Economics of Optimal Family Size

Family size is, in part an economic decision. Gary Becker (1973) wrote, in determining their family size, couples face a choice between the quantity and quality of children they have.[1]

Empirical research has shown the inverse relationship between number of siblings and children's educational performance.[2] The primary explanation for this relationship is “resource dilution” as parents have finite time, limited financial resources and these resources get diluted as a family has more children.[3] In the developing world, fewer children per woman, along with delayed marriage and childbearing “could mean more resources per child and better health and survival rates for mothers and children.”[4] Using twins as instrumental variables, in the developed world, Juhn et. al (2014) found that “increases in family size decrease parental investment, decrease childhood cognitive abilities, and increase behavioral problems.”[5]

Additionally, delaying childbirth can be positive for children’s outcomes: “women who have children young...are less likely to have significant savings or a college degree and career. Their pregnancies are more likely to be unintended.”[6] Barclay and Myrskylä (2016) found that children born to older mothers fare better in terms of educational outcomes and height in early adulthood.[7]

In light of aforementioned factors, governments around the world have several policy levers to incentivize delayed childbearing and smaller family size, including, among others, financial incentives, increasing access to family planning and investment into women’s education.[8] In the next sections we discuss the efficacy of these specific policies.

Female Education and Optimal Choice

Female educational level is strongly correlated with family size, delayed childbearing, and increased child health. Economic theory suggests that educated women have “higher opportunity costs of bearing children in terms of lost income” and are therefore more likely to delay becoming a mother.[9] In an empirical study conducted in Kenya, Ferré (2009) found that one additional year of education decreased a mother’s chances of giving birth while still a

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[1] Becker, G. S., & Lewis, H. G. (1973). On the Interaction between the Quantity and Quality of Children. Journal of political Economy, 81(2, Part 2), S279-S288.
[2] Downey, D. B. (1995). When bigger is not better: Family size, parental resources, and children's educational performance. American sociological review, 746-761.
[3] Ibid.
[4] http://blogs.worldbank.org/health/female-education-and-childbearing-closer-look-data
[5] Juhn, C., Rubinstein, Y., & Zuppann, C. A. (2015). The quantity-quality trade-off and the formation of cognitive and non-cognitive skills (No. w21824). National Bureau of Economic Research.
[6] https://www.nytimes.com/interactive/2018/08/04/upshot/up-birth-age-gap.html
[7] Barclay, K., & Myrskylä, M. (2016). Advanced maternal age and offspring outcomes: Reproductive aging and counterbalancing period trends. *Population and development review*, *42*(1), 69-94.
[8] http://www.people.hbs.edu/nashraf/papers_files/FER_ScienceMag_Jul2011.pdf
[9] http://blogs.worldbank.org/health/female-education-and-childbearing-closer-look-data

teenager by over 10 percentage points. Further, the study found that each additional year of schooling decreased the probability of becoming a mother by 7.3 percent for women who have completed at least a primary school education.[10] By exploiting variation in a compulsory schooling law in Turkey, Gunes (2016) found that finishing primary school reduced teenage fertility by 0.37 births and the incidence of adolescent childbearing by approximately 28 percentage points.[11]

The research also shows there are additional social benefits from female education in terms of child health.[12] Using a regression discontinuity approach to demonstrate causality, Keats (2016) found that women with higher level of education (due to a one-time educational reform) delayed childbearing, had smaller families and increased investment in child healthcare. Specifically, women who experienced the educational reform, at age 28 years old, had .52 fewer children. The reform also reduced the likelihood of a first birth before age 16 by 6 percentage points. Each year of schooling increased the likelihood of a trained health practitioner present at the birth of the first child by 33 percentage points, increased the probability the first-born child received the tuberculosis vaccine by 12 percentage points, and for each year of mother's schooling, first-born children were 37 percent less likely to be stunted.[13]

Access to Family Planning Tools

There is a direct link between access to family planning tools and smaller family size. "Typically, the total fertility rate (TFR) is around six to seven births per woman in countries with no contraceptive use, while fertility is near two births per woman in countries in which the contraceptive prevalence rate (CPR) among women in union is around 75% (lower in populations with significant resort to abortion)."[14]

In Kenya, fertility dropped from "8 to 4.8 births per woman after the government launched aggressive family planning efforts in the early 1980s. In comparison, in culturally and economically similar Uganda, which has a weaker family planning program, fertility has remained high"[15] Lindberg et. al (2016) used a statistical decomposition to show that almost all of the 36% decline in the U.S. adolescent birth rate between 2007 and 2013, was a result of improvements in contraceptive use.[16]

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[10]Ferré, C. (2009). *Age at first child: does education delay fertility timing? The case of Kenya*. The World Bank.
[11] Güneş, P. M. (2016). The impact of female education on teenage fertility: evidence from Turkey. The BE journal of economic analysis & policy, 16(1), 259-288.
[12] Ibid.
[13]Keats, A. (2018). Women's schooling, fertility, and child health outcomes: Evidence from Uganda's free primary education program. *Journal of Development Economics*, *135*, 142-159.
[14]Bongaarts, J. (2017). The effect of contraception on fertility: Is sub-Saharan Africa different?. *Demographic Research*, *37*, 129-146.
[15] http://blogs.worldbank.org/health/female-education-and-childbearing-closer-look-data
[16]Lindberg, L., Santelli, J., & Desai, S. (2016). Understanding the decline in adolescent fertility in the United States, 2007–2012. *Journal of Adolescent Health*, *59*(5), 577-583.

Subsequently, lack of access to family planning has been shown to increase early pregnancies. Packham (2017) found that the closing of 80 family planning clinics in Texas increased teen birth rates by 3.4%.[17]

Fertility-Delay Incentive Tools

Governments employ positive incentives to try to increase their national fertility rate, and fertility-delay incentives to decrease the fertility rate.

Using data from child subsidies in Israel, Heil and Herrmann (2012) found a "significant and positive price effect on fertility: the mean level of marginal child subsidy produces a 7.8 percent increase in fertility", with the effect strongest in the bottom half of the income distribution. There is also significant literature on the statistically significant effects of fertility incentives in many developed nations including Canada[18], France,[19] and Germany.[20]

Several countries have experimented with using cash-incentives to help decrease fertility rates. For example, in the state of Maharashtra, India, the district government piloted a program that paid 5,000 rupees, or about $106, for couples to wait to have children. However, in general the "literature on the causal effect of financial incentives on fertility has been limited to pro-natal policies in developed countries and the OCP in the context of developing countries."[21]

One of the few studies that does look at *fertility-delay* incentive structure studied the Indian government program *Devirupak*. As part of the program, the government sought to lower fertility and the sex ratio (practice of sex-selective abortions used to try to have a male, common in many cultures). To incentivize smaller families and disincentivize sex-selective abortions, the program provided a subsidy worth ten months of average household consumption. While unsuccessful at correcting the sex selection problem, the policy permanently reduced the number of children women had by 1%.[22]

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[17]Packham, A. (2017). Family planning funding cuts and teen childbearing. *Journal of health economics*, *55*, 168-185.
[18] Milligan, K. (2005). Subsidizing the stork: New evidence on tax incentives and fertility. Review of Economics and statistics, 87(3), 539-555.
[19]Laroque, G., & Salanié, B. (2014). Identifying the response of fertility to financial incentives. *Journal of Applied Econometrics*, *29*(2), 314-332.
[20]Raute, A. (2019). Can financial incentives reduce the baby gap? Evidence from a reform in maternity leave benefits. *Journal of Public Economics*, *169*, 203-222.
[21]Anukriti, S. (2018). Financial incentives and the fertility-sex ratio trade-off. *American Economic Journal: Applied Economics*, *10*(2), 27-57.
[22]Ibid.

A Unified Approach to Optimal Family Size

Of the three policies discussed above (family planning, women's education and fertility-delay incentives) which is most economically efficient at reducing family size and delaying childbirth?

While there is no definitive economic evidence pointing to one policy as the most efficient, Jiang and Hardee (2014) find "the impact from investment in reducing unwanted fertility will be much more immediate and significant than only investments in education."[23] Essentially, female education is most effective when combined with family planning access. Incentive-based approaches that combine with educational counseling (with incentives as low as $25 weekly) have shown effective in getting pregnant women to quit smoking in the United States.[24] And while there is still not much research on financial fertility-delay incentives,[25] economic theory suggests that such fertility-delay incentives could provide an efficient approach to achieving delayed-childbearing:

- Fertility delay incentives directly target the decision maker (mother) at the point of decision, compared to adolescent education which is subject to known difficulties of the education system in general, and therefore yields longer term returns,[26]

- The target population for fertility delay incentives (child bearing age female population in the US, ages 15-39, is 51.88 Million) is larger in size compared to the target group for compulsory female education (roughly ages 5-19 which is 30.79 million).[27] Therefore any fixed (and not per capita) investment into fertility delay incentives will have smaller cost (per capita) per recipient, increasing effectiveness as a policy tool - cheaper and larger outreach,

Example Unified Approach: Using Fertility-Delay Incentives to Shift the economic costs of unintended pregnancies into economic benefits of delayed childbearing

In the United States the economic costs of unintended pregnancy are high: unintended pregnancies cost the United States $21 Billion in 2010, or an average of $14,000 per 1.5 million unintended pregnancy. Unintended pregnancies contribute to the high level of childhood poverty in the United States, which is currently 21% (in a ranking of 35 developed nations, the United States ranked 34th).[28] [29]

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[23] Jiang, L., & Hardee, K. (2014). Women's education, family planning, or both? Application of multistate demographic projections in India. *International journal of population research*, *2014*.
[24] Zhang, X., Devasia, R., Czarnecki, G., Frechette, J., Russell, S., & Behringer, B. (2017). Effects of incentive-based smoking cessation program for pregnant women on birth outcomes. *Maternal and child health journal*, *21*(4), 745-751.
[25] Anukriti, S. (2018). Financial incentives and the fertility-sex ratio trade-off. *American Economic Journal: Applied Economics*, *10*(2), 27-57.
[26] https://docs.gatesfoundation.org/Documents/TheSilentEpidemic3-06FINAL.pdf
[27] https://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf
[28] http://www.nccp.org/topics/childpoverty.html

One such policy that researchers have proposed is a guaranteed minimum income voucher per child and a children's saving account (CSA) to incentivize delayed, planned childbearing[30]. For example, if a woman graduates high-school before giving birth, she will receive an incentive in the form of a $2,000 Child Savings Account for any future child and $200/monthly in basic income for that future child. For five years this would total $14,000 (the price of an unplanned US pregnancy). For each additional year she delays childbirth, these amounts would increase (until a certain age).

The guaranteed minimum income voucher for children could then be used (or directly invested for parents by the government) to finance a number of early childhood interventions that have proven to have significant return on investment, such as high quality child-development or moving vouchers. Heckman (2016) has shown that "high-quality birth-to-five programs for disadvantaged children can deliver a 13% per year return on investment."[31] Participation in less expensive head start programs have been shown to have long-term effects on children that include "0.29-year increase in schooling, a 2.1-percent increase in high-school completion, an 8.7-percent increase in college enrollment, and a 19-percent increase in college completion"[32] Moving vouchers, as part of the Move To Opportunity (MTO) Program (where families could choose to move to a lower poverty neighborhood) significantly improved outcomes for children: "children whose families [took] up an experimental voucher to move to a lower-poverty area when they [were] less than 13 years old have an annual income that is $3,477 (31%) higher on average relative to a mean of $11,270 in the control group in their mid-twenties."[33] The MTO counseling costs were $3,783 per family who took up a voucher, compared to the tax revenue gain of $22,400 for each family with two young children that moved.[34]

A comprehensive fertility-delay incentive program could have significant economic effects, including an increase in female education[35], better educational and health outcomes for future children and decreased greenhouse emissions.

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[29]https://www.washingtonpost.com/news/worldviews/wp/2013/04/15/map-how-35-countries-compare-on-child-poverty-the-u-s-is-ranked-34th/?noredirect=on&utm_term=.0f96b50842b4

[30] From HavingKids.org DC City Council Letter, September 4, 2018

[31]García, J. L., Heckman, J. J., Leaf, D. E., & Prados, M. J. (2016). The life-cycle benefits of an influential early childhood program (No. w22993). National Bureau of Economic Research.

[32]Bailey, M. J., Sun, S., & Timpe, B. (2018). Prep School for Poor Kids: The Long-Run Impacts of Head Start on Human Capital and Economic Self-Sufficiency.

[33]Chetty, R., Hendren, N., & Katz, L. F. (2016). The effects of exposure to better neighborhoods on children: New evidence from the Moving to Opportunity experiment. *American Economic Review*, *106*(4), 855-902.

[34]Ibid.

[35] Among dropouts [in the US], 30 percent of girls cite pregnancy or parenthood as a key reason they left school." https://www.progressivepolicy.org/blog/the-drop-out-crisis-and-teen-pregnancy/

Appendix: The Indirect Benefits of Optimal Family Size

Economic evidence supports the finding that smaller families and planned pregnancies are better for a child's future outcomes. While there are many indirect benefits of smaller family size, including government's effects on social programs, educational system and fiscal budgets, in the following section we will focus on the environmental benefits of optimal family size.

Environmental Benefits of Optimal Family Size Policies

Population growth and climate change are directly linked. "In 1970, when worldwide greenhouse gas emissions had just begun to transgress the sustainable capacity of the atmosphere, the world population was about 3.7 billion; today it's about 6.9 billion — an increase of 86 percent. In that same period, worldwide emissions from fossil fuels rose from about 14 billion tons to an estimated 29 billion tons — an increase of 107 percent." Had governments fully taken advantage of the three policy levers in the 20th century, including the less used fertility-delay incentives, the threat of climate change could have been in part mitigated. While most of the developing countries that have high fertility rates currently have lower emissions per capita today, "consumption [will eventually] explode on the base of a population that is large, but it is by then growing more slowly."[36] For example, "throughout the 19th century, the U.S. population grew at rates typical of Africa today. That century of rapid growth helped to make 21st-century America (with 307 million people now) a consumption behemoth."[37]

In a November 2018 report from 13 US federal agencies, scientists predicted that "with continued growth in emissions at historic rates, annual losses in some economic sectors are projected to reach hundreds of billions of dollars by the end of the century—more than the current gross domestic product (GDP) of many U.S. states."[38] Using an "energy–economic growth model" O'Neil et. al (2010) showed that "slowing population growth could provide 16–29% of the emissions reductions suggested to be necessary by 2050 to avoid dangerous climate change."[39] Therefore, targeted policies that help slow population growth in rapidly growing countries and policies that promote delayed-childbearing and smaller family sizes in developed countries[40] can both contribute to the partial long-term mitigation of climate change.

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[36] https://www.scientificamerican.com/article/population-and-sustainability/#googDisableSync
[37] Ibid.
[38] https://nca2018.globalchange.gov/
[39] O'neill, B. C., Dalton, M., Fuchs, R., Jiang, L., Pachauri, S., & Zigova, K. (2010). Global demographic trends and future carbon emissions. *Proceedings of the National Academy of Sciences*, 201004581.
[40] In current conditions in the United States, having a child is one of the environmentally costliest behaviors, "under current conditions in the United States, for example, each child adds about 9441 metric tons of carbon dioxide to the carbon legacy of an average female, which is 5.7 times her lifetime emissions." Murtaugh, P. A., & Schlax, M. G. (2009). Reproduction and the carbon legacies of individuals. *Global Environmental Change*, *19*(1), 14-20.