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EFFECTS OF THE MINIMUM WAGE ON CHILD HEALTH

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ABSTRACT

Effects of the minimum wage on labor market outcomes have been extensively debated and analyzed. Less studied, however, are other consequences of the minimum wage that stem from changes in a household's income and labor supply. We examine the effects of the minimum wage on child health. We employ data from the National Survey of Children's Health in conjunction with a difference-in-differences research design. We estimate effects of changes in minimum wage throughout childhood. We find evidence that an increase in the minimum wage throughout childhood is associated with a large improvement in child health. A particularly interesting finding is that much of the benefits of a higher minimum wage are associated with the period between birth and aged 5.

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differences in frequency of preventive visits between the waves that cannot be explained other than the fact that survey questions changed.[15] Similarly, there is a direct question about seeing medical specialists in 2007 and 2011/12 waves, but not in 2003.

Information on the monthly minimum wage at the state and federal level were obtained from publicly available data by Vaghul and Zipperer (2016), compiled from multiple sources including state legislation and resolutions, the Bureau of Labor Statistics, and state agencies and labor departments. The effective minimum wage of a state is the higher of state legislated minimum wage or federal minimum wage.

3.b. Empirical Model

As discussed earlier, an increase in income over a child's lifetime, as a result of a higher minimum wage, may affect child health through changes in investments in health. And the timing of changes in minimum wage during childhood may matter. Changes in the minimum wage during pregnancy and in early childhood may have different effects than changes at later ages. Therefore, it is important to distinguish between effects of minimum wage changes early in life from more recent changes. We incorporate this notion into our empirical model.

Ideally, we would like to estimate equation (1), but investments in child health are not available in the data. Instead, we estimate the minimum wage effects on child health using a reduced-form specification separately for children aged 6-12 and adolescents 13-17. For ages 6-12 years, the specification is as follows:

[15] The rates of any preventive visit based on these questions is 71%, 85%, and 78% in 2003, 2007, and 2011/12 respectively. The rate is highest when everyone answers the question about preventive services (2007) rather than the two consecutive questions in 2003 and 2011/12.

$$(4)\ H_{iskt} = \boldsymbol{\alpha_s} + \boldsymbol{\gamma_t} + \beta_1\, MW\_P_{iskt} + \beta_2 \overline{MW\_0\_5}_{iskt} + \beta_3 \overline{MW\_6\_s}_{iskt} + \mathbf{E_{skt}}\boldsymbol{\gamma} + \mathbf{X_{iskt}}\boldsymbol{\Phi} + \boldsymbol{\mu_{iskt}}\ .$$

H_{iskt} denotes the health outcome of child *i*, at age *k*, in state *s* at survey year *t*. MW_P_{iskt} is the real minimum wage (adjusted for inflation and converted to 2016 dollars) in the pregnancy year,[16] which we include as a separate period given the fundamentally different types of investments in pregnancy and their importance for child health, as well as prior evidence of effects of minimum wage during pregnancy on infant health (Wehby et al, 2019). $\overline{MW\_0\_5}_{iskt}$ is the real minimum wage (averaged over birth year and each year up to age 5, and computed as follows:

$$(5)\ \overline{MW\_0\_5} = \frac{1}{6}\sum_{k=0}^{5} MW_{sk}\ .$$

For each calendar year, the effective real minimum wage is averaged over 12 months before averaging across years. $\overline{MW\_6\_s}_{iskt}$ is the real minimum wage at survey year t for children aged 6 years, or minimum wage averaged over the years from age 6 until child's age (k) at survey year for children older than 6 as follows:

[16] The NSCH does not provide data on the child's birth year and month (and it does not provide individual-level data on interview month), which generates measurement error in the pregnancy and birth year for some children and in the average minimum wage over specific ages. The 2003 NSCH survey was completed between January 2003 and July 2004 (87% in 2003 and 13% in 2004), the 2007 NSCH survey was completed between April 2007 and July 2008 (79% in 2007 and 21% in 2008), and the 2011/2012 survey was completed between June 2011 and February 2012 (interview rates by year are not available); therefore, we assign 2003, 2007 and 2011 as the survey year to all participants in each NSCH wave. The NSCH documentation provided information about the number of interviews by month in the 2003 and 2007 NSCH waves. By assuming a 9-month pregnancy and equal probability of birth in each month, we estimate that the pregnancy year and the birth year might be inaccurately assigned for 26% and 35% of children in the 2003 survey, respectively; similarly, pregnancy year and birth year might be inaccurately assigned for 17% and 31% of children in the 2007 survey, respectively. Proportions of interview by month and year were not reported in the documentation of the 2011 NSCH survey, and so we could not estimate these errors. Any such misclassification of the pregnancy year would attenuate the effect sizes; the degree of attenuation, however, is likely to be minimal because of: 1) lagged effects the minimum wage on birth outcomes (Wehby et al. 2019); and 2) high correlation in the minimum wage within states over time.

$$(6)\ \overline{\mathrm{MW\_6\_s}} = \frac{\sum_{\mathrm{k=Age\ 6}}^{\mathrm{survey\ year}} \mathrm{MW_{sk}}}{(\mathrm{survey\ year-year\ at\ age\ 6})+1}\ .$$

In this model, β_1 captures the effects of minimum wage changes during pregnancy and β_2 captures effects of minimum wage changes after birth and during early childhood. In contrast, β_3 captures effects of minimum wage changes later in childhood. Note that the coefficients on MW variables in each period embed two effects: the effect of minimum wage on the quantity of investments (and thus health) in that period and the effect of the change in health stock in that period on future investment (i.e. at a later period). The second effect occurs because an increase in health stock at the earlier age raises the stock of health in future periods and, therefore, may affect the quantity and productivity of future investments.

Equation (4) can be thought of a reduced form model in which we have substituted for investments with the minimum wage. The model also includes state fixed effects ($\boldsymbol{\alpha}$), and birth year (cohort) fixed effects ($\boldsymbol{\gamma}$). Also included in **E** are three state-level time varying policy measures: state income eligibility thresholds for child coverage in Medicaid, state EITC credits as percent of federal EITC (including 0 if state has no EITC program), and cigarette taxes. These measures are calculated for each period and child's age and included in the model similar to the minimum wage measures. The variables in **X** are child demographic measures including race/ethnicity, gender, and dummies for child age (year by year).

Conditional on other covariates in the model, we assume the minimum wage is exogenous—uncorrelated with missing investments and initial health shown in equation (1). The exogeneity of the minimum wage is based on the difference-in-differences research design of equation (4) that compares children in the same state who were "exposed" to different minimum wages at specific periods of their childhood while accounting for state, birth cohort, and age at interview effects.[17]

The specification of the minimum wage variable in equation (4) represents one approach to allowing the effects of the minimum wage to differ across the child's life course. In this case, we allow there to be three periods when combining children aged 6 through 12. Our choice represents a compromise between estimating a fully unrestricted specification where we include the minimum wage in each year of the child's life for a given age and simply averaging the minimum wage over the child's life. The former approach is not practical because the minimum wage does not vary on an annual basis and is often constant for several years. This introduces a substantial collinearity problem. Also, it requires estimating separate models for each specific age which is impractical given available sample sizes. The latter approach restricts the effect of the minimum wage to be the same at each age, which is inconsistent with the possibilities highlighted by the conceptual model. In addition to estimating and testing the minimum wage effects in specific periods, we also calculate and test the significance of the sum of the minimum wage effects from all stages.

We also estimate models for adolescents ages 13-17 years. In this case, the model is specified as follows:

$$(7)\ \mathrm{H_{iskt}} = \boldsymbol{\alpha_s} + \boldsymbol{\gamma_t} + \beta_1\,\mathrm{MW\_P_{iskt}} + \beta_2\overline{\mathrm{MW\_0\_5}}_{\mathrm{iskt}} + \beta_3\overline{\mathrm{MW\_6\_12}}_{\mathrm{iskt}} + \beta_4\overline{\mathrm{MW\_13\_s}}_{\mathrm{iskt}} + \mathbf{E_{skt}}\boldsymbol{\gamma} + \mathbf{X_{iskt}}\boldsymbol{\Phi} + \boldsymbol{\mu_{iskt}}$$

$\overline{\mathrm{MW\_6\_12}}_{\mathrm{iskt}}$ is the real minimum wage averaged over ages 6 through 12 as follows:

[17] Because of the cross-sectional nature of the data, we do not observe the same child at different points of their life. However, based on the child's age at the survey, we are able to calculate an average minimum wage across years between pregnancy and survey year.

$$(8)\ \overline{MW\_6\_12} = \frac{\sum_{k=age\ 6}^{Age\ 12} MW_{sk}}{7}\ .$$

$\overline{\mathrm{MW\_13\_s}}_{iskt}$ is the real minimum wage at survey year t for children aged 13 years, or minimum wage averaged from age 13 until child's age (k) at survey year for children older than 13 as follows:

$$(9)\ \overline{\mathrm{MW\_13\_s}} = \frac{\sum_{\mathrm{k=Age\ 13}}^{\mathrm{survey\ year}} \mathrm{MW_{sk}}}{(\mathrm{survey\ year} - \mathrm{year\ at\ age\ 13}) + 1}.$$

As noted earlier, the NSCH sampled an equal number of children from each state for each wave. To address this issue, we estimate weighted regression models that use the NSCH sampling probability weights in order to approximate as best as possible the average partial treatment effect of the minimum wage. The NSCH only provides a final sampling weight that accounts for sample selection and nonresponse, which we use for our estimates. We estimate all models using OLS and construct standard errors allowing for non-independence of observations within state (i.e., robust-cluster standard errors).

5. Main Results

5.a. Variation in Minimum Wages over Child's Life

Before discussing estimates of the effects of a higher minimum wage on child health, we present descriptive information about the extent of minimum wage changes in our sample period. Specifically, for each measure of the minimum wage (pregnancy, ages 0 to 5, ages 6 to current age, ages 6 to 12, and ages 13 to current age), we calculated the residuals from regressions of each minimum wage measure on all covariates included in the regression models of children's health.

Figure 1 shows the distribution of these residuals by age group. There are two points to note about Figure 1. First, there is significant variation in minimum wages in the sample period. Changes in the (average) minimum wage of $0.5 to $1 are not atypical. Second, changes in minimum wages tend to be larger for the younger cohort and larger during later periods in the child's life. Both of these observations reflect the fact that there have been more state changes in minimum wages in the later years (e.g., post 2000).

5.b. Effects of Minimum Wage on Health of Children Aged 6-12

Table 1 reports the effects of the average minimum wage during pregnancy, ages 0-5, and 6 to current age for children between ages 6 and 12 on general health and missed school days due to illness or injury. Most estimates in Table 1 pertaining to the effect of the minimum wage during pregnancy are small and not statistically significant. The exception is for fair/poor health. For this outcome, a $1 increase in the minimum wage during pregnancy is associated with a 1.6 percentage point (24%) decrease in the likelihood of fair/poor health.

For minimum wages during age 0-5 years estimates indicate that a $1 increase in the minimum wage is associated with a 0.11 (2.7%) improvement in general health (on the five category scale) and 6.2 percentage point (8.7%) increase in the probability of very good or excellent health. An increase in the minimum wage at these ages is also associated with a 0.57 (15.6%) decrease in missed school days. Changes in the minimum wage between ages 6 and the child's current age are not significantly related to the outcomes in Table 1.

Finally, we calculated the sum of the coefficients on the minimum wage variables across all ages. These estimates are in the last column of Table 1. These estimates measure the effect of a $1 change in the minimum wage at each age: pregnancy, ages 0 to 5 and ages 6 to child's current age. In the case of general health, a higher ($1) minimum wage throughout a child's life is associated with a 4.4% improvement in health at ages 6 to 12. Analogously, a

$1 increase in the minimum wage throughout childhood is associated with a 7 percentage point (10%) increase in the probability of very good or excellent health. Finally, a $1 increase in the minimum wage throughout childhood is associated with 0.95 (26%) fewer missed school days. All of these estimates are statistically significant.

5.c. Effects of Minimum Wage on Health of Children Aged 13-17

In Table 2, we show estimates of the effect of the minimum wage for adolescents aged 13-17. Here we also find significant evidence of improvement in child health with increases in the minimum wage during childhood. Effects sizes are modest with one exception and, as with younger children, minimum wage changes during ages 0 to 5 contribute most to the improvements in health we observe at ages 13 to 17. A $1 increase in the minimum wage during age 0-5 is associated with: a 0.20 (4.8%) increase in general health; a 7.7 percentage point (10.7%) increase in very good/excellent health; a 6.4 percentage point (91.5%) decrease in risk of poor/fair health; and a 0.65 (16.5%) decrease in missed school days, although this estimate is not statistically significant.

All estimates of the effect of the minimum wage at other ages are not statistically significant. The last column of Table 2 presents the estimates of the effect of a $1 increase in minimum wages throughout childhood. These estimates indicate improvements in child health. Because much of the effects of the minimum wage on general health come from changes during ages 0 to 5, estimates in this column for this outcome are similar to estimates of the effect of an increase in the minimum wage at that age. For missed school days, there is a 41.6% decline with a one dollar increase in the minimum wage throughout childhood.

6. Sensitivity Analyses

6.a. Including Leads of Minimum Wage

We test the validity of the research design by adding 3-year and 6-year leads of the minimum wage to the models used to obtain estimates in Tables 2 and 3. The leads represent the minimum wage values in future years, specifically at 3 and 6 years from the survey year. If our research design is valid, estimates of the effects of the leads of minimum wages should be zero (statistically speaking) because future minimum wages should not affect past child health. We present estimates from these models in Tables 3 and 4 for children ages 6 to 12 and 13 to 17, respectively. As can be observed, none of the estimates associated with the lead variables are statistically significant and all are small in magnitude with the exception of those pertaining to poor health.[18] It is also the case that estimates of the effects of non-lead measures of minimum wages in Table 3 and 4 are similar to those in Tables 1 and 2. Overall, the statistical insignificance of the estimates associated with the lead measures of minimum wages and the lack of effect of the addition of these variables on the estimates of interest suggest that the research design is plausibly valid.

6.b. Adding Demographic and Maternal Health Control Variables

In the model used to obtain estimates in tables 1 and 2, we only include variables that are clearly exogenous. However, we assess the sensitivity of the estimates to adding several household demographic variables that are measured across all NSCH waves: an indicator that the highest household education is less than high school (versus high school), parental marital status, and number of children in the household. We also add indicators for maternal general health and mental health ratings (on five-category scales) to account for a

[18] For this relatively infrequent outcome there is less statistical power to detect reliably small effect sizes.

potential source of variation in reporting child health. We note that some of these variables may be affected by the minimum wage (e.g., maternal mental health) and therefore be mediators of the minimum wage effects reported in Tables 1 and 2. We report the results in Appendix Tables 2 and 3. As shown in those tables, estimates from the model that includes an extended set of covariates are very similar to those reported earlier.

6.c. Effects of Minimum Wage on Child Health in Two-Parent High-Educated Families

As another assessment of the validity of the research design, we examine the effect of the minimum wage on health of children in two-parent, higher-educated households. These are households where the highest attained education is greater than high school. The information in the NSCH related to educational attainment combines any education above high school in one category and reports highest attained education in the household (not separately for each parent). Therefore, it is not possible to only include college graduates and so we include households with a parent with educational attainment greater than high school. For this sample, the minimum wage should have smaller or no effects on children's health because these families are largely unaffected by the minimum wage.

Estimates of the effects of the minimum wage using this sample are presented in Tables 5 (ages 6-12) and 6 (ages 13-17). As expected, there are almost no statistically significant estimates in either table and the few estimates that are significant are much smaller than those found for families more likely to be affected. Even for the few instances when an estimate is statistically significant, there is also no consistent pattern across childhood, as was found in the analysis of more affected families. For example, a higher minimum wage during pregnancy is associated with an increase in the probability of being in poor/fair health at ages 13 to 17. However, all other estimates of the effects of the minimum wage during other periods of childhood on this outcome are negative (and very small).

7. Conclusions

Increases in the minimum wage have been shown to raise wages and income of low-skilled workers with only small, if any, negative effects on employment. While the effects of minimum wages on these outcomes continue to be a focus of interest surrounding the use of this policy, the minimum wage may have other consequences that are important. In this study, we have assessed the effect of the minimum wage on child health. Ours is the first paper to investigate this issue. We paid particular attention to the fact that child health is the result of investments throughout childhood and that minimum wages throughout childhood may have cumulative effects on child health.

Our findings are noteworthy because they suggest that higher minimum wages throughout childhood may have significant and relatively large effects on child health. If so, then the debate over the value of minimum wage increases needs to incorporate this evidence, and consider other potential effects that the minimum wage may have.

An interesting finding in this article is that much of the beneficial effects of the minimum wage are associated with minimum wage increases during ages 0 to 5. This finding is similar to a recent study for EITC, showing that the effect of EITC income during childhood on self-reported general health (reporting excellent or very good health) of young adults is largest for income during their first five years of life (Braga et al., 2019). . It is also the case that increases in the minimum wage during other periods are associated with improvements in health, but are mostly not statistically significant and smaller. However, when we calculate the cumulative effect of a $1 increase in the minimum wage throughout