out here can be extended to study the mechanisms by which family incomes (relative to needs) are affected, something to which we expect to turn in future research.

In all cases, the income data refer to the previous calendar year; although the state of residence is contemporaneous, the matching process ensures that only families living at the same address two years in a row are included in the data. We follow other research in this area (Gramlich, 1976; Card and Krueger, 1995; Burkhauser, et al., 1996) in looking at total family income from all sources. Given the family income data, each family is classified in terms of its income-to-needs ratio (the ratio of total family income to the poverty line).

We appended to each family-year record the minimum wage level that prevailed in the state in May of the year in which family income is measured, as well as the previous year. Because state minimum wage laws do not exempt employers of workers covered by the federal law from the federal minimum wage, and because coverage by the federal law is nearly complete, we use the higher of the federal minimum wage and the state minimum wage for each state and year.

Table 3 reports these minimum wages for each state for most of our sample period. The first column reports the minimum wage prevailing in 1987, while the remaining columns report the new minimum wage following an increase. With the exception of Minnesota, Pennsylvania,

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[6]We 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. All persons satisfying these criteria, including related subfamily members, are considered members of one family.

and New Jersey, all of the state increases have occurred in the New England and Pacific states. The most obvious feature of the table, however, is that most of the minimum wage increases in this sample period stem from federal increases. As the federal minimum wage increases, especially in 1991, coincided with sharp increases in overall unemployment rates, we cannot treat minimum wages as "randomly assigned," but instead must attempt to control for the relationship between minimum wages and unemployment to draw causal inferences regarding the effects of minimum wages on family incomes.[7]

Finally, for weighting purposes we also retained the family-specific sampling weight. We then adjusted this weight to account for the possibility that certain types of families have a lower probability of being in the survey in consecutive years and thus are less likely to be included in our matched sample. In particular, although overall match rates were above 80 percent, families with younger heads and lower income-to-needs ratios were significantly less likely to be successfully matched. Using a logistic regression, we estimated the probability of a successful match for each family, and divided the sampling weight for successfully matched families by this estimated match rate.[8] The resulting adjusted weight is then an estimate of the inverse of the probability of being in our matched sample of families. Of course this procedure does not correct for non-random matching that, conditional on these observables, is correlated with changes in income-to-needs and therefore possibly also with minimum wage changes. Our conjecture is that, if anything, families most adversely affected by minimum wage increases tend to move away from areas where

[7]Below, we explain how we control for changes in the unemployment rate in our non-parametric estimation. In Neumark and Wascher (1997) we incorporate a wide variety of control variables into a parametric framework, including unemployment, the wage distribution, AFDC benefits, and welfare reform. These other controls had relatively little impact.

[8]The age of head and income-to-needs ratio variables were introduced as categorical variables in this regression. The race of the family head was also used as a regressor, but did not have a significant effect on the probability of a match.

minimum wages have increased and toward areas where they have not. If so, the bias from non-random matching will tend to understate the adverse consequences of minimum wage increases. Using matched data also has an important advantage. In particular, when we observe a change in the income-to-needs distribution--such as a decline in the share of families below the poverty line --we can more comfortably conclude that this reflects the actual experiences of families, rather than differences in the set of families sampled in each period. Statistically, the homogeneity of the samples before and after the minimum wage increase leads to more precise inferences.

IV. Empirical Methods

Basic Strategy

In this section, we describe our strategy for estimating the effects of minimum wage increases on the distributions of the levels and changes in the family income-to-needs ratio. Although we present our methods in relation to the density of income-to-needs, the approach carries over to changes in income-to-needs as well.

Our approach is a difference-in-difference estimator. In particular, we use as the treatment group the set of families residing in states in which the minimum wage rose between years 1 and 2; the control group thus consists of families in states in which the minimum wage remained constant between years 1 and 2. Letting numbers in the subscripts denote years, and MW=1 and MW=0 denote the treatment and control groups, we use $f_{1,MW=1}(I)$ to denote the density of income-to-needs in year 1 in the treatment group and $f_{2,MW=1}(I)$ to denote the density in year 2 in the treatment group. Then the difference $f_{2,MW=1}(I) - f_{1,MW=1}(I)$ measures the change in the density at each point I for this group. Because the density of income-to-needs may be changing for reasons other than minimum wage increases, we subtract off the corresponding quantity for the control group, $f_{2,MW=0}(I) - f_{1,MW=0}(I)$. This yields the difference-in-difference estimator of the effect of minimum wage increases on the density at each income-to-needs ratio I:

$$\{f_{2,MW=1}(I) - f_{1,MW=1}(I)\} - \{f_{2,MW=0}(I) - f_{1,MW=0}(I)\} .$$

To estimate each of the four densities in this expression, we use a kernel estimator. In particular, given a kernel K(z), the estimated density function for I is:

$$f_K^e(I) = \frac{1}{n}\sum_{j=1}^{n} \frac{\theta_j}{h} K[\frac{I - I_j}{h}] ,$$

where n is the number of observations in the sample, h is the bandwidth, and θ_j is a sampling weight that has been normalized to sum to one. The points at which the density is estimated are indicated by I, and the data by I_j. The initial bandwidth is chosen according to a normal rule of thumb procedure. Under this rule of thumb, if the data were generated from a normal distribution, the bandwidth used would be optimal (in a RMSE sense). The bandwidths are adjusted to be wider where there are fewer observations (using the adaptive bandwidth rule of Silverman, 1986). This allows for sharper fluctuations in the estimated density than seen in a normal by using less smoothing in ranges in which there are many observations (Härdle, 1991). As the peak of the family income-to-needs distribution is typically near one (i.e., the poverty line), this technique increases the accuracy of the kernel procedure in the area of greatest interest.

When we analyze the densities of changes in income-to-needs, we study subsamples based on year 1 income-to-needs. To accommodate the widely differing sample sizes that result, we pool the data for initial bandwidth selection following Marron and Schmitz's (1992) approach. This keeps the level of smoothing equal for the analyses of families in different initial income-to-needs categories, whereas standard rules would result in more smoothed estimates for smaller sample sizes.

Controlling for Other Differences Between Treatment and Control Groups

There are two important complications that must be addressed in constructing this difference-in-difference estimator. First, as already mentioned, it is probably incorrect to assume that the treatment and control groups are randomly assigned. Table 4 displays separately the distribution of all observations and the distribution of observations with minimum wage increases, across cells defined by changes in state unemployment rates and changes in state poverty rates.[9] With respect to unemployment, minimum wage increases appear non-randomly distributed. For example, in the cells with declines in state unemployment rates of 2 to 3 percentage points, only 11 percent of the observations coincide with minimum wage increases. Conversely, in the cells with increases in unemployment rates of 1 to 2 percentage points, 39 percent of the observations coincide with minimum wage increases. The differences are more pronounced for more extreme changes in unemployment rates, although fewer observations are in those cells. Because minimum wage increases tend to be associated with increases in unemployment rates, and changes in the unemployment rate disproportionately harm low-income families, failure to account for this relationship will overstate any adverse effect of minimum wages on such families. On the other hand, as Table 4 shows, the pattern of minimum wage changes with respect to poverty changes is considerably less pronounced, and there is, if anything, a slight overrepresentation of minimum wage increases among observations with poverty declines. Of course, if changes in poverty stem from minimum wage increases, there is no sense in which we want to "control" for poverty changes.[10] But if there are other policy changes that reduce poverty and are correlated with

[9]We focus on changes in these rates, rather than levels, because we use a difference-in-difference estimator that is not influenced, for example, by persistent state differences in unemployment rates.

[10]This is potentially an issue for unemployment rates as well, but the effects of minimum wages on overall state unemployment rates are likely negligible. Also, controlling for changes in poverty is unappealing because the poverty rate is a transformation of the income-to-needs distribution.

minimum wage increases, then failing to account for these will likely understate, rather than overstate, any adverse effects of minimum wages on poor and low-income families. Thus, our findings that minimum wages tend to increase the proportion of poor and near-poor families would only be strengthened if we controlled for other sources of change in poverty rates.[11]

The intuition behind our strategy for controlling for the correlation between minimum wage increases and changes in the unemployment rate follows DiNardo, et al. (1996). In particular, conditioning is converted to a reweighting problem in which we define a number of cells for the conditioning variable (the change in the unemployment rate), and then reweight the observations in the treatment group so that the distribution of observations across unemployment rate change cells is the same in the treatment and control groups. This can be thought of as creating an artificial sample in which observations with minimum wage increases are no longer, for example, concentrated in years with sharper increases in unemployment.

To see how this works in a particular case, suppose that we want to estimate the density of income-to-needs for observations for which the minimum wage increased, recognizing that the income-to-needs ratio (I) is also related to changes in the unemployment rate U. For the treatment group, this means that we need to estimate the (hypothetical) density of I for observations for which the minimum wage increased but unemployment rate changes were the same as observations for which the minimum wage *did not* increase. This is done for years 1 and 2, for which we now omit the subscript. (We would then compare the change in this hypothetical density with the observed change for the control group.) We write this conditional density for the treatment group as

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[11]This is borne out in the types of specifications used in the parametric analysis in Neumark and Wascher (1997), where adding controls for AFDC benefits and waivers (which reduce poverty) leads to slightly stronger adverse effects of minimum wages.

$$f_{MW=1}(I \mid U_{MW=0}, I(U)) \quad ,$$

where $U_{MW=0}$ represents changes in unemployment rates for the observations for which the minimum wage did not increase, and I(U) is the relationship between income-to-needs and changes in unemployment for observations for which the minimum wage increased. What we observe, however, is

$$f_{MW=1}(I \mid U_{MW=1}, I(U)) \quad .$$

We define a reweighting function $\Psi(U)$ to capture the differences in the relative frequencies of particular ranges of unemployment rate changes in the treatment and control groups,

$$\Psi(U) = \frac{dG(U_{MW=0})}{dG(U_{MW=1})} \quad ,$$

where dG is the proportion of observations with each value of U in the population. The function $\Psi(U)$ is estimable using the proportions of observations at each value of U in the treatment and control groups.

This reweighting function generates the desired density because the reweighted observed density can be written as

$$\int f_{MW=1}(I,U)\Psi(U)dG(U_{MW=1}) \quad ,$$

which equals

$$\int f_{MW=1}(I,U)dG(U_{MW=0}) = f_{MW=1}(I \mid U_{MW=0}, I(U)) \quad ,$$

our desired density. As DiNardo, et al. (1996) show, we can estimate each desired density using the kernel estimator

$$f_K^e(I \mid U_{MW=0}, I(U)) = \frac{1}{n}\sum_{i=1}^{n} \frac{\Psi^e \theta_i}{h} K[\frac{I - I_j}{h}] \quad ,$$

where Ψ^e is the estimate of Ψ.

Contaminated Treatment and Control Groups

A second concern arises in our analysis because previous research has found that the effects of minimum wages are often stronger at a lag of one year (see Neumark and Wascher, 1992 and 1997, and Baker, et al., 1995), and thus we are interested in both contemporaneous and lagged minimum wage effects on the densities of levels and changes of family income-to-needs. This creates complications because the observations for the treatment group (or the control group) may be contaminated by the effects of minimum wage increases not directly captured by the difference-in-difference estimator. For example, when we estimate $f_{2,MW=1}(I)$ for the treatment group for the lagged effect, there could also be a contemporaneous effect in year 2. Similarly, when we estimate the density for the treatment group for the contemporaneous effect, there could be a lagged effect (from a contemporaneous increase in year 1). Of course, we could drop all of the observations in which the treatment is contaminated. But as Table 3 shows, that would entail the loss of many observations. For example, we would not be able to study the contemporaneous effect of the federal minimum wage increase in 1991, because the 1991 data would also reflect the lagged effect of the 1990 increase.

Instead, we employ a procedure that uses all of the observations and distributes the overall effects into "pure" contemporaneous and "pure" lagged effects correcting for the incidence of contaminated treatment and control groups. To explain the procedure, define the following terms:

C(I) = the estimated change in the density from year 1 to year 2 for observations with a contemporaneous increase in year 2, vs. the estimated change for observations with no contemporaneous increase,

L(I) = the similar estimate for lagged increases,

in(I)= the change in the density from year 1 to year 2 for observations with a contemporaneous increase in year 2 and no lagged increase in year 2,

ni(I)= the change in the density from year 1 to year 2 for observations with a lagged increase in year 2 and no contemporaneous increase in year 2,

ii(I)= the change in the density from year 1 to year 2 for observations with a contemporaneous increase in year 2 and a lagged increase in year 2,

nn(I)= the change in the density from year 1 to year 2 for observations with no contemporaneous increase in year 2 and no lagged increase in year 2,

Then C(I) is a weighted average of the estimated changes in densities over four groups:

$$C(I) = \alpha_1\{in(I) - nn(I)\} + \alpha_2\{in(I) - ni(I)\} + \alpha_3\{ii(I) - nn(I)\} + \alpha_4\{ii(I) - ni(I)\} \ ,$$

where the first term corresponds to a change in densities estimated from uncontaminated treatment and control groups, the second term corresponds to an estimate with a contaminated control group only, the third term corresponds to an estimate with a contaminated treatment group only, and the fourth term corresponds to an estimate with a contaminated treatment and control group; the α_k (which sum to one) are the probabilities that the estimate comes from each of these groups.[12]

[12]Define γ as the probability that observations with a contemporaneous increase have a lagged increase as well (i.e., the probability that the treatment group is contaminated); this is estimated from the data. Similarly, define δ as the probability that observations with no contemporaneous increase have a lagged increase (i.e., the probability that the control group is contaminated). Then assuming independence of the two types of contamination (because observations are either in the treatment or control group), $\alpha_1 = (1-\gamma)(1-\delta)$, $\alpha_2 = (1-\gamma)\delta$, $\alpha_3 = \gamma(1-\delta)$, and $\alpha_4 = \gamma\delta$.

Similarly, L(I) can be written as

$$L(I) = \beta_1\{ni(I) - nn(I)\} + \beta_2\{ni(I) - in(I)\} + \beta_3\{ii(I) - nn(I)\} + \beta_4\{ii(I) - in(I)\} \ .$$

Adding and subtracting nn(I) in the second and fourth terms in the equation for C(I), and using the fact that

$$\{ii(I) - nn(I)\} = \{in(I) - nn(I)\} + \{ni(I) - nn(I)\} \ ,$$

we can rewrite the expression for C(I) as

$$C(I) = \{in(I) - nn(I)\} + (\alpha_3 - \alpha_2)\cdot\{ni(I) - nn(I)\} \ .$$

This expression makes intuitive sense. First, the final term in the equation for C(I) drops out because both the treatment and control group are contaminated, leaving the difference-in-difference estimate unaffected. Similarly, if $\alpha_2 = \alpha_3$, so that there are equal likelihoods that the estimate comes from a contaminated treatment group (only) and a contaminated control group (only), the contamination again does not matter, and C(I) is the estimated change in the density for uncontaminated treatment and control groups. On the other hand, if $\alpha_2 < \alpha_3$, so that there is a relatively higher probability of a contaminated treatment group, lagged effects {ni(I) - nn(I)} will be added to C(I). Conversely, if $\alpha_2 > \alpha_3$, so that there is a relatively higher probability of a contaminated control group, lagged effects will be subtracted from C(I).

In parallel fashion, L(I) can be rewritten as

$$L(I) = \{ni(I) - nn(I)\} + (\beta_3 - \beta_2)\cdot\{in(I) - nn(I)\} \ .$$

We can solve the two equations C(I) and L(I) for the unknowns {in(I) - nn(I)} and {ni(I) - nn(I)}, which are the "pure" contemporaneous and lagged treatment effects, respectively, in which we are interested. Finally, we can add the "pure" lagged and contemporaneous effects together to get the combined "long-run" or "one-year-out" effect of minimum wage increases on the income-to-needs density. In a regression framework with contemporaneous and lagged increases as independent variables, this would be equivalent to the sum of the contemporaneous and lagged effects.

V. Results

Difference-in-Difference Estimates of Minimum Wage Effects on Income-to-Needs Densities

Figure 1 displays the entire set of density estimations that we use to infer the effects of minimum wage increases. We begin, in this figure, by showing results for the full matched data set. The first row presents evidence on changes in the income-to-needs distribution in states with contemporaneous minimum wage increases compared with states with no contemporaneous minimum wage increases. The left-hand panel presents estimates of the densities in year 1 and year 2 for the treatment group (observations with increases), and the middle panel for the control group. Because the differences between the densities in each panel are relatively small relative to the scale (and therefore hard to distinguish visually), the right-hand panel summarizes the information by plotting--for the treatment and control groups--the vertical distance between the year 1 and year 2 densities. The difference-in-difference estimate of the effects of contemporaneous minimum wage increases is the vertical distance between these two lines. After applying the methods described in the previous subsection, we extract the "pure" effect of a contemporaneous minimum wage increase, which is displayed in the left-hand panel of the bottom row of Figure 1. We see that the effect of contemporaneous minimum wage increases is to reduce the proportion of families with income-to-needs of 0 to about .5, to increase the proportion with income-to-needs of .5 to 1.5, and to reduce the proportion with income-to-needs of 1.5 to a bit above 2.5. These results are consistent with minimum wages helping the poorest families, but they also are suggestive of some earnings loss among families with initial income-to-needs in the range of approximately 1.5 to 3.

The panels in the second row of the figure report similar estimations, but now defining the treatment group as those observations for which there was a lagged minimum wage increase. The right-hand panel again reports the vertical distances between the year 1 and year 2 densities in the treatment and control groups. The difference-in-difference estimate of the lagged minimum wage effect is reported in the middle panel of the bottom row. In contrast to the estimated effects of contemporaneous minimum wage increases, lagged increases unambiguously increase the proportion of families below the poverty line, with corresponding decreases in the proportion of families with income-to-needs between 1.5 and 3. This evidence, and the contrast with contemporaneous effects, is consistent with disemployment effects (or hours reductions) occurring with a lag.

To calculate the total effect of minimum wage increases, the bottom right-hand panel reports the sum of the contemporaneous and lagged effects. The result is quite striking. There is essentially no net benefit for the poorest families (with income-to-needs below 0.5), as the benefit of the contemporaneous increase is essentially offset by the cost of the lagged increase. There is a marked increase in the proportion of families with income-to-needs between about .5 and 1.5, and a marked decrease in the proportion of families between about 1.5 and 3. These results suggest that the overall net effect of minimum wage increases is to push some families that are initially low-income but above the near-poverty line into poverty or near-poverty.

The first row of Table 5 provides some summary information on the changes in densities displayed in Figure 1. As can be seen in column (1), there is essentially no effect from minimum wage changes on the proportion with income-to-needs between 0 and .5. In contrast, as shown in columns (2) and (3), minimum wage hikes lead to an marked increase of .0079 in the proportion .5 to 1 (and therefore 0 to 1). As the lower panel of the table shows, these changes in proportions represent a 6.6 percent increase in the number of families with income-to-needs of .5 to 1, and a 4.5 percent increase in the overall number of poor families. To assess the statistical significance of these changes, we used a bootstrap procedure for the non-parametric estimation. The standard errors from the bootstrap are shown in parentheses in Table 5. We see that the change in the proportion between 0 and .5 is not statistically significant, while the changes in the proportion between .5 and 1 and the proportion of poor families are statistically significant.[13] As was apparent in Figure 1, column (4) shows a sizable increase in the proportion of near-poor families (.0046, or 3.6 percent) following minimum wage changes, an estimate that is significant at the ten-percent level. Column (5) aggregates over the preceding categories and shows that minimum wage increases raise the proportion of poor and near-poor families by .013, or 4.1 percent, an estimate that is statistically significant. Finally, columns (6)-(8) indicate that minimum wage increases lead to declines in the proportion of families with income-to-needs in the 1.5-2 or 2-3 category of .0049 (3.9 percent) and .0071 (3.0 percent), respectively, while the overall decline in the proportion of families with income-to-needs between 1.5 and 3 is .012 (3.4 percent); the latter two estimates are statistically significant at the five-percent level, and the first at the ten-percent level.[14] To interpret these magnitudes, over the observations in our sample period the average minimum wage increase is 43 cents, or about 10 percent. Thus, the elasticity of changes in the proportion poor or near-poor with respect to the minimum wage is approximately .41, and the elasticity of the proportion with income-to-needs in the 1.5-3 range is about -.34.

The analysis to this point takes no account of the possibility that minimum wage increases

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[13]The implied t-statistics are asymptotically normally distributed. Unless otherwise noted, statements regarding statistical significance are for two-sided tests at the five-percent level.

[14]The figures for income-to-needs ratios of 3 and above indicate generally negligible and statistically insignificant changes.

coincided with other changes in economic conditions that may have influenced the distribution of family income. Estimates that take account of this problem are reported in Figure 2 and the remainder of Table 5. We present two different sets of results. First, we exclude from the analysis minimum wage increases that took effect in 1991 or 1992, years in which the aggregate unemployment rate rose sharply as a result of the recession; this avoids confounding minimum wage effects with the effects of the recession.[15] As the federal minimum wage rose in both 1990 and 1991, this results in dropping the 1991 increase from the analysis of contemporaneous effects of minimum wages, and *all* federal increases from the analysis of lagged effects.[16] Second, we explicitly control for changes in state-specific unemployment rates, using the methods described above. For each of these analyses, the relevant row of Figure 2 shows the difference-in-difference estimate that is conceptually equivalent to the last row of Figure 1 (which is reproduced in the first row of Figure 2); the first graph in each row shows the contemporaneous effect on the income-to-needs density, the second the lagged effect, and the third the total effect.

In each of the analyses reported in Figure 2, the qualitative conclusions are similar to the results reported in Figure 1. The contemporaneous effect of minimum wage increases--displayed in the graphs in the left-hand column--is always beneficial for the families at the very bottom of the income-to-needs distribution. In addition, although the exact shape of the difference-in-difference estimate of contemporaneous effects on the density varies, there generally is an increase in the proportion of families in the .5 to 1.5 range, and a decline in the proportion of families with income-to-needs in some part of the 1.5 to 3 range.

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[15]That is, we exclude observations in both the treatment and control groups corresponding to these increases.

[16]The resulting estimates are very similar, although somewhat less precise, if we drop the federal increases altogether.

On the other hand, the estimated lagged effects--displayed in the graphs in the middle column--systematically show a net increase, rather than a decrease, in the proportion of families in the 0 to .5 range in response to a higher minimum wage, and, more broadly, a net increase in the proportion of families below the poverty line. In addition, the estimates indicate a net reduction in the proportion of families in the 1.5 to 3 range, with the decline especially striking in Panel B; this is presumably the range from which the additional poor and near-poor families are drawn.

Finally, the total effects are displayed in the graphs in the right-hand column. Again, both analyses lead to conclusions that parallel our initial analysis; indeed, the estimated total effects are more similar across the different analyses than are the estimated contemporaneous or lagged effects individually. In particular, raising the minimum wage appears to have little effect on the proportion of families in the lowest income-to-needs range of approximately 0 to .5, and raises the proportion of families in the .5 to 1.5 range; together, these effects imply that a higher minimum results in a net increase in the proportion of families that are poor. Finally, all of the graphs indicate a reduction in the proportion of families in the range of 1.5 to 3. Thus, the evidence points quite unambiguously in the direction of minimum wages increasing the number of poor and near-poor families, with these families coming from the ranks of low-income, non-poor (and non-near-poor) families.

These results are translated into changes in the proportions in various income-to-needs ranges in Table 5. Focusing on the second and third rows, we see that although the qualitative evidence generally points in the same direction as in the first row, the magnitudes and the statistical strength of the evidence varies. In both cases, column (1) indicates small (and statistically insignificant) reductions in the proportion of families in with income-to-needs of 0 to .5. Similarly, columns (2)-(5) consistently show much larger absolute increases in the proportions of families that are poor or near-poor, suggesting that the net effect of minimum wage increases is more poor and near-poor families, while columns (6)-(8) indicate that minimum wages also appear to cause matching reductions in the proportion of families with income-to-needs of 1.5 to 3. For the estimation that excludes the high unemployment years (and therefore most of the identifying information from federal minimum wage increases) the estimated changes are not statistically significant, illustrating the difficulty of identifying minimum wage effects without including the federal increases. In contrast, the inclusion of controls (via reweighting) for changes in state unemployment rates, which should capture the year-to-year variation in economic conditions that could potentially bias the estimated effects, generally leads to statistically significant estimates.

Characteristics of Affected Families

The preceding results suggest that minimum wage increases push families that are initially non-poor into poverty (and families above the near-poverty line below this line). This requires that these families initially have some rather low-wage workers, since we would generally expect low-wage workers to suffer the brunt of the disemployment effects of minimum wages. Table 6 provides some indirect evidence on this and other issues, by documenting characteristics of families in the various income-to-needs categories in year 1.

Columns (1) and (2) provide information on poor families. More than half of poor families have no workers, a relatively high proportion have one worker (.4), and an additional small proportion have two workers. In addition, these families are very unlikely to have one or more teenage workers. Mean income is only about 2000 dollars in families with income-to-needs in the 0 to .5 range, and is over 5200 dollars in families with income-to-needs of .5 to 1 (all figures are 1982-1984 dollars). For near-poor families, described in column (3), the modal number of workers is one, and 15 percent of families have two workers; of course, mean income is considerably higher.

Families with income-to-needs in the 1.5 to 3 range, some of whom appear to be pushed into poverty or near-poverty by minimum wage increases, are relatively more likely to have two or more workers, although again relatively few have teenage workers. Mean income is of course considerably higher for these families. However, the last panel of the table shows that incomes of the non-primary earners in these families are often quite low, with means of about 5700 to 7500 dollars, and 25th centiles of 2200 to 3400 dollars. Thus, it is entirely possible that families with income-to-needs initially in the 1.5 to 3 range have a second worker earning a wage at or near the minimum wage,[17] so that minimum wage increases can have sizable adverse consequences for such families. In the next subsection, we present more direct evidence of such declines.

Direct Evidence on Changes in Income-to-Needs

In order to examine the changes in income-to-needs induced by minimum wage increases, we apply our difference-in-difference procedure for estimating the effects of minimum wages to the distribution of *changes* in income-to-needs. The analysis is performed separately for families initially in each of the following four income-to-needs categories: 0 to 1.5, 1.5 to 3, 1.5 to 2, and 2 to 3. As the results with and without reweighting to control for changes in unemployment rates are very similar, we report estimates only for the analysis using the whole data set without controls.

Figure 3 first reports the density estimates for the 0 to 1.5 and 1.5 to 3 group. As before, we estimate the densities separately for contemporaneous and lagged increases, versus the control group of no increases. The top row is for those families with income-to-needs initially in the 0 to 1.5 range, and the bottom row for those initially in the 1.5 to 3 range. Figure 4 then reports the

[17]The March CPS files have wages only for the outgoing rotation groups, which is why we look at earnings rather than wages here.

difference-in-difference estimates, which are the vertical distances between the graphs in Figure 3.

The first row of Figure 4 is for families initially in the 0-1.5 income-to-needs category. The left-hand graph is the estimated effect of a contemporaneous minimum wage increase. Consistent with our previous finding that the wage increase is the dominant contemporaneous effect, the most notable feature of this graph is the positive mass to the right of zero. This indicates that the contemporaneous effect of a minimum wage increase is a greater proportion of families experiencing increases in income-to-needs than would otherwise be the case. The middle graph displays the estimated lagged effects. This graph is more suggestive of disemployment effects, with the positive mass to the left of zero indicating an increase in the proportion of families experiencing declines in income-to-needs ratios, and the trough to the right of zero indicating a decline in the proportion of families experiencing increases in income-to-needs. Finally, the right-hand panel displays the total effects of minimum wage increases. The picture is relatively unambiguous, with its most prominent feature being the positive mass to the left of zero. This implies that the net effect of minimum wage increases on poor and near-poor families is a decline in income-to-needs.

The graphs in the second row report a similar analysis for families initially in the 1.5 to 3 income-to-needs range. Focusing on the total effects displayed in the right-hand graph, we again see that minimum wage increases result in a net increase in the proportion of families experiencing declines in income-to-needs, and a net decrease in the proportion experiencing increases in income-to-needs.

Note that the bulk of the positive mass to the left of zero in this graph is for declines in income-to-needs of less than one. This suggests that relatively few families with income-to-needs initially above 2 are falling into poverty. What may be happening instead is that some families with income-to-needs of about 2 are falling to 1.5 or so, and others with income-to-needs of 1.5 are falling into poverty. (Think of this as the cumulative effect of many families making small movements to the left in the income-to-needs distribution.) To explore this further, the last two rows of graphs in Figure 4 break out the results for those with initial income-to-needs of 1.5 to 2, and 2 to 3. The same qualitative pattern of a positive mass at small declines in income-to-needs, and a trough at small increases, appears for both groups. But the declines for those with income-to-needs initially in the 2-3 range tend to be relatively small (less than 0.5), suggesting that the declines into poverty or near-poverty are generally coming from families that are initially in the 1.5 to 2 range, or just above the near-poor cutoff.

Table 7 provides a summary description of these results, paralleling Table 5, reporting the change in the proportion experiencing particular changes in income-to-needs (the area under the graphs in Figure 4 in the specified range of changes in income-to-needs). Thus, for example, the .023 figure in the row for initial income-to-needs of 0-1.5, in column (3), indicates that, as a result of minimum wage increases, the proportion of families in this initial income-to-needs category experiencing a decline of 0 to .5 in their income-to-needs is raised by .023. More generally, the table clearly indicates increases in the proportions of families experiencing declines in income-to-needs, and decreases in the proportions of families experiencing increases in income-to-needs, as a result of minimum wage increases. These estimated effects of minimum wage increases on the changes in income-to-needs experienced by families explain what underlies the estimated effects of minimum wage increases on the income-to-needs distribution that were documented in the earlier tables and figures.

VI. Conclusions

This paper presents a non-parametric analysis of the effects of minimum wages on the family distribution of income-to-needs. Our intent is to address the central question regarding the wisdom of the minimum wage as social policy: Do minimum wage increases reduce the proportion of poor and low-income families? Although modest disemployment effects of minimum wages have been interpreted as implying that minimum wages are likely to achieve this goal, there is little basis for this conclusion in the absence of direct evidence on minimum wage effects on family incomes. The evidence we present comes from non-parametric difference-in-difference estimates of the effects of minimum wages on the income-to-needs distribution and on the distribution of changes in income-to-needs.

In our view, the answer we obtain to the question of whether minimum wage increases reduce the proportion of poor and low-income families is a fairly resounding "no." The evidence on both family income distributions and changes in incomes experienced by families indicates that minimum wages raise the incomes of some poor families, but that their net effect is to increase the proportion of families that are poor and near-poor. Thus, it would appear that *reductions* in the proportions of families that are poor or near-poor should not be counted among the potential benefits of minimum wages. Rather, minimum wages appear to *increase* the proportion of families that are poor or near-poor, suggesting that the efficiency and equity effects of minimum wages point in the same negative direction.

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Table 1: Wages of 16-24 Year-Olds, 1995

Wage	Number (Thousands)	Percent	Average Percent Wage Change
< $4.25	817	4.3	0.0
$4.25	1161	6.2	21.2
$4.26-$5.14	2850	15.1	6.6
≥ $5.15	14034	74.4	0.0
Total	18862	100.0	2.3
Affected group	4011	21.3	10.8

Estimates are based on Outgoing Rotation Group files of 1995 CPS. The figures in the fourth column are based on the assumption that all workers between the old and the new minimum are topped off to the new minimum.

Table 2: Simulated Effects of Minimum Wage Increase from $4.25 to $5.15 on Families in Different Income-to-Needs Categories

A. Minimum Wage Employment Elasticity of -0.1

Income/Needs Ratio	Affected Workers	Families	Share of Min. Wage Income	Initial Wage	Relative Hours of Min. Wage Workers	Empl. Elasticity for Affected Workers	Empl. Decline for Affected Workers	Avg. Hourly Income Gain per Worker from Wage Increase	Avg. Hourly Income Gain per Family	Avg. Hourly Income Loss per Worker from Empl. Decline	Avg. Hourly Income Loss per Family	Avg. Net Hourly Income Change per Family
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<1	22%	16.1%	19.3%	$4.65	.88	-.92	-10%	$.40	$.54	-.40	-.55	-.011
1-1.5	13%	10.2%	14.8%	$4.65	1.14	-.92	-10%	$.51	$.65	-.52	-.67	-.014
1.5-2	11.9%	9.7%	12.2%	$4.65	1.03	-.92	-10%	$.46	$.57	-.47	-.58	-.012
2-3	20.3%	17.9%	21.2%	$4.65	1.04	-.92	-10%	$.47	$.53	-.48	-.54	-.011
3+	32.8%	46.1%	32.5%	$4.65	.99	-.92	-10%	$.45	$.32	-.46	-.32	-.007

B. Minimum Wage Employment Elasticity of -0.2

Income/Needs Ratio	Affected Workers	Families	Share of Min. Wage Income	Initial Wage	Relative Hours of Min. Wage Workers	Empl. Elasticity for Affected Workers	Empl. Decline for Affected Workers	Avg. Hourly Income Gain per Worker from Wage Increase	Avg. Hourly Income Gain per Family	Avg. Hourly Income Loss per Worker from Empl. Decline	Avg. Hourly Income Loss per Family	Avg. Net Hourly Income Change per Family
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<1	22%	16.1%	19.3%	$4.65	.88	-1.84	-20%	$.35	$.48	-.80	-1.10	-.62
1-1.5	13%	10.2%	14.8%	$4.65	1.14	-1.84	-20%	$.46	$.58	-1.05	-1.34	-.76
1.5-2	11.9%	9.7%	12.2%	$4.65	1.03	-1.84	-20%	$.41	$.50	-.94	-1.16	-.65
2-3	20.3%	17.9%	21.2%	$4.65	1.04	-1.84	-20%	$.42	$.47	-.96	-1.09	-.62
3+	32.8%	46.1%	32.5%	$4.65	.99	-1.84	-20%	$.40	$.28	-.91	-.65	-.37

Columns (2) and (4) are from Burkhauser, et al. (1996). Column (3) is from Neumark and Wascher (1997). Column (5) is an assumed average wage for workers below the new minimum. Column (6) is implied by the wage increase and the share of minimum wage income going to each group; it is computed as column (4)/column (2). Column (7) is based on an adjustment to the conventional minimum wage employment elasticity to take account of the concentration of employment losses among low-wage workers, and the overstatement of the actual wage increases caused by the minimum wage increase. This adjustment is calculated as [(conventional minimum wage elasticity/proportion of workers affected by minimum wage increase)]/[(average percentage wage increase induced by minimum wage increase/actual percentage increase in the minimum wage)]. Illustrative values for these figures for 16-24 year-olds are taken from Neumark and Wascher (1997). In that paper, the percentage of 16-24 year-olds affected is estimated to be .213. If an age group with fewer minimum wage workers was studied, the conventional minimum wage elasticity would be smaller, but this proportion would also be smaller, so the simulations in this table would still be reasonable. Column (8) is the percentage increase in the minimum wage multiplied by the employment elasticity. Column (9) is the average income gain per worker from the minimum wage increase, and is computed as [5.15 - column (5)]·[1 + column (8)]·[column (6)]. Column (10) is computed as [column (9)]/[column (2)/column (3)]. Column (11) is the average income loss from the disemployment effect, and is computed as [column (8)]·[column (6)]·[column (5)]. Column (12) is computed as [column (11)]/[column (2)/column (3)]. Column (13) is computed as [column (10) - column (12)].

Table 3: Minimum Wages by State and Year

	1987	1988	1989	1990	1991	1992	1993	1994	1995
ME	3.65	...	3.75	3.85	4.25	...	...	...	...
NH	3.45	3.55	3.65	3.80	4.25	...	...	...	...
VT	3.45	3.55	3.65	3.85	4.25	...	...	...	4.50
MA	3.55	3.65	3.75	3.80	4.25	...	...	...	...
RI	3.55	3.65	4.00	4.25	4.45	...	...	...	...
CT	3.37	3.75	4.25	...	4.27	...	...	...	...
NY	3.35	...	...	3.80	4.25	...	...	...	...
NJ	3.35	...	...	3.80	4.25	5.05	...	...	...
PA	3.35	...	3.70	3.80	4.25	...	...	...	...
OH	3.35	...	...	3.80	4.25	...	...	...	...
IN	3.35	...	...	3.80	4.25	...	...	...	...
IL	3.35	...	...	3.80	4.25	...	...	...	...
MI	3.35	...	...	3.80	4.25	...	...	...	...
WI	3.35	...	...	3.80	4.25	...	...	...	...
MN	3.35	3.55	3.85	3.95	4.25	...	...	...	...
IA	3.35	...	...	3.85	4.25	4.65	...	...	...
MO	3.35	...	...	3.80	4.25	...	...	...	...
ND	3.35	...	...	3.80	4.25	...	...	...	...
SD	3.35	...	...	3.80	4.25	...	...	...	...
NE	3.35	...	...	3.80	4.25	...	...	...	...
KS	3.35	...	...	3.80	4.25	...	...	...	...
DE	3.35	...	...	3.80	4.25	...	...	...	...
MD	3.35	...	...	3.80	4.25	...	...	...	...
VA	3.35	...	...	3.80	4.25	...	...	...	...
WV	3.35	...	...	3.80	4.25	...	...	...	...
NC	3.35	...	...	3.80	4.25	...	...	...	...
SC	3.35	...	...	3.80	4.25	...	...	...	...
GA	3.35	...	...	3.80	4.25	...	...	...	...
FL	3.35	...	...	3.80	4.25	...	...	...	...
KY	3.35	...	...	3.80	4.25	...	...	...	...
TN	3.35	...	...	3.80	4.25	...	...	...	...
AL	3.35	...	...	3.80	4.25	...	...	...	...
MS	3.35	...	...	3.80	4.25	...	...	...	...
AR	3.35	...	...	3.80	4.25	...	...	...	...
LA	3.35	...	...	3.80	4.25	...	...	...	...
OK	3.35	...	...	3.80	4.25	...	...	...	...
TX	3.35	...	...	3.80	4.25	...	...	...	...
MT	3.35	...	...	3.80	4.25	...	...	...	...
ID	3.35	...	...	3.80	4.25	...	...	...	...
WY	3.35	...	...	3.80	4.25	...	...	...	...
CO	3.35	...	...	3.80	4.25	...	...	...	...
NM	3.35	...	...	3.80	4.25	...	...	...	...
AZ	3.35	...	...	3.80	4.25	...	...	...	...
UT	3.35	...	...	3.80	4.25	...	...	...	...
NV	3.35	...	...	3.80	4.25	...	...	...	...
WA	3.35	...	3.85	4.25	...	...	...	4.90	4.90
OR	3.35	...	...	4.25	4.75	...	...	...	...
CA	3.35	...	4.25	...	...	...	...	...	...
AK	3.85	...	...	4.30	4.75	...	...	...	...
HI	3.35	3.85	...	...	4.25	4.75	5.25	...	...

The higher of the state or federal minimum wage prevailing in May of each year is reported. To highlight changes minimum wages are shown only in the year of each increase, except for the first year. In the six years prior to 1987, Alaska and Connecticut had minimum wages above the federal minimum in all years, at $3.85 and $3.37 respectively. Maine raised its minimum to $3.45 in 1985 and $3.55 in 1986. All other states with a minimum higher than $3.35 in 1987 raised their minimum in 1987.

Table 4: Distributions of Observations

	Proportion of Total Number of Observations in Each Cell (1)	Proportion of Observations in Each Cell with Minimum Wage Increases (2)
Overall sample	1.0	.25
Cells based on:		
Annual change in state unemployment rate		
Decline of 3% or more	.05	.05
Decline of 2-3%	.09	.11
Decline of 1-2%	.15	.20
Decline of 1% - Increase of 1%	.46	.22
Increase of 1-2%	.13	.39
Increase of 2-3%	.07	.36
Increase of 3-4%	.04	.41
Increase of 4% or more	.02	.73
Annual change in percentage of families in poverty in state		
Decline of 4% or more	.04	.15
Decline of 3-4%	.06	.25
Decline of 2-3%	.09	.36
Decline of 1-2%	.21	.21
Decline of 1% - Increase of 1%	.45	.25
Increase of 1-2%	.07	.27
Increase of 2-3%	.05	.28
Increase of 3% or more	.03	.18

Cells were chosen to provide a high level of disaggregation, while ensuring that each cell included observations both with and without minimum wage increases. In each range, the lower limit is excluded, and the upper limit included. The reweighting used in the following tables applies a weight to the treatment group in each cell to equalize the proportions in that cell in the treatment and control group.

Table 5: Estimated Effects of Minimum Wage Increases on Proportions in Income-to-Needs Ranges

	Income-to-Needs Categories							
	0-.5	.5-1	***0-1, In Poverty***	***1-1.5, Near-Poor***	***0-1.5, Poor/Near-Poor***	1.5-2	2-3	1.5-3
	(1)	(2)	***(3)***	***(4)***	***(5)***	(6)	(7)	(8)
Absolute changes in proportions:								
No controls	.0005	.0078	***.0083***	***.0046***	***.0130***	-.0049	-.0071	-.0120
	(.0018)	(.0025)	*(.0035)*	*(.0027)*	*(.0040)*	(.0028)	(.0031)	(.0040)
No controls, exclude minimum wage increases in high unemployment years (1991 & 1992)	-.0013	.0049	***.0037***	***.0034***	***.0070***	-.0045	-.0025	-.0070
	(.0030)	(.0047)	*(.0064)*	*(.0053)*	*(.0084)*	(.0051)	(.0063)	*(.0084)*
Reweighted to control for: Annual state unemployment rate changes	-.0001	.0078	***.0077***	***.0034***	***.0111***	-.0057	-.0057	-.0115
	(.0018)	(.0025)	*(.0035)*	*(.0027)*	*(.0040)*	(.0028)	(.0031)	(.0040)
Percentage changes:								
No controls	.7	6.6	***4.5***	***3.6***	***4.1***	-3.9	-3.0	-3.4
No controls, exclude minimum wage increases in high unemployment years (1991 & 1992)	-1.9	4.2	***2.0***	***2.6***	***2.3***	-3.6	-1.1	-1.9
Reweighted to control for: Annual state unemployment rate changes	-.1	6.6	***4.2***	***2.6***	***3.5***	-4.6	-2.5	-3.2

The top panel reports the change in the absolute proportion in the income-to-needs category implied by the density estimates, and the bottom panel reports the implied percentage change in the proportion, relative to the sample mean over all observations. The ranges of unemployment rate changes used to reweight are reported in Table 4. The reweighting equalizes the proportion of the total number of observations with minimum wage increases occurring in each cell. The numbers in parentheses in the top panel are bootstrapped standard errors. These are based on 500 repetitions.

Table 6: Profiles of Families

	Income-to-Needs Categories				
	0-.5	.5-1	1-1.5	1.5-2	2-3
	(1)	(2)	(3)	(4)	(5)
Number of adult workers, proportions:					
0	.57	.51	.39	.28	.19
1	.39	.40	.44	.48	.46
2	.04	.08	.15	.22	.32
3	.002	.005	.008	.014	.025
4+	.000	.001	.001	.003	.005
Number of teenage workers, proportions:					
0	.91	.94	.95	.94	.92
1	.09	.05	.05	.05	.06
2	.003	.004	.005	.007	.009
3+	.000	.000	.000	.001	.001
Income of primary earners, households with at least one earner:					
Mean	2039	5205	8216	11070	15360
(Std. dev.)	(1832)	(2874)	(3973)	(5069)	(6798)
25th centile	830	3660	5885	8339	11290
Average income of non-primary earners, households with at least two earners:					
Mean	1621	3382	4600	5729	7547
(Std. dev.)	(2310)	(3136)	(3993)	(4651)	(5637)
25th centile	424	1015	1591	2257	3360

Income-to-needs categories and income measures are reported for the first year for each family. All estimates are weighted. Incomes are measured in 1982-1984 dollars.

Table 7: Estimated Effects of Minimum Wage Increases on Changes in Income-to-Needs Ratios

	Income-to-Needs Ratio Change					
	< -1	-1 to -.5	-.5 to 0	0 to .5	.5 to 1	> 1
	(1)	(2)	(3)	(4)	(5)	(6)
Absolute changes in proportions:						
Initial income-to-needs						
0-1.5	.004	.001	.023	-.010	-.011	-.007
1.5-3	.011	.001	.017	-.010	-.006	-.011
1.5-2	.015	.003	.016	-.004	-.014	-.016
2-3	.009	.000	.015	-.014	-.002	-.008

The panel reports the change in the absolute proportion experiencing the income-to-needs change implied by the density estimates.

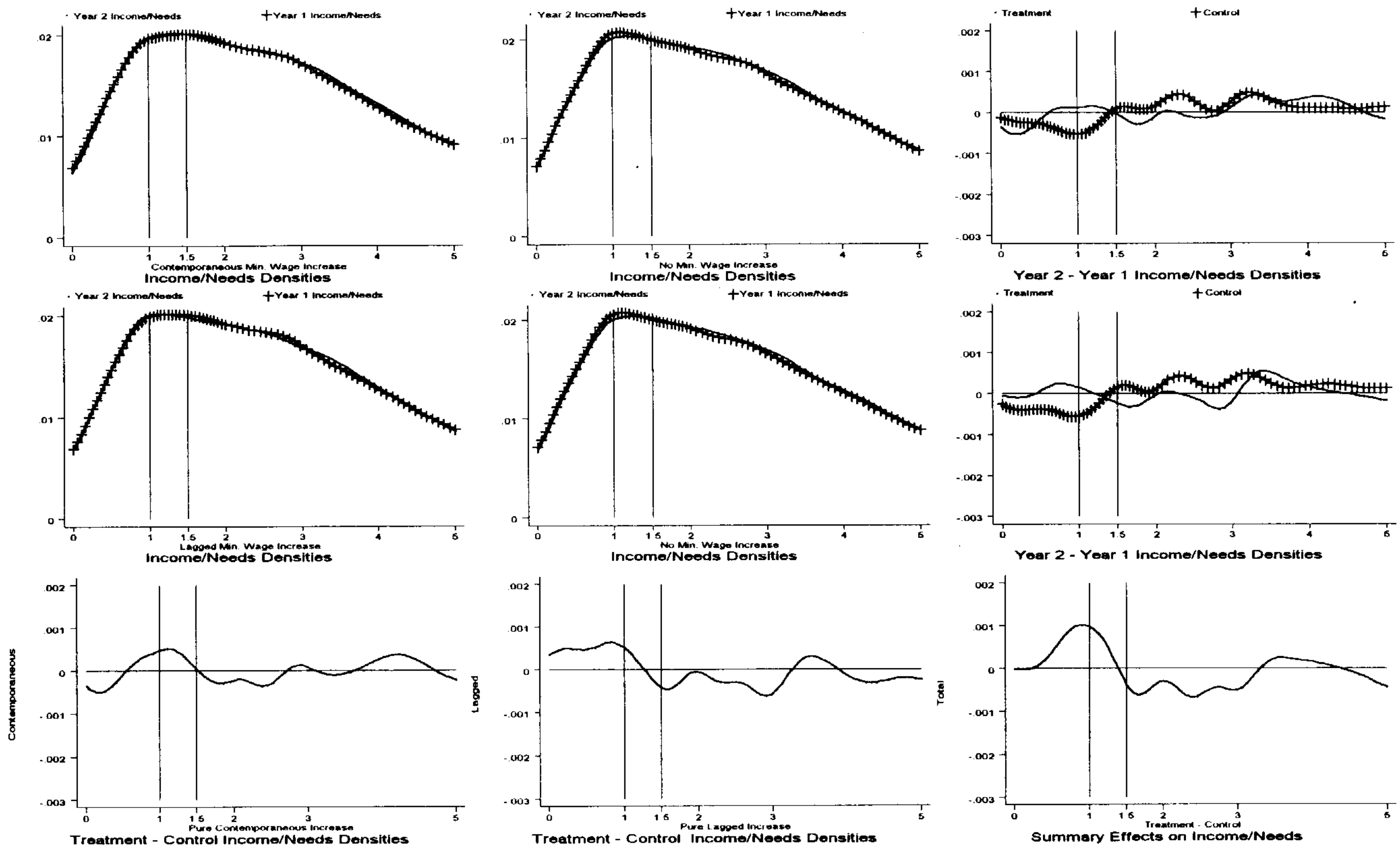

Figure 1: Min. Wage Effects on Income/Needs, No Controls

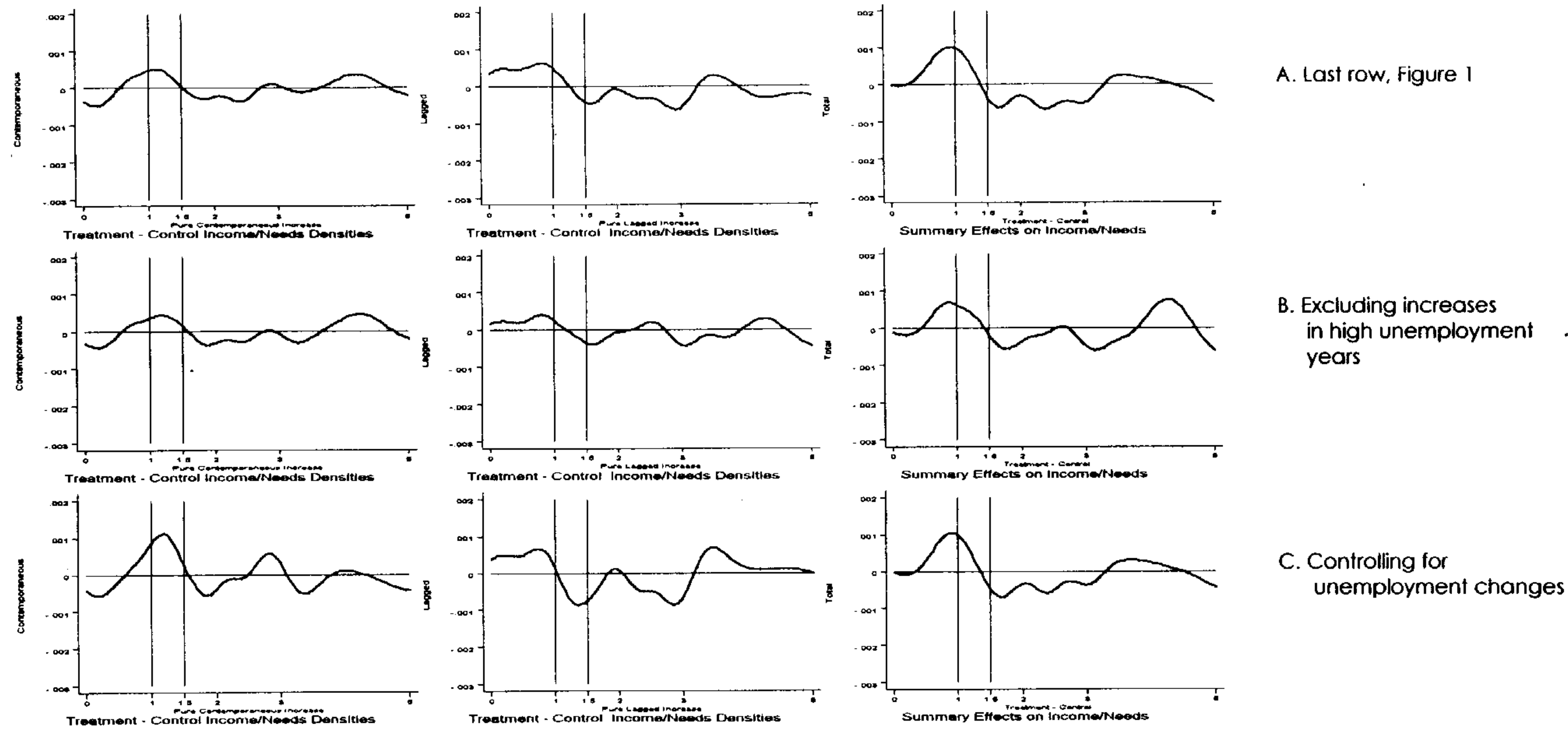

Figure 2: Minimum Wage Effects, Alt. Estimates

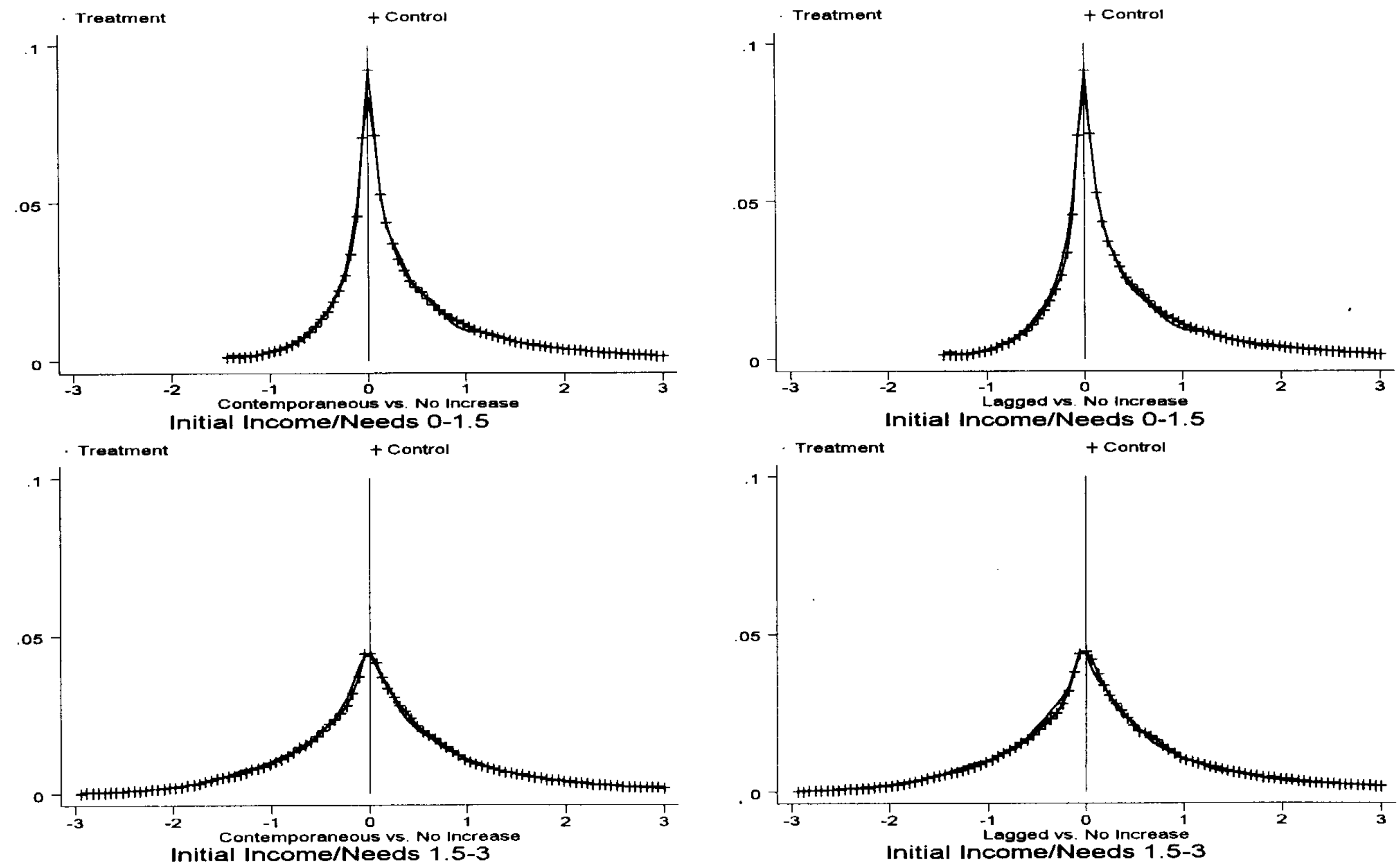

Figure 3: Densities of Change in Income/Needs, No Controls

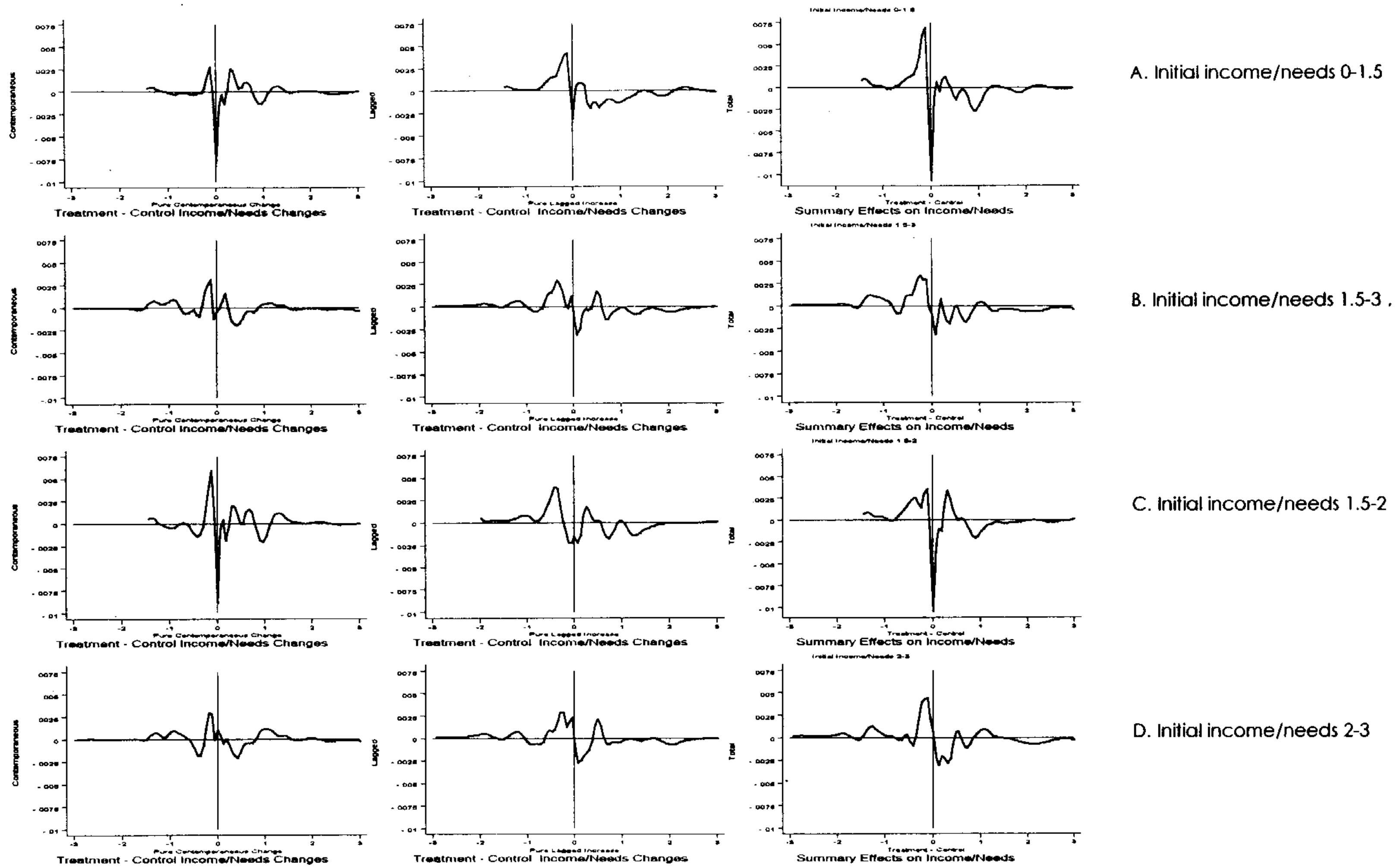

Figure 4: Min. Wage Effects on Changes in Income/Needs