Gender equity and the escape from poverty

Klaus Prettner[1]

Holger Strulik[2]

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Abstract. We set up a unified growth model with intra-household bargaining of spouses. In line with the data for less developed countries, we assume that women desire to have no more children than men and to invest no less in education per child. We show analytically that female empowerment promotes the transition from a state of high fertility, low education, and sluggish economic growth towards a state of low fertility, high education, and fast economic growth if the child quantity-quality preferences of spouses differ substantially. In this case, targeted policies to empower women represent a promising development strategy.

JEL classification: J13, J16, O11, O41.

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[1]University of Hohenheim, Institute of Economics, Schloss, Osthof-West, 70593 Stuttgart, Germany; email: klaus.prettner@uni-hohenheim.de.

[2]University of Goettingen, Department of Economics, Platz der Goettinger Sieben 3, 37073 Goettingen, Germany; email: holger.strulik@wiwi.uni-goettingen.de.

1. Introduction

As emphasized by unified growth theory, countries that enter a phase of sustained economic growth follow a typical pattern of economic-demographic development. First, in the Malthusian regime, fertility is high, education investments in children are low, and incomes stagnate. Once that latent forces such as technological progress or increasing life expectancy raise the returns to education to a sufficient extent, investments in education start to increase, fertility starts to fall, and incomes start to grow (cf. Galor and Weil, 2000; Cervellati and Sunde, 2005).[3]

Here, we investigate whether and how the onset and the speed of the take-off to sustained economic growth depend on the interplay between observed gender-specific preferences on the one hand and the bargaining power of women within the household on the other hand. Specifically, we allow for gender-specific child rearing effort and two distinct dimensions of gender-specific preferences: (i) a potentially stronger desire of fathers for a large number of children and a potentially stronger desire of mothers for education per child (the "quality-quantity preference differential"), (ii) a stronger desire of both spouses for the education of boys (the "daughter-son education preference differential"). We show that female empowerment has a large effect on economic-demographic development if and only if there is a large quality-quantity preference differential. By contrast, female empowerment is relatively unimportant for development when preferences deviate with respect to gender-specific education or if spouses differ only in their contribution to child care. The reason is that women's empowerment expedites the demographic transition through the quality-quantity preference channel and thus directly affects the take-off to sustained economic growth.

Our study contributes to the theoretical literature on the interaction between female empowerment and economic development, which emphasizes different channels and directions of causality. One channel concerns the impact of technological and structural change on the importance of "brain" versus "brawn" in production such that women with a comparative advantage in the former start to become more and more successful on the labour market (cf. Galor and Weil, 1996; Kimura and Yasui, 2010). This in turn has positive effects on the income of women and therefore promotes female empowerment further. Note that these papers consider unitary households in which the preferences of fathers and mothers are not allowed to differ. Another channel by which

[3]For Unified Growth Theory see Galor and Weil (2000), Hansen and Prescott (2002), Galor and Moav (2002, 2006), Doepke (2004), Cervellati and Sunde (2005), Strulik and Weisdorf (2008), Strulik et al. (2013), and many others. See Galor (2005, 2011) for detailed overviews and extensions of the basic models.

technological change promotes female labour force participation and hence gender equality in the course of economic development is advocated by Greenwood et al. (2005): In a social environment in which women disproportionately care for the housework, the invention of new household devices frees female time that can be used to supply formal labour on the labour market, which again has positive repercussions on female empowerment. Finally, Soares and Falcão (2008) show that increasing longevity raises the incentives to invest in human capital with negative repercussions on fertility and the wage differential between men and women.

There are also compelling cases for the reverse causality running from empowerment to development: female empowerment as such stimulates female labour force participation with positive effects on household income and negative effects on fertility. This in turn has the potential to help an economy to escape from a poverty trap that is sustained by high fertility. For empirical evidence that gender equity has the potential to be growth-promoting see Klasen (2002), Knowles et al. (2002), Abu-Ghaida and Klasen (2004), Klasen and Lamanna (2009), and Schober and Winter-Ebmer (2011).

In this paper, we show that female empowerment has a salient impact on the onset and speed of the fertility transition and the take-off to modern growth if women lean toward child quality in the Beckerian child quantity-quality trade-off, while men lean toward child quantity. Studies in the evolutionary psychology literature (Trivers, 1972; Cox, 2007) as well as empirical evidence (cf. Thomas, 1990; Pitt and Khandker, 1998; Becker, 1999; Miller, 2008) suggest that the number of offspring receives a higher weight in the preferences of men, while education, or, more generally, child investments, receive a higher weight in the utility of women. Data from the Demographic and Health Surveys (DHS) confirm that there are indeed large gender-differentials in fertility preferences in many but not all developing countries. In Table 2 in the appendix we present the reported fertility preferences of women and men for the latest DHS survey (as of February 2016) in 54 countries for which the data are available. We observe that in almost all countries men desire more children than women with the exceptions of Burundi and Rwanda. On average, the desired fertility rate of men is 1 child more than that for women. The difference is substantial for African countries such as Chad, Mali, and Niger, while it is relatively small for Asian countries such as Cambodia, Indonesia, and Nepal.

With respect to our other gateway of gender-specific preferences, the education bias for boys, the empirical literature is less conclusive. Although there is undeniably a significant gender bias

in favour of boys observable it is apparently difficult to attribute it to gender discrimination due to parental preferences. While the earlier empirical literature failed to confirm such a gender bias even where it is known to exist (Deaton, 1997, p. 239-41), some more recent studies found evidence in favour of discrimination against girls for some developing countries (Aslam and Kingdon, 2008; Zimmermann, 2012; Barcellos et al., 2014). Moreover, individual preferences may be biased against girls through social norms (Lagerlöf, 2003; Strulik, 2013). In any case, we show in this paper that the impact of female empowerment on the fertility transition and the take-off to growth can be expected to be largely independent from whether there is preferential education of boys. Vice versa, the model predicts only a small role for women's empowerment on the take-off to growth if there were only a daughter-son education preference differential and no quality-quantity preference differential.

Naturally, one would expect that the overall relationship between development and empowerment is bi-causal and that the importance of the various channels by which these two processes mutually reinforce each other differ between different regions and societies. In an extension of our basic model we consider the case where female empowerment is itself endogenously determined by the relative income of women versus men and show that this re-enforces the mechanism and creates a feedback loop where female empowerment is both cause and consequence of successful development. In countries or societies, however, in which the quality-quantity preference differential is small, the crucial channel by which female empowerment exerts a positive effect on economic development is switched off such that female empowerment is less effective in reducing poverty. Consequently, our theory sheds new light on the mixed cross-country evidence with respect to the impact of female empowerment on economic development (Duflo, 2012).

There are a couple of studies that are related to our approach. The effects of changes in female bargaining power on economic development are analysed by de la Croix and Vander Donckt (2010) in a model with intra-household bargaining and endogenous fertility and education. They show by way of numerical examples that an increase in female life expectancy and in female wages raises economic growth for exogenous female bargaining power, while a decrease in the institutional and social gender gap reduces fertility and fosters economic growth only in case of endogenous female bargaining power. Yet, they do not analytically address the question as to what extent female empowerment changes the characteristics under which an economy escapes from the Malthusian trap. Rees and Riezman (2012) analyse how globalization affects fertility, human capital, and

economic growth through its impact on job opportunities for women versus those of men. For the case that opportunities for women rise relative to those of men, they show that female bargaining power increases with globalization. Due to the stronger preference of women for the quality of children, this in turn reduces fertility and raises human capital accumulation and growth. However, also Rees and Riezman (2012) do not analyse the implications of female empowerment for the escape of a Malthusian poverty trap. Lagerlöf (2003) develops a formally elegant approach on the gender bias in education, based on the assumption that spouses are not only interested in the human capital of their children but also in the human capital of the family of their children. The fact that parents cannot control the human capital of their offspring's future spouses creates an externality and causes the optimal solution for the division of schooling expenses among sons and daughters to be indeterminate and subject to self-sustained social norms. Finally, Diebolt and Perrin (2013a,b) set forth a framework with skilled and unskilled workers, in which the fraction of skilled workers endogenously determines female empowerment. They show that an economy stagnates at low levels of gender equality and low levels of initial productivity. With technological progress, stagnation becomes unstable, gender equality and the share of skilled workers start to rise and fertility starts to fall. The developed economy approaches a steady state of low gender inequality, low fertility, and a large fraction of skilled workers.[4]

Our paper is organized as follows. Section 2 outlines the framework that we use for the analysis, derives the household optimum, and characterizes the threshold levels at which an economy switches between different growth regimes. In Section 3 we derive our central results and in Section 4 we illustrate them numerically. In Section 5 we extend the basic framework to allow for endogenous female empowerment and an endogenous determination of the time spent for child-care. In Section 6 we conclude.

2. The Model

2.1. **Households and Firms.** Consider a developing economy populated by households consisting of parents and children. Matching is assumed to occur between parents of different gender

[4]We treat female bargaining power either parametrically or, in an extension, as being determined by the relative income of spouses. This exogenous (reduced-form) modeling of female bargaining power appears to be appropriate because we focus on the consequences and not on the causes of female empowerment. A related literature focuses on a politico-economic foundation of changes in female bargaining power in the course of development but without considering the impact of female empowerment on the demographic transition and the take-off to modern growth (Doepke and Tertilt, 2009; Fernández, 2010). Hiller (2014) proposes a model on the joint dynamics of gender power and cultural norms. However, by assuming that the number of children is exogenously fixed at the replacement rate, he cannot discuss the impact of female empowerment on the fertility transition.

randomly and without frictions. The male and female spouse collectively decide upon parental consumption, fertility, and education of daughters and sons subject to the household's budget constraint as shaped by the sum of the earnings of the male and female parent. We abstract from differences in sex ratios at birth, in particular, we assume that there is no selective abortion. We conceptualize intra-household trade-offs by assuming a logarithmic utility function that captures gender-specific differences in tastes with respect to consumption, fertility, and education of daughters and sons as well as (potentially endogenous) gender-specific differences in the bargaining power of the male and female spouse.[5] This means that the utility function is given by

$$\begin{aligned} U_t &= \theta \left[\log c_{t,m} + \alpha_m \log n_t + \gamma_m \log(e_{t,m} + \bar{e}) + \delta_m \log(e_{t,f} + \bar{e})\right] \\ &\quad + (1-\theta)\left[\log c_{t,f} + \alpha_f \log n_t + \gamma_f \log(e_{t,m} + \bar{e}) + \delta_f \log(e_{t,f} + \bar{e})\right], \end{aligned} \tag{1}$$

where $c_{t,i}$ for $i = m, f$ is consumption of the male and female parent, respectively, n_t is the number of children, α_i is the utility weight of the number of children, $e_{t,i}$ is education per child of gender i, $\bar{e}$ represents the basic skills of children learned by observing parents and peers, γ_i is the utility weight of the education of sons, δ_i is the utility weight of the education of daughters, and $\theta \in [0, 1]$ represents the bargaining power of men such that women's empowerment is measured by $1-\theta$. Each member of the household is endowed with one time unit and the costs of child-rearing are measured in forgone wages due to the time requirement of child-care. In such a setting, the household faces a budget constraint of the form

$$w_t \left[h_{t,m}(1 - \psi_m n_t) + h_{t,f}(1 - \psi_f n_t)\right] = (e_{t,m} + e_{t,f})\frac{n_t}{2} + c_{t,f} + c_{t,m}, \tag{2}$$

in which w_t is the wage rate per unit of effective labour and ψ_i measures the time requirement for child-rearing that potentially differs between the male and female parent. The left hand side of Equation (2) represents household income as the wage rate per unit of effective labour (w_t) multiplied by the efficiency units of labour that each parent supplies on the labour market [$h_{t,m}(1-\psi_m n_t)$ and $h_{t,f}(1-\psi_f n_t)$, respectively]. Effective labour supply depends in turn positively on male and female education levels ($h_{t,i}$) and negatively on the time that either spouse spends

[5] In order to reduce complexity, our bargaining setup is "reduced-form". It avoids to model explicitly the outside option of spouses and commitment issues in a multi-period setting. Rasul (2008) and Doepke and Kindermann (2015) investigate the bargaining of spouses over fertility in a simpler partial equilibrium context without education and show that commitment problems lead to inefficient solutions, in particular, inefficiently low fertility in a developed country context. Here, we cannot address efficiency problems at the family level and focus instead on the impact of women's bargaining on the fertility transition and macro-economic development in the long run.

on raising children ($\psi_i n_t$). The right hand side of Equation (2) reflects household expenditures for education of girls and boys $[(e_{t,m}n_t)/2+(e_{t,f}n_t)/2]$ and gender-specific consumption expenditures ($c_{t,i}$).

Households maximize (1) subject to (2) and given non-negativity constraints on all variables. As motivated in the introduction, we generalize the standard knife edge assumption of equal preferences of spouses by allowing for $\alpha_m \geq \alpha_f$, $\gamma_f \geq \gamma_m$, and $\delta_f \geq \delta_m$. We refer to the case where these conditions apply with strict inequality as the "quality-quantity preference differential". Furthermore, we assume that men do not spend more time on child care than women $\psi_f \geq \psi_m$. Note the crucial point that we explicitly allow for identical preferences of men and women and also an equal distribution of the time requirement for child-care between both parents. To rule out positive educational investments in non-existing offspring, $\alpha_i > \gamma_i$ has to be fulfilled. Finally, we assume that parents want to invest no less in the education of boys than girls, $\gamma_i \geq \delta_i$ and we refer to this condition with strict inequality as the "daughter-son education preference differential". Optimal consumption levels of the male and female spouse are then obtained as

$$c_{t,m} = \frac{\theta(h_{t,m}+h_{t,f})w_t}{1+(1-\theta)\alpha_f+\theta\alpha_m}, \qquad c_{t,f} = \frac{(1-\theta)(h_{t,m}+h_{t,f})w_t}{1+(1-\theta)\alpha_f+\theta\alpha_m}, \tag{3}$$

irrespective of gender-specific human capital. However, as far as fertility and educational investments in daughters and sons are concerned, there are crucial differences between the different stages of development. Let $\widehat{w}_{t,m}$ and $\widehat{w}_{t,f}$ denote the threshold levels of the wage rate per unit of effective labour above which investments in male and female education become positive, respectively. The threshold levels $\widehat{w}_{t,m}$ and $\widehat{w}_{t,f}$ are then given by

$$\widehat{w}_{t,m} = \frac{\bar{e}\left[(\theta-1)\alpha_f-\theta\alpha_m\right]}{2\left[(\theta-1)\gamma_f-\theta\gamma_m\right](\psi_f h_{t,f}+\psi_m h_{t,m})}, \tag{4}$$

$$\widehat{w}_{t,f} = \frac{\bar{e}\left[(\theta-1)\alpha_f+\gamma_f-\delta_f-\theta\left(\gamma_f-\delta_f+\alpha_m-\gamma_m+\delta_m\right)\right]}{2\left[(\theta-1)\delta_f-\theta\delta_m\right](\psi_f h_{t,f}+\psi_m h_{t,m})} \tag{5}$$

and we have the following results for optimal fertility, optimal education of sons, and optimal education of daughters:

$$n_t = \begin{cases} \frac{\left[(1-\theta)\alpha_f+\theta\alpha_m\right]\left(h_{t,f}+h_{t,m}\right)}{\left[(1-\theta)\alpha_f+\theta\alpha_m+1\right]\left(\psi_f h_{t,f}+\psi_m h_{t,m}\right)} & \text{for } w_t \leq \widehat{w}_{t,m} \\ \frac{2w_t\left(h_{t,f}+h_{t,m}\right)\left[(1-\theta)\alpha_f-\gamma_f+\theta\left(\gamma_f+\alpha_m-\gamma_m\right)\right]}{\left[(1-\theta)\alpha_f+\theta\alpha_m+1\right]\left[2w_t\left(\psi_f h_{t,f}+\psi_m h_{t,m}\right)-\bar{e}\right]} & \text{for } w_t \leq \widehat{w}_{t,f} \\ \frac{w_t\left(h_{t,f}+h_{t,m}\right)\left[(1-\theta)\alpha_f-\gamma_f-\delta_f+\theta\left(\gamma_f+\delta_f+\alpha_m-\gamma_m-\delta_m\right)\right]}{\left[(1-\theta)\alpha_f+\theta\alpha_m+1\right]\left[w_t\left(\psi_f h_{t,f}+\psi_m h_{t,m}-\bar{e}\right)\right]} & \text{otherwise.} \end{cases}$$

$$e_{t,m} = \begin{cases} 0 & \text{for } w_t \leq \widehat{w}_{t,m} \\ \frac{\bar{e}\left[\theta\alpha_m+(1-\theta)\alpha_f\right]+2w_t\left[(\theta-1)\gamma_f-\theta\gamma_m\right]\left(\psi_f h_{t,f}+\psi_m h_{t,m}\right)}{(\theta-1)\alpha_f+\gamma_f-\theta\left(\gamma_f+\alpha_m-\gamma_m\right)} & \text{for } w_t \leq \widehat{w}_{t,f} \\ \frac{\bar{e}\left[(1-\theta)\alpha_f+\gamma_f-\delta_f+\theta\left(-\gamma_f+\delta_f+\alpha_m+\gamma_m-\delta_m\right)\right]+2w_t\left[(\theta-1)\gamma_f-\theta\gamma_m\right]\left(\psi_f h_{t,f}+\psi_m h_{t,m}\right)}{(\theta-1)\alpha_f+\gamma_f+\delta_f-\theta\left(\gamma_f+\delta_f+\alpha_m-\gamma_m-\delta_m\right)} & \text{otherwise.} \end{cases}$$

$$e_{t,f} = \begin{cases} 0 & \text{for } w_t \leq \widehat{w}_{t,m} \\ 0 & \text{for } w_t \leq \widehat{w}_{t,f} \\ \frac{\bar{e}\left[(1-\theta)\alpha_f-\gamma_f+\delta_f+\theta\left(\gamma_f-\delta_f+\alpha_m-\gamma_m+\delta_m\right)\right]+2w_t\left[(\theta-1)\delta_f-\theta\delta_m\right]\left(\psi_f h_{t,f}+\psi_m h_{t,m}\right)}{(\theta-1)\alpha_f+\gamma_f+\delta_f-\theta\left(\gamma_f+\delta_f+\alpha_m-\gamma_m-\delta_m\right)} & \text{otherwise.} \end{cases}$$

These results imply the following pattern of development.

PROPOSITION 1. *Economic development passes through a minimum of two and a maximum of three stages. At the first stage, there is no investment in education of sons and daughters. If* $\gamma_i > \delta_i$*, there is a second stage with investment only in the education of sons. At the final stage there is investment in education of sons and daughters.*

The proof is provided in Appendix A. Notice that a preference for the education of sons is necessary and sufficient to capture the phenomenon that the education of sons takes off before the education of girls (Goldin, 2006; Lagerlöf, 2003). Otherwise, $\widehat{w}_{t,m} = \widehat{w}_{t,f}$ and boys and girls experience the take-off of formal education simultaneously.

Assuming that human capital of the next generation is produced by teachers who earn the prevailing wage rate w_t, we divide nominal expenditures on education by w_t to get real education expenditures. Finally, real education expenditures per child multiplied by the productivity of teachers, which we denote by B, determines average human capital formation per child according to

$$h_{t+1} = \begin{cases} \bar{e} & \text{for } w_t \leq \widehat{w}_{t,m} \\ \frac{Be_{t,m}}{2w_t} + \bar{e} & \text{for } w_t \leq \widehat{w}_{t,f} \\ \frac{B(e_{t,m}+e_{t,m})}{2w_t} + \bar{e} & \text{otherwise.} \end{cases} \tag{6}$$

Let L_t denote the labour used in production such that there are $L_t/2$ female and $L_t/2$ male workers. The production technology is linear such that $y_t = A_t\bar{h}_t L_t$, in which $\bar{h}_t = h_{t,f}(1 - \psi_m n_t) + h_{t,m}(1 - \psi_m n_t)$ refers to human capital employed per household (human capital adjusted for absence due to child-care) and A_t is the state of technology. As in Galor and Weil (2000),

we assume that technological progress is driven by education and, up to a certain degree, by population size (scale effect). Specifically, we assume that technology evolves according to the following functional form adapted from Lagerlöf (2006)[6]

$$A_{t+1} = \frac{h_{t,m}(1-\psi_m n_t) + h_{t,f}(1-\psi_f n_t)}{2} \cdot \min\{\eta_1 N_t, \eta_2\} \cdot A_t + A_t. \tag{7}$$

The parameter η_1 measures the strength of the scale effect, while the parameter η_2 refers to its upper bound. The wage rate per unit of effective labour is then given by $w_t = A_t$ and household income amounts to $w_t\bar{h}_t = w_t[h_{t,f}(1-\psi_m n_t) + h_{t,m}(1-\psi_m n_t)]$. This completes the model description.

3. Empowerment and Education

The wage rate per unit of effective labour grows according to Equation (7) such that the economy will go through the three stages of development as described in Proposition 1. At the first stage, the wage rate per unit of effective labour is low, fertility is high, and educational investments in daughters and sons are not worthwhile from a household's perspective. The reason is that children acquire a baseline level of human capital costlessly and that incomes are so low that the marginal utility of consumption is higher than the marginal utility of the "warm glow" of providing education to the offspring above the basic level. Consequently, household human capital stagnates and household income only grows because of technological progress. Once wages surpass the threshold level $\widehat{w}_{t,m}$, fertility starts to decline and male human capital (and therefore also household human capital) starts to accumulate. At this point, the economy enters the second stage of economic development. Declining fertility contributes to higher household income because it generates free parental time that has previously been used for child-care and hence raises labour force participation. In addition, human capital accumulation of men also raises household income because it increases the productivity of the male spouse. Both of these effects complement the increase in productivity due to technology adoption/creation and spur household income growth. Finally, at some point, the wage rate per unit of effective labour surpasses the threshold level above which investments in female education become worthwhile from the household's perspective and the economy enters the third stage of economic development. Fertility declines even faster

[6]For currently less developed countries the appropriate interpretation is that Equation (7) explains technology diffusion.

and female human capital accumulation increases, which again has positive repercussions on the growth of household income.

Taking a closer look at the threshold levels of the wage rates per unit of effective labour [Equations (4) and (5)] affords the following proposition.

PROPOSITION 2. *If preferences of spouses differ with respect to fertility and education, then female empowerment lowers the education thresholds for boys and girls ($\widehat{w}_{t,m}$ and $\widehat{w}_{t,f}$).*

Proof. We take the derivatives of $\widehat{w}_{t,m}$ and $\widehat{w}_{t,f}$ with respect to θ:

$$\frac{\partial \widehat{w}_{t,m}}{\partial \theta} = \frac{\bar{e}\left(\gamma_f \alpha_m - \alpha_f \gamma_m\right)}{2\left[(\theta-1)\gamma_f - \theta\gamma_m\right]^2\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)}, \tag{8}$$

$$\frac{\partial \widehat{w}_{t,f}}{\partial \theta} = \frac{\bar{e}\left[\delta_f\left(\alpha_m - \gamma_m\right) + \delta_m\left(\gamma_f - \alpha_f\right)\right]}{2\left[(\theta-1)\delta_f - \theta\delta_m\right]^2\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)}. \tag{9}$$

The denominator of Equation (8) is always positive. Since $\alpha_m > \alpha_f$ and $\gamma_f > \gamma_m$, the numerator of Equation (8) is also positive. Consequently, female empowerment as measured by $1-\theta$ lowers the education threshold for boys. This establishes the first part of the proof.

For the second part, note that the denominator of Equation (9) is always positive. Furthermore, $\alpha_m > \alpha_f > \gamma_f > \gamma_m$ implies that $\alpha_m - \gamma_m > 0$ and $\gamma_f - \alpha_f < 0$. Note also that $\mid \alpha_m - \gamma_m \mid > \mid \gamma_f - \alpha_f \mid$. Since, in addition, $\delta_f > \delta_m$, the numerator of Equation (9) is also positive. Consequently, female empowerment as measured by $1-\theta$ lowers the education threshold for girls. This establishes the second part of the proof. □

Proposition 2 implies that female empowerment has the potential to spur economic development if the preferences of men and women differ to a large extent. The intuition for this result is that, since women desire fewer children and better education for each child due to the quantity-quality preference differential, increasing their intra-household bargaining power ceteris paribus lowers fertility and raises education of the children for any given wage rate. This in turn reduces the threshold levels of the wage rate per unit of effective labour above which individuals start to invest in education of daughters and sons. The crucial consequence is that female empowerment has a positive intertemporal side effect on men because it also raises educational investments for sons. Encouraging the empowerment of women is therefore, apart from gender-equity reasons, in the own long-run interest of men (cf. Duflo, 2012).

Furthermore, we can show that our mechanism crucially depends on the quantity-quality preference differential. In particular, for the case where preferences of parents with respect to fertility and education do not differ, we obtain the following result:

PROPOSITION 3. *If male and female preferences with respect to fertility and education coincide, i.e., for $\alpha_f = \alpha_m$, $\gamma_f = \gamma_m$, and $\delta_f = \delta_m$, female empowerment has no impact on the timing of the take-off of male and female education, irrespective of gender differences with respect to child rearing costs and a gender-bias in favour of education for boys.*

Proof. In this case the derivatives of the threshold levels $\hat{w}_{t,m}$ and $\hat{w}_{t,f}$ with respect to θ are zero, which is easily verified by investigating Equations (8) and (9). □

The intuition for this result is the following. For identical preferences of the spouses with respect to the number of children and their education, the quantity-quality preference differential is switched off. This implies that female empowerment has no effect on the demand for fertility and education expenditure. Consequently, increasing the bargaining power of women does not affect the timing of the demographic transition.

Altogether, Proposition 3 implies that the effect of female empowerment on economic development is largely driven by the extent to which female preferences are different from those of men, in particular, how strongly women prefer more education of the offspring and fewer children as compared to men. The feature that the education thresholds are invariant for identical preferences does not imply that female empowerment has no effect at all on fertility, education, and income (as we will see in the numerical illustration later on). However, these effects are much weaker in case of identical preferences because the timing of the take-off remains unaffected. Consequently, our theory provides an explanation for why empirical studies sometimes find only weak or insignificant effects of female empowerment on economic development (cf. Duflo, 2012). For countries, in which male and female preferences differ to a large extent, in contrast, the theory predicts a strong causal effect of female empowerment on economic development. In this case the empowerment of women constitutes a strong lever for economic policy to achieve both goals, development and gender equity.[7]

Given that female empowerment has the potential to exert such a crucial influence on economic development through the quantity-quality preference differential it comes perhaps as a surprise

[7]Of course, since gender equity is a valuable goal in and of itself, this does not imply that female empowerment should not be promoted in the case of similar male and female preferences.

that it is the preference for the education of sons that primarily drives development, as established by the following Proposition.

PROPOSITION 4. *If there is a daughter-son education preference differential, then an increasing desire for the education of boys reduces the education threshold for girls. An increasing desire for the education of girls, in contrast, has no effect on the education threshold for boys.*

Proof. The parameter restriction with respect to the daughter-son education preference differential implies $\gamma_i > \delta_i$. The derivatives of the threshold $\widehat{w}_{t,f}$ with respect to the desire for education of boys are given by

$$\begin{aligned}\frac{\partial \widehat{w}_{t,f}}{\partial \gamma_m} &= \frac{\theta \bar{e}}{2\left[(\theta-1)\delta_f - \theta\delta_m\right]\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)} < 0,\\ \frac{\partial \widehat{w}_{t,f}}{\partial \gamma_f} &= \frac{(1-\theta) \bar{e}}{2\left[(\theta-1)\delta_f - \theta\delta_m\right]\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)} < 0,\end{aligned}$$

while the derivatives of the threshold $\widehat{w}_{t,m}$ with respect to the desire for education of girls are zero for both spouses because $\widehat{w}_{t,m}$ neither depends on δ_f, nor on δ_m. □

The intuition for this perhaps surprising finding is the following. If there is a daughter-son education preference differential, then the take-off of male education occurs before the take-off of female education. When male education takes off earlier or increases faster after its take-off, fertility is lower and the threshold level of income above which positive investments in female education become desirable is reached earlier. By contrast, if the preference for female education rises, this has no effect on the take-off of male education because it neither changes the income trajectory nor fertility before the take-off of male education.

4. Empowerment and the Escape from Poverty

To illustrate how the effects derived in the analytical part of our study impact upon the transitional dynamics, we solve the model for the parameter values displayed in Table 1. The values for α_i, γ_i, δ_i, and ψ_i were chosen such that the total fertility rate (TFR) is close to 7 children per woman in the low-growth regime, which is consistent with the TFRs of most low-income countries in 1980 according to the World Bank (2014), and such that fertility converges to a level slightly below the replacement rate in the long run, which is consistent with the experience of most rich countries in the year 2012 according to the World Bank (2014). In the baseline scenario we set the female bargaining power to 0.3, which is roughly the value of an average measure for the

gender gap with respect to labour force participation and education in low development countries in the year 2012, based on data from UNDP (2012). In the alternative scenario we increase the female bargaining power to 0.4, which is the value that we obtain in the same way for countries classified as highly developed by UNDP (2012). These numbers were obtained by first calculating the ratio of female to male labour force participation and the ratio of female to male education (in terms of the population with at least secondary education). Then we normalized the results such that perfect gender equality would be reflected by a value of 0.5 for both measures. In the last step, we calculated the averages of these two measures for the countries classified as "high human development" countries and for those classified as "low human development" countries. In the former case the precise value for $1-\theta$ is 0.3963 and in the latter case it amounts to 0.3171. Finally, the parameters η_1 and η_2 are chosen such that the annualized growth rate increases slightly over time from 0.1% to 0.5% until the onset of the fertility transition. During the transition, the rate rises gradually until it reaches the long-run level of roughly 2.7%.

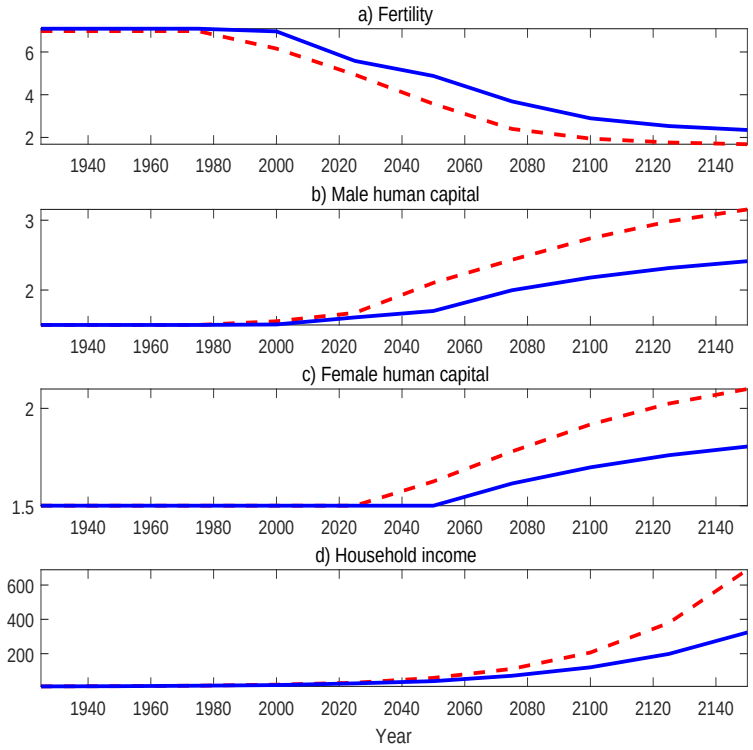
The results of the baseline simulation (solid blue lines) and of the alternative scenario with an increase in female bargaining power (red dashed lines) are displayed in Figure 1. We see that higher female bargaining power induces fertility rates to decline faster and to converge toward a lower level, while both male and female education grow faster and converge to higher levels. Furthermore, income growth is higher in case of higher female bargaining power and the onset of male and female education occurs earlier. These observations illustrate Proposition 2 and the claim that female empowerment has the potential to promote economic development. This holds true as long as there is a quality-quantity preference differential with women preferring fewer and better educated children than men.

TABLE 1. Parameter values for simulation

Parameter	Value	Parameter	Value
$\bar{e}$	1.500	θ	0.700
β	0.270	B	1.100
α_f	0.600	α_m	0.800
γ_f	0.550	γ_m	0.350
δ_f	0.250	δ_m	0.100
ψ_f	0.120	ψ_m	0.000
η_1	0.007	η_2	0.300

In Figure 2 we illustrate that female empowerment has a much weaker effect on economic development in case that male and female preferences with respect to fertility and education of

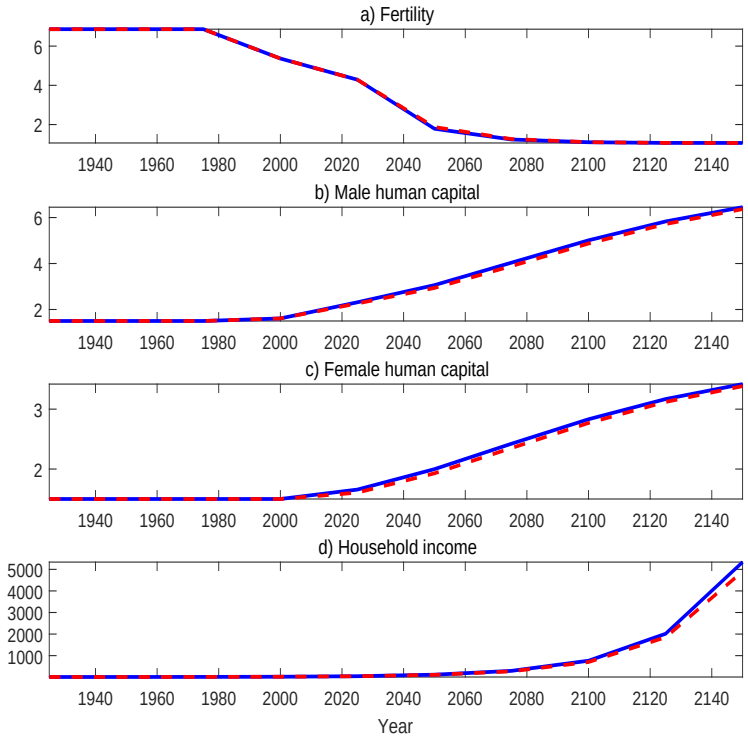
FIGURE 1. Stages of Development for Alternative Levels of Female Empowerment



Solid lines refer to an economy in which the female bargaining power is given by $1-\theta=0.3$. Dashed lines refers to an economy in which the female bargaining power is given by $1-\theta=0.4$.

daughters and sons do not differ, i.e., when the quality-quantity preference differential is switched off and only the daughter-son education preference differential operates. This holds true irrespective of the gender-specific differences in the time requirement for child-care. The solid blue lines refer to the baseline scenario in which the female bargaining power is given by $1-\theta=0.3$, while the dashed red lines refer to the alternative scenario in which the female bargaining power is given by $1-\theta=0.4$. The timing of the take-off of female and male education is not affected by increases in female bargaining power, which is consistent with Proposition 3. Furthermore, fertility levels, male human capital, and household income do not differ appreciably between the two scenarios. However, when explaining the intuition behind Proposition 3, we noted that a similar timing of the take-off does not imply that the trajectories after the take-off are necessarily the same. This feature is visible especially in the graph for female human capital accumulation. Yet, the positive effect that female empowerment has on the trajectory of female human capital is much weaker

FIGURE 2. Stages of Development: Identical Preferences of Men and Women



Solid lines: $1-\theta=0.3$. Dashed lines: $1-\theta=0.4$.

than for the case in which the channel associated with the quality-quantity preference differential is operational.

5. Extensions and Robustness

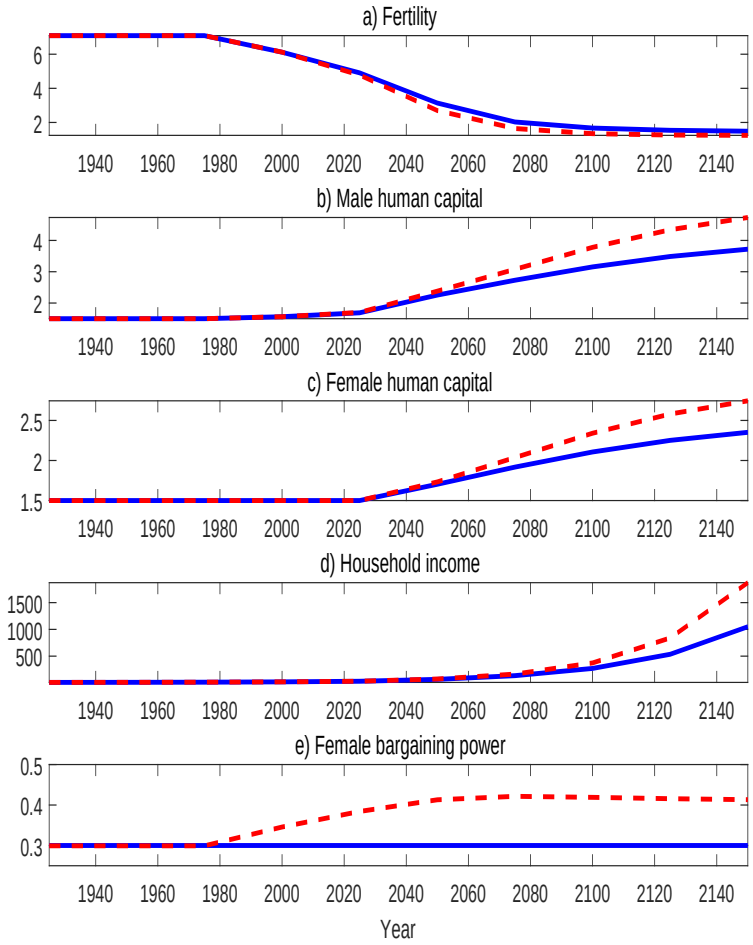
5.1. **Endogenous Female Bargaining Power.** We consider endogenous female empowerment in the sense that the bargaining power in the next period θ_{t+1} is determined by the relative income of men versus women (see for example Attanasio and Lechene, 2002; Geddes and Lueck, 2002; Iyigun and Walsh, 2007; Rees and Riezman, 2012, who follow a similar approach). A convenient formulation of this idea is represented by the following function.

$$\theta_{t+1}=1-\frac{1}{2}\left[\frac{h_{t,f}(1-\psi_f n_t)}{h_{t,m}(1-\psi_m n_t)}\right]^{\beta}, \tag{10}$$

in which β measures the responsiveness of the bargaining power to the gender wage gap. In light of Equation (10), male bargaining power converges to $\theta=1$ for a growing gap between male and female income, while it attains a value of $\theta=0.5$ for equal incomes. Endogenous female

empowerment has two implications: on the one hand, it fosters economic development because, as fertility decreases, the amount of time that women supply on the labour market increases relative to men. Consequently, their relative income and their bargaining power both rise. On the other hand, endogenous female empowerment also has the potential to hamper economic development. The reason is that male education takes off earlier, which, ceteris paribus, raises the relative income of men and hence raises their bargaining power at the expense of women. Due to Proposition 2, it follows that the income threshold for positive educational investments in daughters increases, with a further negative effect on development. The evolution of gender-specific earnings, gender-specific education, and female labour force participation in the United States suggests that the former effect clearly dominates (cf. Goldin, 2006, Figures 3, 7, and 10).

FIGURE 3. Stages of Development: Exogenous vs. Endogenous Empowerment



Solid lines: exogenous bargaining power and $1 - \theta = 0.3$. Dashed lines: bargaining power evolves endogenously according to Equation (10).

Development under endogenous bargaining power is shown in Figure 3. For a better comparison, solid lines re-iterate the baseline case from Figure 1, in which female bargaining power is exogenously given and set to 0.3. Dashed lines refer to an economy in which bargaining power evolves endogenously according to Equation (10). In both scenarios, fertility starts to decline once the income threshold for educational investments in sons is surpassed. The decline of fertility disproportionally frees time of mothers which they use for wage work. This in turn reduces the intra-household gender income gap, irrespective of the fact that the education gap is widening at the beginning of the process. Altogether, in case of endogenous bargaining power, the resource allocation of the household shifts in favour of women, implying that the decline of fertility accelerates and that human capital accumulation of sons increases. Both of these developments have additional positive feedback effects on household income growth. The take-off to growth happens faster when bargaining power evolves endogenously.

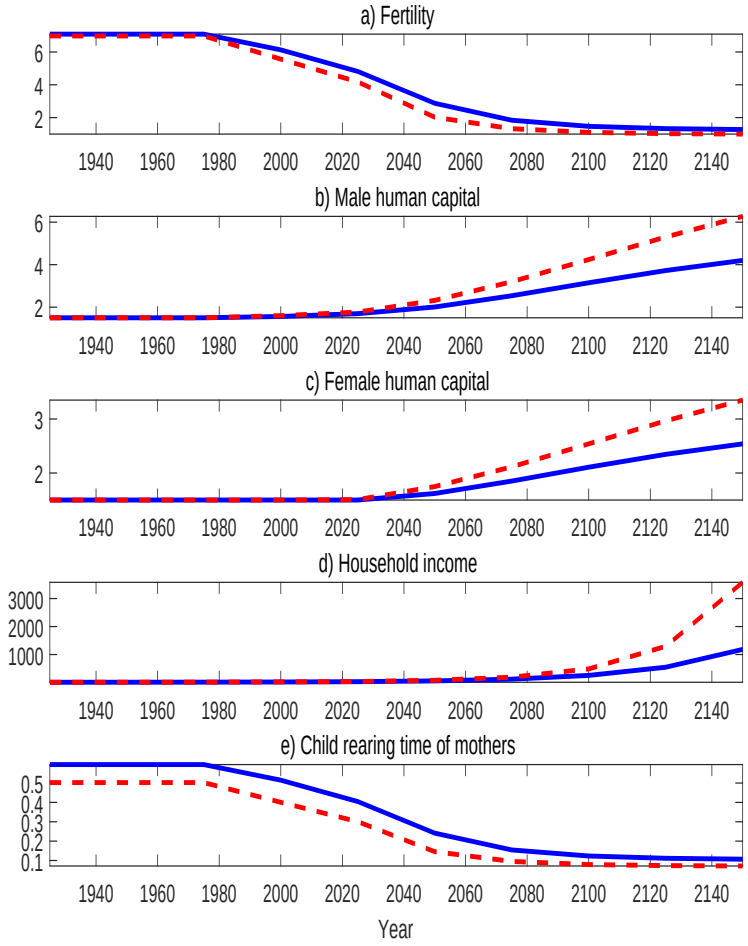
5.2. **Empowerment and Child Rearing Time.** In this section we take into account that the division of child-rearing time depends on spousal bargaining power. We conceptualize this aspect by modifying the budget constraint such that

$$w_t \left\{ h_{t,m} \left[1 - (1-\theta)\psi n_t \right] + h_{t,f}(1 - \theta\psi n_t) \right\} = (e_{t,m} + e_{t,f})\frac{n_t}{2} + c_{t,f} + c_{t,m}. \tag{11}$$

The allocation of parental time spent on child-care is now also subject to intra-household bargaining. Fathers spend $(1-\theta)\psi$ units of their time with each child, while the corresponding figure is $\theta\psi$ units for mothers.

The results are displayed in Figure 4. The solid blue lines refer to the baseline scenario in which the female bargaining power is given by 0.3, while the dashed red lines refer to the alternative scenario in which the bargaining power is 0.4. Altogether, female empowerment leads to faster increases in human capital for women and men as well as to faster household income growth once that the corresponding threshold levels of the wage rate per unit of effective labour are surpassed. Furthermore, fertility starts to decrease earlier and also decreases by more than in the scenario with lower female bargaining power. Finally, we observe that the time that women spend on childcare decreases substantially with falling fertility and increasing female power. For the case of higher female bargaining power, the time that women spend on childcare is lower throughout the whole period of time that is considered. Altogether, these findings indicate that our qualitative

FIGURE 4. Stages of Development: Endogenous Time Requirements of Child Care.



Solid lines: $1-\theta=0.3$. Dashed lines: $1-\theta=0.4$.

results are robust to the introduction of endogenous female bargaining power and to bargaining over child-rearing time.

6. Conclusion

Our study has shown that female empowerment ceteris paribus leads to a an earlier onset of the demographic transition and a faster take-off to sustained growth if there are substantial differences in the preferences of men and women regarding the quantity and quality of their children. In this case female empowerment is predicted to be a powerful lever for development and poverty reduction. Potential measures in favour of female empowerment not only consist of top-down policies such as changes in legal requirements that are often difficult to enforce (in particular, in rural areas with strong traditional norms), or investments in schooling, particularly

for girls, but also of bottom-up interventions such as microcredits that are targeted toward female entrepreneurs (see Hashemi et al., 1996; Khandker, 2005; Angelucci et al., 2014, for the effects of microcredits on female empowerment), or targeted interventions to improve the health of women, which have been shown to be highly effective in promoting development (see Field et al., 2009; Luca et al., 2014; Bloom et al., 2015).

One way of deciding whether gender-specific policies might be effective is to rely on the data provided by Surveys [such as the Demographic and Health Surveys (DHS) or the World Value Surveys (WVS)] with respect to the preferences of men and women for fertility and/or education of the children. Data from the DHS indeed suggests that there are large gender-differentials in fertility preferences in many but not all developing countries. Most countries in which fertility preferences differ substantially between fathers and mothers are located in Africa, suggesting female empowerment as a successful development strategy in this region. By contrast, fertility preferences are by and large quite similar between fathers and mothers in Asian countries, suggesting that female empowerment as a development strategy is more likely to fail in this region. Our theory therefore provides an explanation for why empirical studies sometimes find only weak or insignificant effects of female empowerment on economic development in Asian countries (cf. Breierova and Duflo, 2004; Chou et al., 2010; Duflo, 2012).

A second aspect of human capital investment, apart from education, is investment in health. For the ease of exposition we abstracted from deliberate investments along the health dimension of human capital. This implies that we also abstract from feedback effects between health and education: If women prefer to invest more in the health of their children than men, then our results would be reinforced due to the positive effect of health on educational outcomes (e.g. Bleakley, 2007).

An interesting question for future research is to link the emergence of gender-specific parental norms and preferences stronger to the corresponding geographical and cultural background. Another potential avenue for future research is to acknowledge that preferences are endogenous in the very long run (cf. Hiller, 2014; Strulik, 2013; Prettner and Strulik, 2014). Consequently, female empowerment and social norms with respect to the desired number of children and the desired education level for each child might evolve together and mutually reinforce each other. Eventually, this implies that ongoing gender differentials in outcomes (education, income, bargaining power) might work toward sustaining gender-biased preferences such that there is another feedback loop

between female empowerment and the fertility transition. Finally, Field et al. (2015) show that not only the desired fertility rate of married men is higher than that of married women, but also the realized fertility rate due to polygamy. It could be worthwhile to analyse the changing realized fertility rates due to changes in social norms with respect to the acceptance of polygamy and/or divorce.

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Appendix A

Proof of Proposition 1. It suffices to show that the threshold for female education is higher than the threshold for male education if the daughter-son education preference differential is operative. Calculating $\widehat{w}_{t,f} - \widehat{w}_{t,m}$ gives the expression

$$\widehat{w}_{t,f} - \widehat{w}_{t,m} = \frac{\bar{e}}{2\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)} \left[1 + \frac{(\theta-1)\alpha_f + \gamma_f - \theta\left(\gamma_f + \alpha_m - \gamma_m\right)}{(\theta-1)\delta_f - \theta\delta_m} + \frac{\theta\alpha_m - (\theta-1)\alpha_f}{(\theta-1)\gamma_f - \theta\gamma_m}\right].$$

Since $\bar{e}/\left[2\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)\right] > 0$, a sufficient condition for $\widehat{w}_{t,f} - \widehat{w}_{t,m} > 0$ is that the expression in square brackets is also larger than zero. Expanding the three terms in square brackets such that all three terms have the same denominator yields

$$\begin{aligned} & \frac{[(\theta-1)\delta_f - \theta\delta_m][(\theta-1)\gamma_f - \theta\gamma_m]}{[(\theta-1)\delta_f - \theta\delta_m][(\theta-1)\gamma_f - \theta\gamma_m]} \\ + \quad & \frac{[(\theta-1)\alpha_f + \gamma_f - \theta\left(\gamma_f + \alpha_m - \gamma_m\right)][(\theta-1)\gamma_f - \theta\gamma_m]}{[(\theta-1)\delta_f - \theta\delta_m][(\theta-1)\gamma_f - \theta\gamma_m]} \\ + \quad & \frac{[(\theta-1)\delta_f - \theta\delta_m][\theta\alpha_m - (\theta-1)\alpha_f]}{[(\theta-1)\delta_f - \theta\delta_m][(\theta-1)\gamma_f - \theta\gamma_m]}. \end{aligned}$$

Since the common denominator of the three terms is positive because it is the product of two negative terms, we can focus on the numerator. Simplifying the numerator yields

$$\begin{aligned} & [(\theta-1)\alpha_f + \gamma_f - \theta\left(\gamma_f + \alpha_m - \gamma_m\right)]\left[(\theta-1)\gamma_f + \delta_f - \theta\left(\delta_f + \gamma_m - \delta_m\right)\right] = \\ = \quad & (\underbrace{-\alpha_f + \gamma_f}_{<0} \underbrace{+\theta\alpha_f - \theta\alpha_m}_{\leq 0} \underbrace{-\theta\gamma_f + \theta\gamma_m}_{\leq 0})(\underbrace{-\gamma_f + \delta_f}_{\leq 0} \underbrace{+\theta\gamma_f - \theta\gamma_m}_{\leq 0} \underbrace{-\theta\delta_f + \theta\delta_m}_{\leq 0}). \end{aligned}$$

The first term of this expression is always negative, while the second is always non-positive and it is even strictly negative if the daughter-son education preference differential is operative. Consequently, the numerator is always positive if the daughter-son education preference differential is operative such that there are three stages of development in this case. By contrast, if the daughter-son education preference differential is not operative, the second term could be zero such that we would have the minimum of two phases of development. □

Appendix B

We downloaded the following data from `www.statcompiler.com` by using the updated Beta STATcompiler. For each variable and each country with available data we used the data from the corresponding latest DHS survey (as of February 2016). For details on the quality and consistency of the DHS fertility estimates see Schoumaker (2014). Table 2 contains the mean ideal fertility rate as reported by women and by men. The last column contains the differences in the reported fertility preferences between men and women. On average, women prefer a substantially lower TFR (by 1 child). Only in two countries (Burundi and Rwanda) the desired fertility rate is lower for men than for women.

TABLE 2. Ideal fertility for married women and men

Country	Ideal TFR (women)	Ideal TFR (men)	Difference
Albania	2.7	2.7	0.0
Armenia	2.7	2.9	0.2
Azerbaijan	2.6	3.0	0.4
Benin	4.9	6.6	1.7
Bolivia	2.6	3.0	0.4
Brazil	2.5	2.9	0.4
Burkina Faso	5.8	7.4	1.6
Burundi	4.3	4.2	-0.1
Cambodia	3.3	3.4	0.1
Cameroon	6.1	7.9	1.8
Centr. African Republic	6.7	9.0	2.3
Chad	9.2	13.7	4.5
Comoros	5.6	6.3	0.7
Congo (Brazzaville)	5.3	5.8	0.5
Congo (DR)	6.6	8.2	1.6
Cote d'Ivoire	5.7	6.7	1.0
Ethiopia	4.9	6.2	1.3
Gabon	5.0	6.0	1.0
Gambia	6.5	9.2	2.7
Ghana	4.7	5.4	0.7
Guinea	6.2	9.0	2.8
Guyana	3.1	3.5	0.4
Haiti	3.0	3.0	0.0
Honduras	3.1	3.8	0.7
India	2.4	2.4	0.0
Indonesia	2.7	2.8	0.1
Kazakhstan	3.0	3.4	0.4
Kenya	3.9	4.3	0.4
Kyrgyz Republic	4.2	4.4	0.2
Lesotho	3.2	3.8	0.6
Liberia	5.3	5.6	0.3
Madagascar	4.9	5.6	0.7
Malawi	4.2	4.4	0.2
Maldives	3.1	3.7	0.6
Mali	6.0	8.5	2.5
Mauritania	6.8	8.7	1.9
Mozambique	5.3	6.6	1.3
Namibia	3.7	4.6	0.9
Nepal	2.2	2.3	0.1
Niger	9.5	13.0	3.5
Nigeria	7.1	9.3	2.2
Pakistan	4.1	4.3	0.2
Rwanda	3.6	3.0	-0.6
Sao Tome and Principe	3.7	4.6	0.9
Senegal	5.6	9.6	4.0
Sierra Leone	5.4	6.7	1.3
Swaziland	2.7	3.6	0.9
Tanzania	5.3	5.3	0.0
Timor-Leste	5.7	5.8	0.1
Togo	4.7	5.5	0.8
Turkey	2.5	2.7	0.2
Uganda	5.1	6.6	1.5
Ukraine	2.0	2.1	0.1
Zambia	5.1	5.9	0.8
Zimbabwe	4.1	4.8	0.7
Average	4.5	5.5	1.0

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