A Online Appendix

A.1 A Stylized Model of Fertility Transitions

Consider an economy or social group in which the average number of children per woman at the end of her reproductive life reflects a decision-making process in which individuals or couples weigh several factors when making fertility choices: economic factors (e), institutional factors (i), cultural factors (s), and health-related factors (h). Fertility in a given society, denoted by F, can thus be modeled as a function of these determinants:

$$F = f\left(e, i, s, h\right).$$

Economic factors (e) include wages, education, assets, returns to human capital, the economic value of child labor or old-age support. Examples of family institutions (i) are marriage institutions, such as the European Marriage Pattern in historical Europe or polygamy in sub-Saharan Africa, and inheritance rules, which may be partible or impartible. Culture (s) relates directly to fertility through the ideal family size, and indirectly through religious beliefs, attitudes towards sex and contraception, educational expectations (e.g., competitive schooling environments), or gender roles in society. Finally, health-related factors (h) encompass child and maternal mortality, access to contraception and the availability of infertility treatments.

We adopt a functional form for f that incorporates economic factors e into the individual decision problem. A representative household chooses fertility n based on an indirect utility function of quadratic form:

$$U(n) = b(e)n - \frac{c(e)}{2}n^2 \quad \text{with} \quad \underline{n}(i, s, h) \leq n \leq \overline{n}(i, s, h)\,.$$

Here, $b(e)$ represents the intrinsic benefits from children, while $c(e)$ captures their costs, following Akerlof (1997). Economic factors thus influence both the marginal benefits and the marginal costs of having an additional child in our setup, in line with standard economic models of fertility. Note that the exact shape of $b(e)$ and $c(e)$ is often the focus of economic theories of the fertility transition. For simplicity, we normalize benefits to $b = 1$ and assume that the cost of children increase with economic development, i.e., $\frac{\partial c}{\partial e} > 0$.

Importantly, our framework also captures that individual decisions are made within a broader societal context, shaped by factors that are often not fully incorporated into standard economic models of fertility. Specifically, we consider a combination of family institutions i, health technology h, and culture s. These factors impose bounds on fertility choices, such that fertility n must satisfy:

$$\underline{n}(i,s,h) \leq n \leq \overline{n}(i,s,h) \, .$$

These bounds also imply that economic factors may no longer influence fertility outcomes if optimal choices lie at the boundary of what is feasible. In other words, when fertility is constrained by prevailing family institutions, culture, or health factors, changes in economic incentives no longer influence fertility behavior.

Our stylized framework encompasses several classes of models that analyze fertility transitions. Demographers often focus on how these bounds change over time when health factors (h), such as child mortality or the availability of contraception, vary. In our framework, $\underline{n}$ declines as child mortality drops and when birth control technologies become available. Social scientists typically stress the role of family institutions, i, in shaping fertility bounds. For example, the European Marriage Pattern historically led to high female ages at marriage, which implied a lower $\underline{n}$ than a marital institution where age at marriage is very young. Finally, diffusion models of the fertility transition focus on how changes in the bounds propagate through changes in cultural factors, s. While stylized, the model highlights our key point that the environment imposes constraints on household choices that may restrict how fertility choices respond to economic forces. Suppose we want to understand why economic development and fertility decline do not always go hand in hand; that is why changes in human capital and GDP per capita are not strongly correlated with changes in fertility within countries.

The optimal fertility chosen by the household, n^*, is given by

$$n^* = \min\left\{\max\left\{\underline{n}(i,s,h), \frac{1}{c(e)}\right\}, \overline{n}(i,s,h)\right\} \, .$$

This expression gives rise to two thresholds, determined by institutions, culture, and health factors. To the left of the first threshold and to the right of the second threshold, economic factors no longer influence fertility, that is, when the economic cost of children approaches zero or infinity. Between these thresholds, fertility responds to economic factors in the way predicted by standard economic theories of fertility. We can thus distinguish three possible equilibria: the standard interior equilibrium and two corner equilibria, in which economic factors cease to affect fertility.

1. The *interior equilibrium*, where $n^* = 1/c(e)$. In this case, fertility responds directly to economic factors. Standard economic mechanisms–such as the quan-

tity–quality trade-off and the opportunity cost of time–shape fertility decisions. Historically, this corresponds to the early stages of fertility transitions, when economic development is low and family labor or old-age security are important. As the transition progresses and the cost of raising children increases, fertility declines. If these costs become extremely high, the result may be ultra-low fertility.

2. The *lower corner equilibrium*, where $n^* = \underline{n}(i, s, h) > 1/c(e)$. In this case, fertility is higher than predicted by economic factors, because the environment (i, s, h) makes very small families difficult or impossible. This pattern is characteristic of early-transition societies, where prevailing norms, institutional settings, or health conditions hinder the adoption of low fertility.

3. The *upper corner equilibrium*, where $n^* = \overline{n}(i, s, h) < 1/c(e)$. Here, fertility is lower than what economic factors alone would predict, because the maximum achievable fertility is constrained by the environment (i, s, h). This situation typically arises at the end of the fertility transition, when biological limits, delayed childbearing, or restrictive norms impose a binding ceiling on fertility.

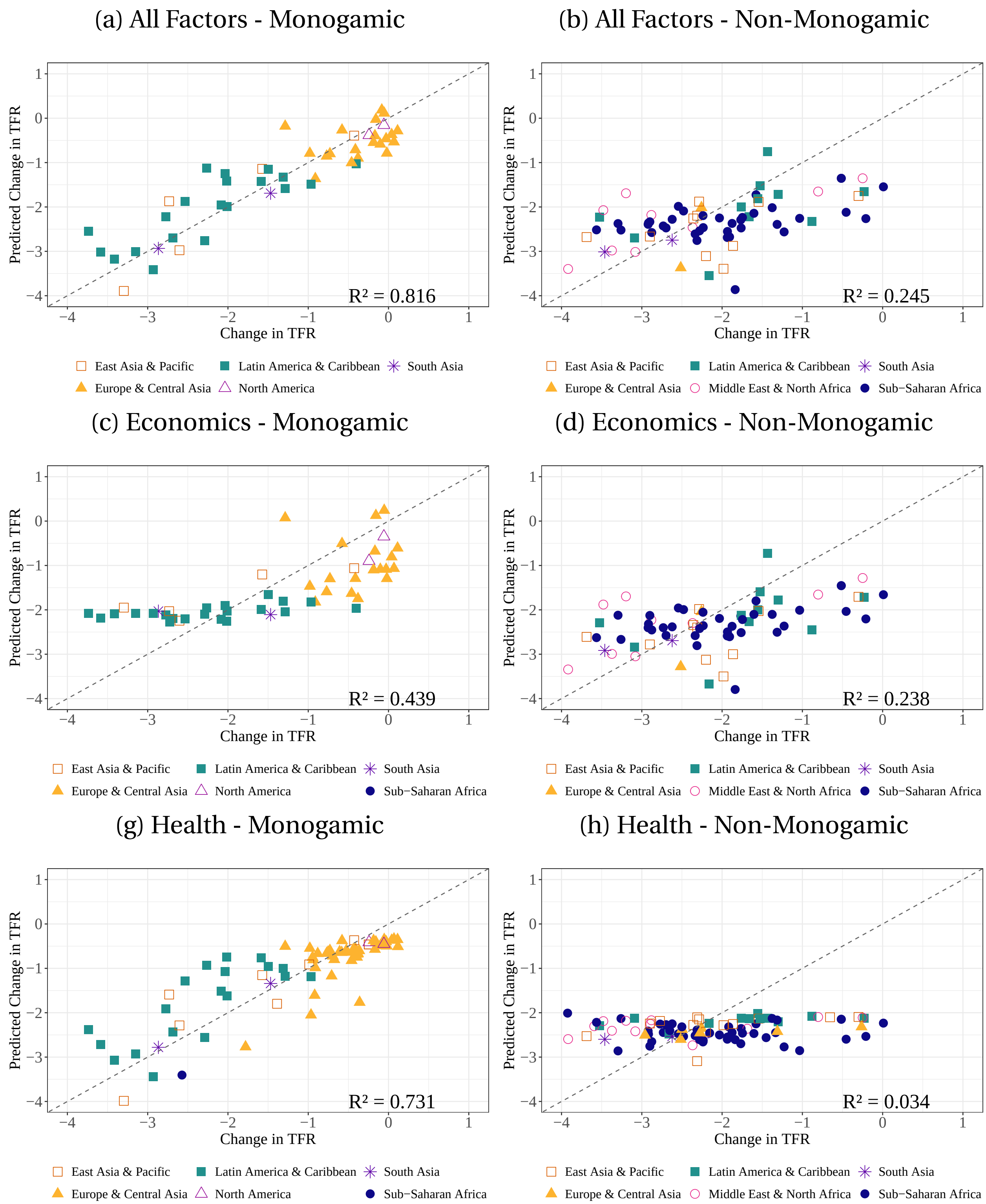
A.2 Additional Tables and Figures

Table A.1: Selection of Recent Evidence from the Literature

Determinant	Effect on Fertility*	Method	Context	References
I. Economic Factors				
QQ trade-off	-20%	Micro, causal	Increase in school enrollment in Prussia mid-19th century	Becker, Cinnirella and Woessmann (2010)
QQ trade-off	-20%	Micro, causal	Increase in returns to schooling in the US in 1910s	Bleakley and Lange (2009)
QQ trade-off	-0.1 child or -4%	Micro, causal	Free primary education in sub-Saharan Africa	Collins, Guarnieri and Rainer (2025)
Child labor	-0.25 child	Micro, causal	Switch from agriculture to manufacturing in the US in 1890s	Ager, Herz and Brueckner (2020)
Child labor	-0.5 child	Micro, causal	Decline in subsistence farming in Burkina Faso today	Dupas et al. (2023)
(Old-age) Social security	-1 to -1.3 child	Micro, causal	Extension of old-age pensions in Namibia and Brazil in 1990s	Rossi and Godard (2022); Danzer and Zyska (2023)
Social security	-0.25 child or -21%	Macro, quantitative	US in 2000. Response to a 10% tax increase to finance social security.	Boldrin, De Nardi and Jones (2015)
Social security	-0.7 to -1.6 child	Macro, quantitative	Increase in the size of social security by 10% of GDP in the US in 2000	Boldrin, De Nardi and Jones (2015)
Female time costs	-0.15 child	Macro, quantitative	12% increase in women's wages between 1980 and 1992 in the US	Caucutt, Guner and Knowles (2002)
Female time costs	+1 to 2 child	Macro, descriptive	Lack of wage employment in SSA compared to other LMIC today	Zipfel (2025)
Household technology	+0.4 child	Macro, quantitative	Diffusion of household technology from 1940 to 1960 in the US	Greenwood, Seshadri and Vandenbroucke (2005)
Labor market competition	+0.55 child	Macro, quantitative	Increased female labor market competition after WWII in the US	Doepke, Hazan and Maoz (2015)
Economic uncertainty	+0.6 child	Micro, causal	Lower economic uncertainty for US cohorts in 1933 relative to 1910	Chabé-Ferret and Gobbi (2025)
TFP shocks	-0.25 child (1930), +0.6 child (1950)	Macro, quantitative	Fertility cycles in the US induced by TFP shocks 1930 (TFP shock: -13.1%) vs. 1950 (TFP shock: 7.5%)	Jones and Schoonbroodt (2016)
II. Health Factors				
Child mortality	negligible	Macro, quantitative	Decline in mortality in England in late 19th century	Doepke (2005)
Child mortality	-0.14%	Macro, empirical	Mortality decline of 1%; Panel of 119 countries from 1950 to 1999	Herzer, Strulik and Vollmer (2012)
Maternal mortality	+0.4	Macro, quantitative	Improvement in maternal health and mortality; US 1930-1960	Albanesi and Olivetti (2016)
Life expectancy	-1.4%	Macro, causal	Increase in life expectancy by 1%. Panel of 47 countries.	Cervellati and Sunde (2011)
Contraception	negligible	Micro, RCT	Financial barriers in Burkina Faso, Ethiopia, Zambia today	Desai and Tarozzi (2011); Ashraf, Field and Leight (2013); Dupas et al. (2025)
Contraception	-40%	Micro, causal	Introduction of the pill in the US; Effect on marital fertility 1955-1965	Bailey (2010)
Family planning programs	-5% to -35%	Review of micro	Family planning programs in LMICs in 20th century	Miller and Babiarz (2016)
Family planning programs	-9%	Micro, causal	US Program expansion; Reduction in births among newly eligible	Kearney and Levine (2009)
Family planning programs	-19 to -30%	Micro, causal	US roll-out of programs 1964 to 1973; Effect among poor women	Bailey (2012)
Infertility treatments	+3%	Micro, causal	Universal subsidy of treatments in Sweden today	Bögl et al. (2024)
III. Institutional Factors				
Marriage	-20% to -40%	Macro, descriptive	Marriage Patterns in Europe in 14-19th century	Voigtländer and Voth (2013); Perrin (2022)
Marriage	+40%	Macro, quantitative	Polygamy in sub-Saharan Africa today	Tertilt (2005)
Inheritance	-0.5 child	Micro, causal	Partible inheritance in France in 18th century	Gay, Gobbi and Goñi (2025)
Inheritance	+1 child	Micro, causal	Impartible inheritance in sub-Saharan Africa today	Fontenay, Gobbi and Goñi (2025)
Inheritance	-1 child	Micro, causal	Inheritance rights for widows in Namibia in 1990s	Sage (2025)
Women's rights	-0.2 child or -7%	Micro, causal	Legal and economic rights to women in the US in late 19th century	Hazan, Weiss and Zoabi (2022)
Childcare coverage	+44%	Macro, empirical	Access to childcare in Europe today on having a second child	d'Albis, Gobbi and Greulich (2017)
Childcare	+27.6%	Macro, quantitative	Price decline of childcare; Effect on the highly educated in the US	Bar et al. (2018)
Labor market institutions	-0.22 child	Macro, quantitative	Temporary contracts and split-shift jobs; Spain; cohorts 1966-1971	Guner, Kaya and Sánchez-Marcos (2024)
IV. Cultural Factors				
Religion	-1 child	Micro, causal	Secularization in France in 18th century	Blanc (2023)
Religion	+0.5 to -1 child	Macro, descriptive	Beliefs in the role of ancestors in sub-Saharan Africa today	Álvarez-Aragón (2025)
Culture	0.4 child	Micro, causal	Higher fertility in origin country; 2nd generation women; US; 1970	Fernández and Fogli (2009)
Media	-5%	Micro, causal	Brazil 1979–1991, Exposure to soap operas (novelas)	La Ferrara, Chong and Duryea (2012)
Media	-4.3%	Micro, causal	Teen births in the US 2009-10; Reality show on teenage childbearing	Kearney and Levine (2015)
Peer effect	-28%	Macro, quantitative	Status externalities in education in Korea today	Kim, Tertilt and Yum (2024)
Peer effect	-0.3 child	Micro, causal	Diffusion of fertility restrictions in China in 1970s	Rossi and Xiao (2025)

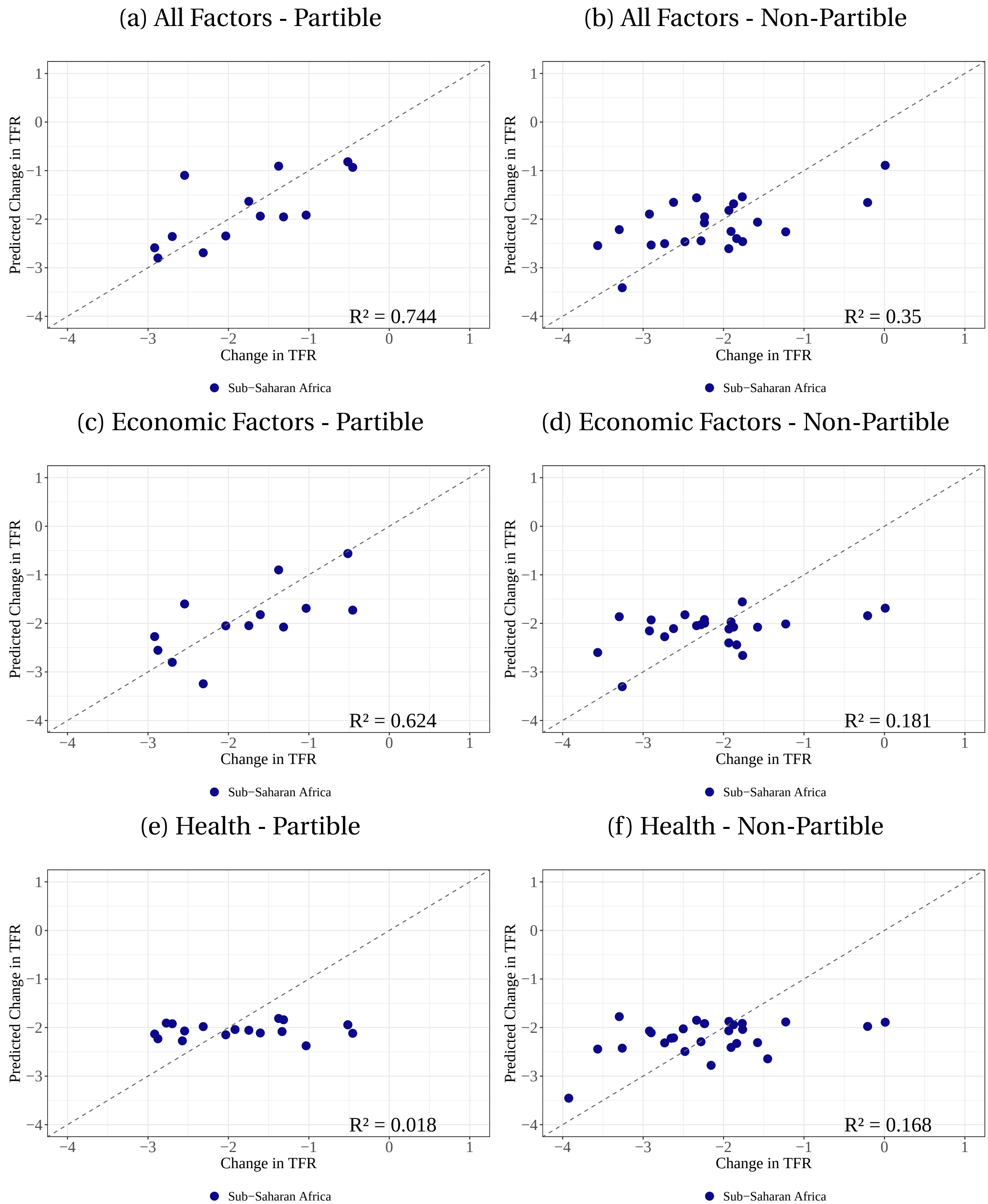
* Note: The precise measure of fertility varies across studies, and differences in sample restrictions may limit the direct comparability of the reported effects.

Figure A.1: **World**: Monogamy versus Polygamy



Notes: Time period: 1975–85 and 2013–23. We estimate a linear regression of changes in TFR on changes in economic factors (log GDP per capita, secondary school enrollment) and health factors (maternal mortality, child mortality). Data are from the World Bank (2025). All variables are averaged over the two decades (1975–85 and 2013–23), and changes are computed as differences between these averages. Using the estimated coefficients, we predict changes in TFR and plot them against the observed changes.

Figure A.2: **Sub-Saharan Africa**: Partible versus Impartible Inheritance



Notes: Time period: 1975–85 and 2013–23. We estimate a linear regression of changes in TFR on changes in economic factors (log GDP per capita, secondary school enrollment) and health factors (maternal mortality, child mortality). Data are from the World Bank (2025). All variables are averaged over the two decades (1975–85 and 2013–23), and changes are computed as differences between these averages. Using the estimated coefficients, we predict changes in TFR and plot them against the observed changes.

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