The Effects of Aggregate and Gender-Specific Labor Demand Shocks on Child Health

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In this paper, we investigate the extent to which changes in labor market opportunities affect children's health. An extensive literature documents that negative shocks to labor market demand are, perhaps counter-intuitively, associated with reductions in mortality and improvements in adult health.[1] We know very little, however, about how children's health responds to changes in labor market conditions.[2] Understanding this relationship is important, as health in early life is increasingly appreciated as a significant input to human capital development and a determinant of long-term health and socio-economic status (Almond and Currie, 2011). A contemporaneous relationship between labor market opportunities and children's health may have important implications for the wellbeing of the next generation of workers.

Economic theory does not provide clear predictions about how changes in aggregate labor market conditions should affect child health. On one hand, the decreases in family income that typically accompany a labor market contraction might lead to reductions in parental investments in children's health.[3] On the other hand, declining labor market opportunities are associated with reductions in the opportunity cost of parental time investments, which could lead to improvements in children's health by causing parents to substitute parental care for market-based childcare (reducing their children's exposure to infectious diseases, for example) or through increases in other time-intensive health investments. Meanwhile, both recessions and individual job loss have been linked to declines in adult mental health (e.g. Dooley and Catalano, 1984; Dooley, Catalano and Rook, 1988; Fenwick and Tausig, 1994; Schaller and Stevens,

[1] A non-exhaustive list of studies includes Ruhm (2000, 2003, 2005a, 2005b), Ruhm and Black (2002), Evans and Graham (1988), Gruber and Frakes (2006), Stevens et. al, (2015), Xu (2013).
[2] Two exceptions are Dehejia and Lleras Muney (2004), and Lindo (2015). Both of these studies focus on infant health (mortality and birthweight).
[3] Similarly, reductions in employer provided health insurance coverage, which also accompany labor market contractions, may lead to reductions in children's health.

2015), which may affect children's health either directly or indirectly (Conger and Conger, 2007). When combined with cyclical changes in environmental contributors to children's health such as pollution, the multitude of potentially changing within-family inputs leaves the overall relationship as an empirical question.

Moreover, there is reason to believe that the effect of an aggregate economic downturn on children's outcomes might mask contradictory effects of changes in labor market outcomes (employment, hours, and wages) for mothers versus fathers. For example, as fathers are often primary earners, average income effects from changes in fathers' labor market opportunities may be larger. Research in psychology and sociology has suggested that fathers may also experience greater increases in stress than mothers following job displacement (Kalil and Ziol-Guest, 2008). Meanwhile, women are more likely than men to substitute time in the labor market directly for time spent with children, which suggests that changes in mothers' labor market opportunities may have larger effects on the source and quality of child care (see, e.g., Aguiar et al., 2013; Pailhé and Solaz, 2012). Recent empirical research does reveal differing effects of male and female employment outcomes on children,[4] which suggests that the estimated effects of an aggregate downturn (which is likely to affect both male and female labor market opportunities negatively) may obscure heterogeneous effects of shocks to male and female labor market conditions.

A key challenge in estimating the effects of shocks to parental labor market outcomes on child health is endogeneity. In particular, child health is likely to influence family income and labor supply decisions and these factors are likely to be correlated with unobservable preferences

[4]An extensive literature finds that maternal employment is detrimental to children's health (Anderson, Butcher, and Levine, 2003, Gennetian et al., 2010, Morrill 2011), while Lindo (2011) finds that infant health declines in the wake of a paternal job loss. Recent work also suggests that children's health outcomes respond differently to mothers' vs. fathers' job displacements (Liu and Zhao, 2011, Schaller and Zerpa, 2015).

and attributes of children and families. Existing literature also highlights important differences between the effects of family income and the effects of changes in parental (especially maternal) time use. However, separately identifying how these mechanisms contribute to changes in child health is difficult in light of endogeneity concerns, which are particularly salient when considering maternal employment outcomes.

This paper makes three contributions. First, we are among the first to provide estimates of the relationship between cyclical changes in aggregate labor market opportunities and children's health in the United States, and (to our knowledge) the first to consider cyclical variation in child health outcomes other than infant health or mortality. Combining restricted data from the National Health Interview Survey with state monthly unemployment rates, we examine the effect of contemporaneous aggregate employment opportunities on a wide variety of outcomes for children, including general ratings of health, activity limitations, and the incidence of specific health conditions. This analysis complements existing work that uses a similar empirical approach to explore changes in adult health outcomes over the business cycle.

Second, in order to address the potential endogeneity of aggregate unemployment rates, we generate predicted employment growth rates that exploit variation in base-period industry employment shares across states, together with national rates of employment growth across industries. These "shift-share" indices, which are similar to those used by Bartik (1991), Katz and Murphy (1992) and Blanchard and Katz (1992), and others, allow us to isolate variation in child health due to demand-induced changes in labor market opportunities. Finally, using a variation on the shift-share strategy, we create gender-specific predicted employment growth rates to estimate the effects of changes in labor market opportunities for men and women separately.

Our findings are summarized as follows. In contrast with recent studies that focus on adult health, we find no systematic evidence that general labor demand conditions are associated with improvements in contemporaneous measures of children's health. Instead, we find that increases in the local unemployment rate are associated with increases in the incidence of injuries and mental health problems among children. However, these associations become weaker when we use the predicted employment growth rate as our measure of economic conditions. We do not find any effects of aggregate unemployment rates on parent-rated health, asthma, ear infections, activity limitations or sick days from school.

Turning to the effects of gender-specific labor market conditions, we find that focusing on a broad measure of employment opportunities does obscure the true extent to which the labor market affects children. Specifically, we find evidence that improvements in labor market conditions facing women are associated with worse parent-reported child health and increases in asthma and mental health problems among children. Meanwhile, improvements in men's labor market conditions are associated with reductions in the incidence of both asthma and injuries. For many outcomes, our results suggest that the correlation between children's health and a gender-inclusive measure of employment opportunities averages together positive associations between male labor market opportunities and child health and negative associations between female labor market opportunities and child health, and masks important underlying patterns.

One possible interpretation of these patterns is that mothers and fathers may provide different inputs into the production of children's health, with mothers making relatively larger time investments, on average, and fathers providing higher levels of monetary support. While income losses that are associated with negative employment shocks are accompanied by increases in the amount of time that parents have available to invest in child care related activities, the balance between these two effects is likely to be different for mothers and fathers. These findings underscore the importance of both monetary and time inputs in the production of children's health.

The remainder of our paper is organized as follows. In Section II we provide a review of the related literature, showing that there are substantial reasons to expect that labor market opportunities might affect children's health, and that the impact of male and female employment conditions might be expected to differ. In Section III we describe our data. We then explain our empirical framework in Section IV, where we also describe the construction of the predicted employment growth rates that we use to address potential endogeneity. Section V provides our results, and Section VI concludes.

II. Background

Many studies have documented that higher unemployment rates are associated with reductions in mortality (Ruhm, 2000; Ruhm, 2003; Ruhm, 2005a; Ruhm, 2005b) and improvements in other measures of adult health (Ruhm, 2003; 2005). This relationship is often thought to result from improvements in health-related behaviors that occur as a result of changes in the opportunity cost of time that accompany declining labor market opportunities (Evans and Graham, 1988; Ruhm, 1996; Ruhm and Black, 2002; Ruhm, 2005b; Gruber and Frakes, 2006; Freeman, 1999; Xu, 2013).[5] Nearly all of these studies focus on adult health, but mortality is known to vary cyclically across all age groups. Stevens et. al. (2015), for example, find that a one percentage point increase in the unemployment rate is associated with a 0.3% reduction in mortality overall, but a 1.4% reduction in mortality among children between the ages of 0 and 4,

[5] An exception is Stevens et. al. (2015) who note that most of the cyclically induced deaths are among older individuals, for whom the opportunity cost of time is not likely to be strongly affected by changes in labor demand.

and a statistically insignificant reduction of 0.04% among adults between the ages of 45 and 61. This suggests that, relative to adults, children's health may be particularly sensitive to cyclical variation in labor market conditions.

To our knowledge, the only studies to date that have focused on the impact of aggregate economic conditions on children's health have focused on infant health. Using U.S. vital statistics data, Dehejia and Lleras-Muney (2004) document that higher unemployment rates are associated with reductions in infant mortality and in the incidence of low and very low birthweight, which they attribute to both positive selection and changes in maternal health behaviors, such as smoking and drinking. They conclude that changes in the opportunity cost of women's time may be an important determinant of cyclical changes in health during pregnancy, and more generally suggest that reducing the opportunity cost of maternal time inputs may be a possible mechanism for improving children's health outcomes.

Dehejia and Lleras-Muney's conclusion is echoed in a larger literature that focuses on identifying the effect of maternal employment on children's health outcomes. That literature, largely framed in the context of understanding the implications of long-term trends in women's labor force participation, generally finds that mothers' employment negatively affects children's health. An empirical challenge faced by all of these studies, however, is that mothers' labor supply decisions may be partly determined by unobserved factors that also affect their children's outcomes. While two recent studies make some headway on this endogeneity problem—Gennetian et al. (2010) use experimental variation in maternal work incentives that was generated by the 1990s welfare to work experiments, and Morrill (2011) uses variation in maternal employment induced by the youngest child's eligibility for kindergarten—there is a dearth of causal evidence on the effect of maternal employment on children's health.

Many fewer studies directly investigate the impact of father's employment, but among those that do, there is no evidence that paternal employment has negative effects on children's health, and there is some suggestive evidence that it has positive causal effects (Anderson et al., 2003; Phipps et al., 2006; Morrissey et al., 2011). Lindo (2011), for example, compares the birth weight of infants born before vs. after a paternal job displacement, and finds that father's job loss reduces infant birthweight by over four percent. When considered together with the literature on the maternal employment, this finding suggests that mothers and fathers may influence the production of children's health very differently. Two recent studies that consider the impacts of mothers and fathers job loss simultaneously provide further evidence in this regard: Schaller and Zerpa (2015) find that maternal job loss is associated with reductions in the incidence of acute infectious conditions, while paternal job loss is associated with worse mental health among children. Liu and Zhao (2011) examine the impacts of job displacement in China and find that while mother's job loss has no effect on children's height and weight, father's job loss has a negative impact.

There are a number of reasons that mothers' and fathers' job losses may have different effects on the production of child health. Even conditional on work status, mothers spend approximately twice as much time engaged in child care related activities as do fathers (Guryan, Hurst and Kearney, 2008; Kalil and Ziol-Guest, 2013), and more of that time is devoted to routine care (Bryant and Zick, 1993; Pleck, 1997). Changes in mothers' employment status may, therefore, have larger impacts on time inputs into children's health. Recent research suggests that, indeed, recession-induced declines in work generate relatively larger increases in the amount of time mothers spend with their children (Aguiar et al., 2013; Lindo, Schaller, and Hansen, 2013). These findings suggest that if parental time inputs are important to the production of children's health then a mother's job loss may have a more positive effect than a father's job loss.

Furthermore, in the majority of American families, husbands' earnings contribute more to household income than wives' earnings (Bertrand et al., 2015). For most families, therefore, a father's job displacement will generate a larger shock to family income. Given the well documented positive correlation between income and health (Case, Lubotsky and Paxson, 2002), the income losses associated with a paternal job loss might have a negative impact on child health that exceeds that of a maternal displacement. Similarly, paternal job loss might also have a larger effect on the level of stress that a family experiences. Existing studies have shown that negative employment shocks are associated with reductions in adult mental health (Brand et al., 2008; Browning and Heinesen, 2012; Schaller and Stevens, 2015) and impaired family functioning (Conger et. al., 1994). The Family Stress Model (Conger, et. al, 1994) predicts that this will have a direct, negative, effect on children's outcomes.

In addition to suggesting that male and female employment opportunities may have different effects on children's health, the opposing mechanisms outlined above make it difficult to predict the sign of the relationship between overall labor market opportunities and children's health. It is also important to keep in mind that parental job loss is only one route by which labor market conditions might affect children's health. Recessions lead to changes in time use, reduced earnings and wealth, and higher stress levels even among parents who hold onto their jobs (Dooley and Catalano, 1984; Dooley, Catalano and Rook, 1988; Fenwick and Tausig, 1994; Kalil and Ziol-Guest, 2013; Morrill and Pabilonia, 2015). If such channels are important to children's health outcomes then studies that focus on the impacts of parental job displacement will understate the overall effects that result from labor market contractions. Labor market contractions may also affect children's health through environmental, rather than family level changes. For example, a growing body of research documents that manufacturing induced changes in pollution affect children's health.[6]

III. Data

Our analyses are based on data from the 1997-2012 National Health Interview Survey (NHIS), which is one of the primary surveys used to monitor health trends in the United States population. The NHIS is a repeated cross-sectional survey that collects and provides health information on 34,000-40,000 families each year. We use the restricted use version of the NHIS because the public use version does not include state identifiers, which are necessary to our identification strategy: a child's state of residence is required to assign the relevant state/year labor market variables. We include in our main sample all children between the ages of 0 to 17 (or 5 to 17 for school-related outcomes).

The NHIS has two components that we make use of in our analyses. The Person-Core questionnaire includes demographic and health data for each member in each surveyed household. The Sample Child questionnaire includes detailed questions about health and well-being for one randomly sampled child from each household. The answers to the questions in the Sample Child survey are provided by a knowledgeable adult, who is the child's parent more than 90 percent of the time. Because we use data from these two separate NHIS files, the number of observations in our sample varies across outcome variables. In particular, the estimates for

[6] e.g. Almond, Edlund and Palme, 2009; Chay and Greenstone, 2003; Currie and Neidell, 2005; Currie, Neidell and Schmieder, 2009; Currie and Walker, 2011; Currie and Schmieder, 2009; Knittel, Miller and Sanders 2011; Reyes, 2007; Sanders, 2012.

outcomes from the Sample Child file are based on samples that are substantially smaller than those for outcomes from the Person-Core file.[7]

We focus on a set of health outcomes that are relatively common among children and have a reasonable likelihood of exhibiting transitory fluctuations over time. Our outcome variables include four general measures of overall health: 1) whether the parent reports that the child is in excellent health, 2) whether the parent reports that the child is in fair or poor health, 3) whether the child currently has a health condition that limits their activities, and 4) the number of days in the last year that a child over the age of 5 has missed school due to illness.[8] The indicators for excellent and fair/poor health status comes from a survey question where parents are asked to rank the health of their children on a scale of one to five with one being excellent and five being poor. Roughly 50% of the sample reports that their children are in excellent health, while less than 2% of parents report that their child is in fair or poor health.

We also examine the effect of labor demand conditions on a set of more narrowly defined health outcomes. Our choice of specific health conditions is motivated in part by the Agency of Health Care Research and Quality's (AHRQ) ranking of childhood health conditions by total expenditures (Soni, 2014). According to this publication, the five most costly childhood health conditions are: mental disorders, asthma, trauma related disorders, respiratory infections, and ear infections. As a large share of costs related to these health outcomes is born outside of the household (for example, according to Soni, 2014, over half of total expenditures on asthma and mental health were paid for by Medicaid in 2011), changes in the incidence of these conditions

[7]Since children are randomly selected within households for the Sample Child file, we do not expect that treatment effects should be heterogeneous across the different samples. However, we plan to estimate our main results on the smaller sample of children selected for the Sample Child file to see if the results are robust to the change in sample.

[8]Parent-reported health (1-5 scale), activity limitations, and injuries are part of the Person-Core questionnaire and are available for every child in the NHIS sample. All other health outcomes that we consider are from the Sample Child questionnaire, and are reported for one randomly selected child per household.

may have important policy implications. In our data, we currently identify (1) whether a child has experienced severe emotional difficulties in the last six months, (2) whether a child has had an asthma attack in the last year, (3) whether the child has experienced an injury in the past three months, and (4) whether the child has experienced three or more ear infections in the last year.

Each of the specific health outcomes that we consider is plausibly linked to labor market conditions through changes in family income, parental time use, and family stress. For example, changes in child mental health are most likely to be directly related to their parents' mental health,[9] while changes in the incidence of ear infections are more likely to be a result from changes in children's time use. The incidence of injuries may be associated either with changes in time use such as changes in daycare attendance or sports participation, or with changes in parental mental health, if injuries reflect child maltreatment.[10]

For asthma in particular, there are multitude of potential mechanisms linking economic conditions to the incidence of asthma among children. For example, childhood asthma attacks are known to be triggered by air pollutants, the level of which varies with aggregate economic activity, and parental stress has been found to enhance the effect of environmental pollution on childhood asthma incidence (Shankardass et al., 2009). Furthermore, exposure to dust, animal hair, cockroaches, and molds is associated with asthma attacks (Institute of Medicine, 2000), and such factors are linked to the cleanliness of a home, possibly becoming more prevalent when parents spend less time at home. Childhood asthma attacks have also been linked with exposure to second hand smoke (Sabia 2008), and there is evidence that adult smoking also fluctuates with

[9] Several existing studies have linked adult mental health to aggregate economic conditions, including Blanchflower and Oswald, 2004; Dooley and Catalano, 1984; Dooley, Catalano and Rook, 1988; Fenwick and Tausig, 1994.

[10] Lindo, Schaller, and Hansen (2013) find that overall economic conditions are not strongly related to rates of substantiated child abuse, but they do find that increases in male layoffs per capita are associated with increases in abuse rates, while increases in female layoffs per capita are associated with reductions in abuse rates.

the business cycle (Ruhm, 2005b). Finally, the incidence of asthma symptoms may depend on children's level of physical activity. Though we are unable to precisely identify the relative contributions of different mechanisms to each of the health outcomes that we consider, throughout our analysis we acknowledge that the relative importance of different mechanisms depends on the condition considered and interpret our findings accordingly.

We merge the NHIS data with state and time varying economic and demographic data obtained from other sources. State monthly unemployment rates are from the Bureau of Labor Statistics. Predicted employment growth rates, described in detail below, are created using data from the decennial Census and Current Population Surveys. State population shares by race/ethnicity and age are calculated using data from the National Cancer Institute's Surveillance, Epidemiology and End Results Program (SEER). State population shares in four educational attainment categories (less than high school, high school graduate, some college, and college graduate) are from the Basic Monthly Current Population Survey. Data on housing prices at the state level are from the Federal Housing Finance Agency House Price Index.

Because the relevant reference period varies across our dependent variables, we vary the time period over which we average the key explanatory variables as well. Specifically, when the reference period is contemporaneous, we use the unemployment rate for the interview month. When the reference period is the past three months, we average the unemployment rate over the past three months, and so on. Out of our eight dependent variables, three are contemporaneous ("excellent" health, "fair/poor" health, and activity limitations), one has a reference period of three months (injuries), one has a reference period of six months (severe emotional difficulties), and the remaining outcomes have a reference period of 12 months (sick days, asthma, and ear infections).[11] Table 1 shows summary statistics for our key health outcomes, labor market indicators, and demographic controls.[12]

IV. Empirical Framework

IV.A. Estimating Equations

We estimate a state panel data model that leverages variation across US states in the timing and severity of business cycles. Initially, we follow the existing literature, and use the state monthly unemployment rate as our measure of local labor market conditions. We estimate a variant of a difference-in-differences model that allows us to compare health outcomes among children living in a state that is experiencing a labor market contraction to those living in the same state when employment opportunities are better, while controlling for nationwide shocks. Specifically, we estimate:

$$Y_{ast} = \emptyset_s + \emptyset_{at} + \beta U_{st} + \pi X_{st} + \varepsilon_{ast} \qquad (1)$$

where Y_{ast} represents an average health outcome for children currently age a, living in state *s*, observed in year *t;* $\boldsymbol{\emptyset_s}$ is a vector of state fixed-effects, which allows us to control for unobserved differences across states, and $\boldsymbol{\emptyset_{at}}$ is a vector of age-year fixed effects. U_{st} is the unemployment rate in state s in year t, and X_{ist} is a vector of individual controls that includes the parents' marital status, child race, child gender, and mother's education. In some of our regressions we also include state-specific linear trends to control for unobserved variables correlated with health

[11] Because we are concerned about respondents' ability to accurately remember events over an entire 6- or 12-month period, we additionally estimate models for variables with longer reference periods in which the dependent variable is averaged only over the most recent 3-month period.
[12] In Table 1 we have multiplied all of our dichotomous outcomes by 100 for ease of reading. Given that most children have zero injuries, we also multiply number of injuries by 100, such that the mean of 2.40 injuries represents there being 2.4 injuries per 100 children. We plan to do this in the remainder of the tables as well, but have not yet done it.

that change linearly over time within states. In other specifications we include a number of controls for state and time varying demographic factors that may be correlated with both labor market conditions and children's health, but are not necessarily trending linearly. Specifically, we control for calendar month of interview, state average home prices, state measures of the number of births in a year, the fraction of the population in a given education group in a year (high school dropout, high school, some college, and college educated), and the fraction of the population in a given race group in a year (white, black, other). Our standard error estimates are clustered at the state level, to account for the fact that the error term may be correlated across time periods within each state.

IV.B. Predicted Employment Growth Rates

Though unemployment rates are commonly used as an indicator of local economic conditions in studies of the effects of business cycles on individual and family outcomes, their use is potentially problematic in this setting. In particular, because the denominator of the unemployment rate measures active labor force participation, unemployment rates are likely to capture changes in labor supply as well as changes in labor demand. This increases the likelihood that changes in unemployment will be correlated with changes in other unobserved variables that may also be related to child outcomes. There also may be a direct reverse-causality bias. If exogenous declines in children's health cause a decline in parent's labor force attachment, the denominator of the unemployment rate will decline and, if total employment remains fixed, the measured unemployment rate will increase. As a result, OLS coefficients may be biased downward. Another potential source of bias is measurement error: unemployment rates are a noisy measure of actual labor market opportunities. This is especially true in an economic downturn: because "discouraged workers" (workers who want to be employed but are no longer actively searching for a job) are not counted in measured unemployment rates, the unemployment rate may not be capturing the full extent of the contraction.

As an alternative to unemployment rates, we capture shocks to labor demand by creating an index of predicted employment growth. The approach is based on the shift-share model developed by Bartik (1991), Katz and Murphy (1992), and Blanchard and Katz (1992).[13] We create a predicted employment growth rate by weighting the national industry-specific employment growth rates by industry shares in each state in a base period and then summing over industries within each state-year as follows:

$$D_{st} = \sum_{i} G_{it} * \frac{E_{is0}}{E_{s0}} \qquad (3)$$

where G_{it} is the growth rate of industry i in year t from the March CPS and $\frac{E_{is0}}{E_{s0}}$ is the ratio of industry i employment in state s to total employment in state s from the 1990 Census. Because variation over time in this index is driven by national employment growth rates, it will be uncorrelated with state-level supply shocks, as long as there is no industry for which employment is concentrated in a single state (Blanchard and Katz, 1992). In order to ensure that this is true, while maintaining cross-sectional variation in the base-period industry composition, we use data from seventeen industry categories.[14] Cross sectional variation in state employment

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[13] The shift-share indices in this paper are identical to those used by Schaller (forthcoming) to estimate the effects of gender-specific labor demand on fertility.

[14] The 17 industry categories are: (1) agriculture, forestry and fishing (2) mining (3) construction (4) low tech manufacturing (lumber, furniture, stone, clay, glass, food, textiles, apparel and leather (5) basic manufacturing (primary metals, fabricated metals, machinery, electrical equipment, automobile, other transport equipment (excluding aircraft), tobacco, paper, printing, rubber, and miscellaneous manufacturing) (6) high tech manufacturing (aircraft, instruments, chemicals, petroleum) (7) transportation (8) telecommunications (9) utilities (10) wholesale trade (11) retail trade (12) finance, insurance, and real estate (13) business and repair services (14) personal services (15) entertainment and recreation services (16) professional and related services (17) public administration. The division of manufacturing into low-tech and high-tech categories follows Katz and Murphy (1992).

shares also helps identify the effect of demand shocks, since aggregate demand shocks in a particular industry will have larger employment effects in states where the affected industry makes up a relatively greater share of total employment.

We take a similar approach to our estimation of equation (2) by creating analogous shift share indices that reflect gender specific labor demand conditions. Specifically, rather than weighting national industry employment growth rates by the base-period share of *total* state employment in each industry, we weight by the base period share of males or females employed in a given state in each industry, summing across industries, by gender, within the state as follows:

$$D_{stg} = \sum_i G_{it} * \frac{E_{isg0}}{E_{sg0}} \tag{4}$$

where g indexes the group (male, female). These indices can be interpreted as gender-specific predicted employment growth rates. We include the male and the female index in the same regression so that the coefficient on the male index can be interpreted as the effect of a one percentage-point increase in the predicted employment growth rate for males, holding predicted female employment growth constant, and vice versa.

Because the time variation in our predicted employment growth measures is based on national industry employment growth from March of the previous year to March of the current year (as it is based on March CPS employment estimates), the annual measures will be less accurate the further from March the interview month is. To correct for this, we adjust the timing of the shift-share indices by weighting our predicted employment growth rates differently depending on the month of interview. For March, we use the current-year index (as it represents predicted employment growth from last March to this March). For February, we put 11/12 weight on this year's index and 1/12 weight on last year's index, since the first month of the reference period would have fallen prior to the previous March CPS. For April, we put 11/12 weight on this year's index and 1/12 weight on next year's index, and so on. After doing this, we average over the relevant reference period for each outcome variable, as discussed in the previous section.

V. Results

V.A. Effects of General Labor Market Conditions on Children's Health

We begin by estimating the relationship between aggregate employment conditions and children's health outcomes. Table 2 follows the existing literature and focuses on the unemployment rate as the regressor of interest. We see that although most of the point estimates suggest that labor market contractions are negatively associated with children's health outcomes, the results are generally statistically insignificant. In particular, unemployment rates do not appear to be correlated with parent-reported general health, activity limitations, asthma attacks, ear infections, or the number of sick days a child takes from school. There are, however, two health outcomes for which the association with unemployment rates is statistically significant and robust across specifications: injuries and severe emotional difficulties. We find that a one percentage point increase in the state unemployment rate (averaged over the months in the relevant reference period) is associated with a 3.5 to 5.8 percent increase in the number of injuries, depending on the specification, and a 7.5 to 10 percent increase in the likelihood that a child experienced severe emotional difficulties. Both effects are quite small in absolute terms, as the average count of injuries in the sample is 0.023 and the average share of children reporting severe emotional difficulties is 1.2 percent.

Notably, these findings contrast both with the literature on changes in adult health over the business cycle, which has generally shown that increased unemployment rates are associated with *improvements* in adult health, and with the literature on the relationship between unemployment rates and infant health, which has found that economic downturns are associated with reductions in infant mortality and the incidence of low birthweight. On the other hand, they are consistent with recent work looking at the direct effects of parental job displacement on child health: Schaller and Zerpa (2015) find that paternal job loss is associated with worse mental health among children and leads to increases in injuries among children in low-socioeconomic status families.

Table 3 shows results from regressions in which we replace the unemployment rate with an exogenous index of predicted employment growth. We use this index as an alternate measure of overall economic conditions for a few reasons. First, as discussed in the previous section, to the extent that movements in the unemployment rate represent changes in labor supply as well as labor demand, the estimates in Table 2 will be biased if changes in labor supply are related to changes in child health. Second, the unemployment rate is a static measure of labor market conditions, capturing the cumulative effects of hiring and firing behavior in previous periods. It may be that children's health outcomes respond differently to the rate of *change* in employment levels than to unemployment rates if parental investments in children respond to perceived future opportunities. Finally, we estimate the effects of aggregate predicted employment growth rates in order to generate estimates that are more easily compared to the corresponding estimates using gender-specific labor demand indices that are presented in the next section.

We find that when we replace unemployment rates with predicted employment growth rates, the small statistically significant relationships between labor market conditions and injuries and emotional difficulties mostly disappear (note that in Table 3, an increase in the explanatory variable represents *improvement* in economic conditions rather than deterioration as in Table 2). One explanation for this result is that the coefficients in the previous table reflect an association between the determinants of child health and participation in the labor force, and thus suffer from endogeneity bias. However, as discussed above, an alternative explanation for the changes between Table 2 and Table 3 is that the two measures of labor market conditions represent substantively different treatments. In other words, the effects of an increase in the state unemployment rate (both above and beyond the state average and trend for that variable and above and beyond aggregate year effects), may simply be different from the effects of an increase in the state employment growth rate. Regardless, the takeaway from Table 3 is that the state-level aggregate predicted employment growth rate is *not* significantly associated with child health (with the exception of a weakly significant and small (less than one percent) decrease in the likelihood of reporting "excellent" health).

V.B. Effects of Gender Specific Labor Market Conditions on Children's Health

The overall effects shown in Table 3 may mask very different relationships between children's health and contemporaneous male and female labor market opportunities. As discussed in Section II, there are many reasons to believe that male and female labor market conditions potentially have different influences on child health, aggregate measures of labor market conditions will capture changes in labor market opportunities for both men and women.

We examine this possibility in Table 4, which shows the estimated coefficients on gender-specific predicted employment growth rates. The pattern of the estimates is striking: positive labor demand shocks for females are associated with decreases in parent-reported child health and increases in the likelihood that a child experiences severe emotional difficulties, while positive labor demand shocks for males are associated with reductions in the incidence of injuries (though this result is not significant in the model with state-specific time trends included). Though the results for the other outcomes in the table are not significant, the contrast between the point estimates for the male and female indices, which is apparent across all specifications and health outcomes, suggests that in general improvements in labor market opportunities for fathers are associated with improvements in child health while improvements in labor market opportunities for mothers are associated with worse child health.

Finally, because we are concerned about the potential for recall bias, or respondents' inability to accurately recall health events over a long time period, we reestimate the models from Table 4 for each of the child-sample variables (all of which have a reference periods of 6 or 12 months) with the dependent variable averaged over a 3-month period only. These results, in Table 5, suggest that recall bias may be a factor, particularly in the reporting of asthma attacks. We find that a one percentage point increase in the male predicted employment growth index, averaged over the three months prior to the interview, is associated with a 5.1 percent decrease in the number of asthma attacks reported, while a one percentage point increase in the female predicted employment growth index, averaged over three months, is associated with a 6.9 percent *increase* in reported asthma attacks among children.

VI. Discussion of Mechanisms

Our results echo those of recent studies that document differential impacts of maternal and paternal job loss on children's health and achievement (Schaller and Zerpa, 2015; Liu and Zhao, 2011; Kalil and Ziol-Guest, 2008). Our analyses differ from the previous research, however, because we focus on the impact of aggregate demand conditions, rather than individual job loss. As described in Section II, there are a number of reasons that the impacts of parental job loss may differ from the impacts of community-level employment opportunities. For example, some researchers have argued that because pollution moves counter-cyclically, it might contribute to the pro-cyclical variation in mortality. Our estimates are not consistent with pollution playing an important role, however, as men are more likely than women to be employed in industries that produce high levels of pollution. We find no evidence that male employment opportunities are associated with worse children's health outcomes – which suggests that pollution is unlikely to be a leading mechanism, at least in the short-run. Similarly, it is unlikely that the estimates reflect variation in the provision of social services or availability of public care over the business cycle, as such variation would be tied to variation in tax revenues and should produce positive coefficients on both the male and female employment indices.

Our estimates do line up well with several well-known empirical facts. First, in most married couple households, husbands work more hours than wives, are more likely to be employed full time, and have higher wages.[15] This suggests that compared to changes in women's labor market opportunities, improvements in men's opportunities should have a larger effect on family income. To the extent that income is a positive input to children's health, improvements in men's employment opportunities should therefore have a relatively larger positive effect on children's health.

At the same time, it is well known that employed women spend more time in housework and child-care than employed men, even conditional on hours of paid work (e.g. Hartman et. al.,

[15] Recently Bertrand et al. (2015) documents that from 2008-2011, wives earn more than their husbands in only 27% of households.

2010). For example, among married parents who are full time workers, 71% of mothers spend some time caring for their children, whereas only 54% of fathers do so (BLS, 2008). Among parents who have recently become unemployed, mothers are more likely than fathers to re-allocate their time to parenting tasks (Aguiar et al., 2013; Pailhé and Solaz, 2012). This suggests that if parental care is an important contributor to children's health, improvements in female labor market opportunities will have a relatively greater (negative) impact on children's health.

Finally, we do not think that the estimates are driven by changes in insurance coverage, as most studies find that, for children, this varies little over the business cycle (see, for example, Cawley et al. 2013). Moreover, when we estimate equation (2) using measures of insurance coverage as a dependent variable, the estimated coefficients on the male and female employment indices are not statistically different from zero and follow no discernible pattern.

VI. Conclusions

This paper examines the link between labor market conditions and children's health. An extensive literature documents that adult health declines when labor market opportunities improve, but we know very little about the extent to which this relationship translates to children's health outcomes. Economic theory does not provide clear predictions about the sign of the relationship. Moreover, existing research hints that changes in labor demand for mothers and fathers may affect the production of children's health very differently.

We are among the first to examine the relationship between cyclical changes in labor market opportunities and children's health, and the first to address the potential endogeneity that is inherent in related empirical analyses that rely on common measures of employment opportunities, such as the unemployment rate. We do this by developing a predicted employment growth rate that exploits state specific industry employment shares in a base period together with national, industry-specific, employment growth. We then take this approach to analyses of labor demand conditions and gender-specific influences on children's health.

Unlike most studies of adult health, we find no systematic evidence that general labor demand conditions are associated with improvements in contemporaneous measures of children's health outcomes. Instead, we find that increases in local unemployment rates are associated with small but significant increases in the incidence of injuries and severe emotional difficulties among children. This empirical result also contrasts with previous studies that have documented a negative correlation between the unemployment rate and infant health outcomes.

We also find consistent evidence that focusing on a broad measure of employment opportunities masks important underlying relationships. Specifically, we find that improvements in male labor market conditions are associated with decreases in injuries among children, while improvements in labor market conditions facing women are associated with declining parent-reported child health and increases in the likelihood that children experience severe emotional difficulties. One possible interpretation of these patterns is that mothers and fathers typically provide different inputs into the production children's health, with mothers making relatively larger time investments and fathers providing higher levels of monetary support.

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Table 1. Summary Statistics

Variable	Mean	Observations	Dataset
<u>Outcomes</u>			
Excellent health	54.96	410009	Person file
	(49.75)		
Activitiy limiting conditions	7.36	410985	Person file
	(26.11)		
Number of injuries	2.19	410981	Person file
	(14.63)		
Child asthma (past 12 months)	5.47	194009	Child file
	(22.75)		
Sick days from school	3.52	134197	Child file
	(6.55)		
Severe emotional difficulties	1.21	130690	Child file
	(10.93)		
<u>Demographic</u>			
Child Age	8.53	194056	Child file
	(5.18)		
% Mothers HS dropout	0.16	361959	Person file
	(0.36)		
% Mothers HS grad	0.26	361959	Person file
	(0.44)		
% Mothers some college	0.56	361959	Person file
	(0.50)		
% Unmarried	0.26	368515	Person file
	(0.44)		
<u>Economic Conditions</u>			
Unemployment rate	5.60	410985	Person File
	(2.07)		
Female labor demand index	0.97	410985	Person File
	(1.46)		
Male labor demand index	0.39	410985	Person File
	(2.16)		
Total index	0.74	410985	Person File
	(1.72)		

Notes: The data are from the 1997-2012 Person and Child Files of the National Health Interview Survey. State monthly unemployment rates are from the Bureau of Labor Statistics. Labor demand indices, described in detail in Section IV, are created using data from the decennial Census and Current Population Surveys.

Table 2: The Effect of the Unemployment Rate on Child Health

Outcome	Dependent Variable Mean	Model 1	Model 2	Model 3
Full Sample Outcomes				
Excellent health	0.550	-0.0018	-0.0019	-0.0030
N = 409983		(-0.0028)	(-0.0024)	(-0.0036)
Fair/Poor health	0.018	0.0003	0.0003	-0.0001
N = 409983		(-0.0003)	(-0.0004)	(-0.0004)
Activity-Limiting Condition	0.074	0.0002	-0.0003	-0.0005
N = 410959		(-0.0007)	(-0.0007)	(-0.0009)
Number of Injuries (3 mo)	0.023	0.0013***	0.0010**	0.0008*
N = 410959		(-0.0004)	(-0.0004)	(-0.0004)
Child Sample Outcomes				
Asthma Attack (12 mo)	0.055	0.0007	0.0009	-0.0003
N = 194000		(-0.0009)	(-0.0009)	(-0.0011)
Ear Infections (12 mo)	0.061	-0.0002	0.0010	0.0001
N = 193102		(-0.0009)	(-0.001)	(-0.0013)
Sick Days (12 mo)	3.522	0.0252	0.0452	0.0666
N = 134191		(-0.0318)	(-0.0364)	(-0.0457)
Emotional Difficulties (6mo)	0.012	0.0010**	0.0009*	0.0012*
N = 105681		(-0.0004)	(-0.0005)	(-0.0006)
State and Age-Year FE		Yes	Yes	Yes
State-Year Controls		No	Yes	Yes
State Trends		No	No	Yes

Notes: Standard errors (in parentheses) are clustered at the state level. Health data are from the 1997-2012 Person and Child Files of the National Health Interview Survey. State monthly unemployment rates are from the Bureau of Labor Statistics, and are averaged over the relevant reference period for each dependent variable. State-year control variables include calendar month of interview, state average home prices, number of births, fraction of the population in each of four education groups, and fraction of the population in a given race group in a year.

Table 3: The Effect of the Predicted Employment Growth Rate on Child Health

Outcome	Dependent Variable Mean	Model 1	Model 2	Model 3
Full Sample Outcomes				
Excellent health	0.550	-0.0052*	-0.0048*	-0.0046
N = 409983		(-0.0027)	(-0.0027)	(-0.003)
Fair/Poor health	0.018	0.0005	0.0005	0.0008
N = 409983		(-0.0004)	(-0.0004)	(-0.0005)
Activity-Limiting Condition	0.074	-0.0008	-0.0007	-0.0005
N = 410959		(-0.0012)	(-0.0011)	(-0.0011)
Number of Injuries (3 mo)	0.023	-0.0008*	-0.0007	-0.0003
N = 405203		(-0.0005)	(-0.0005)	(-0.0005)
Child Sample Outcomes				
Asthma Attack (12 mo)	0.055	0.0001	-0.0002	-0.0003
N = 184674		(-0.0014)	(-0.0015)	(-0.0016)
Ear Infections (12 mo)	0.061	-0.0002	-0.0006	-0.0006
N = 183813		(-0.0013)	(-0.0013)	(-0.0015)
Sick Days (12 mo)	3.522	0.0252	0.0452	0.0666
N = 127660		(-0.0318)	(-0.0364)	(-0.0457)
Emotional Difficulties (6 mo)	0.012	0.0009	0.0008	0.0010
N = 102435		(-0.0007)	(-0.0007)	(-0.0007)
State and Age-Year FE		Yes	Yes	Yes
State-Year Controls		No	Yes	Yes
State Trends		No	No	Yes

Notes: Here, unlike in Table 2, an increase in the explanatory variable represents *improvement* in economic conditions rather than deterioration. Standard errors (in parentheses) are clustered at the state level. Health data are from the 1997-2012 Person and Child Files of the National Health Interview Survey. Labor demand indices, described in detail in Section IV, are created using data from the decennial Census and Current Population Surveys, and are averaged over the relevant reference period for each dependent variable. State-year control variables include calendar month of interview, state average home prices, number of births, fraction of the population in each of four education groups, and fraction of the population in a given race group in a year.

Table 4: The Effect of Male and Female Predicted Employment Growth Rates on Child Health

Full Sample Outcomes	Model 1	Model 2	Model 3	**Child Sample Outcomes**	Model 1	Model 2	Model 3
Dependent Variable: Excellent health				Dependent Variable: Asthma Attack (12 mo)			
Predicted Male	0.0008	0.0014	0.0016	Predicted Male	-0.0014	-0.0014	-0.0012
Employment Growth	(-0.0032)	(-0.0034)	(-0.0039)	Employment Growth	(-0.0019)	(-0.0019)	(-0.0019)
Predicted Female	-0.0079**	-0.0083**	-0.0083*	Predicted Female	0.0023	0.0019	0.0014
Employment Growth	(-0.0037)	(-0.004)	(-0.0042)	Employment Growth	(-0.0023)	(-0.0023)	(-0.0022)
Dependent Variable: Health Status (1-5)				Dependent Variable: Ear Infections (12 mo)			
Predicted Male	-0.0001	-0.0008	-0.0017	Predicted Male	-0.0004	-0.0014	-0.0013
Employment Growth	(-0.0052)	(-0.0055)	(-0.0062)	Employment Growth	(-0.0021)	(-0.0021)	(-0.002)
Predicted Female	0.0138**	0.0146**	0.0150**	Predicted Female	0.0004	0.0014	0.0012
Employment Growth	(-0.0054)	(-0.0058)	(-0.0063)	Employment Growth	(-0.003)	(-0.003)	(-0.0029)
Dependent Variable: Activity-Limiting Condition				Dependent Variable: Sick Days (12 mo)			
Predicted Male	-0.0014	-0.0013	-0.0013	Predicted Male	-0.0883	-0.0991	-0.0877
Employment Growth	(-0.0014)	(-0.0014)	(-0.0013)	Employment Growth	(-0.0659)	(-0.0655)	(-0.0631)
Predicted Female	0.0011	0.0010	0.0013	Predicted Female	0.0708	0.0748	0.0446
Employment Growth	(-0.0016)	(-0.0015)	(-0.0015)	Employment Growth	(-0.1)	(-0.0988)	(-0.103)
Dependent Variable: Number of Injuries (3 mo)				Dependent Variable: Emotional Difficulties (6 mo)			
Predicted Male	-0.0014**	-0.0013**	-0.0009	Predicted Male	-0.0012	-0.0012	-0.0013
Employment Growth	(-0.0006)	(-0.0006)	(-0.0007)	Employment Growth	(-0.0009)	(-0.001)	(-0.0011)
Predicted Female	0.0011	0.0012	0.0009	Predicted Female	0.0031**	0.0031**	0.0034**
Employment Growth	(-0.0009)	(-0.0009)	(-0.0009)	Employment Growth	(-0.0014)	(-0.0015)	(-0.0016)
State and Age-Year FE	Yes	Yes	Yes	State and Age-Year FE	Yes	Yes	Yes
State-Year Controls	No	Yes	Yes	State-Year Controls	No	Yes	Yes
State Trends	No	No	Yes	State Trends	No	No	Yes

Notes: Standard errors (in parentheses) are clustered at the state level. Health data are from the 1997-2012 Person and Child Files of the National Health Interview Survey. Labor demand indices, described in detail in Section IV, are created using data from the decennial Census and Current Population Surveys, and are averaged over the relevant reference period for each dependent variable. State-year control variables include calendar month of interview, state average home prices, number of births, fraction of the population in each of four education groups, and fraction of the population in a given race group in a year.

Table 5 - Child Sample Outcomes, 3 Month Reference

	Model 1	Model 2	Model 3
Dependent Variable: Asthma Attack (12 mo)			
Predicted Male	-0.0027*	-0.0030*	-0.0028*
Employment Growth	(0.0015)	(0.0015)	(0.0016)
Predicted Female	0.0039**	0.0038**	0.0038**
Employment Growth	(0.0019)	(0.0018)	(0.0017)
Dependent Variable: Ear Infections (12 mo)			
Predicted Male	-0.000258	-0.000892	-0.000774
Employment Growth	(0.0016)	(0.0016)	(0.0016)
Predicted Female	0.00233	0.00255	0.00245
Employment Growth	(0.0023)	(0.0023)	(0.0022)
Dependent Variable: Sick Days (12 mo)			
Predicted Male	-0.0715	-0.0787	-0.0750*
Employment Growth	(0.0448)	(0.0477)	(0.0441)
Predicted Female	0.1220	0.1110	0.1200
Employment Growth	(0.0738)	(0.0783)	(0.0773)
Dependent Variable: Emotional Difficulties (6 mo)			
Predicted Male	-0.0004	-0.0004	-0.0004
Employment Growth	(0.0009)	(0.0009)	(0.0010)
Predicted Female	0.0020	0.0019	0.0021
Employment Growth	(0.0012)	(0.0013)	(0.0014)
State and Age-Year FE	Yes	Yes	Yes
State-Year Controls	No	Yes	Yes
State Trends	No	No	Yes

Notes: Standard errors (in parentheses) are clustered at the state level. Health data are from the 1997-2012 Person and Child Files of the National Health Interview Survey. Labor demand indices, described in detail in Section IV, are created using data from the decennial Census and Current Population Survey, and are averaged over the three months preceding the interview. State-year control variables include calendar month of interview, state average home prices, number of births, fraction of the population in each of four education groups, and fraction of the population in a given race group in a year.