Bounding Fertility Elasticities

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Abstract

The magnitude of fertility responses to financial incentives is important to both policymakers and economists. In this paper, I propose a new methodology to bound the fertility elasticities. Under mild assumptions, I show that raising the fertility rate by 0.1 children per woman in the United States in 2010 requires the cost of children to fall between \$7,514 and \$35,966. This bound is tighter than that in meta-studies of past estimates and is easy to compute for a different country or year under consideration.

1 Introduction

How much does fertility respond to financial incentives? The answer to this question is important for both policymakers economists. For governments that want to use financial transfers to raise fertility, it is critical to understand how cost-effective these policies are. For economists, on the on hand, fertility elasticity serves as an important discipline to models with endogenous fertility, just as the marginal propensity to consumer (MPC) disciplines the behavior of modern macroeconomic models. On the other hand, for economists that use structural models to understand the consequences of child-related policies, such as the Child Tax Credit (CTC) and the Earned Income Tax Credit (EITC), a good estimate of fertility elasticity allows a transparent evaluation of the exogenous fertility assumption which is common in the literature.

There has been a large empirical literature devoted to estimating the fertility elasticity.[1] Pinning it down using historical policies has proven to be difficult for several reasons. First, there is a lack of large and persistent policies that significantly change the cost of children, making it unlikely for people to change their fertility behaviors, especially the total number of children, in a quantitatively detectable manner. Second, as most pro-natal policies are nationwide, finding a control group is not

[1] See Milligan (2005), Cohen et al. (2013), González (2013) among many others. For review studies, see McDonald (2006) and Stone (2020).

straightforward. This difficulty is especially acute given that most pro-natal policies are adopted to prevent future fertility crashes, while it is unclear whether countries or regions in the control group also suffer from a similar problem. Last, many pro-natal policies come in bundles of incentives that go beyond lowering the financial cost of children, such as measures encouraging women's labor force attachment. Therefore, estimating the fertility elasticity of the underlying policy is not equivalent to estimating the price elasticity of fertility. As a result of these difficulties, empirical estimates vary widely – "there is considerable disagreement across studies about the effectiveness of pro-natal policies" even though "the directional finding that pro-natal benefits boost fertility is nearly uniform" (Stone (2020)) Last, it is unclear whether past estimates are still informative about fertility elasticities in a different time or institutional setting.

In this paper, I propose a new methodology to bound the fertility elasticities. Under mild assumptions, I show that the bound can be derived after knowing (1) the prevailing fertility and cost of children, (2) the maximum desired fertility, and (3) the cost of children such that parents would rather prefer not to have a child. Applying this method to the United States, I find that a transfer of size between \$7,514 and \$35,966 is required to raise the fertility rate by 0.1 children per woman in the year 2010. I argue that this bound is tighter than that in meta-studies of past estimates and is easy to compute for a different country or year under consideration.

The rest of the paper is organized as follows. Section 2 shows the theory behind the bound. Section 3 applies the theory to the United States and compares the results with prior studies. Section 4 concludes.

2 Theory

Denote the Marshallian demand of fertility as $n(p;\boldsymbol{p}^{\text{other}},y)$ where n is fertility, p is the cost of children, $\boldsymbol{p}^{\text{other}}$ is the price of other goods, and y is the household's (lifetime) income.

Assumption 1 The Marshallian demand of fertility $n(p;\boldsymbol{p}^{\text{other}},y)$ is downward sloping, continuously differentiable, and convex.

This is a mild condition that is satisfied by most models of endogenous fertility, either with warm glow (e.g., De La Croix and Doepke (2003)) or with dynastic altruism (e.g., Barro and Becker (1989) and Córdoba and Ripoll (2019)).

Assumption 2 There exists $\overline{p}$ and $\overline{n}$ such that $n(\overline{p};\boldsymbol{p}^{\text{other}},y)=0$ and $n(0;\boldsymbol{p}^{\text{other}},y)=\overline{n}$.

This is also a mild assumption. For example, set $\overline{p}=y$, the condition requires that if having a child costs the parents' entire budget and leaves no resources for the consumption of other goods, then the household would prefer not have a child. The existence of $\overline{n}$ could reflect a satiation of the utility from the number of children or biological constraints of childbearing.

Proposition The fertility responses to prices around (n^0, p^0) is bounded by

$$\left.\frac{dn}{dp}\right|_{(n^0,p^0)} \in \left(\frac{n^0}{\overline{p}-p^0}, \frac{\overline{n}-n^0}{p^0}\right) \tag{1}$$

Proof Figure 1 illustrates the idea of the proof. The Marshallian demand of fertility is given by curve BAC where the coordinates of B and C are $(0, \overline{p})$ and $(\overline{n}, 0)$ correspondingly. Point A denotes the prevailing fertility and cost of children n^0, p^0. We can show that the slope of the demand curve at A is bounded by the slope of AB and the slope of AC by applying the Mean Value Theorem and the assumption that the curve is convex.

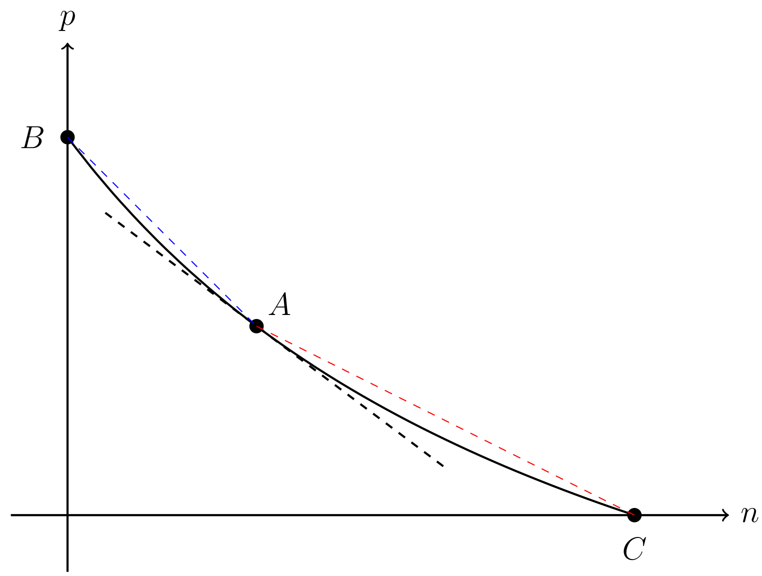

Figure 1: Illustration of the Proof

3 Quantification

I apply the method to the United States in 2010 where fertility $n^0 = 1.9$ and the cost of one child p^0 is \$458,351 for a middle-income household (Córdoba and Ripoll (2019)). To derive the bound, I make the following assumption on $\overline{n}$ and $\overline{p}$.

Assumption 3 Set $\overline{n} = 8$. Choose $\overline{p}$ such that an average household with one child lives in poverty for the rest of their lives, i.e.,

$$y - \overline{p} = y^{\text{poverty}}. \tag{2}$$

Following Córdoba and Ripoll (2019), I set $y = \$2{,}083{,}219$. Using the poverty guideline in 2010, I set $y^{\text{poverty}} = \$18{,}310 \times 18 + \$14{,}570 \times 42 = \$941{,}520$. This implies $\overline{p} = \$1{,}141{,}699$.

Applying the proposition, I find that to raise the fertility by 0.1 children per woman, the change in p needed is between \$7,514 and \$35,966.

Next, I compare my results to meta-studies of past estimates. Stone (2020) summarizes 22 studies since 2000 using historical policies, mostly in low-fertility countries. He concludes that "An increase in the present value of child benefits equal to 10% of a household's (annual) income can be expected to produce between 0.5% and 4.1% higher birth rates."

To facilitate the comparison, we translate the previous bound into percentages using the median annual household income in 2010 – \$49,445. Using the bounding method, an increase in the present value of child benefits equal to 10% of a household's (annual) income can be expected to produce between 0.72% and 3.46% higher birth rates.

Compared with the range of fertility elasticities from past estimates, the bounding method proposed in this paper has two advantages. First, the bound is tighter. Second, the bound is easy to compute for a different country or year as long we know the prevailing (n^0, p^0), y, and y^{poverty}.

4 Conclusion

The magnitude of fertility responses to financial incentives is important to both policymakers and economists. In this paper, I propose a new methodology to bound the fertility elasticities. This approach is complementary to estimating them using historical policies. Under mild assumptions, I show that a transfer of size between \$7,514 and \$35,966 is required to raise the fertility rate by 0.1 children per woman in the United States in 2010. This bound is tighter than that in meta-studies of past estimates and is easy to compute for a different country or year under consideration.

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