# Nutritional Deficits and the Quantity-Quality Trade-off: Evidence from an Exogenous Fertility Shock in Low-Income Urban Settings in the Philippines

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*This paper examines whether increased fertility affects early-life nutritional outcomes in low-income urban households. I exploit a natural experiment created by a 1990 policy in Manila, Philippines, which banned modern contraceptives from city-run health facilities. Using a difference-in-differences framework and nationally representative data from the Philippine Demographic and Health Surveys, I estimate the reduced-form impact of the policy on child height-for-age and weight-for-height. [Will add more after data analysis]*
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## I. Introduction

The trade-off between child quantity and child quality is a foundational concept in the economics of the family. First articulated by Becker (1960) and extended in subsequent models of household behavior (Becker and Lewis, 1973; Becker and Tomes, 1976*a*), this framework posits that parents allocate finite resources—both financial and non-financial—across children. An increase in fertility reduces the resources available per child and, under binding constraints, may lead to lower investments in health, education, and other forms of human capital. This mechanism has served as an explanatory model for changes in fertility behavior and the evolution of population structures in low- and middle-income countries.

Empirical investigations of the quantity–quality trade-off have focused primarily on educational outcomes. Studies in both high-income and low-income settings have examined the effects of fertility on school enrollment, grade progression, test scores, and completed years of schooling (Rosenzweig and Wolpin, 1980; Black, Devereux and Salvanes, 2005; Angrist, Lavy and Schlosser, 2010). These

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outcomes serve as accessible proxies for long-run human capital accumulation, but they represent only one dimension of child quality. Other outcomes, such as nutritional status, are early-onset or biologically constrained. They also tend to be less responsive to remediation later in life. A child who suffers from chronic malnutrition may exhibit permanently reduced cognitive capacity and face limits in physical development that affect long-run productivity regardless of subsequent educational access (Hoddinott et al., 2013; Grantham-McGregor et al., 2007).

The exclusion of nutritional outcomes from much of the empirical literature leaves an important dimension of the trade-off untested. Nutritional investments in early childhood are essential to early childhood development and long-term outcomes (Victora et al., 2008; Hoddinott et al., 2013). They shape brain development, immune system functioning, and physical stature, and they have been shown to predict later-life earnings and health outcomes across a wide range of settings (Grantham-McGregor et al., 2007; Alderman, Hoddinott and Kinsey, 2006). The biological irreversibility of early-life nutritional deficits further distinguishes them from other forms of investment. Educational deficits may be partially remediable; nutritional failures often are not. A credible estimate of the trade-off between fertility and child quality must account for nutrition if it aims to assess the full set of consequences associated with fertility shocks.

This study addresses this gap by examining the nutritional effects of a localized, exogenous increase in fertility in the Philippines. In 1990, the mayor of Manila implemented an executive policy that prohibited the provision of modern contraceptives in all city-run health facilities. The order removed access to pills, condoms, intrauterine devices, and related public health materials and instructed healthcare providers to offer only natural family planning methods. This policy remained in place for nearly a decade and affected only the jurisdiction of the Manila city government. The national government did not implement a comparable restriction, and surrounding cities within Metro Manila continued to provide access to modern contraceptives. The policy thus created a spatial and temporal discontinuity in contraceptive access that was uncorrelated with underlying fertility preferences or concurrent shifts in household income or governance. As a result, the Manila ban serves as a quasi-experimental source of variation in fertility exposure among poor urban households.

I use this natural experiment to estimate the causal effect of increased fertility on child nutrition. The analysis relies on nationally representative data from multiple waves of the Philippine Demographic and Health Survey (DHS), which provide data on household structure and maternal characteristics, as well as measurements of child anthropometry. The outcomes of interest are height-for-age and weight-for-height z-scores, which serve as standardized indicators of chronic and acute malnutrition, respectively. These outcomes are widely used in the global health and development literature and capture nutritional deprivation over both long and short time horizons (Victora et al., 2008). The empirical strategy follows a difference-in-differences design that compares child outcomes

in Manila and comparable urban areas before and after the onset of the policy.

The identification strategy rests on two key assumptions. First, in the absence of the contraceptive ban, nutritional trends in Manila would have evolved in parallel with those in comparison cities. Second, any other policy or economic shocks affecting Manila during the study period must not coincide precisely with the timing and scope of the contraceptive policy. I test these assumptions using falsification checks, placebo comparisons, and robustness specifications that include city-specific time trends, maternal fixed effects, and controls for baseline demographic differences.

The analysis proceeds in three stages. I first replicate existing work (Dumas and Lefranc, 2019) to confirm that the contraceptive ban led to an increase in fertility among affected women. I then estimate reduced-form effects of policy exposure on nutritional outcomes for children under five years of age. Finally, I examine heterogeneity in effects across subsamples defined by maternal education, household wealth, and access to prenatal care. These dimensions serve as proxies for household resource availability and capacity to buffer the nutritional consequences of fertility increases.

This study contributes to the literature in several important ways. It provides new evidence on how increases in fertility—caused by policy restrictions on family planning—can affect child nutrition in poor, urban communities. Most past research has focused on education, but this study expands the idea of child quality to include biological measures such as stunting and wasting. It also adds to the small number of studies that use unexpected changes in reproductive health policy to examine long-term effects on children's well-being. More broadly, the results show that local restrictions on family planning can unintentionally harm children's health, especially in settings where families already face poverty, food insecurity, and limited public services.

## II. Review of Related Literature

### *A. Theoretical Background*

Gary Becker's early work reframed fertility as an economic decision and drew on microeconomic theory to how families choose whether and how many children to have. In his 1960 paper, Becker challenged the then-dominant view that fertility declines with income were simply the result of better access to contraception or changing social values. Instead, he proposed that childbearing decisions could be modeled using the tools of consumer choice theory. Within this framework, children are treated as goods that provide utility, with households allocating resources to balance their desire for more children (quantity) against the desire to invest in each child (quality).

Becker argued that children serve both consumption and production purposes. They bring direct satisfaction to parents and may also contribute economically, especially in agrarian or informal settings. In the Philippines, many children aged

5–17 work informally—through street vending or helping in family businesses—to support household income, with an estimated 1.09 million children working in 2023 (Manila Bulletin, 2024). This economic role aligns with Becker's framework and may partly explain why some low-income households continue to prefer larger families. At the same time, fertility tends to decline as income rises and per-child investments increase. According to the 2017 National Demographic and Health Survey, women in the poorest wealth quintile had an average of 4.5 children, compared to just 2.0 in the richest (Philippine Statistics Authority and ICF International, 2018). This inverse relationship between income and fertility, observed globally, also appears in the Philippine context: poorer households often maintain larger families, while wealthier ones prioritize child quality.

Becker and Lewis (1973) build on these conceptual foundations to introduce the formal concept of a quantity–quality (Q–Q) trade-off. They develop a utility-maximizing framework in which parents allocate resources between the number of children and the quality of investments in each child. The model formalizes how parents maximize utility from consumption $c$, number of children $n$, and child quality $q$:

$$U = U(c, n, q)$$

subject to the full income constraint:

$$I = c + n(p_n + q \times p_q)$$

where $p_n$ denotes the direct cost associated with bearing each additional child (e.g., delivery, basic needs), and $p_q$ represents the marginal cost of investing in quality per child, such as health care or education. The trade-off is reflected in the structure of the cost function, which reveals interaction effects: the marginal cost of improving child quality rises as the number of children increases, and similarly, the cost of an additional child rises with the level of quality investment per child. This complementarity is captured through the positive cross-derivatives:

$$\frac{\partial MC_q}{\partial n} > 0 \quad \text{and} \quad \frac{\partial MC_n}{\partial q} > 0$$

In short, the more children a family has, the more difficult it becomes to allocate sufficient resources—such as time, nutrition, and education—to each child.

While the static Q–Q model explains the immediate trade-offs families face between the number and quality of children, it remains limited in scope by assuming a single-period decision framework, which fails to account for intertemporal linkages—for instance, how early investments in child health or education may constrain or enhance later household choices—and overlooks how forward-looking behavior, such as anticipated returns to child quality in the form of future earnings or social mobility, may influence present-day household choices. To address this, Becker and Tomes (1976*b*) developed a dynamic model that explicitly in-

corporates intergenerational mobility. In this model, parents account for how their fertility and investment choices shape the human capital outcomes of their children—for example, how a decision to space births more closely can constrain parental resources and reduce per-child investments in health and education. The resulting dynastic utility function captures both present and future-oriented preferences:

$$U = u(c) + \beta \cdot n \cdot V(q)$$

where $\beta$ denotes child altruism, or the extent to which parents value their children's future well-being relative to their own consumption. A higher $\beta$ indicates stronger intergenerational concern, meaning parents are more willing to sacrifice current resources to improve their children's prospects. For example, a low-income family in the Philippines might choose to send a child to private school despite financial constraints to increase the child's future earnings or social mobility. Conversely, a lower $\beta$ implies a stronger emphasis on present needs and diminished willingness to invest in long-term child outcomes. This may occur in households facing severe income insecurity, where sending children to work may be prioritized over education. On the other hand, $V(q)$ represents the expected return on child quality. A high $V(q)$ implies that parents expect substantial future benefits from quality investments, such as access to better-paying jobs or improved life expectanc, making such investments more worthwhile than having additional children. A low $V(q)$, in contrast, suggests that even with significant investments, the perceived or actual gains are limited, often due to barriers like poor school quality, weak labor demand, or geographic constraints.

To formalize the trade-off similarly as in the static model, we again impose the full income constraint. In optimizing this problem, the first-order condition for child quality becomes:

$$\beta \cdot V'(q) = p_q + n \cdot \frac{\partial p_q}{\partial q}$$

This condition implies that the marginal benefit of child quality, scaled by altruism $\beta$, must equal the marginal cost of improving that quality. As family size $n$ increases, the cost of maintaining or increasing quality also rises. This reinforces the quantity–quality trade-off: families with more children may face sharper constraints in deepening investments per child. In contexts like the Philippines, where income constraints are binding and child quality has high private returns, this model predicts lower fertility and increased education spending among upwardly mobile households.

## REFERENCES

**Alderman, Harold, John Hoddinott, and Bill Kinsey.** 2006. "Long Run Returns to Early Childhood Nutrition." *World Bank Economic Review*, 20(1): 97–118.

**Angrist, Joshua D., Victor Lavy, and Analia Schlosser.** 2010. "Multiple Experiments for the Causal Link Between the Quantity and Quality of Children." *Journal of Labor Economics*, 28(4): 773–823.

**Becker, Gary S.** 1960. "An Economic Analysis of Fertility." *Demographic and Economic Change in Developed Countries*, 209–240.

**Becker, Gary S., and H. Gregg Lewis.** 1973. "On the Interaction between the Quantity and Quality of Children." *Journal of Political Economy*, 81(2): S279–S288.

**Becker, Gary S., and Nigel Tomes.** 1976*a*. "Child Endowments and the Quantity and Quality of Children." *Journal of Political Economy*, 84(4): S143–S162.

**Becker, Gary S, and Nigel Tomes.** 1976*b*. "Child endowments and the quantity and quality of children." *Journal of political Economy*, 84(4, Part 2): S143–S162.

**Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes.** 2005. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *Quarterly Journal of Economics*, 120(2): 669–700.

**Dumas, Christelle, and Arnaud Lefranc.** 2019. ""Sex in Marriage Is a Divine Gift"? Evidence on the Quantity-Quality Trade-off from the Manila Contraceptive Ban." *The World Bank Economic Review*, 33(1): 259–285.

**Grantham-McGregor, Sally, Y.B. Cheung, Santiago Cueto, Paul Glewwe, Linda Richter, and Barbara Strupp.** 2007. "Developmental Potential in the First 5 Years for Children in Developing Countries." *The Lancet*, 369(9555): 60–70.

**Hoddinott, John, Harold Alderman, Jere R. Behrman, Lawrence Haddad, and Susan Horton.** 2013. "Adult Consequences of Growth Failure in Early Childhood." *American Journal of Clinical Nutrition*, 98(5): 1170–1178.

**Manila Bulletin.** 2024. "6 in 10 Working Filipino Children Suffer Labor Abuse." Citing PSA data on child labor prevalence.

**Philippine Statistics Authority, and ICF International.** 2018. "Philippines National Demographic and Health Survey 2017: Key Findings." Calverton, Maryland: PSA and ICF.

**Rosenzweig, Mark R., and Kenneth I. Wolpin.** 1980. "Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural Experiment." *Econometrica*, 48(1): 227–240.

**Victora, Cesar G., Linda Adair, Caroline Fall, Pedro C. Hallal, Reynaldo Martorell, Linda Richter, and Harshpal Sachdev.** 2008. "Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital." *The Lancet*, 371(9609): 340–357.

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## Mathematical Appendix