DISCUSSION PAPER SERIES

DP16445
(v. 2)

HOW MUCH DO NORMS MATTER FOR QUANTITY AND QUALITY OF CHILDREN?

Zainab Iftikhar

DEVELOPMENT ECONOMICS AND MACROECONOMICS AND GROWTH

ISSN 0265-8003

HOW MUCH DO NORMS MATTER FOR QUANTITY AND QUALITY OF CHILDREN?

Zainab Iftikhar

Discussion Paper DP16445
First Published 11 August 2021
This Revision 21 March 2023

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

HOW MUCH DO NORMS MATTER FOR QUANTITY AND QUALITY OF CHILDREN?

Abstract

This paper quantifies the effect of social norms, child mortality, and women's education on fertility and children's education in Pakistan. Quantitative analyses show that norms explain 8% of the variation in fertility and 5% of the variation in investment in children's education among the households that differ in the women's socioeconomic background. In comparison, child mortality explains 34% and 17% of the difference in quantity and quality, respectively. The women's wage plays the most crucial role in explaining QQ variation across households. The impact of norms is much higher within ethnic groups as the average quantity and quality reduce by 35% and 143%, respectively, in the absence of norms. Policy analysis shows that conditional transfers perform better than unconditional transfers in promoting investments in children's education. Furthermore, the cost of the policies reduces in the absence of norms and child mortality. Last, the QQ trade-off weakens with the education of women and in the absence of norms and child mortality.

JEL Classification: C13, J13, D10, Z13

Keywords: Quantity-quality trade-off, Child mortality

Zainab Iftikhar - iftikhar@econ.uni-frankfurt.de
Goethe University Frankfurt and CEPR

Acknowledgements
C13, J13, D10, Z13

How Much Do Norms Matter for Quantity and Quality of Children? *

Zainab Iftikhar †

March 21, 2023

Abstract

This paper quantifies the effect of social norms, child mortality, and women's education on fertility and children's education in Pakistan. Quantitative analyses show that norms explain 8% of the variation in fertility and 5% of the variation in investment in children's education among the households that differ in the women's socio-economic background. In comparison, child mortality explains 34% and 17% of the difference in quantity and quality, respectively. The women's wage plays the most crucial role in explaining QQ variation across households. The impact of norms is much higher within ethnic groups as the average quantity and quality reduce by 35% and 143%, respectively, in the absence of norms. Policy analysis shows that conditional transfers perform better than unconditional transfers in promoting investments in children's education. Furthermore, the cost of the policies reduces in the absence of norms and child mortality. Last, the QQ trade-off weakens with the education of women and in the absence of norms and child mortality.

Keywords: Fertility norms, Quantity-quality trade-off, Indirect inference, Child mortality
JEL codes: C13, J13, D10, Z13.

*I am grateful to David de la Croix for guiding this research. I also thank Bastien Chabé-Ferret, Christiane Clemens, Frédéric Docquier, Éric Roca Fernández, Nicola Fuchs-Schündeln, Paula Gobbi, Leo Kass, Alexander Ludwig, Maurice Schiff and Gerald Willmann for their useful comments. This research is part of the ARC project 15/19-063 on "family transformations" (French speaking community of Belgium). I acknowledge financial support from European Doctorate in Economics Erasmus Mundus and the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2126/1-390838866 for financial support.

†Bonn University, CEPR: iftikhar@bonn-uni.de.

1 Introduction

Pakistan is a developing country with one of South Asia's lowest school enrolment rates and high child mortality, especially among less educated mothers. The country has a conservative society with specified gender roles that put women mainly in the reproduction business while men provide for the family. The country has shown persistently high fertility rates over the years and has the second-highest fertility rate in Asia (WDI, 2021). A combination of factors contributes to high fertility rates in developing countries. Economic factors such as poverty, inequality, and low education lead to high fertility rates in these countries; however, social norms also contribute to high fertility rates. According to Dasgupta and Dasgupta (2017), fertility patterns are regulated by social norms. Social norms may affect women's fertility by; confining the role of women to household production, limiting human capital accumulation and labor force participation, unequal distribution of childcare responsibilities, and socially pressuring women to procreate. Additionally, child mortality rates are high in most developing countries. Child mortality is often linked to high fertility rates, and several studies suggest that a decline in fertility is a subsequent outcome of reduced child mortality (Carlsson, 1968; Coale, 1984; Davis, 1945; Freedman, 1963).

High birth rates not only have physical and socio-economic implications for mothers, such as health problems, lower labor force participation, and less financial independence but also consequences for human capital via quantity-quality trade-off.[1] This paper argues that social norms and child mortality lead to high fertility (quantity) at the expense of a reduction in the human capital of the children (quality).[2] I investigate how child mortality rates, women's education, and fertility norms contribute to the variation in quantity-quality (QQ) among households with heterogeneous socio-economic backgrounds in Pakistan. For this purpose, I develop a theoretical model, parametrize it, and conduct a detailed quantitative analysis. To the best of my knowledge, this is the first paper that compares the relative strength of norms, child mortality, and women's education in explaining QQ variation across different demographic groups and discusses their roles in the context of population and education policies.

I use pooled cross-section data from "Pakistan Demographic and Health Survey" (PDHS) for the analysis. PDHS has detailed information on the quantity (measured by the number of children ever born to a woman). However, the lack of data on the quality (investments in children's education) does not allow us to directly measure the variation

[1]Literature suggests a trade-off between fertility and investment in the education of children (see Angrist and Schlosser (2010); Becker and Lewis (1973); Becker and Tomes (1976)).

[2]The literature uses aggregate fertility rates to capture the norms/cultural values concerning fertility behavior. Norms, social norms, and fertility norms are interchangeably used in the text.

in QQ explained by norms and child mortality. Nevertheless, a theoretical model that links QQ decisions can be used to replicate the observed fertility patterns of women with heterogeneous socio-economic backgrounds. As the model replicates the fertility behavior, it also predicts the potential corresponding quality for each demographic group. Therefore, I develop a structural model that builds on the QQ model proposed by De la Croix and Doepke (2003) and augment it with the role of norms and child mortality. The model considers heterogeneous households w.r.t four state variables, namely, the mother's wage, fertility norms (measured by the fertility rates of the previous generation), child mortality rates (reflects the survival probability between birth and fifth birthday), and father's income. The households maximize utility in consumption, the number of births, and monetary investment in children's education. Women are endowed with one unit of time, and households decide on the women's time allocation between labor supply and childbearing/rearing. Women bears the full time-cost of bearing and rearing a surviving child, and her wage affects the QQ decisions through time opportunity cost, while the father's wage has an income effect on household decisions. The wage and the child's survival probability increase in women's education. Norms affect household fertility decisions by inflicting a social cost of deviation from norms.

Taking the model to the data, using PDHS waves 2012–13, 2017–18, I distinguish between households by the women's ethnicity and years of schooling. The spouse's income is held constant across households to keep the focus on women's education and norms. The women in the sample belong to seven different ethnic groups. To capture norms for each ethnicity, I develop a lagged measure of norms following De Silva and Tenreyro (2020); Fernández and Fogli (2009); Stichnoth and Yeter (2013). The average fertility rate of married women with completed fertility for a given ethnicity in PDHS (1991) captures the norm for the corresponding ethnic group in the current cohorts. Constructing norms based on the fertility of the previous generation mitigates the problems arising from time-specific correlated effects and endogeneity between fertility and norms.

I consider 17 education categories, with the least educated women put in a group with no formal education and the most educated women put in a group with 16 years of formal schooling. Child mortality rates are assigned by the women's education level. This segregation yields a total of 119 (7×17) demographic groups of households. However, data does not have information on the fertility rates of women in all 119 demographic groups. Therefore, I employ indirect inference to estimate the model's structural parameters. Indirect inference requires estimating an auxiliary econometric model to get stylized facts on fertility patterns of the women in all 119 demographic groups. The information from the empirical analysis and data on Pakistan's aggregate private expenditure on education is used to identify the structural parameters of the theoretical model.

Once parametrized, the theoretical model is simulated to retrieve data on the quality. The variation in QQ comes from the heterogeneity in the mothers' education, child mortality rates, and norms. The quantity varies from 3.67 to 6.39 children between households with the most and least educated women, respectively. Households with uneducated women invest approximately 0.1% while the households where women have a university degree invest about 2.2% of household income in their children's education. 58% of this variation in quantity is explained by differences in wage, 8% by norms, while child mortality differentials explain the rest. About 78% of the variation in the quality of children is explained by wage, 5% by norms, and the rest comes from the differences in child mortality. Though norms explain only a small fraction of between groups variation in QQ, they have a much bigger impact on the QQ within each demographic group. On average, quantity decreases by 35%, and quality increases by 143% in the absence of norms. Without child mortality, quantity reduces by 22% while quality increases by 98%. The results show that, on average, the households substitute 9% of quality for 1% of quantity with each additional year of woman's schooling. The QQ trade-off weakens at higher levels of education and in the absence of norms and child mortality.

Counterfactual experiments compare the effect of alternative population/education policies on QQ decisions. I compare three policy instruments, minimum wage policy; 2) education subsidy; 3) lump-sum transfers. Education subsidies have the strongest impact on quality for their direct effect on the cost of education; wage raises lead to the largest drop in fertility due to their direct effect on the time opportunity cost of having a child, while lump-sum transfers increase both quantity and quality owing to income effects. Furthermore, the analysis suggests that conditional transfers (education subsidy) are more effective than unconditional transfers (lump sum transfers) in promoting investments in children's education. In contrast, unconditional transfers are more effective in increasing welfare as measured by the household utility. The policy effects vary with the education of the women in the households. The cost of policy reduces in the absence of norms and child mortality. Finally, a comparison between the one-child policy and a social change campaign that lowers fertility norms shows that the former lowers fertility at the expense of welfare. In contrast, the latter increases welfare, but fertility reduction is small.

There are several limitations of this research. First, the theoretical model is static and set up in partial equilibrium. This setting does not allow us to gauge the spillover effects of a social change or education/population policies on the future generations. The economic environment and child mortality are exogenous. Therefore, there is no feedback effects of fertility on economic development or child mortality. Hence, the paper is silent about the endogenous relationship between fertility and long-term economic growth. Last, I develop a unitary model that ignores the collective nature of the household's decision-making. This assumption may generate an upward bias in the policy effects. Some of these modeling choices are driven by data constraints, while for others, I relegate possible extensions to future research.

This paper builds on the literature on QQ trade-off, which suggests that parental (monetary and time) investments in the human capital of their children decrease in the number of children (Barro and Becker, 1989; Becker and Lewis, 1973; Becker and Tomes, 1976; Doepke et al., 2015; Rosenzweig and Schultz, 1983; Tamura, 2006). Several papers investigate the existence of this relationship. However, these papers focus on the QQ trade-off resulting from a higher time opportunity cost of having a child (Cavalcanti and Santos, 2020; Cordoba and Ripoll, 2016; De la Croix and Doepke, 2003; Greenwood and Vandenbroucke, 2005; Manuelli and Seshadri, 2009). The novelty of this research is the introduction of child mortality and social norms into a traditional QQ trade-off model. This modification facilitates the measurement of the strength of these factors relative to the mother's time opportunity cost in explaining variation in QQ across households with heterogeneous socio-economic backgrounds.

Most fertility and social norms studies are empirical since it is rather challenging to identify the more complicated theoretical mechanisms given the data restrictions. For example, Munshi and Myaux (2006) provide empirical evidence that high fertility choices and resistance to accepting family planning in Bangladesh are strongly related to cultural norms. Similarly, Fernández and Fogli (2006, 2009) show that culture in the country of origin matters for the fertility behavior of second-generation immigrant women in the U.S. Stichnoth and Yeter (2013) find similar implications for the fertility behavior of migrant women in Germany. Norms may influence the age at first birth and the gap between consecutive births; however, Chabé-Ferret (2019) finds that the norms observed in the country of origin do not affect the entry into motherhood among the second generation migrant women in France and U.S. Nonetheless, the study does support that women from high fertility countries have bigger family size.

There is ample evidence supporting cultural norms' role in demographic transitions observed in many countries.[3] Spolaore and Wacziarg (2022) show that in some European countries fertility rate declined due to the diffusion of lower fertility norms from France. Delventhal et al. (2022) uncover the evidence that a country's entry into a demographic transition is strongly associated with its cultural and geographical proximity to countries that have already entered the demographic transition. However, these papers neither consider the policy relevance of norms nor relate norms to the quality. De Silva and Tenreyro (2020) show that policies targeting social norms and access to contraceptives

[3]Beyond the scope of this paper, but an interesting strand of literature links fertility decline driven by cultural change to long-term economic growth (Alesina and Giuliano, 2015; Alesina et al., 2013; Guiso et al., 2006; Petrakis and Valsamis, 2015)

accelerated and strengthened the decline in global fertility. Nevertheless, it does not consider the influence of norms on human capital accumulation. In this research, I account for this missing link. My findings support the hypothesis that QQ trade-off weakens at a higher level of education (Doepke et al., 2022; Hazan and Zoabi, 2014). Furthermore, I add to the debate by concluding that social development in terms of lower fertility norms also contributes to weakening the QQ trade-off.

I do not incorporate an education norm due to data limitations. A closely related paper to this idea is Kim et al. (2021), which explores the role of education externalities on the QQ decision in South Korea. However, the research focuses on the aspirations of the parents regarding their children's human capital relative to the rest of society. Furthermore, the paper ignores norms, although Myong et al. (2021) suggest that social norms are the main driving force behind the observed fertility patterns in South Korea.

A large body of literature agrees on a positive correlation between child mortality and fertility rates (Angeles, 2010; Chowdhury et al., 1976; Montgomery and Cohen, 1998; Nobles et al., 2015; Palloni and Rafalimanana, 1999; Preston, 1978; Rosenzweig and Schultz, 1983) and stress that reduction in child mortality is one of the central mechanisms responsible for demographic transition (Azarnert, 2006; Ehrlich and Lui, 1991; Falcao and Soares, 2008; Galor and Weil, 1999; Hirota, 2016; Kalemli-Ozcan, 2002; Lagerlöf, 2003; Soares, 2005; Tamura, 2006; Weisdorf, 2004). However, this literature is silent on the relevance of child mortality for the effectiveness of population and education policies. The theoretical framework in this paper formalizes the interactions between child mortality, social norms, and women's education. The quantitative analysis gives insights into the relative importance of one factor compared with the other. Lastly, the policy experiments of the paper relate to the development literature that uses randomized controlled trials to compare the effectiveness of conditional and unconditional transfers (Akresh et al., 2013; Baird et al., 2013, 2014, 2011).

The rest of the paper is organized as follows; sections 2 and 3 provide the context and stylized facts on QQ patterns in Pakistan; section 4 develops the theoretical framework; section 5 explains the identification of structural parameters; section 6 describes the benchmark scenario, discusses the results of the countrfactual simulations and conducts policy experiments; section 7 concludes the research.

2 Context

Pakistan has observed very high fertility rates of between 7 and 6 children per woman till the end of the 1980s. It witnessed a decline in fertility rate below 6 for the first time in the early 1990s (Pakistan Demographic Survey, 1992). Sathar and Casterline

(1998) suggests that critical demographic changes began in the 90s and were motivated by large-scale social and economic changes that led to changes in reproductive behavior in this era. Among other determinants, the paper concludes that female education may be one of the factors that initiated the break from a reproductive regime that characterized the country between the 1960s and the end of the 1980s. The primary school enrolment ratio of females increased from 13% in 1960 to 30% in 1990. Sathar & Casterline calls this change in fertility behavior the onset of fertility transition in Pakistan. Despite the economic and institutional factors lowering the fertility rate, Pakistan still has the second-highest fertility rate in Asia.

Several factors contribute to the high fertility rates in Pakistan. High child mortality, often linked to higher fertility rates (Chowdhury et al., 1976; Chowdhury and Aziz, 1992; Preston, 1978), might be another reason for the observed high fertility rates in the country. Child mortality rates under-5 declined from 140 in 1990 to 65 per 1000 live births in 2020. However, these rates are still very high compared to the average reported for South Asia (39 per 1000 births, WDI, 2021). Sathar (1985) suggests that child mortality negatively correlates with the mother's education. Hence, the woman's education has a twofold effect on her fertility; it increases both the opportunity cost and the survival probability of the child, leading to a decline in fertility.

On the cultural front, Pakistan shows diversity, with several ethnic groups living across the country.[4] These ethnic groups differ in living arrangements, languages, and social norms. For example, on the one hand, there is the Punjabi ethnic group whose people are very similar in their traditions to the Punjabi people from the Indian Punjab. On the other hand, there are Pakhtoons, who are closer in their ways of living and traditions to the people of Afghanistan. Similarly, other large and minority ethnic groups spread nationwide follow diverse traditions and norms. Hence, social norms may be another factor contributing to the high fertility rates in the country.

Fertility and decisions about children's education go hand-in-hand in the quantity-quality literature in economics. Higher fertility rates contribute to lower levels of education via QQ trade-off. According to Andrabi and Khwaja (2008), Pakistan is struggling to meet its Millennium Development Goals relating to education for all, with the lowest literacy rate of 44% in South Asia. Education in Pakistan is not completely subsidized, and a large part of education expenses are paid by the parents. There are several types of education systems running parallel in the country.[5] The main distinction is based on ownership (private or public) of the school and medium of instruction (English or

[4] The primary religion is Islam and ninety-seven percent of Pakistan's population is Muslim. Religiosity may vary by ethnicity but such information is not available.

[5] I do not consider the Madrasa system (Islamic seminaries providing religious education) in this analysis.

Urdu) at school.[6] Public and Urdu medium schools are cheaper than private and English medium schools, and the quality of education provided in private schools is considered superior to that provided at public schools. Private schools charge different fees based on their claim to the quality of education they provide. They work more like brands, and the richer a parent is, the more expensive brand in terms of schooling her child wears. While the country's elite class is almost always sending their children to privately owned expensive schools, there is now an increasing trend in the middle class to send their children to reasonably good private schools. One out of three students in Pakistan goes to private schools (Nguyen and Raju, 2014). The parents choose a school according to their financial circumstances. On the other hand, the poor class of the country is most likely to send their children to cheap (in terms of expenditure) public schools. Despite all these changes, Pakistan has the one of the region's lowest primary, secondary, and tertiary enrolment rates. For example, according to the latest figures available at WDI, Pakistan has a net secondary enrolment of 44%, while in India and Bangladesh, it is above 70%. In Iran, it is above 80%. Being a developing country with a high fertility rate, conservative cultural values, orthodox attitudes toward family planning, and diverse education systems makes the quality-quantity trade-off easy to observe. Hence, making Pakistan a suitable and interesting case study for the analysis.

3 Stylized Facts

This section discusses some stylized facts on fertility and how it correlates to the social and economic backgrounds of the women. These facts are drawn from the Pakistan Demographic and Health Survey (PDHS). PDHS is a representative sample providing detailed information on the fertility, education, ethnic and economic background of the women from Pakistan. The first wave for Pakistan is available from 1990, while the latest wave is available for 2017–18. The data is published every five years after a detailed nationwide survey.[7] I measure fertility as the number of children ever born (NCEB) to a woman.[8]

I pool PDHS waves 2013–14 and 2017–18 and consider ever-married women with completed fertility; this gives 7098 observations on women aged 40–49. Some papers consider a group of age 45+ for capturing completed fertility. Limiting the sample to the age group 45–49 reduces the sample size by more than half, making a meaningful

[6] Urdu is the national language of the country.

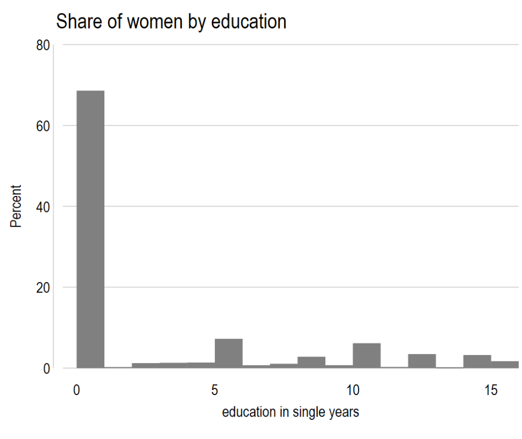
[7] There is a special edition of the PDHS available for 2019; however, this wave is focused on fertility and women's health and lacks the information required for this research. Therefore, I do not use the 2019 wave for my analysis.

[8] Throughout the analysis, the terms fertility, quantity, and the number of children are interchangeably used, and they all imply the number of births per woman.

analysis, especially in the context of norms, very difficult. Social norms are measured by the average fertility of a reference ethnic group, and a smaller group results in Manski's classic "reflection problem" (Manski, 2000). Section 3.3 explains the construction of fertility norms in detail. Furthermore, the average age at first birth is 21.6 years and the fertility span in Pakistan usually ends around the early 40s. Only 4% of the women were above 30 (only 15 women were between 41–44) at the time of first birth, while no one gave birth at 45+, which makes including 40–44 years old women in the completed fertility group a reasonable choice. I ignore childless women as they form only 3% of the sample, and there is no information on whether it is voluntary or natural sterility. The women belong to six majority ethnic groups: 1) Punjabi, 2) Sindhi, 3) Pakhtoon, 4) Baloch, 5) Urdu speaking, and 6) Saraiki. There are also several minority ethnicities, such as Baruhi, Hindko, Kohistani, etc. I included them in a group labeled "Other" in the analysis. A detailed sample profile is presented in table 2.

3.1 Fertility by education

The country is ridden by low levels of education. A whopping 67.06% of the women in the sample have not received any formal education, only about 4% of the women have tertiary education (13 years of schooling or more), the rest of the women have education between 1 to 12 school years. Figure 1 shows the share of the sample population by education. The mean education is less than three years. Figure 2 shows the average fertility by education. The figure shows a negative correlation between fertility and education. The women in the least educated groups have, on average, between 6–7 children. In comparison, the women with 16 years of schooling (Masters's degree in Pakistan's schooling system) have, on average three children.



Note: The figure shows the distribution of ever married women aged 40–49, by years of schooling.
Source: author's calculations using PDHS (2012–13, 2017–18).

Figure 1: Distribution of women by years of schooling

Notes: The figure shows the average fertility rates by years of schooling for the ever married women aged 40–49. Source: author's calculations using PDHS (2012–13, 2017–18).

Figure 2: Average fertility rates by years of schooling of women

3.2 Fertility by child mortality

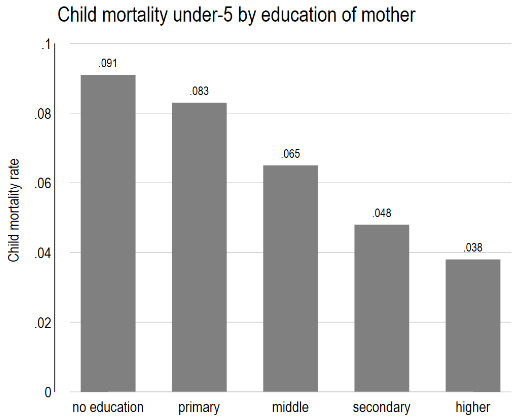
The PDHS 2017–18 reports child mortality under-5 for the ten years before the survey. Child mortality rate under-5 is defined as the number of deaths between birth and fifth birthday per 1000 live births. Figure 3 shows child mortality under-5 by the mother's education level. There are five groups in total with no formal education, primary (5 years of schooling), middle (8 years of schooling), secondary (10 years of schooling), and higher (11+ years of schooling).[9] Child mortality reduces with the mother's education, the mothers with no formal education have the highest child mortality rate of 91 death per 1000 live births. Mothers with tertiary/higher education have the lowest child mortality rates.

Figure 4 shows that fertility is increasing in child mortality. The mothers facing lower child mortality rates have fewer children on average. Child mortality is perfectly correlated with the education of the mother. Nevertheless, the literature provides evidence that child mortality increases fertility owing to replacement and hoarding effects (Montgomery and Cohen, 1998; Palloni and Rafalimanana, 1999; Preston, 1978; Rosenzweig and Schultz, 1983). The first effect causes the mothers to have another child to replace the deceased child. The second effect causes mothers to give birth to more children expecting future mortality. Consequently, child mortality has first-order effects on fertility.

3.3 Fertility by ethnicity/norms

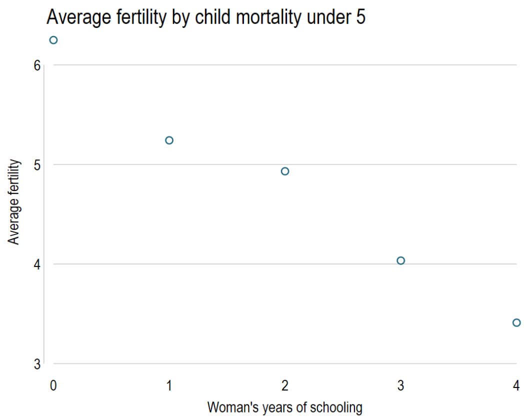
Social norms may affect fertility behavior in society through several channels. Society may stigmatize contraceptives, alienate women or couples who are childless or have fewer children than the average observed per couple in society or put continuous pressure on

[9] In Pakistan's schooling system, secondary means a high school diploma achieved after successfully passing the exam at the end of the ten years of schooling.



Notes: The figure shows the child mortality rates under-5 by the education of the mother. Child mortality is decreasing in education of the mother. The mortality rates are deaths between birth and fifth birthday per 1000 live births. Data on child mortality is taken from PDHS report 2017–18.

Figure 3: Child mortality rates by mother's education



Notes: The figure shows that women facing a higher child mortality rate have higher fertility. The mortality rates are deaths between birth and fifth birthday per 1000 live births. Data on child mortality is taken from PDHS report 2017–18. Fertility rates are calculated using PDHS (2012–13, 2017–18).

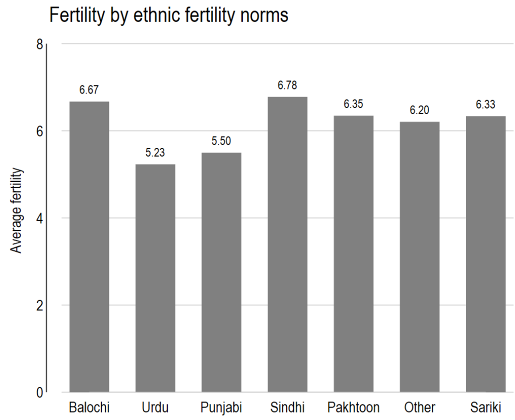
Figure 4: Average fertility by child mortality rates faced by women

couples to procreate and confine the role of women to reproduction. Other than directly dictating fertility behavior, social norms also affect fertility via effects on human capital accumulation and women's labor force participation. Norms may vary between social groups due to ideological differences regarding aspects of life. Generally, groups with similar beliefs and ethnicity interact more with each other, leading to differences in how social norms look across different groups in society. However, it is not easy to disentangle the effect of social norms on fertility from other economic and institutional factors. Here, the notion put forward by Fernández and Fogli (2009) that norms persist over time and space provides a helpful way to capture the effect of norms on fertility. The paper examines the effect of culture on the fertility behavior of second-generation immigrant American women. The fertility rate of the past generation of women from the country of origin of immigrants is used to proxy culture. Stichnoth and Yeter (2013) and De Silva and Tenreyro (2020) also use the fertility of the previous generation as a measure of norms. Constructing norms based on the previous generation's fertility mitigates the problems arising from time-specific correlated effects (such as physical, institutional, and economic environment) and the endogeneity between norms and fertility.

Following the same idea, I use data from PDHS 1990–91 to construct a proxy for social norms. First, I construct seven social groups based on the ethnicity of the women. In the next step, I compute the average completed fertility rates for each group and assign the value to the corresponding ethnicity in the pooled dataset of 2013–14 and 2017–2018. These rates reflect cultural attitudes towards women and fertility. If attitudes persist over time, the average fertility rates of 1990–91 cohort will capture the effect of cultural ideologies on the fertility behavior of the women in current cohorts. The mother tongue differs across ethnicities in Pakistan. Therefore, the ethnic fertility norms also capture the effect of linguistic heterogeneity. However, the spillover effects of the norms of one ethnic group on the other groups are ignored to keep the theoretical model tractable.

Pakistan has an endogamous and consanguineously espousing culture. According to Iqbal et al. (2022), 63% of all marriages between 1990 and 2018 were consanguineous marriages. This implies cultural inertia due to a lack of exposure to new cultures and ideologies. The women are subject to strict norms and traditions that are preserved over generations due to intra-family marriages. The study finds a positive association between consanguineous marriages and fertility. Safdar et al. (2022) also provide evidence of endogamy in the largest province Punjab. This evidence suggests that women are likely to interact with women from the same ethnic groups. These interactions will have an impact on the fertility behavior of the women.

Figure 5 shows the average fertility by ethnicity. The groups with higher fertility norms (the bars on the left) show a lower fertility rate. In Balochistan, the fertility rate has increased over time despite relatively lower norms. Balochistan is the poorest province with the lowest level of economic growth. The situation in Balochistan could be a combined result of fertility norms and extreme poverty. Table 1 gives the average fertility of the seven social groups, the corresponding fertility norms, and their share in the sample population. Despite slight variations in the fertility norms, an empirical exercise in section 5.3.1 shows a significant positive correlation between social norms and fertility. Although an empirical exercise may help explain between-ethnicities variation in fertility, a theoretical model is required to quantify the effect of norms on fertility within an ethnic group.



Notes: The number at the top of each bar shows average fertility rates for given ethnicity. Source: author's calculations using PDHS (2012–12, 2017–18).

Figure 5: Average fertility by ethnicity

Table 1: Average fertility and corresponding social norms as captured by previous cohort's fertility rates

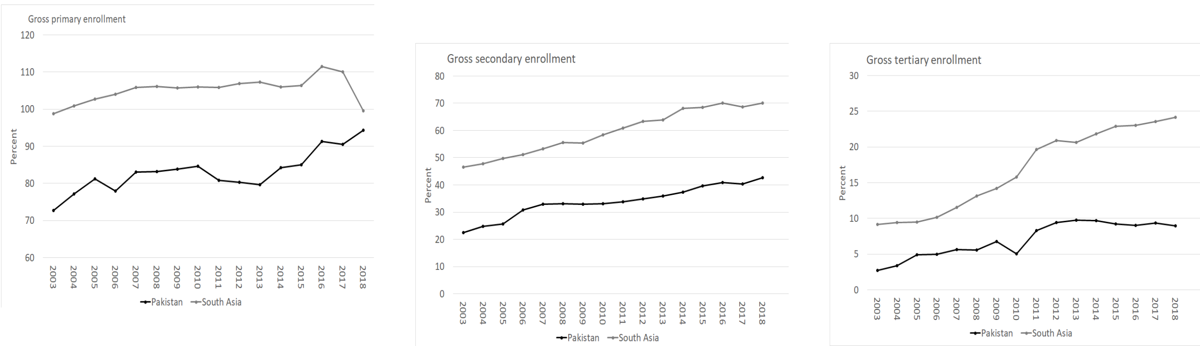
Group	Fertility norm	Average fertility	Population share	Number of observations
Baloch	6.269	6.669	2.87%	204
Urdu speaking	6.320	5.229	15.19%	1078
Punjabi	6.341	5.495	38.49%	2732
Sindhi	6.415	6.669	8.95%	635
Pakhtoon	6.719	6.345	13.42%	952
Saraiki	7.199	6.334	13.29%	553
Other	6.772	6.204	7.80%	944

Note: Source: Fertility rates are author's calculations using pooled PDHS data (2012–13, 2017–18). The population shares are calculated using sample weights to represent the sahre of the group in the population. Total number of observations are 7098. The fertility norms are constructed using PDHS data 1990–91.

3.4 Education

Section 3.1 provides a glimpse of women's education, but PDHS contains no information on parents' investments in children's education. Information on the investments in the children's education is not available, specifically by the social and economic backgrounds of the mothers. The annual government expenditure on education remains around 3 percent of the GDP.

On an aggregate level, figures are available for school enrolments. Figure 6 shows the primary, secondary, and tertiary enrolments between 1990–2018, as reported by WDI (2021). The figure compares Pakistan's primary, secondary, and tertiary enrolment rates to the average observed in South Asia from 2003 to 2018. The enrolment rates on all three levels have remained consistently well below the regional average. This trend shows a low investment in human capital, particularly in children's education. The low human capital investments could be related to low economic development, child mortality, and fertility norms. A low level of development directly limits parents' resources available for investment in the children. For women, it also affects the opportunity cost of having a child. Women may want to have more children rather than work at lower wage to avoid social costs associated with lower fertility. On the other hand, social norms pressure women to have more children, reducing the investment in children's education via a quantity–quality trade–off. Higher child mortality rates affect education via a similar trade–off mechanism.



Notes: The figures show a comparison of school enrolment rates at primary, secondary and tertiary level between Pakistan and South Asia. The data is taken from WDI.

Figure 6: School enrolment rates: Pakistan vs. South Asia

In the next section, I develop a theoretical model that provides potential explanation for the causal effect of child mortality, education of women and social norms on QQ decisions.

4 Theoretical Framework

I build on the QQ model developed by De la Croix and Doepke (2003) and extend it by introducing fertility norms and child mortality. Mothers bear the full responsibility of bearing and rearing a child, while a father's contributions are monetary. Society punishes households for deviation from socially acceptable fertility by inflicting social costs. Furthermore, the mothers have different child mortality rates, which correlate with their education level.

Households decide on the mother's labor supply, the number of births given the exogenous survival probability of a child, the investment in the education of surviving children, and household consumption. The goal of the theory is to understand better how the mother's education, compared to fertility norms and child mortality, affects the QQ decisions of households. First, the structural parameters of the model are estimated using indirect inference. Then, different model variants are simulated to disentangle the impact of the mothers' education, child mortality, and the norms on QQ decisions. Finally, I conduct several counterfactual experiments to understand the relevance of alternative

Table 2: Descriptive Statistics

Variable	Mean	Sd	Min	Max
Total number of children ever born (NCEB)	5.885	2.559	0	19
Child mortality under-5	0.082	0.017	0.038	0.091
Years of Schooling women	2.657	4.380	0	16
Years of Schooling husband	5.565	5.194	0	16
Age at first birth	21.411	4.513	12	44
Terminated pregnancy	0.437	0.496	0	1
Fertility by education of women				
No formal education	6.486	2.556	1	19
1–5 years of schooling	5.385	2.330	1	13
6–12 years of schooling	4.425	1.768	1	14
13–16 years of schooling	3.201	1.202	1	8
Fertility by ethnicity of women				
Punjabi	5.495	2.283	1	15
Sindhi	6.779	2.920	1	16
Baloch	6.669	2.837	1	14
Pakhtoon	6.345	2.371	1	19
Urdu Speaking	5.229	2.531	1	14
Saraiki	6.334	2.262	1	14
Others	6.204	2.852	1	14
Fertility by region				
Punjab	5.716	2.443	1	15
Sindh	5.957	2.866	1	16
Balochistan	6.700	2.806	1	19
KPK	6.199	2.323	1	14
Fertility by poverty level				
Poorest	6.816	2.733	1	19
Poorer	6.624	2.560	1	14
Middle	6.180	2.380	1	16
Rich	5.714	2.584	1	14
Richest	4.648	2.010	1	16

Source: Pakistan Demographic and Health Survey. 2012–13, 2017–18
Total number of observations= 7098 ever-marreid women age 40–49

education/population policies for welfare and the impact of norms and child mortality on the cost-effectiveness of policies.

4.1 Households

Consider a hypothetical economy populated by heterogeneous households. Each household i consists of a (heterosexual) couple and their children. The household is characterized by four state variables: the wage of the woman w_i, the income of her spouse R_i, survival probability s_i of the child, and the fertility norms N_i that the household observes. Both w_i and s_i are increasing in women's education. Households maximize utility by choosing the level of consumption c_i, the number of births n_i, and the total units of education e_i purchased for the surviving children $(s_i \times n_i)$. Education has a cost p per unit. The investment in the education of children leads to a better quality of children (higher human capital) and yields positive utility to parents. The utility function of the household is given as follows:

$$U_i = \log c_i + \theta \log[(n_i - \pi N_i) + a_1] + \lambda \log[e_i + a_2] \tag{1}$$

where π is the intensity of the effect of the norms N_i and a_1 and a_2 are auxiliary parameters with the restrictions $a_1 \geq \frac{1}{\phi}$ and $a_2 \geq 1$. They are added to the model to allow for fertility below norms and zero investment in children's education. I assume a warm-glow nature of the parent's investment in children's education; therefore, λ is the warm-glow parameter associated with quality. θ is the preference parameter for the quantity. Note that households maximize utility in number of births, attempting to attain the desired number of surviving children.

This specification is similar to *keeping up with the Joneses* type, introduced by Gali (1994), where individual utility depends on the distance from a reference point. In those models, the agents compete with an aspirational group. However, in the specification in eq. (1), households do not compete with an aspirational group; instead, they can deviate from the average social behavior N_i at a cost πN_i. Society levies this cost on all households to ensure high fertility rates. This formulation allows capturing the fact that societies that prefer higher fertility inflict an asymmetric cost on households above and below the norms. In such a society, childlessness is the most expensive in terms of social cost. Assuming symmetric costs in a society that favors higher fertility can lead to an overestimation of childlessness or an underestimation of fertility along the intensive margin.[10] Households with higher fertility pay a lower cost of deviation from norms. However, they compromise the quality of children, and thus, they are not necessarily better off than those with lower fertility. Kim et al. (2021) use a similar specification when modeling education externality.

The total available time to women in the households is normalized to 1. There is a fixed time cost ϕ of bearing and rearing a child who survives with probability s_i. It is entirely borne by the mother.[11] Since s_i is positively correlated with the education/wage

[10] Assuming a symmetric cost of deviation from norms does not permit a closed-form solution. The asymmetric cost of deviation from norms more realistically captures the behavior of a society that prefers higher fertility and provides analytical convenience.

[11] One could also assume two components of ϕ, a cost of birth and an additional component for rearing a surviving child, as in Doepke (2005). However, identifying the two components separately is only meaningful in the presence of endogenous child mortality. In the case of endogenous mortality, the time of cost of child-rearing can be estimated using child mortality rates as target moments.

of the women, a more educated woman faces a lower child mortality rate. This assumption implies a differential cost of child-rearing across mothers from different education/wage groups. The household decides the allocation of a woman's time between labor supply and childbearing/rearing. Men work full-time and bring home an income R_i. The budget constraint of the household is given as follows:

$$c_i = w_i(1 - \phi n_i s_i) - e_i p + R_i \tag{2}$$

The other set of restrictions is given as follows:

$$\begin{aligned} 0 & \leq n_i \leq \frac{1}{\phi s_i} \\ e_i & \left\{ \begin{array}{ll} \geq 0, & \forall n_i > 0 \\ = 0, & \forall n_i = 0 \end{array} \right\} \end{aligned} \tag{3}$$

Where $\frac{1}{\phi s_i}$ is the maximum number of birth per woman given the time constraint. It is referred to as full specialization throughout the text. The optimization problem of the household is given as follows:

$$\max_{n_i, e_i, c_i} U_i[n_i, e_i, c_i] \quad \text{s.t.} \quad (2) \quad (3)$$

There is a trade-off between quantity and quality; as n_i increases, the household's net income $(w_i(1 - \phi n_i s_i) + R_i)$ decreases, leading to fewer resources available for investment in the education of children. Similarly, if w_i increases, the opportunity cost of having a child increases. Since both quantity and quality are normal goods, an increase in the price of quantity leads to the substitution of quality for quantity. Utility maximization yields the following result:

Proposition 1 *There exist thresholds w_I, w_{II}, w_{III}, w_{IV}, w_V and $\overline{R}$ such that if*

1. *$Max[w_I, w_{II}] \leq w_i \leq w_{III}$, then $\frac{1}{\phi s_i} > n_i \geq 0$, $e_i \geq 0$ and $R_i \leq \overline{R}$ (Interior regime)*
2. *$w_V \leq w_i \leq Min[w_{IV}, w_{II}]$ and $R_i \leq \overline{R}$, then $\frac{1}{\phi s_i} \geq n_i > 0$, $e_i = 0$ (No quality)*
3. *$w_i \leq w_V$ and $R_i \leq \overline{R}$, then $n_i = \frac{1}{\phi s_i}$ and $e_i = 0$ (Full specialization without quality)*
4. *$w_i \geq Min[w_{III}, w_{IV}]$, then $n_i = 0$ and $e_i = 0$ (Childlessness)*
5. *$R_i \geq \overline{R}$ and $w_i \leq w_I$, then $n_i = \frac{1}{\phi s_i}$ and $e_i \geq 0$ (Full specialization with quality)*

Proof: See Appendix A.

Given the parameters of models $\{\theta, \lambda, \phi, \pi, a_1, a_2\}$ and variables $\{w_i, s_i, R_i, N_i\}$, the thresholds in the proposition are defined as follows:

$$
\begin{array}{llll}
w_I & = \frac{a_2p+R_i\theta}{1+\lambda+s_i(1+\lambda)(a_1-\pi N_i)\phi} & w_{II} = \frac{a_2p(1+\theta)-R_i\lambda}{\lambda+s_i\lambda(a_1-\pi N_i)\phi} \\
w_{III} & = -\frac{(a_2p+R_i)\theta}{\theta-s_i(1+\lambda)(a_1-\pi N_i)\phi} & w_{IV} = -\frac{R_i\theta}{\theta-s_i(a_1-\pi N_i)\phi} \\
w_V & = \frac{R_i\theta}{1+s_i(a_1-\pi N_i)\phi} & \overline{R} = \frac{pa_2}{\lambda}
\end{array}
$$

The regimes are briefly discussed below, for details refer to appendix A.

4.2 Quantity-Quality Regimes

Interior regime: When $\frac{1}{\phi s_i} > n_i > 0, e_i \geq 0$, the households are in the interior regime, and the QQ are given as follows:

$$
n_i^I \equiv n_i = \frac{\theta(a_2p + R_i + w_i) - s_i w_i(1+\lambda)(a_1 - \pi N_i)\phi}{s_i w_i(1+\theta+\lambda)\phi} \tag{4}
$$

$$
e_i^I \equiv e_i = \frac{-a_2p(1+\theta) + \lambda(R_i + w_i + s_i w_i(a_1 - \pi N_i)\phi)}{p(1+\theta+\lambda)} \tag{5}
$$

Note that;

$$
\left\{ \frac{\partial n_i^I}{\partial s_i} = -\frac{(a_2p + R_i + w_i)\theta}{{s_i}^2(1+\lambda+\theta)\phi} \right\} < 0
$$

The model captures the positive correlation between the number of births and child mortality.

No quality: When $\frac{1}{\phi s_i} > n_i > 0, e_i = 0$, then n_i is defined as follows:

$$
n_i^{NQ} \equiv n_i = \frac{R_i\theta + w_i\theta - s_i(a_1 w_i - \pi N_i w_i)\phi}{s_i\phi(1+\theta)w_i} \tag{6}
$$

Full Specialization without quality: In this regime, procreating the maximum number of children ($\frac{1}{\phi s_i}$) is the optimal decision for households. For this regime, R_i must be below $\overline{R}$; otherwise, wages do not matter for investment in children's education.

Childlessness*:* In the case of opportunity-driven childlessness, both $e_i, n_i = 0$. In this regime, the value of the wages is such that the opportunity cost of having children is very high, and households choose childlessness.

Full specialization with quality: In this regime, households can have very low or zero wages but $R_i > \overline{R}$. Thus, it is possible to have both full specialization and investment in children's human capital. In this case, the investment in the education of children is independent of the wage of the mother and is given as follows:

$$e_i^F \equiv e_i = -\frac{a_2 p - R_i \lambda}{p + p\lambda} \tag{7}$$

5 Estimation of Structural Parameters

To parametrize the model, I assume seven ethnic groups in the fictional economy with differential fertility norms, as observed in the PDHS dataset. Furthermore, I distinguish women by years of schooling. The least educated women observed in the data have no formal schooling, while the most educated women have 16 years of schooling. This distinction gives 17 groups of women by education. In total, the fictional economy has $17 \times 7 = 119$ demographic groups. The groups by child mortality do not add to the dimensions of the demographic groups, as child mortality is perfectly correlated with education. The model now has 7 structural parameters $\{\phi, a_1, a_2, p, \theta, \lambda, \pi\}$ and 4 exogenous state variables $\{w_i, N_i, s_i, R_i\}$. I set a couple of parameters a priori while the remaining parameters are estimated.

5.1 Preset parameters and state variables

The ϕ is set at 0.0526. This value is based on the maximum number of births by a woman observed in the data. The auxiliary parameter a_1 is set at $\frac{1}{\phi}$. The ethnic norms in table 1 are used for N_i. The survival probability of a child for each group is computed by subtracting the child mortality rate from 1. The child mortality rates by the mother's education (discussed in section 3.2) are taken from PDHS. I assume a single average value of R for all groups. This choice allows us to keep the focus on women's education, norms, and child mortality and also provides computational convenience. Once the parameters are estimated, it is straightforward to simulate the model for different values of R_i to evaluate the impact of the spouse's income on QQ decisions. Hence, R is treated as a parameter and estimated with other structural parameters.

5.2 Wages

There is no information on women's wages in PDHS but only on their education. I normalize the wage of women without any formal education to 1. For the rest of the sixteen groups, I use the following relationship to estimate wages (following De la Croix and Delavallade (2018)):

$$w_i = exp \left\{ \begin{array}{l} \text{(1-5 school years)} \times \rho_1 + \\ \text{(6-12 school years)} \times \rho_2 + \\ \text{(13-16 school years)} \times \rho_3 \end{array} \right\} \tag{8}$$

Where ρ_i is the Mincer rate of return to education, which varies across primary (1-5 years of schooling) (ρ_1), secondary (6-12 years of schooling) (ρ_2) and tertiary (13-16 years of schooling) (ρ_3) levels.

5.3 Indirect inference

Now, there is a vector of 9 structural parameters,$\{p, R, \theta, \lambda, \pi, \rho_1, \rho_2, \rho_3\}$ to be estimated. For this purpose, I use the PDHS dataset discussed in section (3). It has detailed information on women's fertility, education, child mortality rates, and ethnicity. The fictional economy has 119 demographic groups. However, in the data we do not observe women in all education groups for all ethnicities. To retrieve information on the missing values, I employ indirect inference. The method generates empirical moments using an auxiliary econometric model for all 119 demographic groups. These empirical moments are used as the target for estimating structural parameters. The next section discusses the econometric model used to generate target moments.

5.3.1 Econometric model

I use Poisson Regression Model (PRM) with the following specification for the auxiliary model:

$$E[n_i|X_i] = e^{X_i\beta} \tag{9}$$

β is the vector of estimated parameters and $\epsilon = 2.71828$ is the mathematical constant. X_i is the vector of the covariates. It includes the fertility norms by ethnicity, years of schooling of the women, spouse's education, region fixed effects, indicator variables for the sex of the first born child, assets, and living standards (measure by a wealth index in PDHS). The estimation results are presented in table 12 in appendix B. The second column has the coefficients of PRM in terms of incident rate ratio (IRR), the third column shows the IRR converted into percentage change, and the last column has the standard errors. The reference group is the poorest married female aged 40–44, lives in the urban area of Balochistan, owns no assets, and her firstborn is a boy.

Results and target moments: The results show that the fertility rate increases by more than 5% with a unit increase in norms. A significant positive correlation between norms and fertility reflects the well-studied hypothesis that human behavior is affected by social interactions (Guiso et al., 2006; Manski, 1993, 2000; Munshi and Myaux, 2006; Spolaore and Wacziarg, 2022). On the other hand, women's education significantly reduces the fertility rate by 3.4% for each additional year of schooling.

I use the auxiliary model to predict fertility rates for women by ethnicity and schooling. The fertility rates predicted for 119 demographic groups are used as target moments. The moments are presented in table 13 in the appendix B. I conduct several robustness checks to stress that there is a robust positive correlation between norms and fertility. I do not use the child mortality rate in the baseline model as it is perfectly correlated with education. In the sensitivity analysis, the results are robust to child mortality rate, terminated pregnancy experience, husband's age, year fixed effects, age at first birth, and preference for a son. The details are discussed in the appendix C.

5.4 Education expenditure

There is no information available on the education expenditure of children in PDHS. Therefore, I use the aggregate private expenditure in Pakistan as the target moment to guide the estimation of the quality-related structural parameters. Once parametrized, the model assists in retrieving data on the investments in the children's education by the mother's socio-economic background. I collect data from different sources to compute aggregate private expenditure on education. The Pakistan Social and Living Standards Measurement Survey (PSLM, 2015, 2020) reports for 2013–14 and 2018–19 provide information on the household's average annual expenditure per pupil on primary, secondary, and tertiary schooling based on fees, admission, and other expenditures.[12] Pakistan Education Statistics (2014, 2020) provide national level data on the annual enrolments in primary, secondary, and tertiary education for years 2012–13 and 2017–18. I use the information from the two sources to compute the total private expenditure on education ($\sum \hat{e}$) in Pakistan. I then calculate it as the share of GDP spent on education ($\hat{E} = \frac{\sum \hat{e}}{GDP}$) for the respective years. The average of the two years yields a value of 1.12%. The model is simulated such that the share of income spent on education expenditure in the fictional economy equals 1.12%.[13] Table (14) in appendix B shows the data on the education

[12] The reports do not link the expenditures to the mother's education and ethnicity.

[13] The Household Integrated Economic Survey (HIES (2020)) Pakistan, suggests that households spent about 3.7% of the total monthly consumption expenditure on education in 2018–19. However, the HIES survey is based on a smaller sample of 27000 households and drops out several areas of the country (especially the poorer/remote regions) from the survey. On the contrary, the enrolment data is based on statistics from all over the country.

expenditure collected from the above mentioned sources.

5.5 Minimum distance procedure

I use 119 fertility and one education moment as the target to estimate the structural parameters using the minimum distance procedure. This procedure solves for the vector of structural parameters that minimizes the distance between the empirical moments and the corresponding moments implied by the theoretical model. The unique role of parameters $\{\theta, \pi, \lambda, R, p\}$ in identifying the QQ is presented in appendix D. The objective function to minimize is given as follows:

$$\min_{\theta,\lambda,\pi,\rho_1,\rho_2,\rho_3,p,R,a_2} \left\{ \sum_{i=1}^{119} \left(\frac{\hat{n}_i - n_i'}{\hat{n}_i} \right)^2 + \chi \left(\frac{\frac{\sum_{i=1}^{119} e_i' p}{\sum_{i=1}^{119} w_i(1-\phi s_i n_i')+R)} - \hat{E}}{\hat{E}} \right)^2 \right\} \tag{10}$$

$\hat{n_i}, \hat{E}$ denote the empirical moments, while n_i' and e_i' are the corresponding quantity and quality moments, respectively, as implied by the theoretical model. The second term minimizes the error between Pakistan's private education expenditure as the share of GDP and the share of the total income of the fictional economy spent on education. χ is the weight imposed on the education moment to ensure the optimization routine does not ignore the education moment. The empirical moments are used as weights, this leads to minimizing the square of percentage deviations. Figure (7) shows the fit of the structural model to the data. The first panel shows the model's fit to the target moments, while the second panel shows the fit to non-target moments. For the non-target moments, I compute fertility rates using the auxiliary model while holding all covariates (including norms) except for education at the mean. I then simulate the theoretical model to see the fit with the non-target moments. The match is reasonable and provides internal validity. Table 15 in appendix B presents the non-target moment used for internal validity of the model.

Table (3) shows the estimation results. The fertility preference parameter θ has a value of 0.377, which is lower than the value of the preference parameter for education λ(0.425). However, notice that π, capturing the intensity of the effect of norms, has a value of 0.319. These values imply that though society may have a stronger preference for quality, quantity has additional pressure from norms. Given the data constraints, it is difficult to model an education norm, but the estimation results suggest that the quality parameter will respond to such a modeling choice. The education norms in Pakistan are more likely to be gender specific and, in particular, discourage female education. This also is a direct implication of the high fertility norms, which restrict women's role to care for the household and childbearing and rearing. Currently, the education preference

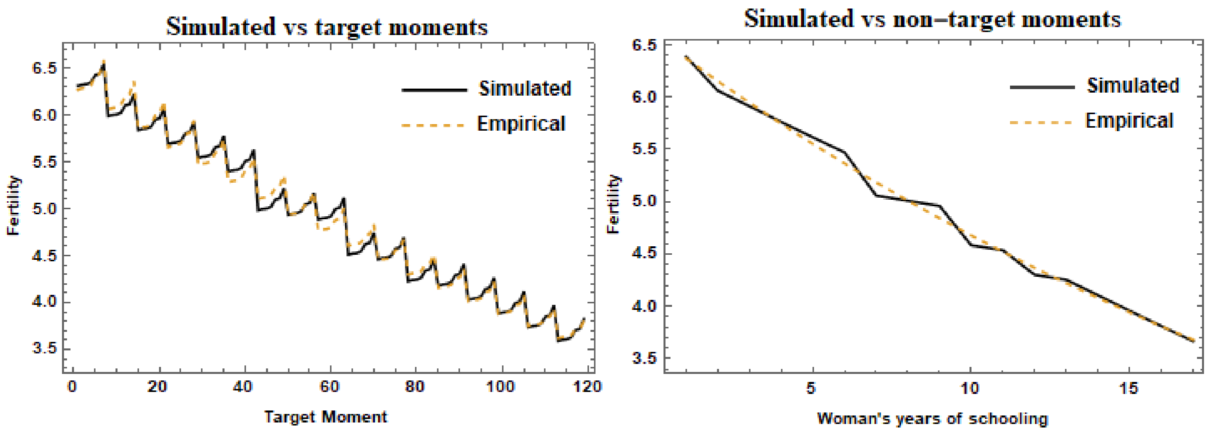


Figure 7: Simulated moments versus empirical moments.

parameter also captures the effect of education norms and hence is downward biased. Introducing education norms will result in an education preference parameter larger than its current estimated value. The education norm parameter will capture the effect of norms on education. Such a setup will allow to separate the effect of education preferences from education norms.

The values of the Mincer rates of returns to education ρ_i are very low, corresponding to the level of economic development and the country's social norms. The literature on returns to the capital for Pakistan suggests much higher returns to human capital. The average rate of return in literature for an additional year of schooling is between $5-7\%$ (Hyder, 2007; Jamal and Khan, 2003; Khan and Toor, 2003; Nasir and Nazli, 2000). Aslam (2009) reports a return of 13–18 percent for women, while a more recent study by Jamal (2015) reports an average return of 5 percent for each additional year of schooling using the Pakistan Labour Force Survey (PLFS, 2013) for a period of 1990–2013. My estimates are not directly comparable with these estimates as none of the studies consider the role of social norms. Second and more important, all papers estimate the returns conditional on labor force participation. In contrast, my estimates reflect both economic and social returns to education. I do not observe whether the women worked during their childbearing period. Information is available on employment for the last 12 months. Only 24 percent of the women report having worked in the past 12 months. This figure is consistent with aggregate figures by WDI, reporting a female labor force participation rate of 23 and 21 percent for 2014 and 2018, respectively. Thus the estimated mincer rates capture the lower attachment of women to the labor market due to a stigma attached to working women. This situation points to the conservative norms the society has in place for gender roles. Women are assumed to bear children and take care of the household. When women join the labor force, they defy such norms leading to a social cost that reduces the overall implicit returns to human capital.

The value of p is estimated at 1.283, higher than the minimum wage of 1 in the fictional economy. Education is expensive relative to the available resources to parents; this signals that poverty could be the leading cause of low investment in education. R is estimated at 2.262, much higher than the highest wage (1.127) for women, suggesting that the husband generally is the household's breadwinner.

Table 3: Structural parameters

Parameter	Definition	Value	Source
ϕ	time cost of bearing and rearing a surviving child	0.0526	inverse of maximum number of births to a mother observed in data
a_1	auxiliary	$\frac{1}{\phi}$	
a_2	auxiliary	0.976	estimated to match the moments
θ	preference parameter for quantity	0.377	estimated to match the moments
λ	preference parameter for quality	0.425	estimated to match the moments
π	social cost parameter for norms	0.319	estimated to match the moments
ρ_1	Mincer rate of return to primary schooling	0.010	estimated to match the moments
ρ_2	Mincer rate of return to secondary schooling	0.004	estimated to match the moments
ρ_3	Mincer rate of return to tertiary schooling	0.011	estimated to match the moments
p	price per unit of education	1.283	estimated to match the moments
R	income of spouse	2.262	estimated to match the moments

Note: The table shows the structural parameters estimated by minimizing distance between target and simulated moments.

6 Quantitative Analysis

This section discusses the details of the quantitative analysis. The quantitative analysis has three objectives: 1) retrieve the information on the quality of children, 2) assess the effect of norms, opportunity cost of women, and child mortality on QQ decisions, and 3) evaluate the relevance of norms and child mortality for policy goals. Nonetheless, the results in the following sections should be taken with a pinch of salt, mainly for two reasons; 1) I abstract from child labor which will affect the opportunity cost of having children hence, the QQ trade-off, 2) I develop and estimate a unitary model, in contrast to a collective model where bargaining position of the women affects the decision making in the household. Unfortunately, both limitations cannot be addressed due to data constraints.[14] Furthermore, I ignore endogenous labor force participation decisions. Therefore, these results provide an upper bound on different policy effects when both partners in the household are in perfect harmony regarding tastes and preferences for QQ, as is assumed in a traditional unitary model. Last, all the results hold in a static partial equilibrium. The dynamic effects of changing norms and mortality on future generations are beyond the scope of this research.

[14]Neither the data on child labor nor time use (individual consumption) is available for households. The data on time use (individual consumption) is required to estimate the bargaining positions of the partners in a couple.

6.1 Quality of children

To retrieve data on the quality, I simulate the structural model and compute quality as the investment in education as a percentage of the household income ($E_i = \frac{p*e_i}{w_i(1-\phi s_i n_i)+R}*100$). The results for the benchmark case are shown in table (4). The values are averaged over all ethnic groups in the same education category. The first column shows the woman's education, the second and third columns show her wage and child mortality rate, respectively, the fourth column shows the quantity, the fifth column shows the quality, and the last column shows the absolute value of the QQ trade-off. The results show that the households with the highest wage of women spend the most on children's education, amounting to approximately 2.2% of household income; this group also has the lowest fertility of approximately 3.7 children. The highest fertility is about 6.4 children, observed in households with uneducated women. These households invest approximately 0.1 percent of their household income in their children's education. The detailed results by women's ethnicity and education in table 22 in appendix E show that quantity is increasing while the quality is decreasing in norms and child mortality.

The QQ trade-off is measured as the percentage change in quality for a one percent change in quantity with each additional year of women's schooling. When the woman's wage increases, the opportunity cost of raising a surviving child ($w_i \phi s_i$) increases, and the households substitute quality for quantity. The QQ trade-off is decreasing in education. The least educated women trade-off the highest amount of quantity for quality, while the more educated women show a smaller QQ trade-off. This result is in line with the recent literature that suggests that QQ trade-off weakens at high levels of education/income (Doepke et al., 2022; Hazan and Zoabi, 2014). On average, a one percent decrease in quantity leads to a 9 percent increase in quality. The results are expressed in absolute values. Note that the estimated structural parameters yield an interior regime for all women. Given the lack of information on household-specific quality, it is impossible to estimate the structural parameters matching the share of all the regimes discussed in section 4. Besides, the childless and full-specialization regimes are only relevant for a negligible fraction of the population. The data shows that only 3 percent of women are childless, while only about 1 percent have more than 12 children. The interior regime appears to be the dominant regime for the representative women in different demographic groups.

Table 23 in appendix E shows the correlation coefficients between quantity, quality, norms, child mortality and women's education. The correlation is negative and strong between; quantity-quality, quality-child mortality, and quantity-child mortality, while it is weak between quantity-norms and quality-norms. There is a strong negative correlation between women's education and QQ trade-off.

Table 4: Quantity and quality across households with heterogeneous socio-economic backgrounds

Years of schooling	Wage	Child mortality	Quantity	Quality	QQ trade-off
0	1.000	0.091	6.390	0.077	—
1	1.0101	0.083	6.068	0.277	51.478
2	1.020	0.083	5.917	0.421	20.980
3	1.031	0.083	5.769	0.565	13.606
4	1.041	0.083	5.622	0.709	9.986
5	1.051	0.083	5.476	0.853	7.834
6	1.055	5.063	5.065	1.030	2.756
7	1.059	0.065	5.013	1.081	5.002
8	1.063	0.065	4.963	1.132	4.737
9	1.066	0.048	4.588	1.302	1.974
10	1.070	0.048	4.539	1.352	3.693
11	1.074	0.038	4.305	1.472	1.722
12	1.078	0.038	4.258	1.523	3.117
13	1.090	0.038	4.108	1.683	3.002
14	1.102	0.038	3.960	1.843	2.649
15	1.114	0.038	3.814	2.004	2.357
16	1.127	0.038	3.670	2.164	2.111
Mean	1.062	0.081	4.913	1.146	9.064

Note: The table shows the household's QQ averaged across ethnicities belonging to the same education group. The detailed results by education and ethnicity are given in appendix E in table 22. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman. The QQ trade-off is measured as percentage change in quality for a percentage change in quantity with each additional year of schooling of the woman.

6.2 Dissecting the variation

In this section, I quantify the contribution of women's education, norms, and child mortality to variation in QQ between social groups and their impact on within-group QQ decisions.

6.2.1 Contribution of norms, child mortality and women's education to between groups variation

The maximum quantity-quality difference between the households with the most and least educated women is 2.7 children and about 1.13 percentage points, respectively. These women belong to the social groups with the lowest and highest fertility norms (child mortality), respectively. The model is simulated in several steps to estimate the contribution of norms, opportunity cost, and child mortality to the variation in QQ across households. In the first step, I set the child mortality for the households with the most educated woman equal to those with the least educated woman keeping, w, N at the observed level. This setting yields the QQ for a hypothetical household where women have the highest education and lowest fertility norms but face highest child mortality rate (equivalently, lowest child survival probability s_i). The change in QQ thus yields the contribution of child mortality to the QQ variation between groups.

The fertility norms are set at the highest level in the second step. We now have a woman with the highest; wage, child mortality, and fertility norms. This exercise gives the contribution of norms to the QQ variation. In the third step, the wage is adjusted to that of the least educated woman to assess the impact of opportunity costs on the QQ decisions of the households. Table (5) shows the results; when the most educated woman is exposed to the highest child mortality, fertility increases by 0.993 children, while quality decreases by 0.476 percentage points. As both norms and child mortality are at the highest level, fertility increases by 0.235 children, and quality decreases by 0.114. When the wage also declines to that of the least educated woman, fertility increases further by 1.729 children, while quality decreases by 1.725 percentage points.

Table 5: Role of opportunity cost, child mortality and norms in explaining variation in quantity and quality of children

At values	Quantity	Quality	Δ quantity	Δ quality
Norm= 6.269, $w = 1.127$, Child mortality= 0.038	3.592	2.202	–	–
Norm = 6.269, $w = 1.127$, Child mortality= 0.091	4.585	1.840	+0.993	-0.476
Norm= 7.199, $w = 1.127$, Child mortality= 0.091	4.820	1.726	+0.235	-0.114
$N = 7.199$, $w = 1.000$, Child mortality= 0.091	6.549	0.001	+1.729	-1.725

Note: The table shows the contribution of fertility norms, child mortality and opportunity cost in explaining QQ variation between demographic groups. Quantity is the number of births per woman while quality is the expenditure on the education of children expressed as a percentage of household income. Δ quantity, expresses the change in number of births while Δ quality, expresses the percentage points change in quality.

Figure (8) shows that fertility norms explain only 8% of the fertility differentials between households, while they explain 5% of the difference in the quality of children. Child mortality rates contribute to 34% of the variation in quantity and 17% of the variation in quality. Wage differentials among women are the main reason for the observed variation in QQ between groups. They account for 58% of the variation in quantity and 78% of the variation in quality.

It is reasonable to ask, how might the results change if the model was estimated to match quality gradient? A plausible answer is that it would allow matching households in different regimes. However, it is observed in the data that only about 3% of women are childless, while less than 0.05% have the maximum number of children. The remaining 94% could be either in the interior or in no quality regime. It is most likely that a vast majority of the households are in the interior regime. Assuming that the interior regime is the dominant regime, the prediction about quality may change slightly quantitatively if we are to match the quality gradient. Nevertheless, it is less likely that this would affect the relative contribution of norms and child mortality to variation in quantity-quality across households.

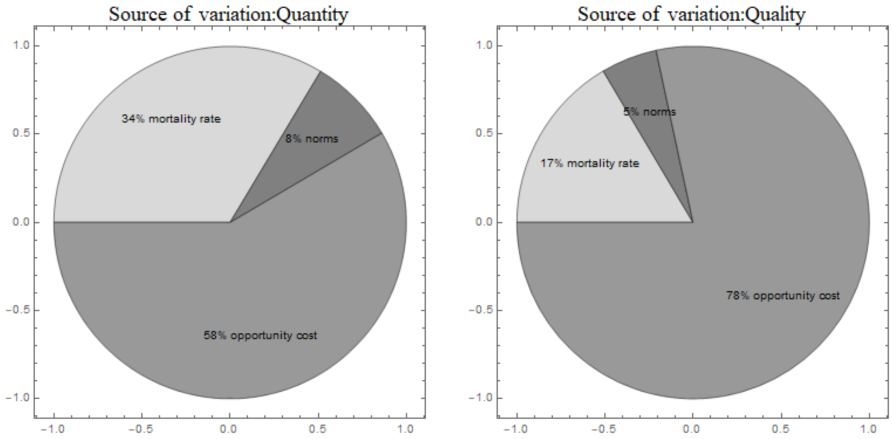


Figure 8: Contribution of norms, child mortality and opportunity costs to variation in quantity-quality decisions between women with highest and lowest number of births.

6.2.2 Impact of norms and child mortality on QQ within social groups

The effect of norms on QQ variation between groups turns out to be very small. One reason for this result is that fertility norms vary little between ethnicities. A more reasonable question would be; how would the QQ decisions change if women were not affected by social norms? One could ask the same question regarding child mortality. To answer these questions, I simulate variants of the benchmark model without norms and child mortality. Let us refer to the optimal QQ decisions without norms and/or child mortality as the intrinsic optimal in the spirit of Spolaore and Wacziarg (2022). Table 6 shows the results averaged across ethnicities within the same education group. The detailed results by ethnicities are shown in table 24 in appendix E.

To quantify the effect of norms on the QQ within each social group, I simulate the model setting $\pi = 0$ and compare the results with the benchmark case ($\pi = 0.319$). The first and second columns of table 6 list the average percentage change in QQ in each social group in the absence of norms. The bracketed terms in the second last row show the average amount of QQ and can be compared to the baseline in the last row of table 4. The quantity (quality) reduces (increases) for all women with an average of about 35 (143) percent for the economy. However, there is a pattern; the reduction in quantity is increasing while the increment in quality is decreasing in education. This pattern suggests that educated women were farthest from the intrinsic optimal fertility while they were closest to the intrinsic optimal quality. Norms have a larger impact on the fertility of educated women, while the impact is more prominent on the quality for the least educated women.

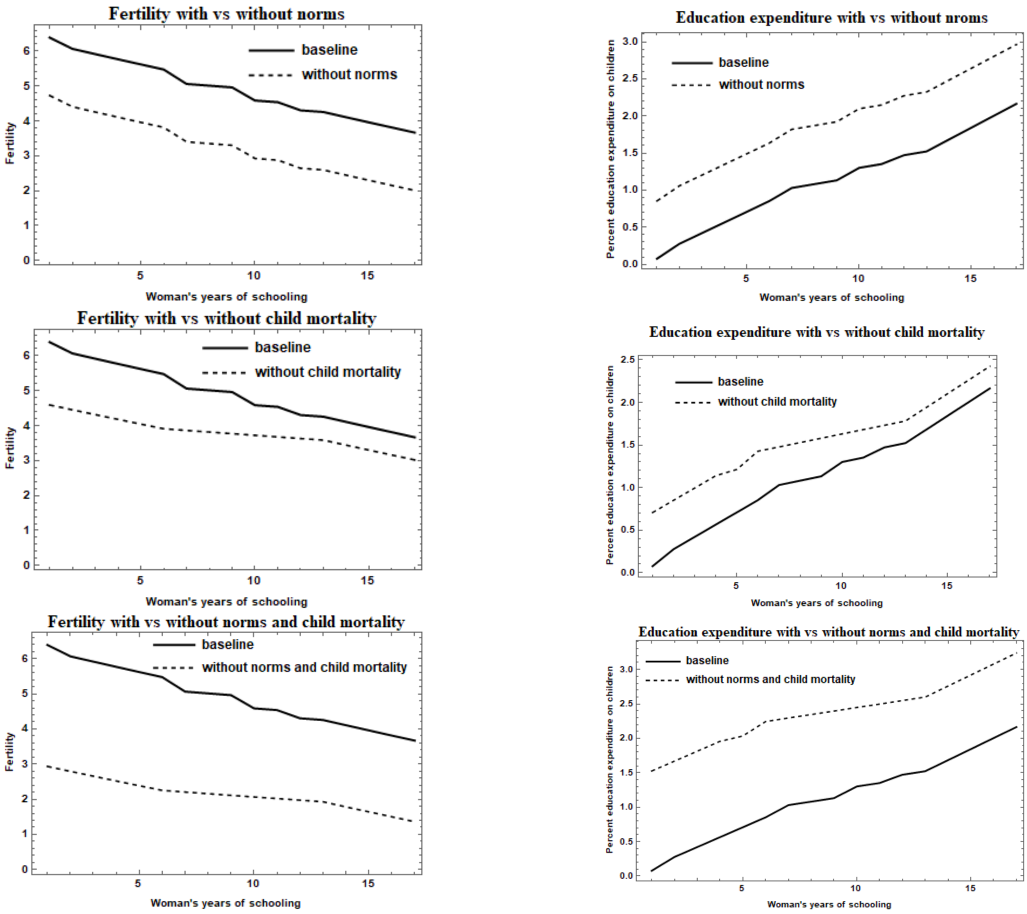
On the other hand, child mortality has a bigger effect on quantity and quality in less educated women. This is because less educated women face a higher child mortality rate, inducing women to have more children than the intrinsic optimal. Hence, when the child's survival probability is 100 percent, the least educated women must adjust the most to be at the intrinsic optimal. Figure 9 shows the effects of norms and child mortality on the values of QQ within social groups. The gap between intrinsic optimal and observed QQ reduces at a higher level of education when the households face no child mortality. Nevertheless, the average effect of removing social norms is bigger on QQ than removing uncertainty regarding children's survival probability. Simultaneously removing child mortality and the impact of norms increases average quantity by about 57 percent while the average quality by 248 percent. The effect on quantity is increasing in education while it is decreasing quality. This is because the groups adjust more along the margin, where it is less costly to do so.

Note that the percentage changes in quality appear too big, especially for the least educated women. They are 1013, 821, and 1886 percent for $\pi = 0$, $s_i = 1$, and ($\pi = 0, s_i = 1$), respectively. However, table 24 in appendix E shows that the investment in children's education changes from 0.1 percent to only 0.9, 0.7, and 1.5 percent of household income, respectively. Additionally, women only differ in education once the effect of norms or child mortality is set at zero. Therefore, we get the same values of QQ for all ethnicities, but note that the change is bigger for the ethnicities with higher norms, change in QQ is increasing in fertility norms.

Table 6: Effect of norms and child mortality on quantity-quality within each demographic group

Years of schooling	%Δ quantity $\pi = 0$	%Δ quality $\pi = 0$	%Δ quantity $s_i = 1$	%Δ quality $s_i = 1$	%Δ quantity $\pi = 0, s_i = 1$	%Δ quality $\pi = 0, s_i = 1$
0	-25.96	+1013	-28.13	+821	-54.09	+1886
1	-27.35	+282	-26.58	+207	-53.93	+502
2	-28.05	+186	-27.04	+136	-55.09	+ 331
3	-28.77	+138	-27.53	+102	-56.29	+ 246
4	-29.52	+110	-28.03	+71	-57.55	+187
5	-30.30	+91	-28.56	+67	-58.86	+163
6	-32.78	+77	-23.66	+43	-56.43	+123
7	-33.10	+73	-23.83	+41	-56.93	+117
8	-33.43	+70	-23.99	+40	-57.43	+112
9	-36.17	+61	-18.78	+ 25	-54.95	+88
10	-36.56	+59	-18.93	+24	-55.49	+ 85
11	-38.55	+54	-15.59	+18	-54.14	+73
12	-38.98	+53	-15.73	+17	-54.70	+71
13	-41.90	+43	-16.62	+14	-56.56	+64
14	-40.39	+48	-16.16	+15	-58.52	+58
15	-43.51	+40	-17.11	+13	-60.62	+54
16	-45.22	+37	-17.64	+12	-62.86	+50
Mean	-34.74(3.25)	+143(1.94)	-21.99 (3.79)	+98(1.56)	-56.73(2.14)	+248(2.37)
Corr school	+0.98	-0.64	-0.83	-0.64	+0.69	-0.64

Note: The table gives the percentage change in QQ in the absence of norms and child mortality. The results are averaged across all ethnicities in the same education group. The bracketed terms in the "Mean" row give the average value of quantity and quality for the given counterfactual experiment. The detailed results by education and ethnicity are given in appendix E in table 24. The coefficient of correlation shows the correlation between years of education and the absolute change in each column.



Note: The figure shows the effect of norms and child mortality on QQ within a social group. Three variants of the baseline model are simulated to capture the effect of absence of norms and child mortality on the QQ. The panels on the left show the impact on fertility while the right panels show the effect on quality. Quantity is measures as the number of births per woman, while quality is expressed as a fraction of household income spent on education of children.

Figure 9: Effect of norms and child mortality on QQ within social groups

6.2.3 Impact of norms and child mortality on QQ trade-off

Several studies document the effect of norms or child mortality on fertility decisions, but the literature is relatively silent on the effect of these factors on the QQ trade-off. This section discusses the implications of norms and child mortality for the QQ trade-off. For this purpose, I compute the QQ trade-off for the QQ levels shown in table 6. The values of QQ trade-off thus obtained are presented in table 7. The first column shows the results when $\pi = 0$, the second column shows the results at $s_i = 1$, and the last column shows the results at $\pi = 0, s_i = 1$. The QQ trade-off reduces substantially in all three cases. The average trade-off is the smallest when norms and child mortality are simultaneously removed from the model. The average is 1.087% compared to the benchmark, which is above 9%. The literature links this trend with high economic development and associated income effects (Doepke et al., 2022; Hazan and Zoabi, 2014). Nevertheless, the results in table 7 suggest that social norms and lower child mortality levels also weaken the QQ trade-off. Although child mortality and lower fertility norms could be an outcome of economic development, my analysis suggests they have first-order effects on QQ trade-off at lower economic development levels. Figure 14 in appendix E shows that the QQ trade-off gets prominently weaker even in the benchmark case once the education level crosses the primary level (5 years of schooling).

Table 7: Effect of opportunity cost on QQ trade-off in absence of norms and child mortality

Years of schooling	QQ trade-off at $\pi = 0$	QQ trade-off at $s_i = 1$	QQ trade-off at $\pi = 0, s_i = 1$
0	—	—	—
1	4.714	6.727	1.991
2	5.495	5.474	1.750
3	4.764	4.583	1.547
4	4.189	2.026	0.739
5	3.725	5.326	1.845
6	1.503	2.974	1.087
7	2.829	2.847	1.044
8	2.735	2.729	1.003
9	1.213	2.618	0.964
10	2.287	2.514	0.927
11	1.121	2.416	0.891
12	2.015	2.324	0.856
13	1.963	2.245	0.825
14	1.791	1.999	0.727
15	1.639	1.789	0.639
16	1.504	1.6089	0.559
Mean	2.718	3.137	1.087
Corr school	-0.803	-0.808	-0.819

Note: The table shows QQ trade-off in absence of norms and/or child mortality. The QQ trade-off is measured as percentage change in quality for a percentage change in quantity with each additional year of schooling of the woman. Quality is the expenditure on education of children expressed as a percentage of household income. Quantity is the number of births per woman.

6.3 Policy experiments

This section is devoted to quantifying the effects of education and population policies on QQ. I look at three policy interventions; 1) a minimum wage policy that increases the opportunity cost of having a child, 2) an education subsidy that reduces the price of education, and 3) a lump-sum transfer that shifts the income constraint. These experiments allow us to compare the effect of economic development, conditional (CCT), and unconditional (UCT) cash transfers on QQ. Many developing countries have introduced such programs to achieve a broader range of development outcomes (examples include the Dibao program in China, Bolsa Familia in Brazil, Universal Child Allowance (AUH) Programme in Argentina, the National Rural Employment Guarantee Act (NREGA) in India, The Kenya Cash Transfer for Orphans and Vulnerable Children (CT-OVC), Benazir Income Support Program (BISP) in Pakistan). There is a debate in the literature over the effectiveness of these policies in achieving the set goals (Banerjee and Olken, 2017; Del Boca et al., 2021; Fenoll and Quaranta, 2023; Freelander, 2007; Schubert and Slater, 2006). The policy experiments discussed below show that households respond differently to the same economic incentive provided in different forms. Since I explicitly model women's wages, the impact of the policy accounts for the identity of the recipient of the minimum wage policy incentive. In the case of lump-sum transfers and education subsidies, I assume that the incentive is provided to the household and not to a specific individual in the couple.

For the policy experiments, I redefine the baseline model. In the baseline scenario, the fertility norms are set at an average of 6.65 for all ethnic groups. This setting reduces the dimensions of the vectors to be estimated from 119 to 17 while still accounting for the effect of norms on the household. It makes the exposition and interpretation of the results more straightforward without taking away from the goals of the analysis. The variation in norms between groups is small, and section 6.2.1 already provides information on how it contributes to the variation between groups. On the other hand, the impact of norms within a social group is much more significant, which is still captured by exposing all social groups to the same norms. The model is simulated assuming a minimum wage policy that increases wages by 10% for all women.[15] The education subsidy and lump-sum transfer policies are implemented to change the household's potential income by 10% of the woman's wage. This setting implies that all three policies entail the exact cost and that all households receive comparable benefits.

6.3.1 Economic development/wage increase

Economic development results in higher wages, increasing the opportunity cost of bearing and rearing a child. To show how this effect comes into play in the presence of norms and child mortality, I simulate the model for a 10% increase in the wage of all women. A wage increase implies a higher price per child. Both quantity and quality are normal goods; as children become expensive, fertility becomes less attractive and declines. Investment in the education of children increases as households substitute quality for quantity. Table 8 shows that, on average, the quantity decreases by 26.5% while the quality increases by 251%. In addition, the average fertility drops from 5 children to about 3.6, while quality increases from 1.146 to 2.52 (bracketed terms in the "Mean" row). The results align with the papers that propose that economic development reduces fertility and boosts human capital accumulation (De la Croix and Doepke, 2003; Galor, 2011, 2012). There is also ample evidence on the impact of fertility decline on economic growth. However,

[15]Increasing the wage for all women with a minimum wage policy appears to be slightly ad hoc, but it provides a basis for the comparison of the opportunity cost of women with a lump-sum transfer and a subsidy policy.

the theoretical model in this paper is set in partial equilibrium and does not allow the investigation of feedback effects of lower fertility and high human capital on economic development.

Quantity reduces more in households with highly educated women, while quality increases more in households with less educated women. This response appears because highly educated women invest more in children's education ex-ante. The marginal utility of increasing quality for educated women is less than that of increasing consumption (the MU channel), while the opposite is true for less educated women. The quantity responds more in highly educated women because they face a higher price per child (opportunity cost channel) than less educated women. Finally,the bottom panel of the table 8 shows the average QQ trade-off is 9.4% of quality for a one percent of quantity. The correlation of the QQ trade-off with women's education is negative, as in the baseline model.

6.3.2 Subsidy on the cost of education

The educational subsidy is a popular policy instrument used to promote investment in education. Education subsidies are conditional transfers, where the benefit is only awarded if the household chooses to invest in their children's education. Schultz (2004), Glewwe and Olinto (2004), and Maluccio and R. (2005), all find a positive effect of such transfers on education. To assess the effectiveness of such policies in Pakistan, I simulate the model assuming a subsidy on the cost of education that has a similar impact on household income as a 10% wage increase. This approach implies that the per-unit price of education ($p - 0.1 * w_i$) varies across households. Qualitatively, the effect of a subsidy is similar to that of a wage increase; however, as shown in table (8), the education subsidy has a much larger effect on quality for each group. Average quantity increases by about 9% (drops to 4.5 children) while the average quality increases by about 460% (rises to 3.7). Education subsidies make quality less expensive; hence, they directly motivate investment in quality due to the price effect. Second, as the price of education decreases, it increases the disposable income for consumption. This outcome has an indirect effect on the opportunity cost. The household's optimization behavior ensures they further benefit from this policy by increasing the women's labor supply. This adjustment reduces the quantity and increases the quality further via QQ trade-off.

The effect of education subsidy on quantity is increasing in education, while on quality, it is decreasing in education. Reasons include the MU and opportunity cost channels discussed in the previous section. Yet another reason could be the behavior change. Behavior changes occur when parents invest more in their children's education in response to a conditional incentive (Das et al., 2005). In the case of education subsidy, poorer households will invest in children's education due to a reduction in the effective cost of education; richer households will continue to invest in quality even without such incentives. Therefore, the effect on quality is much more substantial for poorer households. Note that wage increases have a larger effect on quantity, while education subsidies have a larger impact on quality. These outcomes indicate that households respond more to direct changes in the prices of quantity and quality, and their responses have spillover effects on other components of the utility function. The QQ trade-off has a value of 9.1%, and the correlation of the QQ trade-off is stable at -0.7.

6.3.3 Lump sum transfer

To quantify the effect of a lump sum transfer on QQ, the model is simulated assuming an increase in the husband's income equivalent to a 10% of wife's wage. In contrast to the subsidy and wage effect, a lump sum transfer increases both quantity and quality. The results in table 8 show that the average quantity increases by 8% (increases to 5.34 births per woman) while the average quality increases by 141% (1.91 percent of household income). The income effect on quantity is stronger in households with highly educated women. These findings support the papers which conclude that better economic conditions are positively correlated with fertility due to strong income effects (Orsal and Goldstein, 2010; Siegel, 2017). The effect on quality is decreasing in women's education.

Note that, through the lens of the model, a lump sum transfer is equivalent to an increase in the husband's income. Therefore, the results imply that in a social setting where men bear a negligible 'time cost' of rearing a child, fertility increases with their income. At the same time, an increase in quality is flatter than in cases where fathers bear the time cost of having a child. An important conclusion emerges from these policy experiments. Although Pakistan is a developing country with a high QQ trade-off and a strong negative association between women's wage and fertility, we still see signs of weakening of these effects as the education/wage of women increases. Figure (15) in appendix E compares the effect of these policies in the absence of norms and child mortality. In line with the findings in section 6.2.2, setting $\pi = 0, s_i = 1$ magnifies the effect of all policies suggesting norms and child mortality matter for the effectiveness of these policies.

6.3.4 A note on cost-effectiveness

The policy experiments in the previous sections show that despite bearing similar fiscal costs, lump sum transfer is the least effective policy in encouraging investment in children's education. In contrast, education subsidy is the most effective policy in this regard.[16] The findings are in line with the evidence provided in the RCT literature. Pa-

[16]The quantitative results hold under the assumption that conditional or unconditional transfers do not alter the prices in the economy. For example, an education subsidy that induces a price change in the

Table 8: Effect of a 10% wage raise, an equivalent amount of lump sum transfer and an equivalent education subsidy on quantity-quality

Years of	Wage raise		Education subsidy		Lump sum transfer	
schooling	%Δ quantity	%Δ quality	%Δ quantity	%Δ quality	%Δ quantity	%Δ quality
0	-21.87	+1786	-6.68	+3261	+6.85	+1008
1	-22.61	+495	-6.98	+ 906	+ 7.15	+278
2	-22.96	+326	-7.15	+599	+7.33	+183
3	-23.31	+243	-7.34	+449	+7.52	+137
4	-23.69	+194	-7.53	+359	+7.72	+108
5	-24.08	+161	-7.73	+299	+7.92	+91
6	-25.45	+133	-8.20	+248	+8.40	+74
7	-25.61	+127	-8.28	+236	+8.49	+71
8	-25.78	+121	-8.37	+226	+8.57	+68
9	-27.29	+105	-8.89	+196	+9.10	+58
10	-27.49	+101	-8.98	+189	+9.20	+56
11	-28.58	+ 93	-9.37	+174	+9.60	+51
12	-28.80	+90	-9.48	+168	+9.71	+49
13	-29.51	+ 81	-9.82	+153	+10.07	+45
14	-30.28	+74	-10.19	+ 140	+10.44	+41
15	-31.09	+ 68	-10.58	+130	+10.84	+38
16	-31.95	+ 63	-10.99	+121	+11.27	+35
Mean	-26.49(3.63)	+251(2.52)	-8.62(4.50)	+463(3.70)	+8.34(5.34)	+141(1.91)
Corr school	+0.97	-0.64	+0.98	-0.64	+0.98	+0.64
	QQ trade-off wage raise			**QQ trade-off education subsidy**		
Mean	9.358			9.100		
Corr school	-0.700			-0.702		

Note: Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman. (%Δ quantity) shows the percentage change in the number of children, and (%Δ quality) shows the percentage change in investment on the education of children resulting from a wage raise, education subsidy and a lump sum transfer. The bracketed terms show the average QQ post policy shock. The first row of the bottom panel shows the average QQ trade-off measured as a percentage change in quality due to a one percentage change in quantity with an additional year of schooling. The second row shows the correlation of QQ trade-off with the years of schooling of women.

pers by Baird et al. (2013, 2011) and Akresh et al. (2013) show that CCTs, compared to UCTs, were more effective in improving education outcomes in Malawi, Burkina Faso, and low-income countries, respectively. ‘

I assume that all households take advantage of the education subsidy and lump sum transfers. The effectiveness of the education subsidy will substantially reduce if we assume that the income distribution within the poorer households is such that those at the lower end of the distribution are income constrained and will not invest in children's education despite a subsidy. The cost-effectiveness of conditional transfer compared to unconditional transfer holds if we compare households receiving the transfers.

Wage increase outperforms other policies concerning population control. In the counterfactual experiment a minimum wage policy applies to all households. However, when the minimum wage policy applies only to the poorer labor market segment, the aggregate effects on fertility will reduce. Similarly, compliance with minimum wage law also mat-

per unit cost of education in the private sector due to a higher demand may reduce the cost-effectiveness of the policy.

ters for the effectiveness of this policy. The conclusion that minimum wage is the most effective population control policy and education subsidy is the most effective education policy holds when we compare households receiving the same benefits from alternative policies.

Another important conclusion from the policy experiments is that households adjust more the demand of the good that experiences a price change. Since education subsidy affects the price of quality, it has the most substantial impact on investments in children's education. While a wage raise affects the price of having a child, it has the strongest effect on quantity. On the contrary, the lump sum transfers do not affect the prices of QQ, so they increase QQ.

The impact of policy depends on whether the policy influences a good's effective price, and the effect's magnitude varies by women's education. The quality gradient is sharpest in the least educated women, while the quantity gradient is sharpest among the most educated women. It is reasonable to expect these patterns to remain the same if the model was to match the quality gradient. There is no intuitive explanation of why matching the education gradient may change the mechanisms responsible for policy effectiveness.

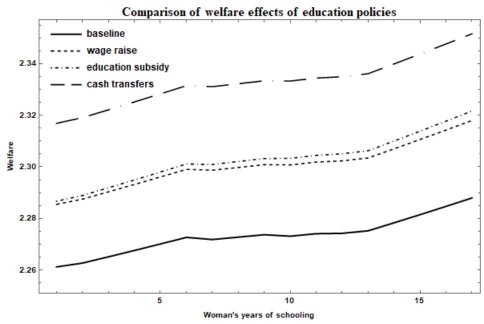
Similarly, introducing an education norm will likely not affect the relative effectiveness of the policies. Figure 15 in appendix E shows that the relative strength of the policies is unaffected in the absence of fertility norms. Wage raise reduces fertility the most, at the same time, education subsidy has the largest impact on quality. The results suggest that introducing education norms will not affect the conclusion regarding the relative cost-effectiveness of the policies. The relative cost-effectiveness of a policy does not depend on the type (magnitude) of the norm or preference parameter. However, the absolute effect of each policy depends on these parameters. Therefore, introducing education norms will affect the absolute effect of each policy on QQ decisions without altering the order of the strength of these policies.

6.3.5 Welfare effects of alternative population policies

Policy-makers often introduce transfer programs to improve welfare by increasing consumption or reducing poverty. In this section, I discuss the welfare implications of the policies discussed in the preceding sections. I measure welfare in terms of utility and compute the percentage change in the household's utility to assess the policy's impact. The results are shown in table 9. Lump sum transfers are most successful in increasing welfare. The household welfare increases by an average of about 3%, while the total welfare of the economy increases by about 45%. The results are not surprising, given that households use the transfers to increase consumption, quantity, and quality. Other papers, such as Handa et al. (2018), also find that large-scale government UCT programs increase food expenditure in selected African countries. Similarly, Hjelm (2016) find a positive effect of UCTs on dietary diversity and consumption of nutritious food. These findings suggest that lump sum transfer can indeed be welfare-enhancing. Education subsidies and minimum wage policies have similar effects on welfare. Both increase the average welfare by a little above 1% while the total welfare improves by around 20%.

In all three cases, the welfare effects of policies are similar in magnitude across education groups, unlike the cost-effectiveness, which varies substantially between less and more-educated groups. Moreover, the correlation between the welfare effects and women's education is positive. The gain is higher for educated women because the consumption levels respond more in highly educated women, and consumption has a higher weight in utility relative to QQ. This pattern implies that both conditional and unconditional transfers will increase consumption inequality if transfers are made across the board to all households, irrespective of their financial situation. On the contrary, transfers made to specific groups, for example, the poorest (least educated) households, will reduce consumption inequality and the economy's total welfare gains.

Finally, the policy experiments suggest that a policy can be more or less effective than competing policies depending on the goal of the policy-makers. For example, lump sum transfer though ineffective in reducing fertility, is the most effective in increasing welfare. Additionally, the effectiveness of a policy also depends on the economic background of the recipients. For example, both wage raise and education subsidies are more effective in reducing the quantity in households with more educated women. At the same time, they have a larger effect on the quality in households with less educated women.



Note: The figure compares the welfare effect of wage raise, education subsidy and lump sum transfers. Welfare is measured in terms of household utility.

Figure 10: Welfare gains from alternative policies

Table 9: Effect of policies on welfare

Years of schooling	%Δ welfare wage raise	%Δ welfare education subsidy	%Δ welfare lump sum transfer
0	+1.07	+1.13	+2.46
1	+1.10	+ 1.16	+2.49
2	+1.11	+1.18	+2.51
3	+1.13	+1.20	+2.54
4	+1.15	+1.23	+2.56
5	+1.16	+1.25	+2.59
6	+1.18	+1.28	+ 2.60
7	+1.19	+1.29	+2.62
8	+1.19	+1.30	+2.63
9	+ 1.22	+ 1.33	+2.65
10	+1.22	+ 1.34	+ 2.65
11	+1.24	+1.36	+2.67
12	+1.24	+1.36	+2.68
13	+1.26	+1.39	+ 2.70
14	+1.28	+1.42	+2.73
15	+1.29	+1.45	+ 2.76
16	+1.31	+1.47	+2.78
Mean	+1.20	+1.30	+2.63
Total	+20.34	+22.13	+44.62
Corr school	+0.99	+0.99	+0.99

Note: The table shows the percentage change in welfare by education group, arising from alternative population/education policies. The coefficient of correlation shows the correlation between years of education and the absolute change in each column. The calculations are based on the values presented in table 26 in appendix E.

6.4 Effect of fertility norms and child mortality on the cost of policy

We now know that norms and child mortality matter for policy designs, but should the policymakers worry more than that? Could high norms and child mortality also affect the cost efficiency of policies? To answer this question, I estimate the effect of norms and child mortality on the cost of the subsidy and minimum wage policies. For this purpose, I set $\pi = 0$ and $s_i = 1$, one at a time and compute the education subsidy and wage raise required to achieve the same increase in quality as achieved by the wage, subsidy, and lump sum transfer policies in the sections 6.3.1, 6.3.2, and 6.3.3. Once I have the required wage raise, education subsidy and lump sum transfer without norms (child mortality), I calculate the percentage difference between the wage raise and education subsidy with and without norms (child mortality). This difference reflects the effect of norms (child mortality) on policy costs.[17] The results are shown in the table (10). The

[17]Policy costs are measured in terms of the magnitude of the incentives. I assume that the implementation of all policies is frictionless. Nevertheless, the implementation of different policies may incur varying costs. For example, implementing a minimum wage policy will entail additional costs of enforcing the policy through regular inspections, audits, etc. Such costs are not taken into consideration in the

average cost of wage raise policy reduces by about 5% and 9% in the absence of norms and child mortality, respectively. Norms and child mortality matter least for the cost of education subsidy, reducing the average policy cost by approximately 2.6% and 1.3%, respectively. In the case of lump sum transfer, the average cost reduces by about 5% and 2.4%, respectively, in the absence of norms and child mortality.

Figure 11 shows a visualization of the results. The results show a clear pattern whereby the costs are decreasing in women's schooling when $\pi = 0$ while they are increasing in women's education in the absence of child mortality. These experiments indicate that policymakers might also underestimate the cost of a policy or overestimate the policy targets if they ignore the effect of norms and child mortality on household decisions.

Table 10: Effect of norms and child mortality on the cost of policies

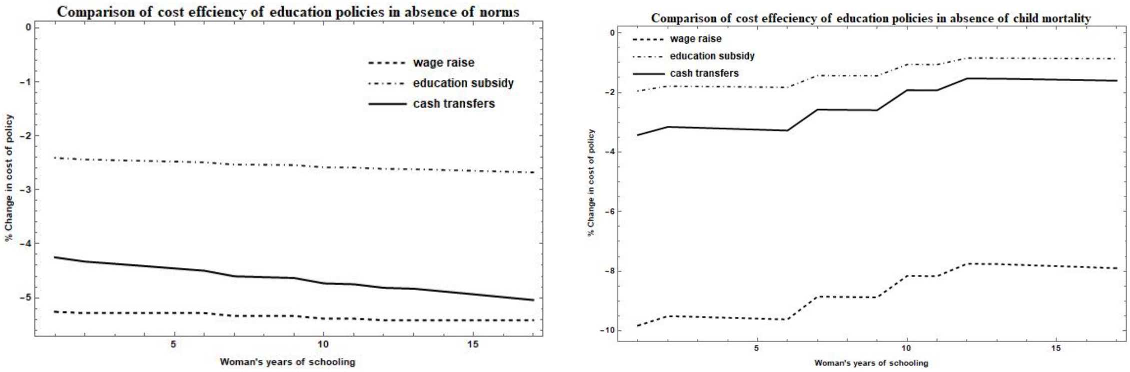
Years	Wage raise %Δ policy cost		Education subsidy %Δ policy cost		Lump sum transfer %Δ policy cost	
of schooling	$\pi = 0$	$s_i = 1$	$\pi = 0$	$s_i = 1$	$\pi = 0$	$s_i = 1$
0	-5.26	-9.83	-2.41	-1.95	-4.25	-3.43
1	-5.28	-9.51	-2.44	-1.79	-4.33	-3.16
2	-5.28	-9.53	-2.45	-1.80	-4.37	-3.19
3	-5.28	-9.56	-2.46	-1.81	-4.41	-3.22
4	-5.28	-9.59	-2.48	-1.82	-4.46	-3.25
5	-5.28	-9.62	-2.49	-1.83	-4.50	-3.28
6	-5.34	-8.86	-2.53	-1.43	-4.60	-2.58
7	-5.34	-8.87	-2.54	-1.44	-4.62	-2.59
8	-5.34	-8.88	-2.54	-1.44	-4.63	-2.59
9	-5.39	-8.16	-2.58	-1.07	-4.73	-1.92
10	-5.39	-8.17	-2.59	-1.07	-4.75	-1.93
11	-5.42	-7.75	-2.61	-0.85	-4.82	-1.53
12	-5.42	-7.76	-2.62	-0.85	-4.83	-1.54
13	-5.42	-7.79	-2.63	-0.85	-4.88	-1.55
14	-5.42	-7.83	-2.65	-0.86	-4.94	-1.57
15	-5.42	-7.86	-2.66	-0.86	-4.99	-1.59
16	-5.42	-7.90	-2.68	-0.87	-5.04	-1.60
Mean	-5.35	-8.67	-2.55	-1.33	-4.66	-2.38
Corr school	+0.90	-0.87	+0.97	-0.88	+0.98	-0.88

Note: The table compares the percentage change in cost of given policy in absence of norms vs. child mortality. The results are obtained by computing the wage raise, education subsidy and lump sum transfer, required in absence of norms/child mortality, to achieve the same increase in quality as in table 8 for the corresponding policy. The results suggest a smaller incentive is required in absence of norms/child mortality to improve investment in education of children.

6.5 Fertility tax or a social change?

High fertility rates are a major concern in many developing countries. Policymakers invest resources into designing effective population control policies. We have the example of China, where a fertility tax in the form of a one-child policy was implemented. The policy assisted with the growing population concerns, but such policies' welfare effects are still unclear. In India, "The Population Control Bill" was proposed in 2019. According to this bill, couples with more than two children would become ineligible for government jobs and subsidies provided by the government. However, the bill did not successfully pass in the

analysis.



Note: The figure shows the effect of norms and child mortality on the cost of policies discussed in sec 6.3. Two variants of the baseline model are simulated to capture the effect of norms and child mortality on the cost of policies. The panels on the left show the impact of norms while the right panels show the effect of child mortality on cost of policies. The effect is measured for wage raise, education subsidy and lump sum transfers policies.

Figure 11: Cost efficiency of alternative policies in absence of norms and child mortality.

parliament due to strong opposition from the public. Such policies are somewhat tricky to propose in Pakistan's traditional and conservative society. Nevertheless, for the sake of argument, I compare the welfare effects of one child policy to the policy that focuses on changing social norms, for example, with the help of media campaigns, normalizing the discussion on family planning, and increasing the availability of contraceptive measures.

I simulate two variants of the baseline model defined in section 6.3. In the first variant, I impose a one-child policy and compute the quality and the welfare in terms of the household's utility. In the second variant, I set the norms at half of the baseline norms ($N = 3.29$) and compute quantity and quality. I call the second policy the social-change policy. Table 11 shows the utility, quantity, quality per child, and change in quality per child from the two policies compared to the baseline model. Note that I report per-child quality for the lower norms so that it is comparable with the one-child policy. The average quality per child (0.425) is lower in the case of lower norms compared to the one-child policy (1.146). Consistent with the patterns in the previous sections, the change in per child quality is decreasing in women's education.

Figure 16 in appendix E shows that one-child policy reduces while social change policy increases welfare. One child policy reduces average welfare by 0.38% per household while the total welfare reduces by about 6.5% (table 27, appendix E). On the other hand, the social change policy is improving welfare as the average household welfare increases by about 1%, and total welfare in the economy increases by more than 13% (table 27, appendix E). Nonetheless, the average fertility is much higher, at 4 children per household. These results only hold in partial equilibrium. If the higher (low) fertility rates lead to lower (higher) wages in the social-change (one-child) scenario, then one may expect the welfare outcomes to reverse between the two policies.

Table 11: QQ with one-child policy vs. a social change that lower norms

Years of schooling	Baseline		One child policy			Lower Norms			
	Utility	Quality per child	Utility	Quality per child	Δ quality per child	Utility	Quantity	Quality per child	Δ quality per child
0	2.261	0.012	2.247	0.077	+530	2.278	5.562	0.085	+604
1	2.263	0.046	2.250	0.277	+507	2.28	5.238	0.129	+181
2	2.265	0.071	2.253	0.421	+492	2.282	5.088	0.161	+126
3	2.268	0.098	2.256	0.565	+477	2.285	4.939	0.195	+99
4	2.270	0.126	2.259	0.709	+462	2.288	4.792	0.231	+83
5	2.273	0.156	2.262	0.853	+448	2.290	4.646	0.269	+73
6	2.272	0.204	2.263	1.030	+406	2.29	4.233	0.338	+66
7	2.273	0.216	2.264	1.081	+401	2.291	4.183	0.354	+64
8	2.274	0.228	2.265	1.132	+396	2.292	4.134	0.371	+63
9	2.273	0.284	2.266	1.301	+359	2.291	3.758	0.454	+61
10	2.274	0.298	2.267	1.352	+354	2.292	3.709	0.473	+59
11	2.274	0.342	2.268	1.472	+330	2.293	3.475	0.540	+58
12	2.275	0.358	2.269	1.523	+326	2.294	3.428	0.563	+57
13	2.278	0.410	2.273	1.683	+311	2.297	3.278	0.637	+56
14	2.281	0.465	2.276	1.843	+296	2.300	3.131	0.719	+54
15	2.285	0.525	2.280	2.004	+281	2.304	2.984	0.807	+54
16	2.288	0.590	2.284	2.164	+267	2.307	2.84	0.905	+53
Mean	2.273	0.260	2.265	1.146	+391	2.291	4.083	0.425	+107
Total	38.647	4.429	38.502	19.487	–	38.954	69.418	7.231	–
Corr school	+0.992	+0.987	+0.999	+0.994	-0.975	+0.995	-0.975	+0.983	-0.614

Note: The table shows the household utility, quality per child, change in quality per child and quantity by education of women resulting from alternative population policies. Quality is expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman. The last row shows the correlation between the years of schooling and absolute change in each column.

7 Conclusion

Social norms influence fertility decisions in all societies. In developing countries, fertility norms are high, and together with high child mortality rates and low economic development, they tend to increase the overall fertility rate. In this paper, I propose that social norms and child mortality rates also have implications for the quality of children (measured by parents' monetary investment in children's education). I consider the case of Pakistan for the analysis. The lack of data on the quality of children does not allow us to directly measure the contribution of norms, child mortality, and economic development to variation in quantity-quality decisions. To overcome this problem, I develop a theoretical model that postulates how household decisions regarding quantity and quality of children are affected by a woman's wage, social norms, and child mortality. To parameterize the model, I use data from PDHS and information on Pakistan's aggregate private education expenditure.

In the quantitative analysis, I simulate the theoretical model to compute the quality of children for households that differ in the education of women, child mortality, and social norms. The analysis shows that 8% of the variation in fertility between women with the highest and lowest number of births is explained by norms. 58% of the difference is explained by wage, while the difference in child mortality explains 34% of the fertility difference. Similarly, approximately 5% of the variation in investment in children's education is explained by norms, 17% by child mortality differentials, and the remainder is attributed to wage differences among mothers. The impact of norms is weaker in explaining between ethnic groups variation in QQ, but their impact is much higher within each ethnic group. On average, fertility reduces by about 35% while quality increases by 143% in the absence of norms. Similarly, without child mortality, the average fertility reduces by 22%, while quality increases by 57%.

Policy experiments show that education subsidies are the strongest tool for promoting investments in children's education due to their direct effect on the cost of education. Wage increases perform better than education subsidies in discouraging high birth rates due to their direct effect on the opportunity cost of having a child. Lump sum transfers increase both quantity and quality of children. However, the increase in quality is the smallest in the case of such transfers, making it a poor policy tool for promoting education. On the contrary, lump-sum transfers are the most effective in increasing welfare as they increase the level of all three utility components: consumption, quantity, and quality. The cost of these policies decreases significantly without the effect of norms and child mortality, and the decline in the cost is heterogeneous over the education distribution of mothers. Counterfactual experiments comparing a one-child policy and a social change that reduces norms show that social change policies enhance welfare while one-child policy reduces welfare. Last, on average, the households substitute about 9% of quality for one percent of quantity with each additional year of the mother's schooling; the QQ trade-off weakens at; higher levels of education, lower levels of norms, and lower child mortality rates.

References

Akresh, R., de Walque, D., and Kazianga, H. (2013). Cash transfers and child schooling: Evidence from a randomized evaluation of the role of conditionality. *World Bank Policy Research Working Paper No. 6340*.

Alesina, A. and Giuliano, P. (2015). Culture and institutions. *Journal of Economic Literature*, 53(4):898–944.

Alesina, A., Giuliano, P., and Nunn, N. (2013). On the origins of gender roles: Women and the plough. *Quarterly Journal of Economics*, 128(2):469–530.

Andrabi, T., D. J. and Khwaja, A. I. (2008). A dime a day: The possibilities and limits of private schooling in pakistan. *Comparative Education Review*, 52(3):329–355.

Angeles, L. (2010). Demographic transitions: Analyzing the effects of mortality on fertility. *Journal of Population Economics*, 23(1):99–120.

Angrist, J., L. V. and Schlosser, A. (2010). Multiple experiments for the causal link between the quantity and quality of children. *Journal of Labor Economics*, 28(4):773–824.

Aslam, M. (2009). Education gender gaps in pakistan: Is the labour market to blame? *Economic Development and Cultural Change*.

Azarnert, L. V. (2006). Child mortality, fertility, and human capital accumulation. *Journal of Population Economics*, 19(2):285–297.

Baird, S., Ferreira, F. H., Özler, B., and Woolcock, M. (2013). Relative effectiveness and cost-effectiveness of conditional and unconditional cash transfers for schooling outcomes in developing countries: A systematic review. *Campbell Systematic Reviews 8. doi:10.4073/csr.2013.8*.

Baird, S., Ferreira, F. H., Özler, B., and Woolcock, M. (2014). Conditional, unconditional and everything in between: a systematic review of the effects of cash transfer programmes on schooling outcomes. *Journal of Development Effectiveness*, 6(1):1–43.

Baird, S., McIntosh, C., and Özler, B. (2011). Cash or condition? evidence from a cash transfer experiment. *The Quarterly Journal of Economics*, 126(4):1709–1753.

Banerjee, A. V., H. R. K. G. E. and Olken, B. A. (2017). Debunking the stereotype of the lazy welfare recipient: Evidence from cash transfer programs. *The World Bank Research Observer*, 32(2):155–184.

Barro, R. J. and Becker, G. S. (1989). Fertility choice in a model of economic growth. *Econometrica*, 57(2):481–501.

Becker, G. S. and Lewis, H. G. (1973). On the interaction between the quantity and quality of children. *Journal of Political Economy*, 81(2):279–288.

Becker, G. S. and Tomes, N. (1976). Child endowments and the quantity and quality of children. *Journal of Political Economy*, 84(4):143–162.

Carlsson, G. (1968). The decline of fertility: Innovation or adjustment process. *Population Studies*, 20(2):149–174.

Cavalcanti, T., K. G. and Santos, C. (2020). Family planning and development: Aggregate effects of contraceptive use. *The Economic Journal*, 131(634):624–657.

Chabé-Ferret, B. (2019). Adherence to cultural norms and economic incentives: Evidence from fertility timing decisions. *Journal of Economic Behavior Organization*, 162(C):24–48.

Chowdhury, A. K., Khan, A. R., and Chen, L. C. (1976). The effect of child mortality experience on subsequent fertility: In pakistan and bangladesh. *Population Studies*, 30(2):249–261.

Chowdhury, A. I., F. V. and Aziz, K. M. (1992). The effect of child survival on contraceptive use in bangladesh. *Journal of Biosocial Science*, 24(4):427–432.

Coale, A. J. (1984). The demographic transition. *The Pakistan Development Review*, 23(4):531–552.

Cordoba, J. C., L. X. and Ripoll, M. (2016). Fertility, social mobility, and long-run inequality. *Journal of Monetary Economics*, 77:103–124.

Das, J., Do, Q.-T., and Özler, B. (2005). Reassessing conditional cash transfer programs. *The World Bank Research Observer*, 20(1):57–80.

Dasgupta, P. and Dasgupta, A. (2017). Socially embedded preferences, environmental externalities, and reproductive rights. *Population and Development Review*, 43(3):405–441.

Davis, K. (1945). The world demographic transition. *The Annals of the American Academy of Political and Social Science*, 237(1):1–11.

De la Croix, D. and Delavallade, C. (2018). Religions, fertility and growth in south-east asia. *International Economic Review*, 52(2):907–946.

De la Croix, D. and Doepke, M. (2003). Inequality and growth: Why differential fertility matters. *American Economic Review*, 93(4):1091–1113.

De Silva, T. and Tenreyro, S. (2020). The fall in global fertility: A quantitative model. *American Economic Journal: Macroeconomics*, 12(3):77–109.

Del Boca, D., Pronzato, C., and Sorrenti, G. (2021). Conditional cash transfer programs and household labor supply. *European Economic Review*, 136.

Delventhal, M. J., Fernandez-Villaverdey, J., and Guner, N. (2022). Demographic transitions across time and space. *IZA Working Paper*, No. 15575.

Doepke, M. (2005). Child mortality and fertility decline: Does the barro-becker model fit the facts? *Journal of Population Economics*, 18:337–366.

Doepke, M., Hannusch, A., Kindermann, F., and Tertilt, M. (2022). The economics of fertility: A new era. *Forthcoming in the Handbook of Family Economics.*

Doepke, M., Hazan, M., and Maoz, Y. (2015). The baby boom and world war ii: A macroeconomic analysis. *Review of Economic Studies*, 82:1031–1073.

Ehrlich, I. and Lui, F. T. (1991). Intergenerational trade, longevity, and economic growth. *Journal of Political Economy*, 99(5):1029–1059.

Falcao, B. L. S. and Soares, R. R. (2008). The demographic transition and the sexual division of labor. *Journal of Political Economy*, 116(6):1058–1104.

Fenoll, A. A. and Quaranta, R. (2023). How to best fight poverty: The uneven ex-post effects of conditional and unconditional cash transfers on labor earnings. *WorkINPS Papers*, pages ISSN 2532–8565.

Fernández, R. and Fogli, A. (2006). Fertility: The role of culture and family experience. *Journal of the European Economic Association*, 4(2-3):552–561.

Fernández, R. and Fogli, A. (2009). Culture: An empirical investigation of beliefs, work, and fertility. *American Economic Journal: Macroeconomics*, 1(1):146–177.

Freedman, R. (1963). Norms for family size in underdeveloped areas. *Proceedings of the Royal Society B*, 159:220–245.

Freelander, N. (2007). Superfluous, pernicious, atrocious, and abominable? the case against conditional cash transfers. *IDS Bulletin*, 38(3):75–78.

Gali, J. (1994). Keeping up with the joneses: Consumption externalities, portfolio choice, and asset prices. *Journal of Money, Credit and Banking*, 26(1):1–8.

Galor, O. (2011). The unified growth theory. *Princeton*, Princeton University Press.

Galor, O. (2012). The demographic transition: Causes and consequences. *Cliometrica*, 6(1):1–28.

Galor, O. and Weil, D. N. (1999). From malthusian stagnation to modern growth. *American Economic Review*, 89(2):150–154.

Glewwe, P. and Olinto, P. (2004). Evaluating the impact of conditional cash transfers on schooling: An experimental analysis of honduras' praf program. *University of Minnesota*, University of Minnesota Unpublished Manuscript.

Greenwood, J., S. A. and Vandenbroucke, G. (2005). The baby boom and baby bust. *American Economic Review*, 95(1):183–207.

Guiso, L., Sapienza, P., and Zingales, L. (2006). Does culture affect economic outcomes? *Journal of Economic Perspectives*, 20(2):23–48.

Handa, S., Daidone, S., Peterman, A., Davis, B., Pereira, A., Palermo, T., and Yablonski, J. (2018). Myth-busting? confronting six common perceptions about unconditional cash transfers as a poverty reduction strategy in africa. *The World Bank Research Observer*, 33(2):259–298.

Hazan, M. and Zoabi, H. (2014). Do highly educated women choose smaller families? *The Economic Journal*, 125(587):1191–1226.

HIES (2020). Household integrated economic survey, 2018–19. *Islamabad, Pakistan: Federal Bureau of Statistics (Pakistan).*

Hirota, Y. (2016). The timing of mortality decline and human capital accumulation. *Theoretical Economics Letters*, 6(1).

Hjelm, L. (2016). The impact of cash transfers on food security. *University of North Carolina, Chapel Hill, Carolina Population Center*, Transfer Project Research Brief 2016-01.

Hyder, A. (2007). Wage differentials, rate of return to education, and occupational wage share in the labour market of pakistan. *Pakistan Institute of Development Economics*, PIDE-Working Papers(2007:17).

Iqbal, S., Zakar, R., Fischer, F., and Zakar, M. (2022). Consanguineous marriages and their association with women's reproductive health and fertility behavior in pakistan: secondary data analysis from demographic and health surveys, 1990–2018. *BMC Women's Health*, 22(118).

Jamal, H. (2015). Private returns to education in pakistan: A statistical investigation. *MPRA paper 70640*.

Jamal, H., T. I. A. and Khan, F. S. (2003). Private returns to education: Evidence for pakistan. *Social Policy and Development Centre, Karachi*, Research Report(50).

Kalemli-Ozcan, S. (2002). Does the mortality decline promote economic growth? *Journal of Economic Growth*, 7(4):411–439.

Khan, F. S. and Toor, I. A. (2003). Changes in returns to education in pakistan: 1990-2002. *The Lahore Journal of Economics*, 8(1):83–98.

Kim, S., Tertilt, M., and Yum, M. (2021). Status externalities and low birth rates in korea. *CEPR Discussion Paper No. DP16271.*

Lagerlöf, N. P. (2003). From malthus to modern growth: Can epidemics explain the three regimes? *International Economic Review*, 44(2):755–777.

Maluccio, J. and R., F. (2005). Impact evaluation of a conditional cash transfer program the nicaraguan red de protección social. *Washington, DC: International Food Policy Research Institute (IFPRI)*, Report 141.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *Review of Economic Studies*, 60(3):531–542.

Manski, C. F. (2000). Economic analysis of social interactions. *Journal of Economic Perspectives*, 40(3):115–136.

Manuelli, R. E. and Seshadri, A. (2009). Explaining international fertility differences. *The Quarterly Journal of Economics*, 124(2):771–807.

Montgomery, M. R. and Cohen, B. (1998). From death to birth: Mortality decline and reproductive change. *Washington DC: National Academy Press*, NBK233813.

Munshi, K. and Myaux, J. (2006). Social norms and the fertility transition. *Journal of Development Economics*, 80(1):1–38.

Myong, S., Park, J., and Yi, J. (2021). Social norms and fertility. *Journal of the European Economic Association*, 19(5):2429–2466.

Nasir, Z. and Nazli, H. (2000). Education and earnings in pakistan. *Pakistan Institute of Development Economics*, PIDE-Working Papers(2000:177).

Nguyen, Q. and Raju, D. (2014). Private school participation in pakistan. *World Bank, Washington, DC*, Research Working Paper(No. 6897).

Nobles, J., Frankenberg, E., and Thomas, D. (2015). The effects of mortality on fertility: Population dynamics after a natural disaster. *Demography*, 52(1):15–38.

Orsal, K. and Goldstein, J. (2010). The increasing importance of economic conditions on fertility. *MPIDR Working paper WP*, 2010-014.

Pakistan Education Statistics, .-. (2014). *National Education Management Information System, Academy of Educational Planning and Management, Ministry of Federal Education and Professional Training, Government of Pakistan.*

Pakistan Education Statistics, .-. (2020). *National Education Management Information System, Academy of Educational Planning and Management, Ministry of Federal Education and Professional Training, Government of Pakistan.*

Palloni, A. and Rafalimanana, H. (1999). The effects of infant mortality on fertility revisited: New evidence from latin america. *Demography*, 36(1):41–58.

PDHS (1991). Pakistan demographic and health survey 1990–1991. *Institute for Resource Development, Macro Systems, National Institute of Population Studies (Pakistan), Fairfax, United States of America: ICF International.*

Petrakis, P. E., K.-P. C. and Valsamis, D. G. (2015). Innovation and competitiveness: Culture as a long-term strategic instrument during the european great recession. *Journal of Business Research*, 68(7):1436–1438.

PLFS (1990–2013). *Pakistan Labour Force Survey, Pakistan Bureau of Statistics.*

Preston, S. H. (1978). The effects of infant and child mortality on fertility. *New York: Academic Press*, 9780125644402.

PSLM (2015). Pakistan social and living standards measurement survey, 2013–14. *Government of Pakistan Statistics Division Pakistan Bureau of Statistics Islamabad.*

PSLM (2020). Pakistan social and living standards measurement survey, 2018–19. *Government of Pakistan Statistics Division Pakistan Bureau of Statistics Islamabad.*

Rosenzweig, M. R. and Schultz, T. P. (1983). Consumer demand and household production: The relationship between fertility and child mortality. *American Economic Review*, 73(2):38–42.

Safdar, M. R., Nasar, A., Akram, M., and Yousaf, F. N. (2022). An assessment of the structural relationship between determinants and implications of caste-based endogamy in pakistan. *International Social Science Journal*, 72(243):29–45.

Sathar, Z. A. (1985). Infant and child mortality in pakistan – some trends and differentials. *Journal of Biosocial Science*, 17(3):351–359.

Sathar, Z. A. and Casterline, J. B. (1998). The onset of fertility transition in pakistan. *Population and Development Review*, 24(4):773–796.

Schubert, B. and Slater, R. (2006). Social cash transfers in low-income african countries: Conditional or unconditional? *Development Policy Review*, 24(5):571–578.

Schultz, P. (2004). School subsidies for the poor: Evaluating the mexican progresa poverty program. *Journal of Development Economics*, 74(1):199–250.

Siegel, C. (2017). Female relative wages, household specialization and fertility. *Review of Economic Dynamics*, 24:152–174.

Soares, R. R. (2005). Mortality reductions, educational attainment, and fertility choice. *American Economic Review*, 95(3):580–601.

Spolaore, E. and Wacziarg, R. (2022). Fertility and modernity. *The Economic Journal*, 132(642):796–833.

Stichnoth, H. and Yeter, M. (2013). Cultural influences on the fertility behaviour of first- and second-generation immigrants in germany. *ZEW-Zentrum fur Europaische Wirtschaftsforschung / Center for European Economic Research*, ZEW Discussion Papers 13-023.

Tamura, R. (2006). Human capital and economic development. *Journal of Development Economics*, 79(1):26–72.

WDI (2021). World development indicators. *The World Bank: Washington, DC.*

Weisdorf, J. L. (2004). From stagnation to growth: Revisiting three historical regimes. *Journal of Population Economics*, 17(3):455–472.

Appendices

A Appendix

Maximization problem

$$\begin{aligned} L = \ & \log[w_i(1 - n_i\phi s_i) - pe_i + R_i] + \theta \log[n_i - \pi N_i + a_1] + \lambda \log[e_i + a_2] + \nu_1(0 - n_i) \\ & + \nu_2(0 - e_i) + \nu_3(\frac{1}{\phi s_i} - n_i) \end{aligned} \tag{11}$$

Where ν_1, ν_2 and ν_3 are KT multipliers associated with $n_i \geq 0$, $e_i \geq 0$ and $n_i \leq \frac{1}{s_i\phi_i}$ respectively and $c_i = w_i(1 - n_i\phi s_i) - pe_i + R_i$.

First order conditions (focs) are as follows

$$-\nu_1 - \nu_3 + \frac{\theta}{a_1 + n_i - N_i\pi} - \frac{s_i w_i \phi}{R_i - pe_i + w(1 - s_i n_i \phi)} = 0 \tag{12}$$

$$\frac{\lambda}{a_2 + e_i} - \nu_2 - \frac{p}{R_i - pe_i + w_i(1 - s_i n_i \phi)} = 0 \tag{13}$$

$$n_i \geq 0, \quad \nu_1 \geq 0 \quad \text{and} \quad \nu_1 n_i = 0 \tag{14}$$

$$e_i \geq 0, \quad \nu_2 \geq 0 \quad \text{and} \quad \nu_2 e_i = 0 \tag{15}$$

$$n_i \leq \frac{1}{s_i\phi}, \quad \nu_3 \geq 0 \quad \text{and} \quad \nu_3(\frac{1}{s_i\phi} - n_i) = 0 \tag{16}$$

Interior regime solution

For the interior solution solving focs for n_i and e_i with $\nu_1 = \nu_2 = \nu_3 = 0$ yields (4) and (5). Due to "complementary slackness conditions" either the Lagrangian multipliers or the related constraints must be zero. Using (4) and (5) in (2) gives following level of consumption in interior regime

$$c_i = \frac{a_2 p + R_i + w + s_i w_i (a_1 - \pi N_i)\phi}{1 + \theta + \lambda} \tag{17}$$

Solving $n^I = 0$ for wage yields w_{III} and gives the upper bound on wage for interior solution from interior regime. Solving $e_i = 0$ for wage yields w_{II} which is the minimum wage required to invest in education of children. The households in this regime are indifferent to childlessness and no quality at w_{III} and Max$[w_I, w_{II}]$ respectively. Solving $n^I = \frac{1}{s_i \phi}$ for wage gives w_I for $R_i \leq \overline{R}$.

No quality solution

For no quality regime we must have $e_i = 0, \nu_1 = 0, \nu_3 = 0, \nu_2 > 0$. Under these conditions solving focs for n_i yields (6) and

$$\nu_2 = \frac{-a_2 p - a_2 p\theta + R_i \lambda + w_i \lambda + a_1 w_i \lambda \phi - N_i w_i \lambda \pi \phi}{a_2 (R_i + w_i + a_1 s_i w_i \phi - N_i s_i w_i \pi \phi)} \tag{18}$$

To get the restrictions on wage for childlessness in this regime, I first solve $n^{NQ} = 0$ and get w_{IV} as the upper bound for childlessness in no quality regime. Solving $\nu_2 = 0$ for wage yields w_{II}, which is the minimum wage required to invest in children's education. If the wage goes above this level ν_2 must be zero, and e_i should be positive for the optimal solution. So in this regime, the households must have a wage below $Min[w_{IV}, w_{II}]$ so that they do not reach either the opportunity-driven childlessness level of wage or w_{II} which enables households to invest in quality. To solve for the lower bound on wage, I solve $n_i = \frac{1}{s_i \phi}$, which yields w_V. Below this wage, households will fully specialize. In this regime, households are indifferent between full specialization and n^{NQ} at w_V. They enter the interior regime if the wage exceeds w_{II} and choose childlessness above w_{IV}. Using n^{NQ} and $e_i = 0$ in (2) gives the consumption in no education regime as follows

$$c_i = \frac{R_i + w + s_i w_i (a_1 - \pi N_i)\phi}{1 + \theta} \tag{19}$$

Full specialization without quality solution

In this regime households fully specialize in child production and invest nothing in quality. It means $n_i = \frac{1}{s_i \phi}$ while $e_i = 0$ which means $\nu_1 = 0, \nu_2 > 0, \nu_3 > 0$. I solve focs under these conditions which gives

$$\nu_2 = -\frac{p}{R_i} + \frac{\lambda}{a_2} \quad \nu_3 = \frac{s_i \phi (R_i \theta + w_i(-1 - a_1 s_i \phi + N_i \pi s_i \phi))}{R_i + R_i s_i (a_1 - N_i \pi)\phi} \tag{20}$$

Solving $\nu_3 = 0$ for wage gives w_V as the threshold on wage for full specialization. At this wage, the households are indifferent between full specialization and no education. In contrast, as soon as wage exceeds this limit, they strictly prefer a "no education" regime and supply labour. When $\nu_2 = 0$ investment in quality is positive, solving $\nu_2 = 0$ for R_i gives the threshold level for non-labor income $\overline{R}$ above this level households will move into "full specialization with quality" regime.

Childlessness solution

Solving focs for $n_i = 0$, $e_i = 0$ and $\nu_3 = 0$ yields

$$\nu_1 = \frac{R_i\theta + w_i(\theta + s_i(N_i\pi - a_1)\phi)}{(R_i + w_i)(a_1 - N_i\pi)} \quad \nu_2 = -\frac{p}{R_i + w_i} + \frac{\lambda}{a_2} \tag{21}$$

Solving $\nu_1 = 0$ for w_i gives $w_i = w_{III}$. As soon as $\nu_1 = 0$, n_i will become positive. So, w_{III} is the threshold for keeping $n_i = 0$ and $\nu_1 > 0$. Note that as soon as $n_i = 0$, quality by default takes the value zero. The same result is obtained when $n_i = 0$ in the "interior regime" is solved for w_i. Above w_{III} households choose childlessness if they are in interior regime. Solving $\nu_1 = 0$ in (21) gives $w_i = w_{IV}$. This is the upper bound on wage for households in the "no education regime". Households in the "no education" regime choose childlessness above w_{IV} due to high opportunity cost. As soon as the wage is above $Min[w_{III}, w_{IV}]$, the optimal fertility level for the household is zero. Note that the households in the interior regime choose childlessness above w_{III}, while those in the no-quality regime choose childlessness when the wage is above w_{IV}. This result implies that opportunity-driven childlessness is not limited to households with highly educated women, and households with less educated women and lower wages can also choose to stay childless. This occurs because forgone wages mean forgone consumption, and for very poor households, the cost of having a child could be very high. The non-homothetic preferences ensure that poor households stay childless as long as the net benefit from a unit of consumption is higher than the net utility from a child. Critical wages are defined in terms of N_i and R_i, which implies that with very high spouse income and/or norms, opportunity-driven childlessness could be impossible despite $a_1 > \frac{1}{s_i\phi}$. Therefore, $a_1 > \frac{1}{s_i\phi}$ is a necessary but not sufficient condition for opportunity-driven childlessness. Consumption in this regime is $w_i + R_i$.

Full specialization with quality solution

Solving focs under condition $n_i = \frac{1}{s_i\phi}, \nu_1 = 0, \nu_2 = 0, \nu_3 > 0, R_i \geq \overline{R}$ yields (7) and the following

$$\nu_3 = s_i\phi\left(-\frac{w_i(1+\lambda)}{a_2+R_i} + \frac{\theta}{1+s_i(a_1-N_i\pi)\phi)}\right) \tag{22}$$

The investment in quality in (7) is independent of the mother's wage and the child's survival probability. The result in (7) is based on a simplified assumption. If the education price varies with the mother's wage (households with high-waged women choose expensive private schools while low-waged women choose low-cost public schools), then the quality in this regime would also depend on w_i.

The investment in quality in (7) is independent of the mother's wage and the child's survival probability. The result in (7) is based on a simplified assumption. If the education price varies with the mother's wage (households with high-waged women choose expensive private schools while low-waged women choose low-cost public schools), then the quality in this regime would also depend on w_i.

Solving (22) $= 0$ for wage gives w_I that is the upper bound on wage for the women to stay in a "full specialization" regime and not supply labor. Above w_I, the household will enter into the interior regime. Remember, in this regime, investment in education only depends on R_i and not w_i regardless of wage. The household is rich enough to afford the child's education. So we have $\overline{R}$ as the required lower bound on non-labor income for a household to invest in children's education without worrying about wages. Consumption in this regime is given as follows

$$c_i = \frac{a_2p + R_i}{1+\lambda} \tag{23}$$

Figure (12) shows the fertility regimes in w and R space for a constant N.

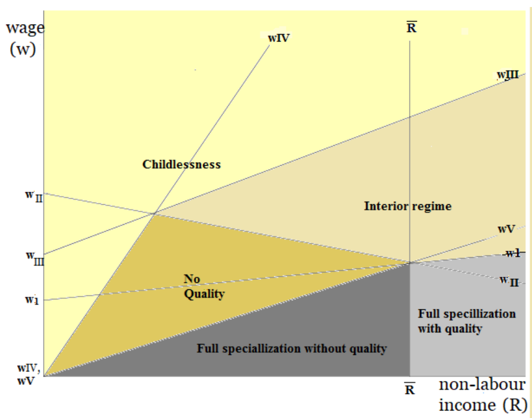


Figure 12: Fertility regimes

B Appendix

Table 12: Results: Auxiliary Model

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility Norm	1.054**	+5.42	0.029
Years of schooling	0.966***	-3.40	0.002
Spouse's education	0.993***	-0.69	0.002
Age 45-49	1.071***	+7.10	0.002
First born girl	1.055***	+5.51	0.013
Assets	1.006	+0.57	0.022
Rural	1.004	+0.39	0.021
Punjab	0.921**	-7.90	0.025
Sindh	0.996	-0.38	0.026
KPK	0.927**	-7.28	0.025
Poorer	0.999	-0.01	0.022
Middle	1.006	+0.60	0.024
Richer	0.967	-3.40	0.027
Richest	0.923**	-7.70	0.028
Constant	4.745***	–	0.861

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13, 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son.
(∗ ∗ ∗: Significant at 99 percent confidence interval ,∗∗: Significant at 95 percent confidence interval , ∗: Significant at 90 percent confidence interval)

Table 13: Target moments for 119 demographic groups

Moment	School	Norms	Quantity	Moment	School	Norms	Quantity
1	0	6.269	6.272	61	8	6.719	4.881
2	0	6.320	6.289	62	8	6.772	4.895
3	0	6.341	6.296	63	8	7.199	5.007
4	0	6.415	6.320	64	9	6.269	4.606
5	0	6.719	6.422	65	9	6.320	4.619
6	0	6.772	6.441	66	9	6.341	4.624
7	0	7.199	6.587	67	9	6.415	4.642
8	1	6.269	6.060	68	9	6.719	4.717
9	1	6.320	6.077	69	9	6.772	4.730
10	1	6.341	6.083	70	9	7.199	4.838
11	1	6.415	6.107	71	10	6.269	4.451
12	1	6.719	6.206	72	10	6.320	4.463
13	1	6.772	6.223	73	10	6.341	4.468
14	1	7.199	6.365	74	10	6.415	4.485
15	2	6.269	5.856	75	10	6.719	4.558
16	2	6.320	5.872	76	10	6.772	4.571
17	2	6.341	5.878	77	10	7.199	4.675
18	2	6.415	5.901	78	11	6.269	4.301
19	2	6.719	5.997	79	11	6.320	4.312
20	2	6.772	6.014	80	11	6.341	4.317
21	2	7.199	6.151	81	11	6.415	4.334
22	3	6.269	5.658	82	11	6.719	4.404
23	3	6.320	5.674	83	11	6.772	4.417
24	3	6.341	5.680	84	11	7.199	4.517
25	3	6.415	5.702	85	12	6.269	4.156
26	3	6.719	5.794	86	12	6.320	4.167
27	3	6.772	5.811	87	12	6.341	4.172
28	3	7.199	5.943	88	12	6.415	4.188
29	4	6.269	5.468	89	12	6.719	4.256
30	4	6.320	5.483	90	12	6.772	4.268
31	4	6.341	5.489	91	12	7.199	4.365
32	4	6.415	5.510	92	13	6.269	4.016
33	4	6.719	5.599	93	13	6.320	4.027
34	4	6.772	5.615	94	13	6.341	4.031
35	4	7.199	5.743	95	13	6.415	4.047
36	5	6.269	5.283	96	13	6.719	4.112

Continued on next page

Table 13 – continued from previous page

Moment	School	Norms	Quantity	Moment	School	Norms	Quantity
37	5	6.320	5.298	97	13	6.772	4.124
38	5	6.341	5.304	98	13	7.199	4.218
39	5	6.415	5.324	99	14	6.269	3.880
40	5	6.719	5.410	100	14	6.320	3.891
41	5	6.772	5.426	101	14	6.341	3.895
42	5	7.199	5.549	102	14	6.415	3.910
43	6	6.269	5.105	103	14	6.719	3.973
44	6	6.320	5.119	104	14	6.772	3.985
45	6	6.341	5.125	105	14	7.199	4.076
46	6	6.415	5.145	106	15	6.269	3.749
47	6	6.719	5.228	107	15	6.320	3.760
48	6	6.772	5.243	108	15	6.341	3.764
49	6	7.199	5.362	109	15	6.415	3.778
50	7	6.269	4.933	110	15	6.719	3.840
51	7	6.320	4.947	111	15	6.772	3.850
52	7	6.341	4.952	112	15	7.199	3.938
53	7	6.415	4.971	113	16	6.269	3.623
54	7	6.719	5.052	114	16	6.320	3.633
55	7	6.772	5.066	115	16	6.341	3.637
56	7	7.199	5.181	116	16	6.415	3.651
57	8	6.269	4.767	117	16	6.719	3.710
58	8	6.320	4.780	118	16	6.772	3.721
59	8	6.341	4.785	119	16	7.199	3.805
60	8	6.415	4.804				

Note: The moments are fertility rates generated by the auxiliary model. The fertility rates are predicted for seven ethnicities in 17 possible school groups. This gives a total of 119 fertility rates used as target in the structural estimation.

Table 14: Average private annual education expenditure in local currency

Survey year	Years of schooling	Education cost (PKR)		Total enrolments	
		Private	Public	Private	Public
2013-14	1-5	2,356	11,664	11,279,057	6,295,792
2013-14	6-8	4,017	17,256	4,039,815	2,079,382
2013-14	9-12	6,955	23,042	1,948,292	887,034
2013-14	13+	24,694	38,142	1,969,854	266,333
2018-19	1-5	3,667	18,209	12,064,447	6,599,309
2018-19	6-8	6,145	27,600	4,238,839	2,183,586
2018-19	9-12	10,125	35,790	2,353,201	995,763
2018-19	13+	32,884	593,999	1,282,890	441,641
2013-14	$GDP = 2,239 \times 10^{10}$ PKR	$\sum \hat{e} \approx 28 \times 10^{10}$ PKR		$\hat{E} = \frac{\sum \hat{e}}{GDP} = 0.013$	
2018-19	$GDP = 3,555 \times 10^{10}$PKR	$\sum \hat{e} \approx 37 \times 10^{10}$ PKR		$\hat{E} = \frac{\sum \hat{e}}{GDP} = 0.011$	

Note: The data on education cost is taken from Pakistan Living Standards Measurement Survey (2013–14, 2018–19), while the data on enrolments is taken from Pakistan Education Statistics (2012–13, 2017–18). The data on GDP is taken from WDI. All values are expressed in local currency Pakistani Rupee (PKR).

Table 15: Non-target moments

Moment	Years of schooling	Norms
1	0	6.370
2	1	6.155
3	2	5.948
4	3	5.747
5	4	5.553
6	5	5.366
7	6	5.185
8	7	5.010
9	8	4.842
10	9	4.678
11	10	4.521
12	11	4.368
13	12	4.221
14	13	4.079
15	14	3.941
16	15	3.808
17	16	3.680

Note: The table has the non-target moments used for the internal validity of the model. These moments are fertility rates by years of schooling, predicted by the auxiliary model with fertility norms and all other covariates set at the average of the sample.

C Appendix

I conduct several checks to establish a robust correlation between fertility and fertility norms. Table 16 shows that the results are robust when controlling for the child mortality rate. The significance, as well as the magnitude of the coefficient, does not change. Child mortality has a positive effect on fertility. Adding years fixed effects (table 17) does not change the significance or the magnitude of the coefficient of the fertility norms. Controlling for husband's age (table 18), preference for son (table 19), the experience of terminated pregnancy (table 20), and age at first birth (to control for teenage pregnancy (table 21) and their effect on education) does not affect the magnitude of the effect of the norms. However, the significance reduces from 5 to 10 percent level.

Table 16: Robustness with child mortality under 5

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.056**	+5.639	0.029
Years of schooling	0.980***	-1.995	0.007
Age 45-49	1.071***	+7.128	0.014
Spouse's education	0.993***	-0.689	0.002
Rural	1.003	+0.308	0.021
First born girl	1.055***	+5.524	0.013
Assets	1.006	+0.628	0.022
Punjab	0.919***	-8.091	0.025
Sindh	0.996	-0.440	0.026
KPK	0.927***	-7.291	0.025
Poorer	0.999	-0.088	0.022
Middle	1.005	+0.500	0.024
Richer	0.963	-3.680	0.027
Richest	0.922***	-7.808	0.028
Child mortality	1.004**	+0.370	0.002
Constant	3.347***	-	0.851

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. ($***$: Significant at 99 percent confidence interval ,$**$: Significant at 95 percent confidence interval , $*$: Significant at 90 percent confidence interval)

Table 17: Robustness with year fixed effects

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.055**	+5.549	0.029
Years of schooling	0.981***	-1.866	0.007
Age 45-49	1.073***	+7.286	0.014
Spouse's education	0.993***	-0.654	0.002
Rural	1.000	+0.024	0.020
First born girl	1.054***	+5.421	0.013
Assets	0.990	-1.014	0.023
Punjab	0.913***	-8.669	0.024
Sindh	0.992	-0.755	0.025
KPK	0.923***	-7.661	0.024
Poorer	0.996	-0.410	0.022
Middle	0.998	-0.186	0.024
Richer	0.952*	-4.755	0.027
Richest	0.907***	-9.296	0.028
2013	0.974	-2.602	0.020
2017	0.941***	-5.883	0.020
2018	0.907***	-9.301	0.016
Child mortality	1.004**	+0.379	0.002
Constant	3.474***	-	0.873

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. (∗ ∗ ∗: Significant at 99 percent confidence interval ,∗∗: Significant at 95 percent confidence interval , ∗: Significant at 90 percent confidence interval)

Table 18: Robustneess with husband's age

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.053*	+5.312	0.029
Years of schooling	0.981***	-1.869	0.007
Age 45-49	1.055***	+5.545	0.014
Spouse's education	0.994***	-0.614	0.002
Spouse's age	1.004***	+0.353	0.001
Rural	0.998	-0.159	0.020
First born girl	1.054***	+5.400	0.013
Assets	0.987	-1.265	0.023
Punjab	0.915***	-8.507	0.024
Sindh	0.992	-0.754	0.025
KPK	0.920***	-7.988	0.024
Poorer	0.995	-0.523	0.021
Middle	0.995	-0.479	0.024
Richer	0.948*	-5.210	0.027
Richest	0.901***	-9.861	0.028
2013	0.976	-2.375	0.020
2017	0.943***	-5.733	0.020
2018	0.907***	-9.323	0.016
Child mortality	1.004**	+0.378	0.002
Constant	2.993***	-	0.751

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. ($***$: Significant at 99 percent confidence interval ,$**$: Significant at 95 percent confidence interval , $*$: Significant at 90 percent confidence interval)

Table 19: Robustness with son preference

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.053*	+5.334	0.028
Years of schooling	0.981***	-1.877	0.007
Age 45-49	1.056***	+5.553	0.014
Spouse's education	0.994***	-0.608	0.002
Spouse's age	1.004***	+0.355	0.001
Rural	0.999	-0.138	0.020
Son preference	1.025	+2.475	0.016
First born girl	1.055***	+5.541	0.013
Assets	0.990	-1.034	0.023
Punjab	0.918***	-8.234	0.024
Sindh	0.994	-0.575	0.025
KPK	0.920***	-8.022	0.024
Poorer	0.995	-0.460	0.021
Middle	0.997	-0.325	0.024
Richer	0.950*	-5.005	0.027
Richest	0.904***	-9.582	0.028
2013	0.976	-2.392	0.020
2017	0.945***	-5.546	0.020
2018	0.908***	-9.233	0.016
Child mortality	1.004**	+0.376	0.002
Constant	2.951***	-	0.741

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. ($***$: Significant at 99 percent confidence interval ,$**$: Significant at 95 percent confidence interval , $*$: Significant at 90 percent confidence interval)

Table 20: Robustness with terminated pregnancy

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.051*	+5.069	0.028
Years of schooling	0.981***	-1.934	0.007
Spouse's education	0.994***	-0.615	0.002
Spouse's age	1.005***	+0.486	0.001
Assets	0.990	-0.963	0.023
Rural	1.001	+0.057	0.020
Punjab	0.917***	-8.336	0.024
Sindh	0.996	-0.426	0.025
KPK	0.916***	-8.409	0.024
Poorer	0.996	-0.378	0.021
Middle	0.998	-0.167	0.024
Richer	0.953*	-4.722	0.027
Richest	0.909***	-9.142	0.028
First born girl	1.056***	+5.618	0.013
Son preference	1.024	+2.429	0.016
Terminated pregnancy	1.018	+1.849	0.014
2013	0.979	-2.080	0.020
2017	0.945***	-5.493	0.020
2018	0.910***	-8.993	0.016
Child mortality	1.004**	+0.372	0.002
Constant	2.867***	-	0.720

Note: The sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. (∗∗∗: Significant at 99 percent confidence interval ,∗∗: Significant at 95 percent confidence interval , ∗: Significant at 90 percent confidence interval)

Table 21: Robustness with age at first birth

Variable	Incident Rate Ratio	Percentage Change	S.E.
Fertility norms	1.043*	+4.312	0.026
Years of schooling	0.988**	-1.208	0.006
Spouse's education	0.995***	-0.503	0.001
Spouse's age	1.001	+0.070	0.001
Assets	0.968	-3.171	0.021
Rural	1.005	+0.459	0.020
Punjab	0.918***	-8.204	0.023
Sindh	0.967	-3.308	0.024
KPK	0.923***	-7.679	0.023
Age at first birth	0.963***	-3.654	0.001
Poorer	0.966*	-3.381	0.019
Middle	0.957**	-4.327	0.021
Richer	0.914***	-8.563	0.025
Richest	0.850***	-15.020	0.025
First born girl	1.062***	+6.182	0.013
Son preference	1.021	+2.149	0.015
Terminated pregnancy - Yes	1.020	+2.028	0.013
2013	0.998	-0.223	0.020
2017	0.943***	-5.658	0.019
2018	0.929***	-7.064	0.014
Child mortality	1.003**	+0.303	0.002
Constant	8.662***	-	1.983

Note: The sample has 7098 observations on married women, frohe sample has 7098 observations on ever married women, from PDHS pooled for 2012–13 and 2017–18. For region fixed effects, wealth effects, assets effects and gender of first born, dummy variables are used. The errors are robust and clustered over the primary sampling unit. The reference group is the poorest married female age 40–44, lives in urban area of Balochistan, owns no assets and her first born is a son. (∗∗∗: Significant at 99 percent confidence interval ,∗∗: Significant at 95 percent confidence interval , ∗: Significant at 90 percent confidence interval)

D Appendix

Figure (13) shows the effects of changes in $\{\theta, \pi, \lambda, R, p\}$ on the quantity-quality regimes. These effects verify that we can identify the structural parameters by replicating the fertility patterns observed in the data. The left panel of the figure shows the fertility (quantity), while the right panel shows the corresponding expenditure on children's education (quality) as a function of the mother's wage. The horizontal part on the top left of each quantity graph represents the full specialization regimes. The horizontal lines on the quality graphs indicate zero investment in children's education. The solid lines show the QQ after a shock to the given parameter. A rise in preference for children θ extends the full specialization regime to higher wages shifting fertility and quality to the right. However, the effect of θ comes into play at the point where the regime shifts from "full specialization without quality" to a "no quality" regime. A rise in intensity of the effect of norms π also moves the fertility and quality to the right, but it does not impact the "full specialization" regime. A rise in preference for children's education λ shifts quantity and quality to the left, unlike θ and π. Like the rise in θ, a rise in R also affects at the point of regime shift, but it can be separately identified because of its unique effect on quality. A sufficiently big rise in R can result in the disappearance of regimes without quality. Lastly, a rise in the price per unit of education p has a similar effect on fertility to that of R and θ; however, its effect on quality differs. While a rise in R can lead to the disappearance of regimes without quality, on the contrary, a rise in p may induce regimes without quality which allows us to identify it separately.

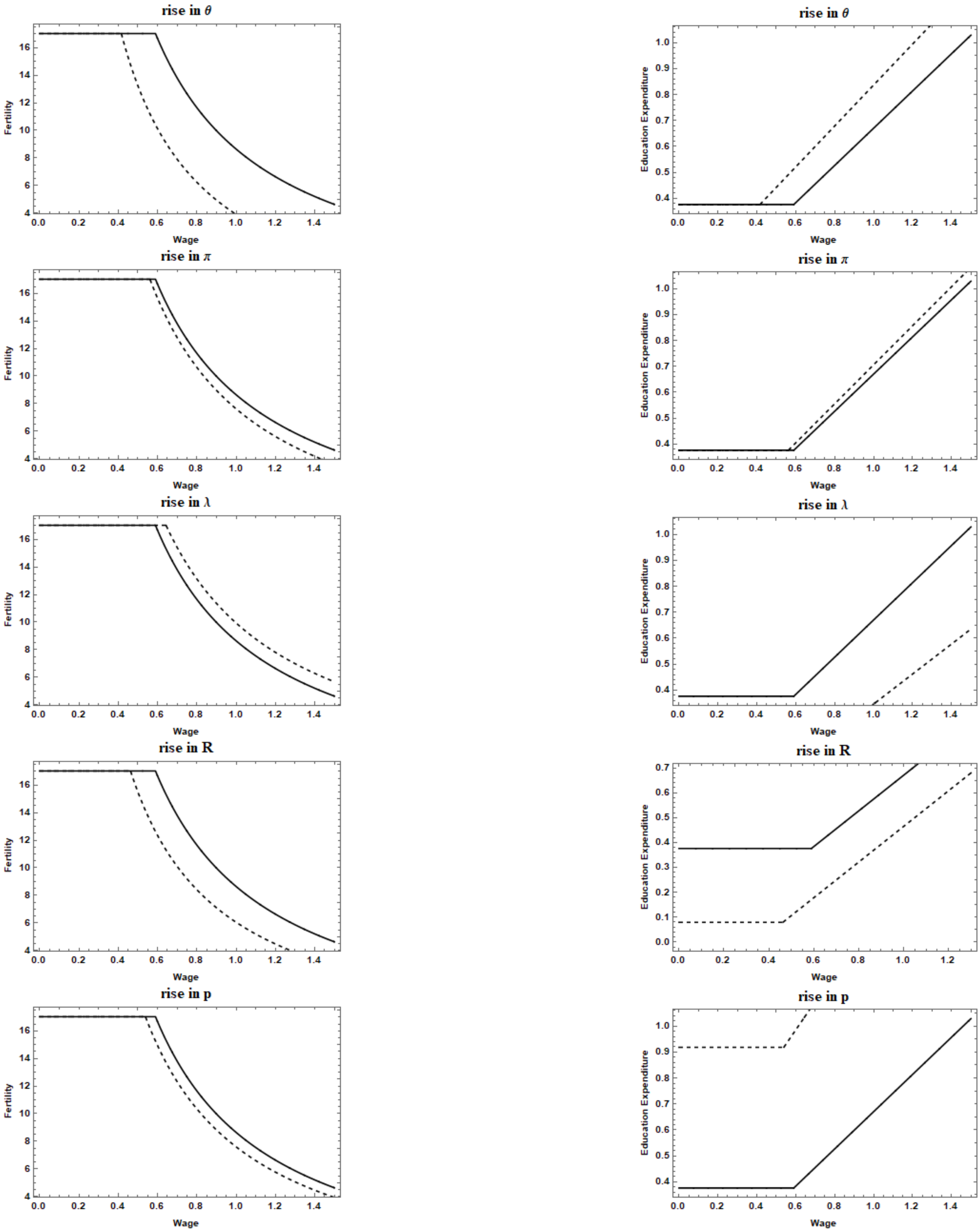


Figure 13: Role of parameters in determining quantity-quality regime; Solid lines in the left panel show the effect of rise in the given parameter on fertility while the solid line in right panel shows the effect of rise in the given parameter on expenditure on education of children

E Appendix

Table 22: Quantity and quality across households with heterogeneous socio-economic backgrounds of mothers

Years of schooling	Wage	Child mortality	Norm	Quantity	Quality
0	1.000	0.091	6.269	6.314	0.114
0	1.000	0.091	6.320	6.327	0.108
0	1.000	0.091	6.341	6.332	0.105
0	1.000	0.091	6.415	6.351	0.096
0	1.000	0.091	6.719	6.428	0.060
0	1.000	0.091	6.772	6.441	0.053
0	1.000	0.091	7.199	6.549	0.001
1	1.010	0.083	6.269	5.990	0.315
1	1.010	0.083	6.320	6.003	0.308
1	1.010	0.083	6.341	6.008	0.306
1	1.010	0.083	6.415	6.027	0.297
1	1.010	0.083	6.719	6.103	0.260
1	1.010	0.083	6.772	6.117	0.253
1	1.010	0.083	7.199	6.225	0.201
2	1.020	0.083	6.269	5.840	0.459
2	1.020	0.083	6.320	5.853	0.452
2	1.020	0.083	6.341	5.858	0.450
2	1.020	0.083	6.415	5.877	0.441
2	1.020	0.083	6.719	5.953	0.404
2	1.020	0.083	6.772	5.967	0.397
2	1.020	0.083	7.199	6.075	0.345
3	1.030	0.083	6.269	5.691	0.603
3	1.030	0.083	6.320	5.704	0.596
3	1.030	0.083	6.341	5.709	0.594
3	1.030	0.083	6.415	5.728	0.585
3	1.030	0.083	6.719	5.805	0.548
3	1.030	0.083	6.772	5.818	0.541
3	1.030	0.083	7.199	5.926	0.489
4	1.041	0.083	6.269	5.544	0.747
4	1.041	0.083	6.320	5.557	0.740
4	1.041	0.083	6.341	5.562	0.738
4	1.041	0.083	6.415	5.581	0.729
4	1.041	0.083	6.719	5.657	0.692

Continued on next page

Table 22 – continued from previous page

Years of schooling	Wage	Child mortality	Norm	Quantity	Quality
4	1.041	0.083	6.772	5.671	0.685
4	1.041	0.083	7.199	5.779	0.633
5	1.051	0.083	6.269	5.398	0.891
5	1.051	0.083	6.320	5.411	0.884
5	1.051	0.083	6.341	5.416	0.882
5	1.051	0.083	6.415	5.435	0.873
5	1.051	0.083	6.719	5.512	0.836
5	1.051	0.083	6.772	5.525	0.829
5	1.051	0.083	7.199	5.633	0.777
6	1.055	0.065	6.269	4.985	1.068
6	1.055	0.065	6.320	4.998	1.062
6	1.055	0.065	6.341	5.004	1.059
6	1.055	0.065	6.415	5.022	1.050
6	1.055	0.065	6.719	5.099	1.013
6	1.055	0.065	6.772	5.112	1.006
6	1.055	0.065	7.199	5.220	0.953
7	1.059	0.065	6.269	4.936	1.119
7	1.059	0.065	6.320	4.949	1.113
7	1.059	0.065	6.341	4.954	1.110
7	1.059	0.065	6.415	4.972	1.101
7	1.059	0.065	6.719	5.049	1.064
7	1.059	0.065	6.772	5.063	1.057
7	1.059	0.065	7.199	5.170	1.004
8	1.062	0.065	6.269	4.886	1.170
8	1.062	0.065	6.320	4.899	1.164
8	1.062	0.065	6.341	4.904	1.161
8	1.062	0.065	6.415	4.923	1.152
8	1.062	0.065	6.719	4.999	1.114
8	1.062	0.065	6.772	5.013	1.108
8	1.062	0.065	7.199	5.121	1.055
9	1.066	0.048	6.269	4.510	1.339
9	1.066	0.048	6.320	4.523	1.333
9	1.066	0.048	6.341	4.528	1.330
9	1.066	0.048	6.415	4.547	1.321
9	1.066	0.048	6.719	4.623	1.283
9	1.066	0.048	6.772	4.637	1.277

Continued on next page

Table 22 – continued from previous page

Years of schooling	Wage	Child mortality	Norm	Quantity	Quality
9	1.066	0.048	7.199	4.745	1.223
10	1.070	0.048	6.269	4.461	1.390
10	1.070	0.048	6.320	4.474	1.384
10	1.070	0.048	6.341	4.480	1.381
10	1.070	0.048	6.415	4.498	1.372
10	1.070	0.048	6.719	4.575	1.334
10	1.070	0.048	6.772	4.588	1.327
10	1.070	0.048	7.199	4.696	1.274
11	1.074	0.038	6.269	4.228	1.510
11	1.074	0.038	6.320	4.240	1.504
11	1.074	0.038	6.341	4.246	1.501
11	1.074	0.038	6.415	4.264	1.492
11	1.074	0.038	6.719	4.341	1.454
11	1.074	0.038	6.772	4.355	1.447
11	1.074	0.038	7.199	4.462	1.394
12	1.078	0.038	6.269	4.180	1.561
12	1.078	0.038	6.320	4.193	1.555
12	1.078	0.038	6.341	4.198	1.552
12	1.078	0.038	6.415	4.217	1.543
12	1.078	0.038	6.719	4.293	1.505
12	1.078	0.038	6.772	4.307	1.498
12	1.078	0.038	7.199	4.415	1.444
13	1.090	0.038	6.269	4.030	1.722
13	1.090	0.038	6.320	4.043	1.715
13	1.090	0.038	6.341	4.049	1.713
13	1.090	0.038	6.415	4.067	1.703
13	1.090	0.038	6.719	4.144	1.665
13	1.090	0.038	6.772	4.157	1.658
13	1.090	0.038	7.199	4.265	1.605
14	1.102	0.038	6.269	3.883	1.882
14	1.102	0.038	6.320	3.896	1.875
14	1.102	0.038	6.341	3.901	1.873
14	1.102	0.038	6.415	3.919	1.864
14	1.102	0.038	6.719	3.996	1.826
14	1.102	0.038	6.772	4.010	1.819
14	1.102	0.038	7.199	4.117	1.765

Continued on next page

Table 22 – continued from previous page

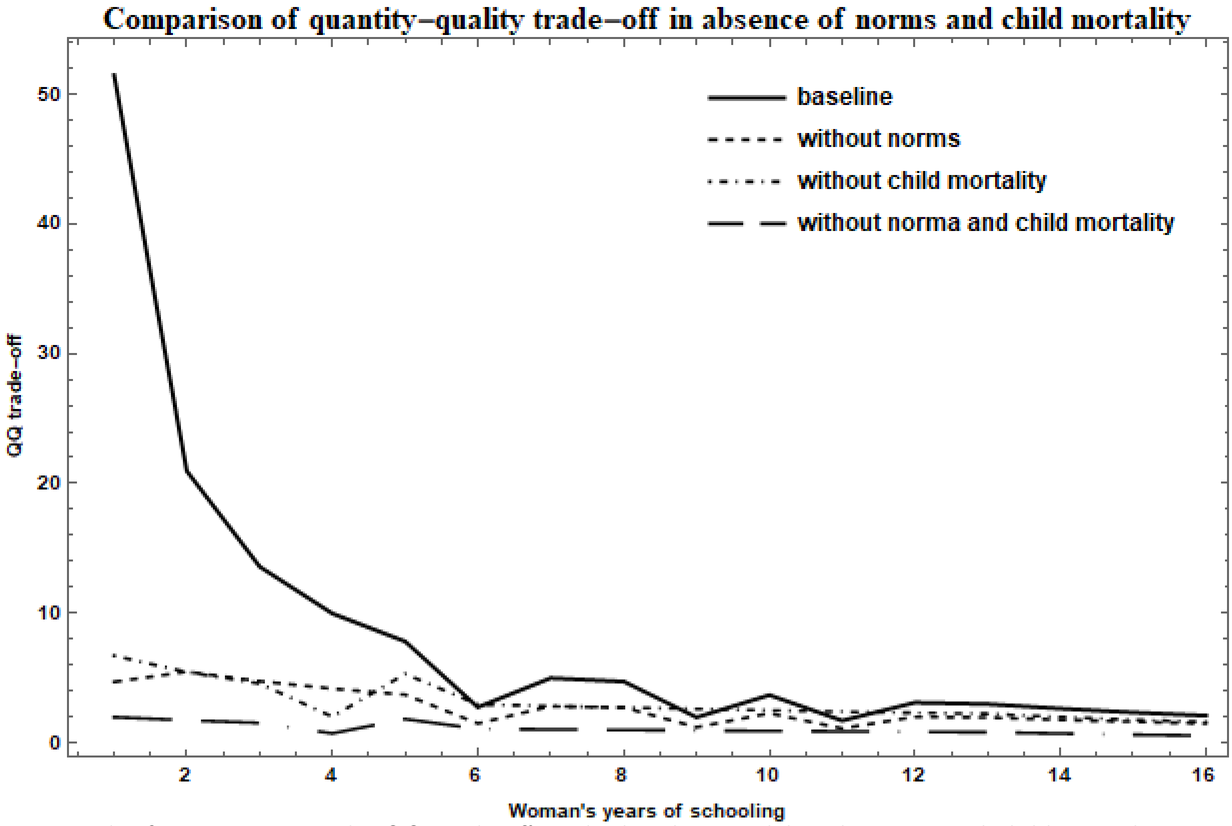
Years of schooling	Wage	Child mortality	Norm	Quantity	Quality
15	1.114	0.038	6.269	3.737	2.042
15	1.114	0.038	6.320	3.749	2.036
15	1.114	0.038	6.341	3.755	2.033
15	1.114	0.038	6.415	3.773	2.024
15	1.114	0.038	6.719	3.850	1.986
15	1.114	0.038	6.772	3.863	1.979
15	1.114	0.038	7.199	3.971	1.926
16	1.127	0.038	6.269	3.592	2.202
16	1.127	0.038	6.320	3.605	2.196
16	1.127	0.038	6.341	3.610	2.193
16	1.127	0.038	6.415	3.629	2.184
16	1.127	0.038	6.719	3.705	2.146
16	1.127	0.038	6.772	3.719	2.139
16	1.127	0.038	7.199	3.827	2.086
Mean	1.062	0.060	6.576	4.913	1.146

Note: Table shows that QQ in baseline scenario at observed level of norms, child mortality, and wage. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman.

Table 23: Correlation between variables

	Coefficient of correlation
Quantity-Quality	-0.993
Quantity-Norms	+0.096
Quantity-Child mortality	+0.965
Quality-Norms	-0.066
Quality-Child mortality	-0.936
QQ trade-off- women's schooling	-0.697

Note: The correlation coefficients are based on the information provided in table 22 in appendix E. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman.



Notes: The figure compares the QQ trade-off in the baseline model with norms and child mortality to the QQ trade-off in the models without norms and/or child mortality. The QQ trade-off is measured as percentage change in quality for a one percentage change in quantity with each additional year of schooling of the woman. Quality is the expenditure on education of children expressed as a percentage of household income. Quantity is the number of births per woman.

Figure 14: QQ trade-off in absence of norms and child mortality

Table 24: Quantity-quality in absence of norms and child mortality

Years of schooling	Norms	quantity $\pi = 0$	quality $\pi = 0$	quantity $s_i = 1$	quality $s_i = 1$	quantity $\pi = 0$ $s_i = 1$	quality $\pi = 0$ $s_i = 1$
0	6.269	4.732	0.855	4.516	0.746	2.935	1.525
0	6.320	4.732	0.855	4.529	0.740	2.935	1.525
0	6.341	4.732	0.855	4.535	0.737	2.935	1.525
0	6.415	4.732	0.855	4.553	0.728	2.935	1.525
0	6.719	4.732	0.855	4.630	0.689	2.935	1.525
0	6.772	4.732	0.855	4.643	0.682	2.935	1.525
0	7.199	4.732	0.855	4.751	0.627	2.935	1.525
1	6.269	4.408	1.059	4.377	0.890	2.795	1.669
1	6.320	4.408	1.059	4.390	0.884	2.795	1.669
1	6.341	4.408	1.059	4.395	0.881	2.795	1.669
1	6.415	4.408	1.059	4.414	0.872	2.795	1.669
1	6.719	4.408	1.059	4.491	0.833	2.795	1.669
1	6.772	4.408	1.059	4.504	0.826	2.795	1.669
1	7.199	4.408	1.059	4.612	0.771	2.795	1.669
2	6.269	4.258	1.203	4.240	1.034	2.658	1.813
2	6.320	4.258	1.203	4.252	1.028	2.658	1.813
2	6.341	4.258	1.203	4.258	1.025	2.658	1.813
2	6.415	4.258	1.203	4.276	1.016	2.658	1.813
2	6.719	4.258	1.203	4.353	0.977	2.658	1.813
2	6.772	4.258	1.203	4.367	0.970	2.658	1.813
2	7.199	4.258	1.203	4.474	0.915	2.658	1.813
3	6.269	4.109	1.347	4.103	1.178	2.521	1.957
3	6.320	4.109	1.347	4.116	1.172	2.521	1.957
3	6.341	4.109	1.347	4.121	1.169	2.521	1.957
3	6.415	4.109	1.347	4.140	1.160	2.521	1.957
3	6.719	4.109	1.347	4.217	1.121	2.521	1.957
3	6.772	4.109	1.347	4.230	1.114	2.521	1.957
3	7.199	4.109	1.347	4.338	1.059	2.521	1.957
4	6.269	3.962	1.491	3.968	1.322	2.386	2.101
4	6.320	3.962	1.491	3.981	1.316	2.386	2.101
4	6.341	3.962	1.491	3.986	1.313	2.386	2.101
4	6.415	3.962	1.491	4.005	1.304	2.386	2.101
4	6.719	3.962	1.491	4.082	1.265	2.386	2.101
4	6.772	3.962	1.491	4.095	1.258	2.386	2.101

Continued on next page

Table 24 – continued from previous page

Years of schooling	Norms	quantity $\pi = 0$	quality $\pi = 0$	quantity $s_i = 1$	quality $s_i = 1$	quantity $\pi = 0$ $s_i = 1$	quality $\pi = 0$ $s_i = 1$
4	7.199	3.962	1.491	4.203	1.203	2.386	2.101
5	6.269	3.816	1.635	3.835	1.466	2.253	2.245
5	6.320	3.816	1.635	3.848	1.460	2.253	2.245
5	6.341	3.816	1.635	3.853	1.457	2.253	2.245
5	6.415	3.816	1.635	3.871	1.448	2.253	2.245
5	6.719	3.816	1.635	3.948	1.409	2.253	2.245
5	6.772	3.816	1.635	3.962	1.402	2.253	2.245
5	7.199	3.816	1.635	4.069	1.347	2.253	2.245
6	6.269	3.404	1.820	3.788	1.517	2.206	2.295
6	6.320	3.404	1.820	3.801	1.511	2.206	2.295
6	6.341	3.404	1.820	3.806	1.508	2.206	2.295
6	6.415	3.404	1.820	3.825	1.499	2.206	2.295
6	6.719	3.404	1.820	3.901	1.460	2.206	2.295
6	6.772	3.404	1.820	3.915	1.453	2.206	2.295
6	7.199	3.404	1.820	4.022	1.398	2.206	2.295
7	6.269	3.354	1.871	3.741	1.568	2.159	2.346
7	6.320	3.354	1.871	3.754	1.561	2.159	2.346
7	6.341	3.354	1.871	3.759	1.559	2.159	2.346
7	6.415	3.354	1.871	3.778	1.549	2.159	2.346
7	6.719	3.354	1.871	3.855	1.510	2.159	2.346
7	6.772	3.354	1.871	3.868	1.504	2.159	2.346
7	7.199	3.354	1.871	3.976	1.449	2.159	2.346
8	6.269	3.304	1.922	3.695	1.619	2.113	2.397
8	6.320	3.304	1.922	3.708	1.612	2.113	2.397
8	6.341	3.304	1.922	3.713	1.610	2.113	2.397
8	6.415	3.304	1.922	3.731	1.600	2.113	2.397
8	6.719	3.304	1.922	3.808	1.561	2.113	2.397
8	6.772	3.304	1.922	3.822	1.554	2.113	2.397
8	7.199	3.304	1.922	3.929	1.500	2.113	2.397
9	6.269	2.928	2.098	3.648	1.669	2.066	2.447
9	6.320	2.928	2.098	3.661	1.663	2.066	2.447
9	6.341	2.928	2.098	3.666	1.660	2.066	2.447
9	6.415	2.928	2.098	3.685	1.651	2.066	2.447
9	6.719	2.928	2.098	3.762	1.612	2.066	2.447

Continued on next page

Table 24 – continued from previous page

Years of schooling	Norms	quantity $\pi = 0$	quality $\pi = 0$	quantity $s_i = 1$	quality $s_i = 1$	quantity $\pi = 0$ $s_i = 1$	quality $\pi = 0$ $s_i = 1$
9	6.772	2.928	2.098	3.775	1.605	2.066	2.447
9	7.199	2.928	2.098	3.883	1.550	2.066	2.447
10	6.269	2.88	2.149	3.602	1.720	2.020	2.498
10	6.320	2.88	2.149	3.615	1.714	2.020	2.498
10	6.341	2.88	2.149	3.620	1.711	2.020	2.498
10	6.415	2.88	2.149	3.639	1.702	2.020	2.498
10	6.719	2.88	2.149	3.716	1.663	2.020	2.498
10	6.772	2.88	2.149	3.729	1.656	2.020	2.498
10	7.199	2.88	2.149	3.837	1.601	2.020	2.498
11	6.269	2.646	2.273	3.556	1.771	1.974	2.549
11	6.320	2.646	2.273	3.569	1.764	1.974	2.549
11	6.341	2.646	2.273	3.574	1.762	1.974	2.549
11	6.415	2.646	2.273	3.593	1.752	1.974	2.549
11	6.719	2.646	2.273	3.670	1.713	1.974	2.549
11	6.772	2.646	2.273	3.683	1.707	1.974	2.549
11	7.199	2.646	2.273	3.791	1.652	1.974	2.549
12	6.269	2.598	2.324	3.510	1.822	1.928	2.599
12	6.320	2.598	2.324	3.523	1.815	1.928	2.599
12	6.341	2.598	2.324	3.529	1.813	1.928	2.599
12	6.415	2.598	2.324	3.547	1.803	1.928	2.599
12	6.719	2.598	2.324	3.624	1.764	1.928	2.599
12	6.772	2.598	2.324	3.637	1.757	1.928	2.599
12	7.199	2.598	2.324	3.745	1.703	1.928	2.599
13	6.269	2.449	2.484	3.367	1.982	1.785	2.759
13	6.320	2.449	2.484	3.38	1.976	1.785	2.759
13	6.341	2.449	2.484	3.385	1.973	1.785	2.759
13	6.415	2.449	2.484	3.403	1.963	1.785	2.759
13	6.719	2.449	2.484	3.480	1.925	1.785	2.759
13	6.772	2.449	2.484	3.494	1.918	1.785	2.759
13	7.199	2.449	2.484	3.601	1.863	1.785	2.759
14	6.269	2.301	2.644	3.224	2.142	1.643	2.919
14	6.320	2.301	2.644	3.237	2.136	1.643	2.919
14	6.341	2.301	2.644	3.243	2.133	1.643	2.919
14	6.415	2.301	2.644	3.261	2.124	1.643	2.919

Continued on next page

Table 24 – continued from previous page

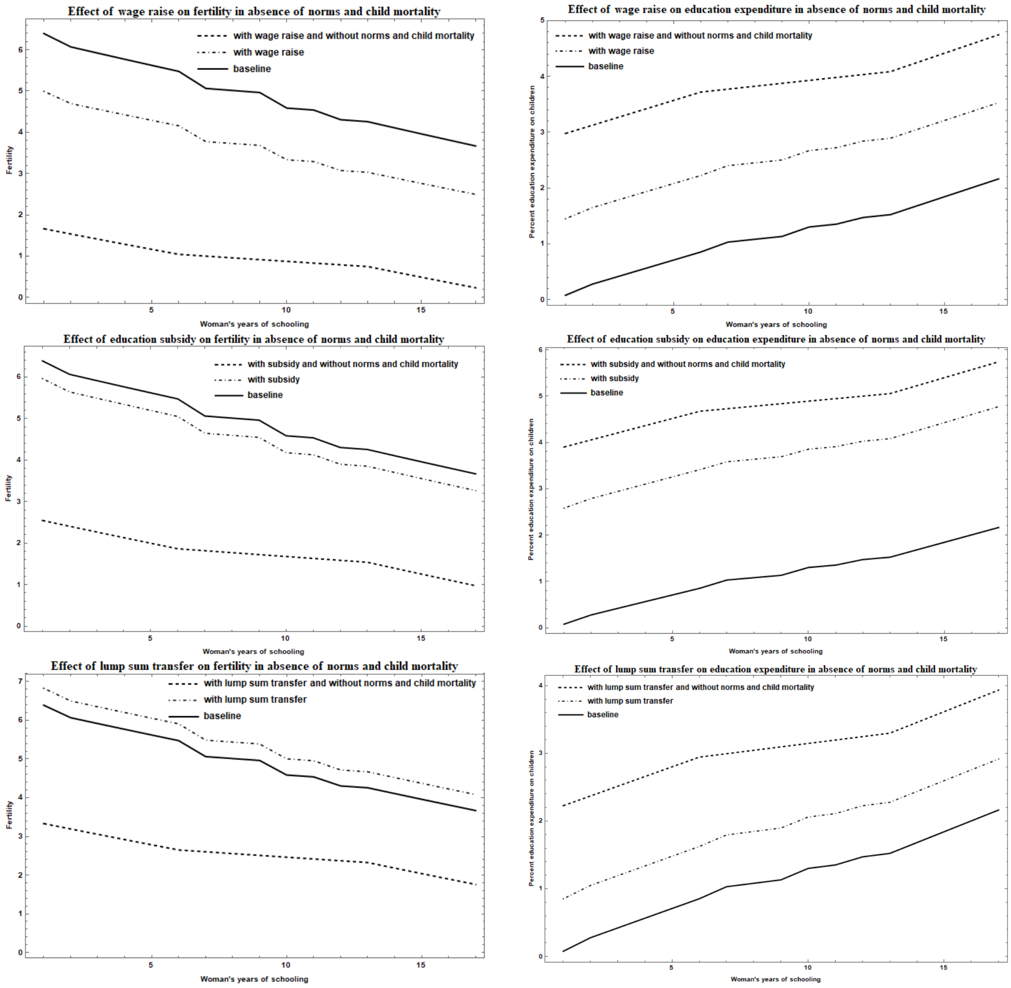
Years of schooling	Norms	quantity $\pi = 0$	quality $\pi = 0$	quantity $s_i = 1$	quality $s_i = 1$	quantity $\pi = 0$ $s_i = 1$	quality $\pi = 0$ $s_i = 1$
14	6.719	2.301	2.644	3.338	2.085	1.643	2.919
14	6.772	2.301	2.644	3.351	2.078	1.643	2.919
14	7.199	2.301	2.644	3.459	2.023	1.643	2.919
15	6.269	2.155	2.804	3.084	2.303	1.502	3.079
15	6.320	2.155	2.804	3.097	2.296	1.502	3.079
15	6.341	2.155	2.804	3.102	2.293	1.502	3.079
15	6.415	2.155	2.804	3.121	2.284	1.502	3.079
15	6.719	2.155	2.804	3.197	2.245	1.502	3.079
15	6.772	2.155	2.804	3.211	2.238	1.502	3.079
15	7.199	2.155	2.804	3.318	2.184	1.502	3.079
16	6.269	2.010	2.964	2.945	2.463	1.363	3.238
16	6.320	2.010	2.964	2.958	2.456	1.363	3.238
16	6.341	2.010	2.964	2.963	2.453	1.363	3.238
16	6.415	2.010	2.964	2.981	2.444	1.363	3.238
16	6.719	2.010	2.964	3.058	2.405	1.363	3.238
16	6.772	2.010	2.964	3.072	2.398	1.363	3.238
16	7.199	2.010	2.964	3.179	2.344	1.363	3.238
Mean	6.576	3.254	1.938	3.795	1.561	2.136	2.379

Note: The table shows the level of QQ in the absence of norms and child mortality. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman.

Table 25: Effect of a 10% wage raise, an equivalent amount of lump sum transfer and an equivalent education subsidy on quantity-quality

Years of schooling	Wage raise		Education subsidy		Lump sum transfer	
	quantity	quality	quantity	quality	quantity	quality
0	4.994	1.449	5.965	2.582	6.829	0.852
1	4.695	1.650	5.644	2.789	6.501	1.049
2	4.559	1.793	5.494	2.945	6.351	1.193
3	4.424	1.937	5.345	3.101	6.202	1.337
4	4.290	2.081	5.198	3.257	6.055	1.481
5	4.157	2.225	5.052	3.412	5.910	1.625
6	3.775	2.402	4.648	3.582	5.488	1.796
7	3.729	2.453	4.598	3.637	5.439	1.846
8	3.684	2.503	4.548	3.692	5.389	1.897
9	3.335	2.672	4.180	3.853	5.005	2.06
10	3.291	2.722	4.131	3.908	4.957	2.111
11	3.075	2.842	3.902	4.026	4.719	2.227
12	3.032	2.893	3.854	4.080	4.671	2.278
13	2.896	3.052	3.704	4.254	4.522	2.438
14	2.761	3.212	3.557	4.427	4.374	2.598
15	2.628	3.371	3.411	4.600	4.228	2.758
16	2.497	3.531	3.266	4.773	4.083	2.918
Mean	3.637	2.517	4.500	3.701	5.337	1.910

Note: Table shows the QQ resulting from a wage raise, education subsidy and a lump sum transfer. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman.



Note: The figure compares the effects of; a 10% wages raise, an equivalent education subsidy, and lump sum transfer on quantity and quality with and without norms and child mortality. Quality is the expenditure on the education of children expressed as a percentage of household income. Quantity is the number of births per woman.

Figure 15: Effect of alternative policies on QQ

Table 26: Effect of alternative education/population policies on welfare

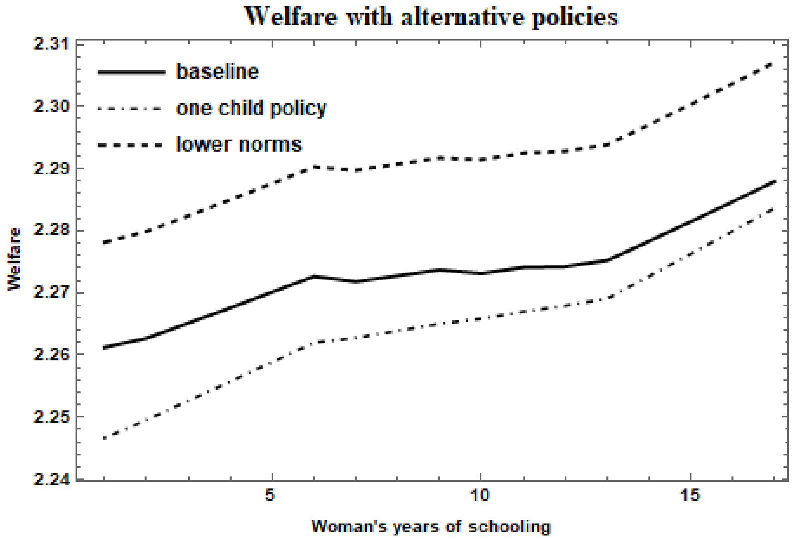
Years of	Utility			
schooling	baseline	wage raise	education subsidy	lump sum transfer
0	2.261	2.285	2.287	2.317
1	2.263	2.288	2.289	2.319
2	2.265	2.290	2.292	2.322
3	2.268	2.293	2.295	2.325
4	2.270	2.296	2.298	2.328
5	2.273	2.299	2.301	2.331
6	2.272	2.299	2.301	2.331
7	2.273	2.300	2.302	2.332
8	2.274	2.301	2.303	2.333

Continued on next page

Table 26 – continued from previous page

Years of schooling	Utility baseline	wage raise	education subsidy	lump sum transfer
9	2.273	2.301	2.303	2.333
10	2.274	2.302	2.304	2.334
11	2.274	2.302	2.305	2.335
12	2.275	2.303	2.306	2.336
13	2.278	2.307	2.310	2.340
14	2.281	2.311	2.314	2.344
15	2.285	2.314	2.318	2.348
16	2.288	2.318	2.322	2.352
Mean	2.273	2.301	2.303	2.333
Total	38.647	39.109	39.150	39.660

Note: The table shows the utility of household resulting from alternative population/education policies by women's education.



Note: The figure compares the welfare gains from a one-child policy as opposed to a social change that lowers the norm to half of the observed level. The welfare is measured in terms of household utility.

Figure 16: Welfare losses(gains) from alternative population policies

Table 27: Welfare effects of one-child vs. lower norms policies

Years of schooling	%Δ welfare one child policy	%Δ welfare lower norms
0	-0.64	+0.75
1	-0.58	+0.76
2	-0.55	+ 0.76
3	-0.52	+0.77
4	-0.50	+ 0.77
5	-0.47	+0.78
6	-0.40	+ 0.79
7	-0.39	+0.79
8	-0.38	+ 0.79
9	-0.32	+ 0.81
10	-0.31	+ 0.81
11	-0.28	+ 0.82
12	-0.27	+ 0.82
13	-0.25	+ 0.82
14	-0.23	+0.83
15	-0.21	+ 0.83
16	-0.19	+0.84
Mean	-0.38	+0.80
Total	-6.48	+13.52
Corr school	-0.97	+0.97

Note: The table shows the percentage change in welfare by education group, arising from alternative population policies. Welfare is measured in terms of utility gains. The coefficient of correlation shows the correlation between years of education and the absolute change in each column. The calculations are based on the utility values presented in table 11.