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Family size effects on childhood obesity: Evidence on the quantity-quality trade-off using the NLSY

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ABSTRACT

In this study, we use matched mother-child data from the National Longitudinal Surveys to study the effects of family size on child health. Focusing on excess body weight indicators as children's health outcome of interest, we examine the effects of exogenous variations in family size generated by twin births and parental preference for mixed sex composition of their children. We find no significant empirical support in favor of the quantity-quality trade-off theory in instrumental variable regression analysis. This result is further substantiated when we make use of the panel aspects of the data to study child health outcomes of arrival of younger siblings at later parities. Specifically, when we employ child fixed effects analysis, results suggest that birth of a younger sibling is related to a decline in the likelihood of being overweight by 4 percentage points and a drop in the probability of illness by approximately 5 percentage points.

1. Introduction

The primary objective of this study is to investigate the effects of family size on child health. Family size effects on children's human capital outcomes have been studied extensively in the economic literature following the quantity-quality trade-off theory developed by Becker and his co-authors (Becker, 1960; Becker and Lewis, 1973; Willis, 1973; Becker and Tomes, 1976). The theory predicts a negative relationship between child quantity and quality as individual allocation of fixed parental resources declines with additional children. In this study, we present a comprehensive empirical analysis of how a change in family size affects child health, as measured by excess body weight indicators (overweight and obesity). To the best of our knowledge, this is the first paper to utilize a US-based sample to evaluate child health outcomes of variations in family size.

Empirical literature on family size effects tends to specifically focus on children's educational outcomes, future labor market performance, and parental investments in childhood development (Rosenzweig and Wolpin, 1980; Blake, 1981; Hanushek, 1992; Black et al., 2005, 2010; Cáceres-Delpiano, 2006; Lee, 2008; Li et al., 2008; Angrist et al., 2010; De Haan, 2010; Ponczek and Souza, 2012; Juhn et al., 2015). Despite the extensive empirical support provided by the majority of existing studies, validity of the quantity-quality trade-off argument is likely to vary by social structure and extent of economic development of the regions studied (Sudha, 1997; Buchmann and Hannum, 2001; Li et al., 2008; Maralani, 2008). For example, generous welfare and institutional support systems, commonly observed in economically advanced countries, can mitigate parents' financial burden imposed by an expansion in family size. On the other hand, families in economically disadvantaged societies are more likely to observe a trade-off between child quantity and quality (Li et al., 2008; Maralani, 2008).

Compared to children's cognitive abilities, child health, an important indicator of child quality, has not received much research attention in the family size literature. Furthermore, the limited number of studies that have explored a causal link between family size and child health are primarily based on developing regions (Rosenzweig and Zhang, 2009; Millimet and Wang, 2011; Peters et al., 2014; Zhong, 2017). Our analysis therefore fills a substantial gap in the existing literature by empirically testing the

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quantity-quality trade-off theory with respect to child health in the context of a developed economy.

Child body weight is an important health indicator. In the US in particular, childhood obesity is a large health-related concern, as excess body weight during childhood increases the risk of being exposed to serious long-term health conditions (Lobstein et al., 2004; Leonard et al., 2008; Reilly and Kelly, 2011; Fryar and Ogden, 2014; Ogden et al., 2016). This has prompted researchers across various academic disciplines to identify social and family-level determinants of childhood obesity and to analyze effectiveness of social policies aimed at addressing the health concern (Dietz, 1998; Cawley et al., 2007a, 2007b; Clark et al., 2007; Cawley, 2010). Based on the quantity-quality trade-off hypothesis, an increase in family size could potentially elevate the risk of having excess weight among children. Given the numerous health-related problems associated with childhood obesity, it is important to understand the validity of the quantity-quality hypothesis in the context of a developed country like the US.

For our analysis, we match mothers' information from the original cohort of the National Longitudinal Survey of Youth (NLSY, 1979) to their children's data in the NLSY Child and Young Adult surveys (NLSY, CYA). We estimate children's body mass index (BMI) using objective measurements of children's height and weight. Using these estimates of BMI, we construct excess weight indicators. In particular, we refer to the age- and sex-specific body weight standards (BMI-for-age) of Centers for Disease Control's (CDC) growth charts[1] to construct binary indicators for being overweight and obese. Further, we estimate the effects of family size on binary health indicators of underweight and incidence of child illness (that requires medical attention).

The identification of family size effects relies on exogenous variation in quantity of children triggered by twin births and parental preference for a mixed sex composition of their children. Regression estimates from our instrumental variable (IV) regressions do not provide evidence of a trade-off between child quantity and health quality. Our cross-sectional regression estimates are robust to multiple sensitivity checks.

In addition, we make use of the longitudinal format of the NLSY mother-child data to study how birth of a younger sibling affects older children's health outcomes. Controlling for unobserved child-specific time-invariant characteristics, we find that birth of a younger sibling leads to a decrease in children's probability of being overweight by 4 percentage points and a decrease in the likelihood of being ill by 5 percentage points. In general, our fixed effects regressions provide additional support to the findings obtained from the IV regression analyses.

The paper is organized as follows: in Section 2, we review existing theories and empirical findings in related literature to explore the underlying mechanisms that can explain a causal link between family size and child health. In Section 3, we describe the NLSY mother-child data used for our empirical analysis. In Section 4, we discuss the empirical strategies employed in our analysis. In Section 5, we present our findings from cross-sectional and longitudinal regression analyses. Finally, in Section 6, we provide brief concluding remarks.

[1] See https://www.cdc.gov/growthcharts/html_charts/bmiagerev.htm; Retrieved on November, 12, 2016.

2. Literature review

2.1. Child quantity and health quality trade-off – a theoretical framework

The quantity-quality trade-off theory postulates that given a budget constraint, an increase in the number of children increases the marginal cost of family investments, which influence child quality (Becker, 1960; Becker and Lewis, 1973; Becker and Tomes, 1976). This is because having additional children requires parental resources to be allocated across a larger number of siblings. In this context, an increase in the quantity of children is expected to adversely affect each child's physical well-being, assuming child health depends on limited parental resources (e.g. market-based goods including food, nutrition, and medical inputs and parental time).

Millimet and Wang (2011) present a simplified extension of Becker & Tomes's (1976) quantity-quality trade-off model by considering health-related resources and health endowment as inputs of child quality. Households' objective is to maximize their utility U given by the function $U = U(n, q, c)$, where n represents child quantity, q represents child quality, and c is consumption. Further, child quality q is a function of market-based health inputs w and child's health endowment θ. In particular, child quality is represented by the production function: $q = q(w, \theta)$, where q is positively related to both w and θ ($q_w > 0$ and $q_\theta > 0$).

Households maximize their utility subject to a budget constraint given by[2]:

$$c.p_c + n.p_n + wn.p_w = I \tag{1}$$

where I denotes household income, p_c is the unit price of consumption, p_n is the cost per child, and p_w represents price of market-purchased health inputs.

The equilibrium condition is:

$$\frac{\partial U}{\partial c} = \lambda p_c = \lambda \pi_c$$

$$\frac{\partial U}{\partial q} = \lambda \frac{p_w}{\partial q / \partial w} n = \lambda \pi_q \tag{2}$$

$$\frac{\partial U}{\partial n} = \lambda (w p_w + p_n) = \lambda \pi_n$$

In the above equations, π_c, π_q, and π_n are the shadow prices of consumption, child quality, and child quantity, respectively.[3] The equilibrium condition suggests that an unplanned or exogenous increase in the number of children increases the shadow price of child quality, and a rise in child quality increases the shadow price of child quantity. In other words, it is costlier for parents to improve child health quality if there are a large number of children in the household, and it is costlier to have additional children if child quality is high.

Additionally, effects of family size on child health outcomes may depend on children's birth spacing and birth order. In particular, closely-spaced younger siblings tend to involve higher parental engagement, thereby subjecting older children to reduced

[2] Millimet and Wang (2011) also include children's sex ratio in their model assuming that having more children belonging to the same sex can provide certain cost advantages to households (discussed later). However, to provide a basic understanding of the quantity-quality trade-off, it is not required to account for sex ratio in the main model.

[3] λ in Eq. (2) represents the Lagrange multiplier of the optimization problem.