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GENDER EQUITY AND THE ESCAPE FROM POVERTY

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Gender Equity and the Escape from Poverty

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Abstract. We set up a unified growth model with gender-specific differences in tastes for consumption, fertility, education of daughters and sons, and consider the intra-household bargaining power of spouses. In line with the empirical regularity for less developed countries, we assume that mothers desire to have no more children than fathers and to invest no less in education per child. We then show that female empowerment has the potential to promote 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 have the potential to constitute a successful development strategy. We demonstrate the robustness of this finding with respect to endogenously evolving bargaining power and division of child-rearing time within the household.

JEL classification: J13, J16, O11, O41.

Keywords: female empowerment, intra-household bargaining, fertility transition, education, economic growth.

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1. Introduction

As emphasized by unified growth theory, countries entering 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 like 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; Galor, 2011; Cervellati and Sunde, 2005).[3]

Here, we investigate whether and how the onset and the speed of the take-off to sustained economic growth depends on the interplay between gender-specific preferences and the bargaining power of women within the household. Specifically, we consider gender-specific child rearing effort and two distinct dimensions of gender-specific preferences: (i) a higher desire of fathers for a large number of offspring and a higher desire of mothers for education per child, (ii) a higher desire of both spouses for the education of boys. We show that female empowerment has a large effect on economic-demographic development if there are large gender differences along the first dimension. By contrast, female empowerment is relatively unimportant for development when preferences deviate mainly along the second dimension or if spouses differ only in their contribution to child care. The reason is that channel (i) has the power to expedite the demographic transition 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 labor 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. Another channel by which technological change promotes female labor 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 washing machines, vacuum cleaners and other

[3]For Unified Growth Theory see Galor and Weil (2000), Kögel and Prskawetz (2001), Jones (2001), 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.

household devises frees substantial amounts of female time that can be used to supply formal labor on the labor 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 hence (under the assumption that women spend more time on child-care) with a negative impact on 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 labor force participation with positive repercussions 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. Furthermore, there exists evidence that women prefer to have fewer children but to invest more in terms of health and education into each single child than men (cf. Thomas, 1990; Pitt and Khandker, 1998; Becker, 1999; Miller, 2008, for a justification). In this case, women would lean toward quality in the Beckerian quantity-quality trade-off, while men would lean toward quantity. Female empowerment then has the potential to directly reduce fertility and directly promote education and therefore to spur economic development.[4]

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. Indeed, in our general equilibrium unified growth model with intra-household bargaining we show analytically that in countries in which male and female preferences with respect to the number of children and their education differ to a large extent, the channel from empowerment to development is particularly strong and hence female empowerment could well represent the most effective lever against poverty. In case that female empowerment is itself endogenously determined by the relative income of women versus men, the positive effect of empowerment might even be reinforced as we show in an extension of the baseline framework. By contrast, in countries or societies, where female and male preferences with respect to the quantity and quality of the children do not differ to a large extent, a crucial channel by which female empowerment exerts a positive effect on economic development is switched off such that female empowerment would be less effective in reducing poverty.

[4]For empirical evidence that gender equity in general, and female empowerment in particular have 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).

Data from the Demographic and Health Surveys (DHS) suggest that there are indeed large gender-differentials in fertility preferences in many but not all developing countries. The DHS provide 123 country studies containing the number of children that both married women and married men consider as "ideal" (ICF, 2012). In 113 studies men prefer on average to have more children than women. In 4 studies there are no gender differences and in 6 studies (3 thereof surveys of Rwanda) women prefer slightly more children than men (on average 0.21 children more). Across the 113 studies in which men preferred more children, we observe large differences in desired fertility differentials. In 24 studies, all of them in Sub Saharan Africa, men prefer to have more than 2 children more than women, up to a difference of 6.6 children, according to the Chad-1997 survey. In Asia, by contrast, the male-female differential of desired fertility is mostly small or even negative (0.1-0.2 in Indonesia, Nepal, and Pakistan and -0.1 in Bangladesh). Our theory therefore implies that female empowerment might be a more successful development strategy in Africa than in Asia and consequently, it sheds new light on the mixed cross-country evidence for the impact of female empowerment on economic development as summarized in Duflo (2012).

As regards our assumption of gender-specific education preferences, that is, that mothers and fathers both prefer education of sons over education of daughters, it has been argued that country-specific geographical features may play a prominent role in shaping these gender-biased norms. For example, Boserup (1970) and Alesina et al. (2013) explain how the adoption of the plough fostered a gender-specific division of labor: while shifting cultivation is typically carried out by using hand-held tools that can be easily operated, plough cultivation requires substantial body strength to either pull the plough or to control the animal that does so. Consequently, in societies that adopted the plough, men tended to specialize on agricultural work on the fields, while women tended to specialize on activities within the home. Alesina et al. (2013) show that this division of labor shaped gender-biased norms that prevailed such that societies in which plough cultivation was practiced in the past have less equal gender norms even today as measured inter alia by female labor-force participation, female representation in politics, and female entrepreneurial activities. It can be expected that in these societies female education is valued less than in societies, in which female participation in the formal labor market is higher.[5]

[5]Related, Hansen et al. (2014) haven shown that, even controlling for historical plough use, countries with a longer history of agriculture have less equality in gender roles concerning labor force participation rates and other measures of equality in gender roles.

There are a couple of studies that are related to our approach. The effects of changes in female bargaining power on economic development are analyzed by de la Croix and Vander Donckt (2010) in a rich 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) analyze 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 female opportunities rise relative to those of males, 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. For the case that male job opportunities rise relative to those of females in the course of globalization, they show that the converse holds true. However, also Rees and Riezman (2012) do not analyze 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 for low levels of gender equality and a low level of initial productivity, an economy is non-developed and stagnates. With technological progress, the stagnation equilibrium becomes unstable, gender equality and the share of skilled workers starts 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.[6]

[6]We treat female bargaining power either parametrically or, in an extension, as being determined by the relative income of spouses. This exogenous (short-cut) modeling of female bargaining power appears to be appropriate because we focus on the consequences and not on the causes of female empowerment. There exists a related literature focusing on a politico-economic foundation of changes in female bargaining power in the course of development: Doepke and Tertilt (2009) and Fernández (2010) explain the endogenous increase of female bargaining power in the United States during the second half of the 19th Century and the first half of the 20th Century via a model in which

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. Section 3 derives our central results and Section 4 illustrates 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. Section 6 concludes.

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 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 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 (see e.g. de la Croix and Vander Donckt, 2010; Rees and Riezman, 2012; Bloom et al., 2014). Building upon Bloom et al. (2014), the utility function has the following specific form

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

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 (cf. Strulik et al., 2013), 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 female empowerment is measured by $1-\theta$. Each member of the household is endowed with one time unit and the costs

men vote over a policy that grants women equal rights. These papers do not characterize the impact of female empowerment on the escape of an economy from a high-fertility and low-education regime. 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.

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 labor, and ψ_i measures the time requirement for child-rearing that potentially differs between the male and female parent.[7] The left hand side of Equation (2) represents household income as the wage rate per unit of effective labor (w_t) multiplied by the efficiency units of labor that each parent supplies on the labor market [$h_{t,m}(1-\psi_m n_t)$ and $h_{t,f}(1-\psi_f n_t)$, respectively]. Effective labor supply depends in turn positively on male and female education levels ($h_{t,i}$) and negatively on the time that either spouse spends on raising children ($\psi_i n_t$). In Section 5 we provide an extension, where the time requirement for child-care of the spouses is determined by the gender-specific bargaining power. The right hand side of Equation (2) reflects household expenditures for education of girls and boys [$(e_{t,m}n_t)/2+(e_{t,f}n_t)/2$] as well as gender-specific consumption expenditures ($c_{t,i}$). Households maximize (1) subject to (2) and given non-negativity constraints on all variables. 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 utility weight on child quantity is higher for men than for women, while the converse holds true for the utility weight on child quality. We capture this pattern by employing the parameter restrictions $\alpha_m \geq \alpha_f$, $\gamma_f \geq \gamma_m$, and $\delta_f \geq \delta_m$ to which we refer as the "quality-quantity preference differential".[8] Furthermore, in line with Albanesi and Olivetti (2007), Doepke and Tertilt (2009), and Bloom et al. (2014), 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 allow for identical preferences of men and women as well as an equal distribution of the time requirement for child-care between both parents by not imposing strict inequalities. To rule out positive educational investments in non-existing offspring, $\alpha_i > \gamma_i$ has to be fulfilled. In order to capture the gender-biased preferences in favor of the education of sons (as described

[7]Note that we abstract from exogenous (e.g. politically or socially motivated) wage discrimination because it is not the focus of our study and because it is not compatible with the assumption of a perfectly competitive labor market.
[8]Eswaran (2002) explains this pattern in economic terms by arguing that the costs of childbearing in terms of foregone wages due to pregnancy and child-rearing as well as in terms of the pain associated with birth are disproportionately higher for women if they exist at all for men. Mason and Taj (1987) argue that females prefer fewer children only in high-fertility environments, while gender-specific differences with respect to the number of children might not play a substantial role in low-fertility environments. Since we allow for a strict equality in our parameter restrictions and since we are primarily concerned with developing countries in a high-fertility setting, this study supports our assumptions on the preferences.

above) as well as the stylized fact that male education takes off earlier than female education (cf. Lagerlöf, 2003), we assume that $\gamma_i > \delta_i$ and refer to this 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 the level of wages. However, as far as fertility and educational investments in daughters and sons are concerned, there are crucial differences for different stages of development. Let $\widehat{w}_m$ and $\widehat{w}_f$ denote the threshold levels of the wage rate per unit of effective labor above which investments in male and female education become positive, respectively. The threshold levels $\widehat{w}_m$ and $\widehat{w}_f$ are then given by

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

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

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

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

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

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

These results imply the following pattern of development.

PROPOSITION 1. *Economic development passes through three stages. At the first stage, there is no investment in education of sons and daughters; at the second stage there is investment only in the education of sons; at the third stage there is investment in education of sons and daughters.*

Proof. See Appendix A. □

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

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

Let L_t denote the labor used in production such that there are $L_t/2$ female and $L_t/2$ male workers.[9] 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)[10]

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

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 labor 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.

[9] We ignore the corner solution of no female wage work.

[10] For currently less developed countries the appropriate interpretation is that Equation (7) explains technology diffusion. Note that the vast majority of R&D expenditures are undertaken by the large industrialized countries (cf. Jones, 2002; Keller, 2002; Ha and Howitt, 2007) and that the resulting technologies diffuse to the developing countries as time goes by. For frameworks that explain knowledge diffusion in more detail see e.g. Howitt (2000), Benhabib and Spiegel (2005), Acemoglu et al. (2006), and Lindner and Strulik (2014).

3. Empowerment and Education

The wage rate per unit of effective labor grows according to Equation (7) such that the economy will go through the three stages of development. At the first stage, the wage rate per unit of effective labor 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 $\widehat{w}_m$, 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 labor 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 labor 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 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 labor [Equations (4) and (5)] affords the following proposition.

Proposition 2. *For a predetermined stock of male and female human capital and differing preferences of spouses with respect to fertility and education, female empowerment lowers the education thresholds for boys and girls ($\widehat{w}_m$ and $\widehat{w}_f$).*

Proof. Note that Proposition 2 refers to the case with a quantity-quality preference differential, that is, it refers to the parameter restriction $\alpha_m > \alpha_f > \gamma_f > \gamma_m > \delta_f > \delta_m$. We take the derivatives of $\widehat{w}_m$ and $\widehat{w}_f$ with respect to θ:

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

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

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 establishes that female empowerment has the potential to spur economic development. 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 labor 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 female empowerment is therefore, apart from gender-equity reasons, in the own long-run interest of males (cf. Duflo, 2012).

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

Proposition 3. *For a predetermined stock of male and female human capital, and in case that male and female preferences with respect to fertility and education coincide, that is, $\alpha_f = \alpha_m$, $\gamma_f = \gamma_m$, and $\delta_f = \delta_m$, female empowerment has no impact on the timing of the take-off of male and female education, irrespective of differences with respect to child rearing costs.*

Proof. In this case the derivatives of the threshold levels $\hat{w}_m$ and $\hat{w}_f$ 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 means that female empowerment has no effect on the demand for fertility and education. 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 and empowerment constitutes a strong lever for economic policy to achieve both goals, development and gender equity. 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.

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

PROPOSITION 4. *For a predetermined stock of male and female human capital, 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 $\widehat{w}_f$ with respect to the desire for education of boys are given by

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

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

The intuition for this finding is the following. Our parameter restriction ensures that the take-off of male education occurs before the take-off of female education, in line with the actually observable pattern (cf. Lagerlöf, 2003) and in line with the notion of the daughter-son education preference differential as implied by the results of Alesina et al. (2013). Therefore, if 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. In 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.

In the next section we illustrate our analytical findings by means of numerical experiments. Furthermore, in Section 5 we introduce two extensions: i) endogenous female bargaining power as being dependent upon the relative income between males and females; ii) endogenous time requirements for child-care as being determined by the relative bargaining power of the corresponding parent.

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 labor 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).[11] Finally, the parameters η_1 and η_2 are chosen such that

[11]These numbers were obtained from UNDP (2012) by first calculating the ratio of female to male labor force participation and the ratio of female to male education (in terms of the population with at least secondary education).

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 line) and of the alternative scenario with an increase in female bargaining power (red dashed line) 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 substantiate 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 according to the findings of Thomas (1990), Pitt and Khandker (1998), Becker (1999), and Miller (2008) with women preferring fewer and better educated children than men.

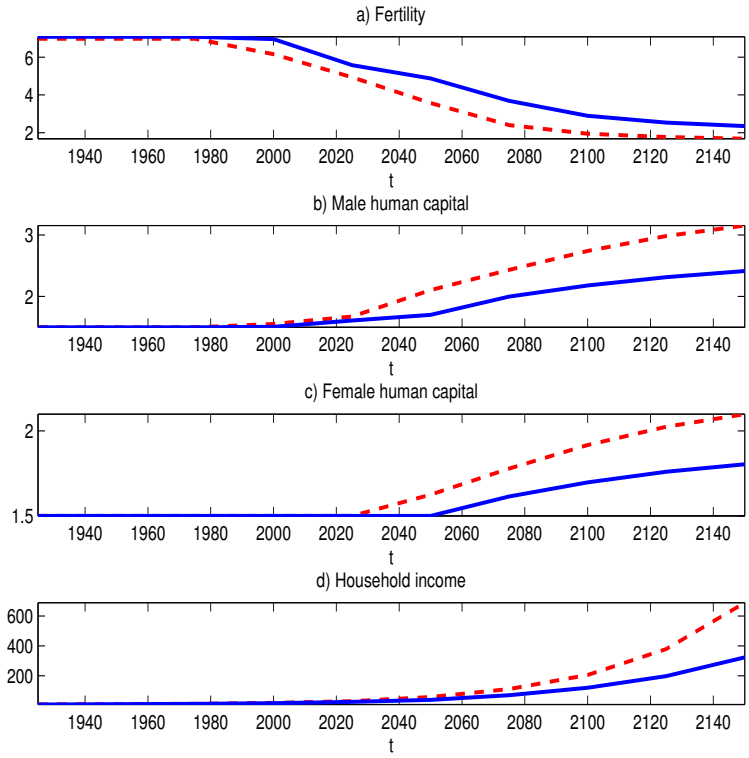
TABLE 1. Parameter values for simulation

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 daughters and sons do not differ, that is, when the quality-quantity preference differential is switched off. This holds true irrespective of the gender-specific differences in the time requirement for child-care. The solid blue line refers to the baseline scenario in which the female bargaining power is given by $1 - \theta = 0.3$, while the dashed red line refers 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

Then we normalized the results such that perfect gender equality would be reflected by a value of 0.5. for both measures. Finally, 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.

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



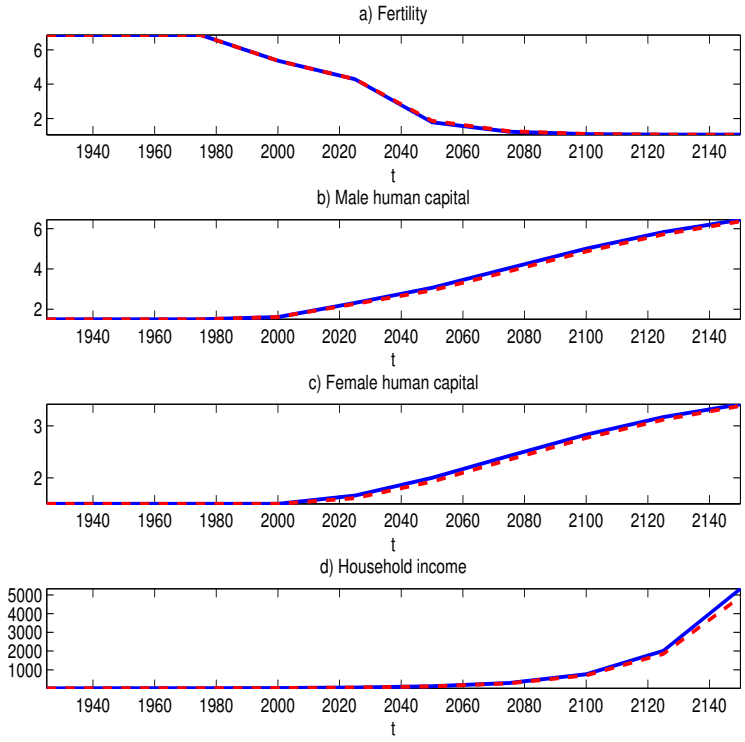
Solid lines refer to an economy in which the female bargaining power is given by $1-\theta=0.3$. Dashed lines refers to an economy in which the female bargaining power is given by $1-\theta=0.4$.

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 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 (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

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



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

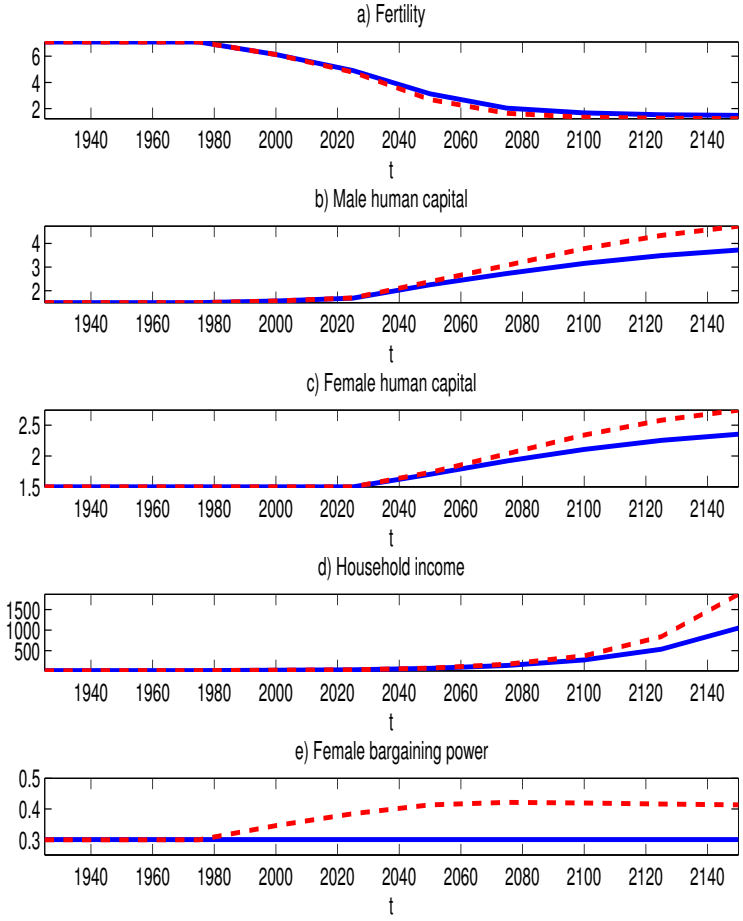
idea is represented by the following function.

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

in which β measures the responsiveness of the bargaining power to the gender wage gap. In light of Equation (10), male bargaining power (θ) converges to 1 for a growing gap between male and female income, while it attains a value of $\theta=0.5$ for equal male and female income. 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 labor market increases relative to men. Consequently, their relative income and their bargaining power rises. 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 education threshold for girls increases, with a further negative repercussion on development. The evolution of gender-specific earnings, gender-specific

education, and female labor 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 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 threshold for male education is surpassed. The decline of fertility disproportionally frees female time which is spent on supplying labor 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

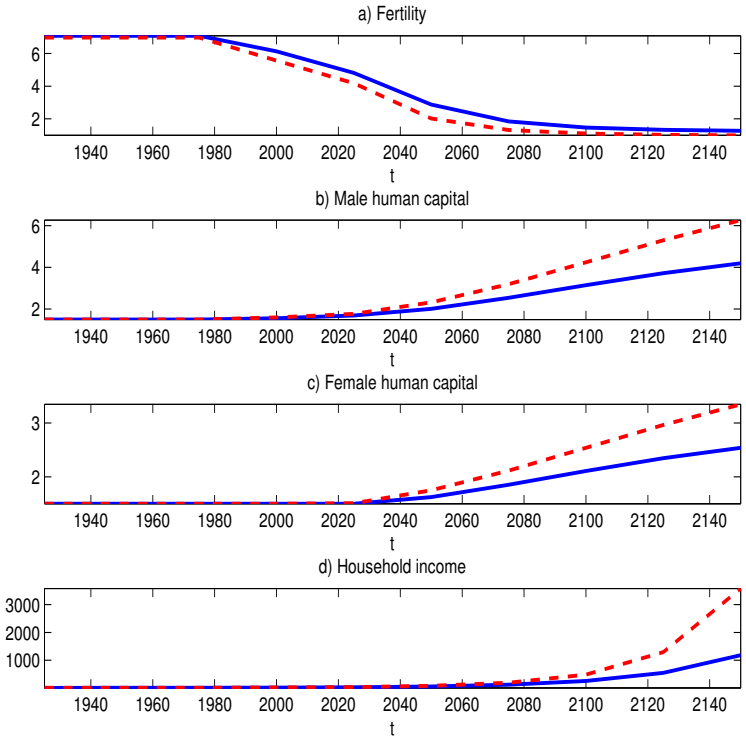
household shifts in favor of female preferences, implying that the decline of fertility accelerates and that human capital accumulation of sons increases. Both of these developments have additional positive feedback effects on household income growth. The take-off to growth happens faster when bargaining power evolves endogenously.

5.2. **Empowerment and Child Rearing Time.** In this section we take into account that 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.

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



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

The results are displayed in Figure 4. The solid blue line refers to the baseline scenario in which the female bargaining power is given by 0.3, while the dashed red line refers 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 labor are surpassed. Furthermore, fertility starts to decrease earlier and also decreases by more than in the scenario with lower female bargaining power. These findings indicate that our qualitative results are robust to the introduction of endogenous female bargaining power as well as 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 offspring. In this case female empowerment is predicted to be a powerful lever for poverty reduction. Potential measures in favor of female empowerment not only consist of top-down policies like changes in legal requirements that are often difficult to enforce (in particular, in rural areas with strong traditional norms), but also of bottom-up interventions like 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).

One way of deciding whether gender-specific policies might be effective is to rely on the data provided by Surveys [like 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 that female empowerment might constitute 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.

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.

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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. Calculating $\widehat{w}_f - \widehat{w}_m$ gives the expression

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

Since $\bar{e}/\left[2\left(\psi_f h_{t,f} + \psi_m h_{t,m}\right)\right] > 0$, a sufficient condition for $\widehat{w}_f - \widehat{w}_m > 0$ 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

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

Since the denominator is the same for all three terms and we see that it is positive because it is the product of two negative terms, we can focus on the numerator. Simplifying the numerator yields

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

Consequently, the numerator is always positive as well, which establishes that $\widehat{w}_f - \widehat{w}_m > 0$. □

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