Gender Inequality and Economic Growth in Korea*

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Abstract

This paper presents a theoretical model that can analyze the impact of gender inequality on long-term economic growth. The model is calibrated to fit to the Korean data. We find that gender equality policies lowering discrimination in the labor market or increasing the time spent by a father on child rearing can contribute positively to female labor market participation and per capita income growth. The simulation results show that if the disparities at home and in the labor market between men and women are completely removed, the female labor force participation rate increases from 54.4% to 67.5%, and the growth rate in per capita income rises from 3.6% to 4.1% on average over a generation.

Keywords: gender inequality, economic growth, female labor market participation, human capital accumulation, Korea

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1. Introduction

South Korea has made significant economic progress in the past 50 years, as demonstrated by its increase in per capita income from mere USD 80 dollars in 1960 to more than USD 24,000 in 2013. A critical factor for Korea's economic success has been its fast-growing well-educated labor force. From 1960 to 2010 the share of adults who have completed secondary schooling or higher soared from 20% to an impressive 87% in 2010 (Barro and Lee, 2013). This abundance of well-educated workers has brought higher levels of labor productivity and returns on investment, and provided capabilities to facilitate technological adoption and innovation. In this way, cheap and good-quality labor has served as the foundation for Korea's successful export-oriented development strategy.

During its rapid industrialization and development period, Korea has made substantial strides toward gender equality in terms of opportunities in education and employment. The gender gap in enrollment ratios at secondary schools and advancement rates to higher education is now negligible. The presence of women in such elite professions as law, medicine, and high-level civil service is more noticeable than ever before.

However, a significant gender gap in labor market participation still exists. According to OECD data, only 55% of Korean women aged 15-64 are in the labor force compared to 65% for OECD countries on average. It lags substantially behind the male participation rate of about 77%, which is close to the OECD average of 79%.

The labor force participation rate of Korean women shows an M-shaped pattern over the life cycle due to a significant drop in their 30s that results from a career interruption after marriage or child birth. While the Korean labor market is likely to eventually encourage active female participation, child rearing remains a major obstacle for highly educated and

able female workers who want to continue their career, as mothers are primarily responsible for raising children. Inflexible working environments and a lack of affordable, good-quality childcare facilities make it challenging to balance work and home.

Korean women have in general a strong perception on the existence of gender inequality in various parts of the society. According to the 2002 Social Survey by Statistics Korea, 72.4 percent of women generally believed the existence of gender inequality in Korean society. Indeed, according to a report on the global gender gap by the World Economic Forum, Korea was ranked 111th in 2013 (Table 1). This index takes into account women's general position in (i) economic participation and opportunity, (ii) educational attainment, (iii) health, and (iv) political empowerment.

The Korean government is aiming to change this, according to the 3-year plan for economic innovation announced last February. Its major goal is to increase the female employment rate from the current 54% to 62% by 2017 through, among other measures, providing affordable, good-quality childcare facilities and expanding paid parental leave, which would help female workers remain in the workforce.

The objective of this paper is to assess the output cost of gender inequality and the impacts of gender-based policies on female labor force participation and long-term economic growth in the Korean economy.

A key source of inequality between women and men in labor force participation stems from the way women allocate their time. At all levels of incomes, Korean women tend to do the majority of housework and childcare, and correspondingly, spend less time on market work. There still exists significant gender discrimination in the labor market.

We present a model, which is built on one in our companion paper (Kim, Lee and Shin, 2014), that accounts endogenously for women's time allocation between home production, child rearing, and market work, and analyze how gender inequality at home and in the labor market effects female labor force participation and economic growth. We then calibrate the model to fit its steady state values to the observed values from Korea and conduct simulations to quantitatively measure the opportunity cost of gender inequality in terms of output foregone, and the impacts of gender-based policies on females' labor market participation and economic growth.

There is an increasing body of literature on gender equality and growth.[1] Existing theoretical literature emphasizes three channels through which gender equality influences growth— female labor market participation, average human capital stock and fertility. A considerable number of empirical papers investigate the impact of gender inequality in education and employment on economic growth and the majority of them find the adverse effects of gender inequality on economic growth.

As gender inequality has been a pressing issue lately in the Korean society, many Korean researchers have studied various aspects of female labor supply and household work, mostly in microeconomic perspectives. Kim and Sung (2007), Woo (2008), Cho (2009) and Choi (2011) estimate empirically or by model calibration the labor supply function of Korean women to investigate the effects of various government policies such as subsidies for childcare and earned income tax credits. Kim and Cho (2003) and Kim (2012) study the determinants of labor market reentry by married women after childbirth or childcare leave,

[1] See Kim et al. (2014) for a succinct survey of recent papers.

including several gender-related policies. Huh (2008) examines the factors for time spent on household production by men and women.

To the best of our knowledge, there has been no academic research that assesses the effects of gender inequality on economic growth in the context of the Korean economy in macroeconomic perspectives. This paper tries to fill in this gap. This paper proceeds as follows. Section 2 provides an overview of gender issues in Korea. Section 3 introduces the formal model. We calibrate the model and derive the benchmark steady state characterized by balanced growth path. In section 4, we experiment the effects of gender equality policies and estimate the output cost of gender inequality. Section 5 provides concluding observations.

2. Gender Inequality in Korea

There are various dimensions—social, cultural, and economic—of inequality that modern Korean women are facing. In a long term historical perspective, the gender inequality problem has been improving greatly since the takeoff of Korean economy in 1970's. However, it is still true that Korean women have many hurdles to leap over for equal treatment at various corners of the society.

On a positive note, the educational achievement of women in Korea has improved substantially in the last half century. In 1990, the average years of schooling for Korean women in their 30's were 10.4 while the average years for men were 11.8. The schooling years rose to 13.9 for women and 14.1 for men in the year of 2010. Furthermore, the average schooling years for women in their 20's in that year reached 14.3 which were even higher than that for the male counterpart at 13.9 years (Social Indicators in Korea, Statistics Korea).

The general improvement in gender equality has been manifested by the change in sex ratio at birth. At the peak of its rise, the sex ratio at birth (measured by the number of boys born per 100 girls) reached 116.5 in 1990. The ratio fell down to the normal level of 106 as of 2007. It is widely believed that rising sex ratio at birth was mainly due to gender inequality in the Korea society. Now the sex ratio coming down to the normal level, Korean parents may not perceive any disadvantage for their daughters in the future.

Albeit several indications of improvement in gender equality, we do still witness significant inequality between men and women in various aspects in Korea.

2.1 Gender gap in labor force participation rat

Despite rapid economic growth and catch-up to advanced economies since 1970's, labor force participation of Korean women has been still lagging behind that of women in developed countries. The female labor force participation rate (LFPR) in Korea is still one of the lowest among OECD countries: the female LFPR in Korea was 12.3 percentage points lower than the U.S. in 20122.

The female labor force participation rate in Korea is significantly lower than the male counterpart, and this gap is larger than that in most OECD countries. According to OECD statistics, in 2011, the difference in LFPR between men and women was 11 percentage points in the U.S., 12.5 percentage points in the U.K., 17.5 percentage points on average in all OECD countries, and 23.4 percentage points in Korea. The gender gap in LFPR has been quite persistent over time in Korea.

[2] See OECD, http://stats.oecd.org

The gender difference in LFPR is more announced when we investigate the participation by marital status. In 2011, married men in Korea had the LFPR at 82.8 percent while single men had the rate at 52.2 percent. On the contrary, the LFPR's of married women and of single women in Korea in that year were 49.3 percent and 50.9 percent, respectively.

The falling LFPR of married women in Korea is well documented in the so-called M curve of labor supply over life cycle. When we plot the employment rate of different cohorts in Korea, we find a dip in the employment rate for Korean women in their 30's unlike Korean men showing no decrease (see Figure 1).

Significantly lower labor market participation by married women in Korea is viewed as a reflection of large burden of childcare on married women. The Korea Time Use Survey conducted in 2009 reports that time spent by a wife on average is more than 3 times longer than a husband (55 minutes per day vs. 14 minutes).

The gender gap in LFPR is also more pronounced among the highly educated. According to the Annual Report on the Economically Active Population Survey by Statistics Korea in 2011, the LFPR of Korean men with university education or more was 88.3 percent while the female counterpart had 62.9 percent. This difference among the more educated is disturbing because it implies a significant waste of human resources for Korean economy.

2.2 Gender gap in employment rate

The female employment rate varies a lot across educational groups. According to Statistical Yearbook of Education by the Ministry of Education, Science and Technology, the employment rate (ER) among female high school graduates in 2011 was 27.3 percent, which was higher than the employment rate among male high school graduates (20.2 percent).

However, the order of the employment rate of men vs. women among the more educated is reported to be reversed. In 2011, the ER's of men and women with masters degrees or higher were 80.6 percent and 59.4 percent, respectively. On the other hand, the ER's of men and women with bachelor degrees were 58.7 percent and 50.0 percent, respectively. This suggests that about half of female college graduates who are provided adequate skills for the labor market are not contributing in the economy, which can be considered an economic loss for Korea.

The gender gap is reported to exist not just at the quantitative dimension of employment, but also at the qualitative dimension. Table 2 below shows the male-female difference in employment types. For example, in 2011, only 3.2 percent of all women employed owned their own businesses while 8.4 percent of men did so. The fraction of temporary workers among women was almost twice higher than that among men (28.7 percent vs. 15.0 percent).

2.3 Gender gap in wage

Another gender difference we observe in terms of economic performances pertains to the wage rate in the labor market. The average monthly wage which is measured by adding the monthly salary and the monthly installment of annul bonus income is reported to be 3.2 million Korean won for men and 2.0 million won for women in year 2010 (Survey on Labor Conditions by Type of Employment, 2010, Ministry of Employment and Labor). This implies that Korean women on average earn 64 percent of what Korean men earn.

It is true that the wage gap has become smaller since the economic takeoff in Korea. According to the Surveys on Labor Conditions by Type of Employment in various years, the

female-male wage ratio was 0.47 in 1985 and 0.63 in 2000. Our concern in this regard is that the gap is still substantial nowadays and it has been quite stable (without a narrowing trend) since the early 2000's.

The gender gap in wage is smaller for more educated women, but the gap is still considerable: women with bachelor degrees or higher earned about 66 percent of what men with the same degrees earned in 2010 (Survey on Labor Conditions by Type of Employment, 2010, Ministry of Employment and Labor).

Interestingly, the wage gap between men and women is more pronounced in occupations that require more advanced skills. In 2010, those women with professional occupations such as medical doctors and attorneys earned only 61.7 percent of what the male counterparts earned when 64 percent was what Korean women earned on average (Survey on Labor Conditions by Type of Employment, 2010, Ministry of Employment and Labor).

2.4 Women's representation in political and government sectors

Beyond the gender inequality in economic aspects, there are concerns raised in other areas such as political representation of women and their participation in the government sector.

Delegates in the 18th National Assembly who were elected in 2008 include only 41 women out of 299 seats in total, which is merely 14 percent. This was a significant improvement from earlier elections. For example, in the 14th National Assembly elected in 1992, the female fraction was 1 percent (3 out of 299 seats). However, considering more than half of the Korean population consists of women (50.1 percent in 2010 to be exact), they are still remarkably underrepresented in the political arena.

Compared to the political sector, women seem to be better represented in the government sector. In 2010, the fraction of female government employees at the federal government level was 41.0 percent. This share is still significantly below 50 percent, nonetheless.

It is also recognized that Korea women are not well represented at the administrative levels of private and public firms. According to the survey conducted by GMI Ratings (2013), the fraction of women in corporate boards is 1.9 percent in Korea and 11.8 percent in OECD countries, putting Korea at the rank of 43 out of 45 countries surveyed. They also find that 19.5 percent of corporations with more than 100 employees have no female executive at all.

2.5 Government policies on gender inequality

The Korean government has been implementing various policies to improve the welfare of women in Korea and reduce gender inequality. Another parallel objective of these policies is to encourage childbearing as the aging of the Korean society has been accelerated in the last few decades with extremely low fertility rates.

With these policies, the Korean government aims in general to provide better environment for child bearing and child rearing so that women are willing to reproduce and able to return to the labor market. The policies can be categorized in three types.

The first type includes those policies to help women giving birth and lower the cost of childbearing for couples.3 They are:

(i) Maternity and paternity leave (for childbirth)

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[3] See the homepage of the Ministry of Gender Equality and Family inKorea (http://www.mogef.go.kr/index.jsp)

(ii) Childcare leave of absence (for children age 0-6): maximum of 1 year with pay

(iii) Reduced work hours during child rearing (for children age 0-6): maximum of 1 year combined with child care leave of absence

The second type of policies pertains to providing parents more reliable childcare facilities for children in grade schools.

(i) Incentives for firms to provide childcare centers at work: implemented in June 2013

(ii) Providing public childcare centers

(iii) Financial support for childcare

(iv) Encouraging private and public childcare centers with financial incentives to offer flexible hours for childcare: implemented in July 2014

The last type is to give incentives for firms to hire back women after child births or child care. Currently private firms can receive tax subsidies if they employ female workers who are trying to return to the labor market after childrearing.

To some extent, these policies have been successful in promoting female labor market participation. For instance, the female employment rate among women age 15 and over rose above the 50 percent mark in 2014 (50.4% to be exact) for the first time (Economically Active Population Survey, 2014). However, the female employment rate is still significantly lower than that in many advanced economies such as Canada (69.2%), Japan (60.7%), and Sweden (71.8%). This still leaves a lot of room for the Korean government to implement better policies for encouraging female labor supply.

3. The Model

The theoretical model has a three-period overlapping generations (OLG) structure where various aspects of gender inequality are related to the growth performance of the economy. Based on a similar model, Kim et al. (2014) showed that improving gender equality can contribute significantly to economic growth by changing female's time allocation and promoting accumulation of human capital.

In order to apply to the Korean economy, we modify the model introduced in Kim et al. (2014) in the following ways. First, besides market and home production, males allocate their time to child rearing and education. This modification will be essential to examine government policy that encourages males to spend more time in child rearing. Second, we assume that father's education level as well as mother's education level determines accumulation of education by children. This change as well as the change in the first modification that males allocate time to education will allow us to investigate the perfect gender-equality case where males and females behave exactly in the same way. Third, we remove the bias toward sons in time allocation and relative preference for children's education. This modification reflects that in the Korean society, the bias for sons almost disappears. Finally we will assume that the government also spends on unproductive usage. This will allow us to explore the government policy that switches spending from unproductive usage to education.

3.1. Model Structure

In the economy, every individual lives for three periods: childhood, adulthood (at middle age) and retirement (at old age). There is a continuum of identical families consisting of parents born at time (t-1) and children born at time t. The family's utility function at time *t* is as follows:

$$U_t = \eta_c \frac{1}{1-\sigma} {c_t}^{1-\sigma} + \eta_q \frac{1}{1-\sigma} {q_t}^{1-\sigma}$$
$$+\eta_e \left[\frac{1}{1-\sigma} \left(\left(\frac{n_t}{2}\right)^{\delta} e_{t+1}^{m} \right)^{1-\sigma} + \frac{1}{1-\sigma} \left(\left(\frac{n_t}{2}\right)^{\delta} e_{t+1}^{f} \right)^{1-\sigma} \right] + \frac{p_A}{1+\rho} \frac{1}{1-\sigma} {c_{t+1}}^{1-\sigma} \quad (1)$$

where c_t (c_{t+1}) is the family's total consumption in parents' adulthood (parents' retirement), q_t consumption (and production) of home goods, n_t the number of children (of which half are sons and the other half daughters), e_{t+1}^{m} (e_{t+1}^{f}) the education level of sons (daughters) which will determine the efficiency of male (female) adult workers at t+1, $\rho > 0$ the time discount rate, σ^{-1} the intertemporal elasticity of substitution and p_A the probability of survival from adulthood to retirement. The coefficient η_C^j is relative preference for today's consumption, η_q relative preference for the home-produced good, and η_e relative preference for children's education.

We assume that the female adult divides her time into four uses: market production, home production, child rearing and child education. Thus the time constraint for the female is as follows:

$$h_t^w + h_t^q + h_t^R + h_t^e = 1 \quad (2)$$

where h_t^w is the female adult's time allocated to market production, h_t^q her time allocated to home production, h_t^R her time allocated to child rearing and h_t^e her time allocated to child education.

We assume that

$$h_t^{mq} = f_1 h_t^q \tag{3}$$

where h_t^{mq} is the male adult's time allocated to home production and f_1 represents the bargaining power of a female with respect to home production. Equation 3 implies that the decision on time allocation to home production by the male and the female is made in two steps: first, the decision on the female's time allocated to home production is made and then second, the bargaining power of a female determines the male's time allocation to home production proportionately. The bigger the bargaining power is the female's, the higher is the proportion. For simplicity, we assume that f_1 is exogenously determined and constant. Generally $f_1 < 1$ and the perfect equality is obtained if $f_1 = 1$. This two-step decision makes us to focus on the female's decision only and hence simplifies the problem. We will make the same assumption for the time allocation to other uses.

We assume that $h_t^R = (2 - f_2)vn_t$ where $2v$ is rearing time needed per child. Again the male's time allocated to child rearing is

$$h_t^{mR} = f_2 vn_t \tag{4}$$

where f_2 represents the bargaining power of a female with respect to child rearing. f_2 is not necessarily equal to f_1 since the comparative advantage of the male and the female in these activities are not the same. In general the female has more comparative advantage in child rearing particularly if child rearing also involves breast feeding.

Finally the time allocated to education satisfies $h_t^e = n_t \epsilon_t^e$ where ϵ_t^e is average education time spent for each child. We assume that the female allocates her time equally between sons and daughters. The male's time allocated to child rearing per child is determined by

$$\epsilon_t^{me} = f_3 \epsilon_t^e \tag{5}$$

where f_3 represents the bargaining power of a female with respect to child education. Hence the total time spent on child education by the male is $h_t^{me} = f_3 n_t \epsilon_t^e$.

Then the time constraint faced by the female can be represented as follows:

$$h_t^w + h_t^q + (2 - f_2) v n_t + n_t \epsilon_t^e = 1 \tag{6}$$

The home production function is

$$q_t = \bar{q}(h_t^q + h_t^{mq})^\gamma [\left(e_t^f\right)^\chi (e_t^m)^{1-\chi}] = \bar{q}(1 + f_1)^\gamma (h_t^q)^\gamma [\left(e_t^f\right)^{\chi_1} (e_t^m)^{1-\chi_1}] \tag{7}$$

where e_t^f and e_t^m are the education level of mother and father, and the second equality holds because of (3). We assume that time spent by a male is perfectly substitutable for time spent by a female. However, we assume that the education of a female and a male is introduced as a Cobb-Douglas functional form where χ_1 and $1 - \chi_1$ are output elasticity of female and male education.

The education level of children that will become productivity when they become adults is determined by three factors, the average government spending on education per (surviving) child, a mother's human capital e_t^f and the time mothers allocate to each child, as follows:[4]

$$e_{t+1}^f = e_{t+1}^m = \bar{e}(\frac{\mu G_t}{n_t^a N_t / 2})^{\nu_1} [\left(e_t^f\right)^{\chi_1} (e_t^m)^{1-\chi_1}]^{1-\nu_1} ((1 + f_3)\epsilon_t^e)^{\nu_2} \tag{8}$$

where G_t is total government spending, μ an indicator of efficiency of government spending, N_t the number of individuals of generation t and n_t^a the average number of

[4] The formulas for children's human capital do not include the role of private education spending. However, the mother's time can be interpreted as comprising private educational spending. The model can be extended to include the allocation of family income to education of children, though the solution of the model becomes much complicated.

children in the households. Since we assume the representative household, $n_t^a = n_t$ holds in equilibrium.

The household budget constraint at t and t+1 are[5]:

$$c_t + s_t = (1-\tau)w_t^H \tag{9}$$

$$c_{t+1} = \frac{(1+r_{t+1})s_t}{p_A} \tag{10}$$

where $\tau \in (0,1)$ is the tax rate, s_t saving, r_{t+1} interest rate between t and t+1, and w_t^H total gross wage income for the household.

$$w_t^H = e_t^m h_t^{mw} w_t^m + e_t^f h_t^w w_t^f$$

$$= e_t^m(1 - f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e) w_t^m + e_t^f (1 - h_t^q - (2-f_2) v n_t - n_t \epsilon_t^e) w_t^f \tag{11}$$

where $h_t^{mw} = 1 - h_t^{mq} - h_t^{mR} - h_t^{me}$ is the time allocated by the male to market production. In this expression, $e_t^m h_t^{mw}$ and $e_t^f h_t^w$ measure labor supply by male and female adults in efficiency units, and w_t^m and w_t^f are effective market wages for male and female adults respectively.

The household maximizes the utility (1) with respect to c_t, c_{t+1}, h_t^q, ϵ_t^e, and n_t subject to the constraints (2)-(11). The first order conditions for c_t and c_{t+1} implies that

$$\left(\frac{c_{t+1}}{c_t}\right)^\sigma = \frac{1+r_{t+1}}{\eta_c(1+\rho)} \tag{12}$$

It is useful to derive the saving rate from (12) as follows:

$$\theta_t = 1 - \frac{1}{1+\frac{P_A}{1+r_{t+1}}\left(\frac{1+r_{t+1}}{\eta_c(1+\rho)}\right)^{1/\sigma}} \tag{13}$$

[5] As in Kim et al (2014), we assume that the savings made by adults who do not survive to old age are confiscated by the government and equally distributed in lump sum to the surviving adults when they become old. Hence the return rate of saving, $\frac{(1+r_t)}{p_A}$ is higher than the actual interest rate, $1 + r_t$.

Market output is produced by identical firms whose number is normalized to unity. Each identical firm *i*'s production function takes the following form:

$$Y_t^i = \bar{Y}(E_t^m H_t^{mw} N_t^{m,i})^\alpha (E_t^f H_t^w N_t^{f,i})^\alpha (K_t^i)^{1-2\alpha} \quad (14)$$

where $\alpha \in (0,1)$ is the elasticity of output with respect to male and female effective labor that is assumed to be the same. Since the representative firm hires labor from the labor market, it hires male and female workers with average labor productivity (education level) E_t^m and E_t^f, respectively. The average male and female adult's time allocated to market production is denoted by H_t^{mw} and H_t^w and the numbers of male and female workers are $N_t^{m,i}$and $N_t^{f,i}$. Finally K_t^i is the amount of capital stock employed by firm *i*.

Profits of firm i are represented as follows:

$$\prod_t^i = Y_t^i - \left(w_t^m E_t^m H_t^m N_t^{m,i} + w_t^f E_t^f H_t^w N_t^{f,i}\right) - r_t K_t^i \quad (15)$$

where the price of the marketed good is normalized to unity and r_t the rental rate of capital that is identical to the rate of return to savings. The firm, taking input prices as given, maximizes profits with respect to the number of male and female workers and capital.

As in Kim et al. (2014), we assume that there is discrimination in the labor market against female workers: while male workers receive their marginal product, female workers receive a faction $d \in (0,1)$ of their marginal product. We assume that profits accrued due to female discrimination in the labor market are thrown away by the firm. Then the optimal choices of the firm for labor and capital satisfy the following equations:

$$w_t^m = \frac{\alpha Y_t^i}{E_t^m H_t^{mw} N_t^{m,i}},\ w_t^f = \frac{d\alpha Y_t^i}{E_t^f H_t^w N_t^{f,i}},\ r_t = (1-2\alpha)\frac{Y_t^i}{K_t^i} \quad (16)$$

In equilibrium, $N_t^{m,i} = N_t^m$, $N_t^{f,i} = N_t^f$ and $K_t^i = K_t$ for all i and the aggregate output is,

$$Y_t = \int_0^1 Y_t^i = \bar{Y}(E_t^m H_t^{mw} N_t^m)^\alpha (E_t^f H_t^w N_t^f)^\alpha (K_t)^{1-2\alpha} \quad (17)$$

From (14) and the equilibrium conditions, the following relation holds between w_t^m and w_t^f:

$$w_t^m E_t^{mw} H_t^m = d^{-1} w_t^f E_t^f H_t^w \quad (18).$$

In equilibrium the following equations hold: $e_t^m = E_t^m$, $e_t^f = E_t^f$, $h_t^{mw} = H_t^{mw}$ and $h_t^w = H_t^w$.

The government finances its expenditure on education, G_t and on unproductive usage, U_t by taxing the wage income.[6] We assume that the expenditure on the unproductive usage is proportional to that on education: $U_t = \emptyset G_t$. Further we assume that the government budget is balanced every period:

$$G_t + U_t = \tau\left(E_t^m H_t^m N_t^m w_t^m + E_t^f H_t^w N_t^f w_t^f\right) \quad (19)$$

where τ is the tax rate of government expenditure. Then

$$(1+\emptyset)G_t = \tau\left(E_t^m H_t^m N_t^m w_t^m + E_t^f H_t^w N_t^f w_t^f\right) \quad (20)$$

or

$$(1+\emptyset)g_t = \tau\left(E_t^m H_t^m w_t^m + E_t^f H_t^w w_t^f\right) \quad (21)$$

where $g_t \equiv \frac{G_t}{N_t^f} = \frac{G_t}{N_t/2}$.

In equilibrium, from (16) and (18)

$$(1+\emptyset)g_t = \tau\left(E_t^m H_t^m w_t^m + E_t^f H_t^w w_t^f\right) = \tau\left(e_t^m h_t^m w_t^m + e_t^f h_t^w w_t^f\right) = \tau(1+d^{-1}) e_t^f h_t^w w_t^f$$

$$= 2\tau(1+d)\,\alpha\frac{Y_t}{N_t} \quad (22)$$

[6] The model can be easily extended to allow non-distortionary revenue financing public education expenditures or unproductive government spending reallocated to education sector. This extension will produce more positive contribution of an increase in government education spending to economic growth.

or

$$(1-\emptyset)G_t = \tau(1+d)\,\alpha Y_t \qquad (23)$$

The competitive equilibrium satisfies the following three conditions:

(i) The household maximizes utility (1) with respect to $c_t,\ c_{t+1}, n_t,\ h_t^w,\ h_t^q,\ h_t^R$ and h_t^e

(ii) The firm maximizes profits with respect to $N_t^{m,i},\ N_t^{f,i}$ and K_t^i

(iii) Markets cleared. In particular the asset-market clearing condition requires that total savings by all households $(0.5N_t)$ in period t are equal to total capital stock at the beginning of period (t+1): $0.5N_t s_t = N_t^f s_t = K_{t+1}$

In the balanced growth path, it can be easily verifiable that $\frac{Y_t}{N_t}$ and $\frac{K_t}{N_t}$ grow at the same rate as e_t^f. Hence the female education (that is the same as the male education is the key to perpetual growth.

The growth rate of per capita GDP in steady state is[7]:

$$1+\gamma_{Y/N} =$$

$$2\bar{Y}(1-fh^{q*}-f_2vn^*-f_3n^*\epsilon^{e*})^{\alpha}\,(1-h^{q*}-(2-f_2)vn^*-n^*\epsilon^{e*})^{\alpha}(k^*)^{-2\alpha}d\alpha\Phi\theta^*(n^*)^{-1} \qquad (24)$$

where the variables with * are steady state values and $k^{f*} = (\frac{K}{e^f N^f})^*$.

3.2 Calibration and Balanced Growth Path

[7] See the appendix for the derivation.

Most parameter values are from the macroeconomics literature and Kim et al. (2014). Some of our parameters are derived from the calibration of our model to fit to its steady state values, which are derived from the average values from Korea for period 2005-2010, reported in the World Development Indicators by World Bank, Bank of Korea data, and Korea Time Use Survey (2009) data, as follows:

(1) Fertility: 1.17

(2) Annual per capita income growth rate: 3.6%

(3) Net private saving rate (% of disposable income): 16.10%8

(4) Female and male labor force participation rate: 54.43% and 75.92%

(5) Wife-husband ratio of child rearing time: 5.19 (51 min. a day by wife and 10 min. by husband)

(6) Wife-husband ratio of child education time: 3.25 (26 min. a day by wife and 8 min. by husband)

f_2 is derived from $(2 - f_2)/f_2 = 5.1$. f_3 is derived from $1/f_3 = 3.25$. Since the male labor force participation rate in our model is $(1 - f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e)$, parameter f_1 can be estimated from the equation:

$f_1 h_t^q = 1 - 0.7592 - f_2 v n_t - f_3 n_t \epsilon_t^e$,

where h_t^q, n_t, and ϵ_t^e are endogenously determined in our model. From the calibration with other average values, we are able to pin down the following parameter values:

$f_1 = 0.5897$;

8 Net saving rate is private saving rate (22.10%) minus depreciation (6%).

9 Child rearing time includes time spent on washing, feeding, sending off to school, putting in bed, and transportation of children. Child education time includes time spent on helping homework, teaching, and reading.

f_2 = 0.3279;

f_3 = 0.3077;

v = 2.8099,

ρ = 0.5982,

$\bar{e}$ = 4.2797, and

$\bar{q}$ = 23.6313.

Table 3 reports the parameter values used for the calibration, and Table 4 presents the steady-state values of key variables in the model economy.

4. Estimation of Economic Effects of Gender Inequality in Korea

4.1 Output Costs of Gender Inequality

We can measure the output costs of gender inequality by comparing the performances of the benchmark case with those of a hypothetical Korean economy with no gender inequality. In the hypothetical gender-equal case, males and females have the same opportunities and power at home, education, and labor markets.

Table 5 illustrates the alternative steady-state of the economy with complete gender equality ($d = 1$, and $f_1 = f_2 = f_3 = 1$). The table shows the values of fertility rate, female labor participation rate, and per capita output growth rate in the new steady-state.

According to the simulation results, with complete gender equality, the female labor market participation rate increases from 54.4 to 67.5. Note that in our framework, the labor force participation rates for males and females are equal with no gender bias at home and labor market. Per capita output growth rate in the new steady-state increases to a higher value.

The results show that, by eliminating the gender inequality, the annual growth rates of per capita income can be enhanced by approximately 0.5% point, by increasing from the current level of 3.6%. to 4.1%..

According to the simulation results, in the hypothetical gender-equal economy, the fertility rate becomes 0.98, lower than the current value, 1.17.

The table also presents the new steady state values reached by the Korean economy if one of the four inequalities or the inequalities both in home production and labor market are eliminated for a comparison with the case of complete gender equality. The result in column 3, for example, shows that the complete elimination of the gender discrimination in labor market alone (i.e., d=1), female labor market participation rate increases from 54.4% to 59.3%, and per capita income growth increases from 3.6% to 4.3% on average over a generation.

Interestingly, removing only the gender inequality in home production ($f_1 = 1$) or education ($f_3 = 1$) lowers the growth rate of per capita income. The decrease in per capita output growth rate is mainly due to decrease in male labor market participation rate as in male increases time allocated to home production, child rearing and education in turn lowers male participation in labor market. Another growth-decreasing effect for the case of ($f_1 = 1$) comes from the increase in fertility that lowers per capita output growth.

4.2. Gender-based Policies

We consider the following three policies to promote gender equality.

(i) Lower discrimination in the labor market: $d \uparrow$

(ii) Increase the time spent by a male on child rearing: $f_2 \uparrow$

(iii) Lower time cost for child rearing: $v \downarrow$

In Figure 2, we illustrate the change in three key variables of most interest—fertility rate, female labor market participation rate and per capita income growth—when the three policies are implemented.`

Lowering the discrimination in the labor market,d , by changing the value of d from 0.6 to 0.7 increases the growth rate of per capita output by about 0.2% point. When the distortion in the labor market is reduced, the female's time allocated to market production significantly increases, contributing to the increase in per capita output growth. In this case, the fertility is lowered as females allocate more time to market production.

If males increase time for child rearing, i.e. raising f_2 (from 0.328 to 0.667) both female labor market participation and growth rate of per capita output increase. In this case, the fertility rate decreases..

Contrastingly, when the rearing time needed per child v is lowered from 2.810 to 2.5, the growth rate of per capita output decreases. Since a decrease in v implies that the cost involved with increasing the quantity of children is lowered, the optimal decision is to increase the fertility. In this case, the increase in the fertility rate dominates the increase in aggregate output, eventually lowering the growth rate of the per capita output.

5. Concluding Remarks

The paper provides a theoretical framework that can explain the determination of female labor market participation, human capital accumulation and economic growth in the Korean economy. We employ this framework to quantitatively analyze the output cost of gender inequality. Our results indicate that the output cost of gender inequality is quite sizable. If the gender inequality is completely eliminated, the female labor force participation rate increases from 54.4% to 67.5%, and the annual per capita income growth rises from 3.6% to 4.1% on average over a generation. The increase in the economic growth rate implies that with the complete elimination of gender inequality per capita income will become approximately 15% higher over one generation. We believe that this growth enhancing effect of gender equality is quite comparable to that of other types of policies contemplated in the Korea economy such as increasing public infrastructure investment and removing unnecessary regulations..

Among various policy measures related with gender equality we contemplated in our study, we find that the most effective policy in terms of enhancing the growth rate of per capita income is eliminating the discrimination in the labor market. Policies that attempt to mitigate gender inequalities by reducing women's time allocated to home production, child rearing and education would be helpful for enhancing growth when they are combined with the reduction of fundamental discrimination in the labor market and they are designed to minimize negative influences on male's labor market participation.

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Appendix

In this appendix we derive equations needed to solve the steady states. Then we calculate the balanced growth rate.

The household problem is to maximize the household utility function:

$$U_t = \eta_c \frac{1}{1-\sigma} {c_t}^{1-\sigma} + \eta_q \frac{1}{1-\sigma} {q_t}^{1-\sigma}$$

$$+\eta_e \left[\frac{1}{1-\sigma} \left(\left(\frac{n_t}{2} \right)^{\delta} e_{t+1}^{m} \right)^{1-\sigma} + \frac{1}{1-\sigma} \left(\left(\frac{n_t}{2} \right)^{\delta} e_{t+1}^{f} \right)^{1-\sigma} \right] + \frac{p_A}{1+\rho} \frac{1}{1-\sigma} {c_{t+1}}^{1-\sigma} \quad \text{(A1)}$$

Subject to

$$q_t = \bar{q}(1+f_1)^{\gamma} (h_t^q)^{\gamma} e_t^f \quad \text{(A2)}$$

$$(1-\tau) e_t^m (1 - f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e) w_t^m$$

$$+(1-\tau) e_t^f \left(1 - h_t^q - (2-f_2) v n_t - n_t \epsilon_t^e\right) w_t^f - c_t - \frac{p_A c_{t+1}}{1+r_{t+1}} = 0 \quad \text{(A3)}$$

$$e_{t+1}^m = \bar{e} \left(\frac{\mu G_t}{n_t^a N_t / 2} \right)^{\nu_1} [e_t^f]^{1-\nu_1} ((1+f_3)\epsilon_t^e)^{\nu_2} \quad \text{(A4)}$$

$$e_{t+1}^f = \bar{e} \left(\frac{\mu G_t}{n_t^a N_t / 2} \right)^{\nu_1} [e_t^f]^{1-\nu_1} ((1+f_3)\epsilon_t^e)^{\nu_2} \quad \text{(A5)}$$

<u>FOCs</u>

$$(c_t) \qquad \eta_c {c_t}^{-\sigma} = \lambda$$

$$(c_{t+1}) \quad \frac{p_A}{1+\rho} {c_{t+1}}^{-\sigma} = \lambda \frac{p_A}{1+r_{t+1}}$$

$$=> \left(\frac{c_{t+1}}{c_t} \right)^{\sigma} = \frac{1+r_{t+1}}{\eta_c (1+\rho)} \quad \text{(A6)}$$

$$(h_t^q) \ \eta_q \bar{q}^{1-\sigma} \gamma (1+f)^{\gamma(1-\sigma)} (h_t^q)^{(1-\sigma)\gamma - 1} \left(e_t^f\right)^{1-\sigma} = \eta_c {c_t}^{-\sigma} (1-\tau)(f_1 e_t^m w_t^m + e_t^f w_t^f) \quad \text{(A7)}$$

$$(\epsilon_t^e) \quad \eta_e \left(\left(\frac{n_t}{2}\right)^{\delta} e_{t+1}^{m} \right)^{-\sigma} \left(\frac{n_t}{2}\right)^{\delta} \bar{e} \left(\frac{\mu G_t}{\frac{n_t^a N_t}{2}} \right)^{\nu_1} (e_t^f)^{1-\nu_1} (1+f_3)^{\nu_2} \nu_2 (\epsilon_t^e)^{\nu_2 - 1}$$

$$+ \eta_e \left(\left(\frac{n_t}{2}\right)^{\delta} e_{t+1}^{f} \right)^{-\sigma} \left(\frac{n_t}{2}\right)^{\delta} \bar{e} \left(\frac{\mu G_t}{\frac{n_t^a N_t}{2}} \right)^{\nu_1} (e_t^f)^{1-\nu_1} (1+f_3)^{\nu_2} \nu_2 (\epsilon_t^e)^{\nu_2 - 1}$$

$$= \eta_c c_t^{-\sigma} (1-\tau) [e_t^m (f_3 n_t) w_t^m + e_t^f (n_t \epsilon_t^e) w_t^f] \quad \text{(A8)}$$

$$(n_t) \quad \eta_e (e_{t+1}^m)^{1-\sigma} \left(\frac{1}{2}\right)^{\delta(1-\sigma)} \delta (n_t)^{\delta(1-\sigma)-1} + \eta_e (e_{t+1}^f)^{1-\sigma} \left(\frac{1}{2}\right)^{\delta(1-\sigma)} \delta (n_t)^{\delta(1-\sigma)-1}$$

$$= \eta_c c_t^{-\sigma} (1-\tau) [e_t^f w_t^f (\epsilon_t^e + (2-f_2)v) + e_t^m w_t^m (f_3 \epsilon_t^e + f_2 v)] \quad \text{(A9)}$$

Since $e_t^m = E_t^m$, $e_t^f = E_t^f$, $h_t^m = H_t^m$, $h_t^f = H_t^f$, $Y_t^i = Y_t$ and $N_t^{m,i} = N_t^{f,i} = \frac{1}{2} N_t$ hold in equilibrium,

$$w_t^f = \frac{2d\alpha}{e_t^f h_t^w} \frac{Y_t}{N_t} \quad \text{(A10)}$$

and

$$w_t^m = \frac{2\alpha Y_t}{e_t^m h_t^{mw} N_t} = \frac{2\alpha}{e_t^f (1 - f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e)} \frac{Y_t}{N_t} \quad \text{(A11)}$$

Dynamics for N_t

The number of adults next period N_{t+1} is the surviving children born at time t. Since the number of households at time t is $\frac{N_t}{2}$ and each household gives birth to n_t that will survive with probability p_c, the dynamics of N_t follows:

$$N_{t+1} = n_t \frac{N_t}{2} \quad \text{(A12)}$$

Savings in Equilibrium

From (7) and (8),

$$c_t + \frac{p_A c_{t+1}}{(1+r_{t+1})} = (1-\tau) w_t^H \quad \text{(A13)}$$

Substituting (A6) into (A13) yields,

$$c_t + \frac{p_A}{1+r_{t+1}} \left(\frac{1+r_{t+1}}{\eta_c(1+\rho)}\right)^{1/\sigma} c_t = (1-\tau) w_t^H \quad \text{(A14)}$$

$$c_t = \frac{1}{1+\frac{p_A}{1+r_{t+1}} \left(\frac{1+r_{t+1}}{\eta_c(1+\rho)}\right)^{1/\sigma}} (1-\tau) w_t^H \quad \text{(A15)}$$

Hence the saving rate θ_t is

$$\theta_t = 1 - \frac{1}{1+\frac{p_A}{1+r_{t+1}} \left(\frac{1+r_{t+1}}{\eta_c(1+\rho)}\right)^{1/\sigma}} \quad \text{(A16)}$$

Since $e_t^m = E_t^m$, $e_t^f = E_t^f$, $h_t^m = H_t^m$ and $h_t^f = H_t^f$ hold in equilibrium, total gross wage income for the household becomes:

$$w_t^m e_t^m h_t^{mw} = d^{-1} w_t^f e_t^f h_t^w \quad \text{(A17)}$$

Then the budget constraint for the household becomes

$$w_t^H = e_t^m h_t^{mw} w_t^m + e_t^f h_t^w w_t^f = (1+d^{-1}) e_t^f h_t^w w_t^f \quad \text{(A18)}$$

Then savings S_t in equilibrium are

$$S_t = \theta_t (1-\tau)(1+d^{-1}) e_t^f h_t^w w_t^f = \theta_t \Phi e_t^f \left(1 - h_t^q - (2-f_2) v n_t - n_t \epsilon_t^e\right) w_t^f \quad \text{(A19)}$$

where $\Phi = (1-\tau)\left(1+d^{-1}\right)$.

Interest rate

$$r_{t+1} = (1-2\alpha) \frac{Y_{t+1}}{K_{t+1}} \quad \text{(A20)}$$

Dynamics for K_t

$$K_{t+1} = 0.5\left(N_t^m + N_t^f\right) S_t = N_t^f S_t$$

$$= \Phi N_t^f \theta_t e_t^f \left(1 - h_t^q - (2 - f_2)vn_t - n_t\epsilon_t^e\right)w_t^f$$

$$= d\alpha\Phi\theta_t Y_t \quad \text{(A21)}$$

$$\frac{K_{t+1}}{K_t} = d\alpha\Phi\theta_t \frac{Y_t}{K_t} \quad \text{(A22)}$$

$$Y_t = \bar{Y}\left(\frac{E_t^m N_t^m}{K_t}\right)^{\alpha}\left(\frac{E_t^f N_t^f}{K_t}\right)^{\alpha} (1 - f_1 h_t^q - f_2 vn_t - f_3 n_t\epsilon_t^e)^{\alpha} (1 - h_t^q - (2 - f_2)vn_t - n_t\epsilon_t^e)^{\alpha} K_t$$

(A23)

$$\frac{Y_t}{K_t} = \bar{Y}\left(\frac{1}{k_t^m}\right)^{\alpha}\left(\frac{1}{k_t^f}\right)^{\alpha} (1 - f_1 h_t^q - f_2 vn_t - f_3 n_t\epsilon_t^e)^{\alpha} (1 - h_t^q - (2 - f_2)vn_t - n_t\epsilon_t^e)^{\alpha},$$

(A24)

where $k_t^m = \frac{K_t}{E_t^m N_t^m}$ and $k_t^f = \frac{K_t}{E_t^f N_t^f}$

Since $e_{t+1}^f = e_{t+1}^m$ $k_t^m = k_t^f$. (A25)

$$\frac{Y_t}{K_t} = \bar{Y} (1 - f_1 h_t^q - f_2 vn_t - f_3 n_t\epsilon_t^e)^{\alpha} (1 - h_t^q - (2 - f_2)vn_t - n_t\epsilon_t^e)^{\alpha}\left(\frac{1}{k_t^f}\right)^{2\alpha}$$

(A26)

<u>Dynamics for Education</u>

From (6), (17) and (18),

$$e_{t+1}^f = e_{t+1}^m = \bar{e}\left(\frac{\mu G_t}{n_t^a N_t/2}\right)^{\nu_1} (e_t^f)^{1-\nu_1}[\epsilon_t^e]^{\nu_2} =$$

$$\bar{e}\left(\frac{\mu\tau(1+d)\alpha}{n_t^a/2}\right)^{\nu_1}\left(\frac{(1-\emptyset)^{-1}Y_t}{N_t}\right)^{\nu_1} (e_t^f)^{1-\nu_1}[\epsilon_t^e]^{\nu_2} \quad \text{(A27)}$$

By definition,

$$\frac{Y_t}{0.5 e_t^f N_t} = \frac{Y_t}{K_t}\frac{K_t}{e_t^f N_t^f} = \frac{Y_t}{K_t} k_t^f$$

$$= \bar{Y} \left(1 - f_1 h_t^q - f_2 vn_t - f_3 n_t\epsilon_t^e\right)^{\alpha} \left(1 - h_t^q - \left(2 - f_2\right)vn_t - n_t\epsilon_t^e\right)^{\alpha}\left(k_t^f\right)^{1-2\alpha}$$

(A28)

Dynamics for k_t^f

$$k_{t+1}^f = \frac{K_{t+1}}{E_{t+1}^f N_{t+1}^f} = \frac{K_{t+1}}{E_{t+1}^f 0.5 n_t N_t / 2} = \frac{d\alpha\Phi\theta_t Y_t}{0.25 E_{t+1}^f n_t N_t}$$

$$= \frac{d\alpha\Phi\theta_t Y_t / N_t}{0.25 n_t \bar{e}\left(\frac{\mu\tau(1+d)\alpha}{n_t/2}\right)^{\nu_1}\left(\frac{Y_t}{N_t}\right)^{\nu_1}(e_t^f)^{1-\nu_1}\left[\epsilon_t^e\right]^{\nu_2}}$$

$$= \frac{d\alpha\Phi\theta_t}{[2(1-b)]^{\nu_2}\bar{e}(n_t)^{1-\nu_1}}(\mu\tau(1+d)\alpha)^{-\nu_1}\left(\frac{Y_t}{0.5 e_t^f N_t}\right)^{1-\nu_1} 2(\epsilon_t^e)^{-\nu_2}$$

$$= \Gamma\theta_t \left(\frac{Y_t}{0.5 e_t^f N_t}\right)^{1-\nu_1} (\epsilon_t^e)^{-\nu_2}$$

$$= \Gamma\theta_t \left(\bar{Y}\Gamma_1\right)^{1-\nu_1} (1 - f h_t^q)^{\alpha(1-\nu_1)} (1 - h_t^q - v n_t - n_t\epsilon_t^e)^{\alpha(1-\nu_1)} (\epsilon_t^e)^{-\nu_2} (k_t^f)^{(1-2\alpha)(1-\nu_1)} \quad \text{(A29)}$$

where $\Gamma = \frac{2d\alpha\Phi}{\bar{e}(n_t)^{1-\nu_1}}(\mu\tau(1+d)\alpha)^{-\nu_1}$

Steady-State Growth Rate

From (A11), (A21), and (A24)

$$\frac{Y_{t+1}}{N_{t+1}} = \frac{Y_{t+1}}{K_{t+1}}\frac{K_{t+1}}{N_{t+1}} = \frac{Y_{t+1}}{K_{t+1}} K_{t+1}\frac{1}{N_{t+1}}$$

$$= \bar{Y}\,(1 - f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e)^{\alpha}\,(1 - h_t^q - (2 - f_2) v n_t$$

$$- n_t\epsilon_t^e)^{\alpha}\left(\frac{1}{k_{t+1}^f}\right)^{2\alpha} d\alpha\Phi\theta_t Y_t \frac{1}{n_t \frac{N_t}{2}}$$

$$=2\bar{Y}\,(1-f_1 h_t^q - f_2 v n_t - f_3 n_t \epsilon_t^e)^\alpha\,(1-h_t^q-(2-f_2)vn_t -$$

$$n_t\epsilon_t^e)^\alpha(\frac{1}{k_{t+1}^f})^{2\alpha}\,d\alpha\Phi\theta_t\frac{1}{n_t}\frac{Y_t}{N_t}$$

In the steady state

$$1+\gamma_{Y/N}=$$

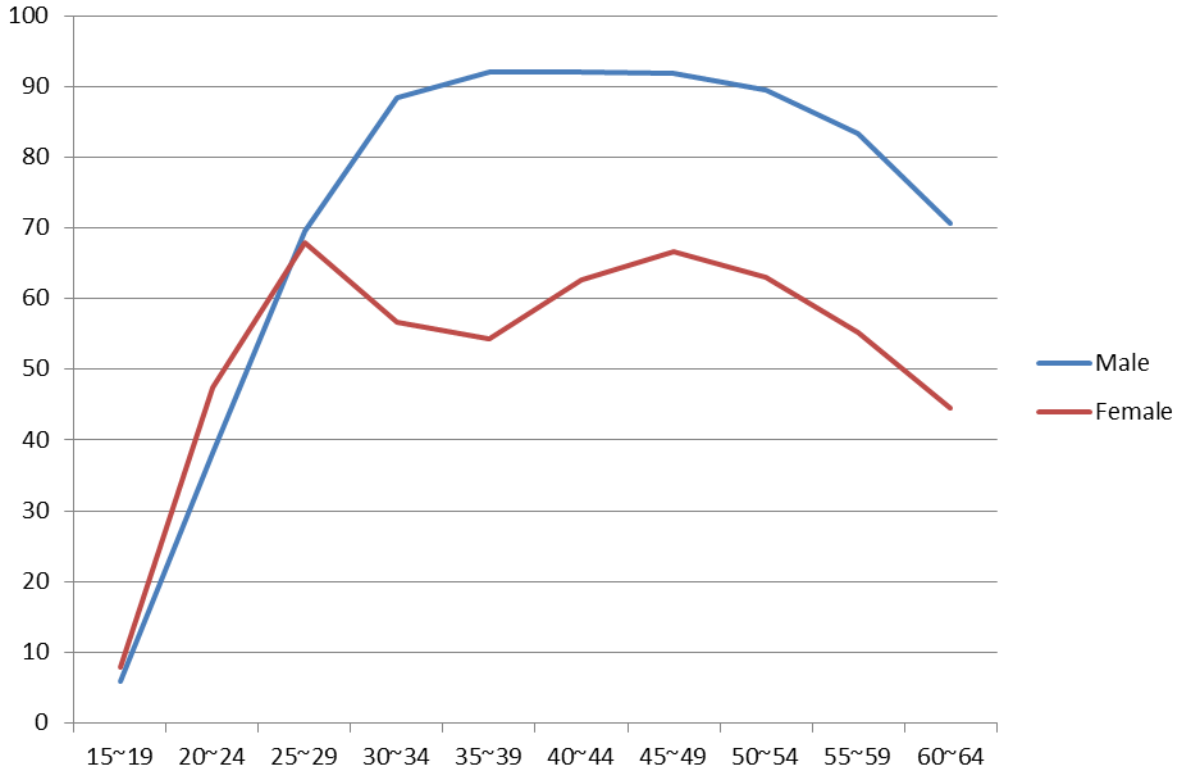
$$2\bar{Y}(1-fh^{q*}-f_2 v n^* - f_3 n^*\epsilon^{e*})^\alpha(1-h^{q*}-(2-f_2)vn^* -$$

$$n^*\epsilon^{e*})^\alpha(k^*)^{-2\alpha}d\alpha\Phi\theta^*(n^*)^{-1} \qquad \text{(A30)}$$

where the variables with * are steady state values and $k^{f*}=(\frac{K}{e^f N^f})^*$.

When f increases, depending on what happens to the steady state solutions, particularly h^q, the steady state growth rate can either increase or not.

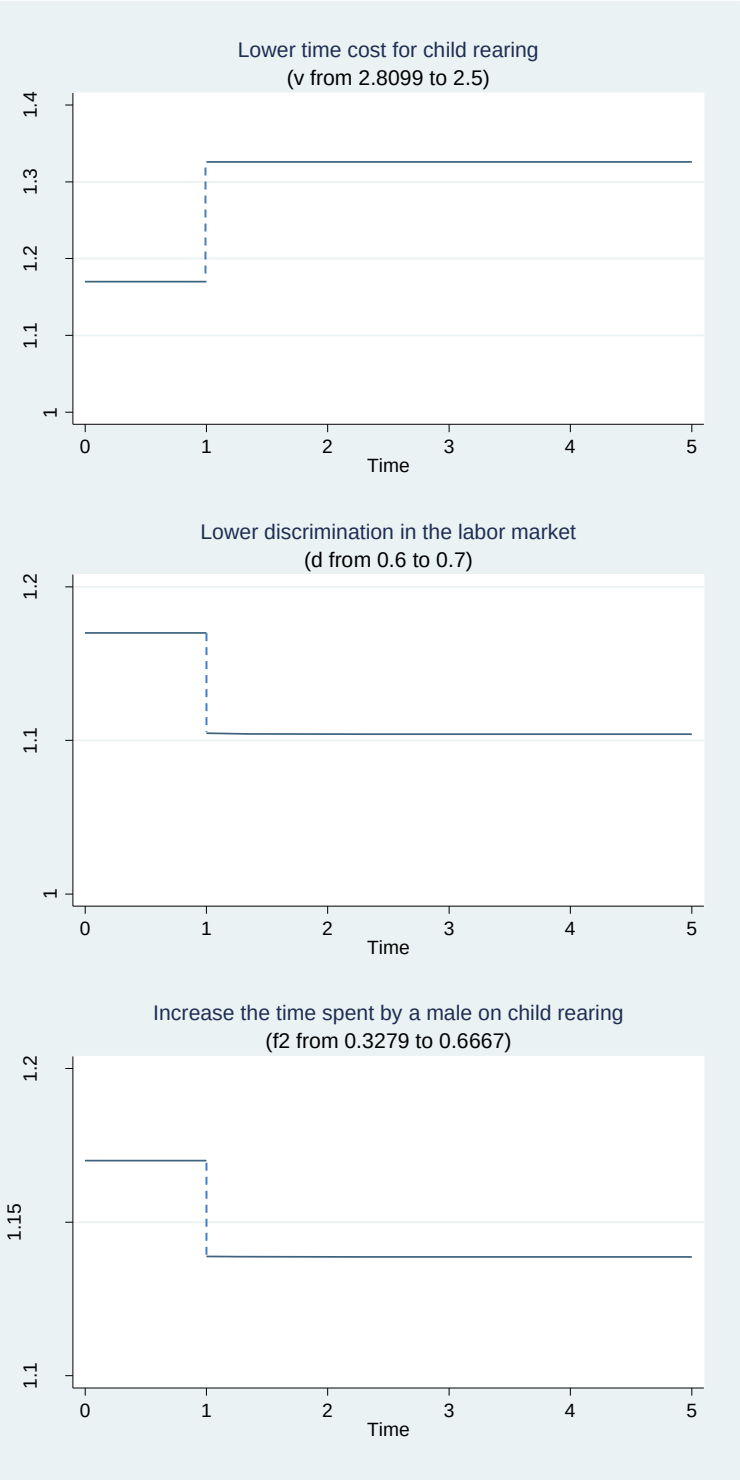
Figure 1. Cohort Employment Rate in 2013: Male vs. Female in Korea



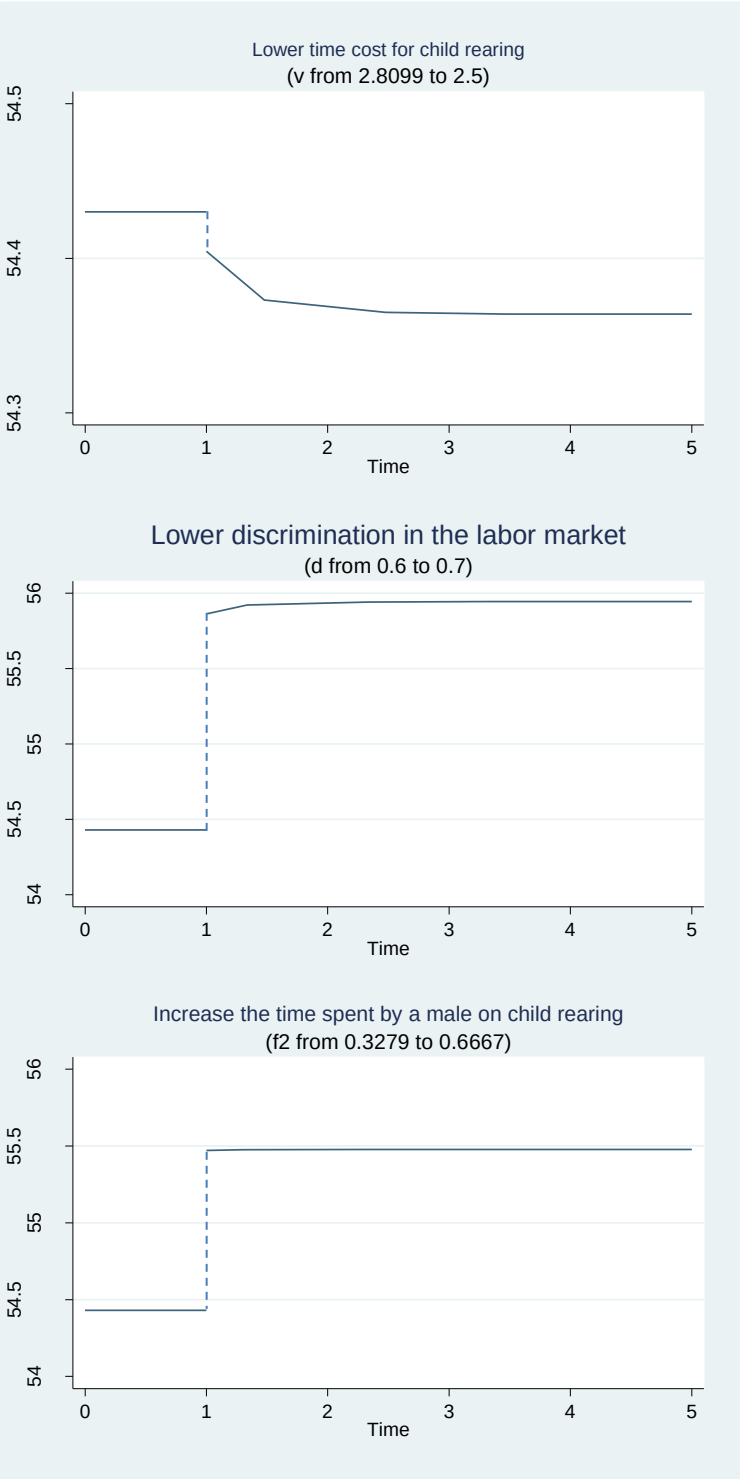
Source: OECD (http://stats.oecd.org)

Figure 2. The Impact of Gender Equality Policies

2.1 Fertility



2.2 Female's Time Allocated to Market Production



2.3 Per Capita Output Growth

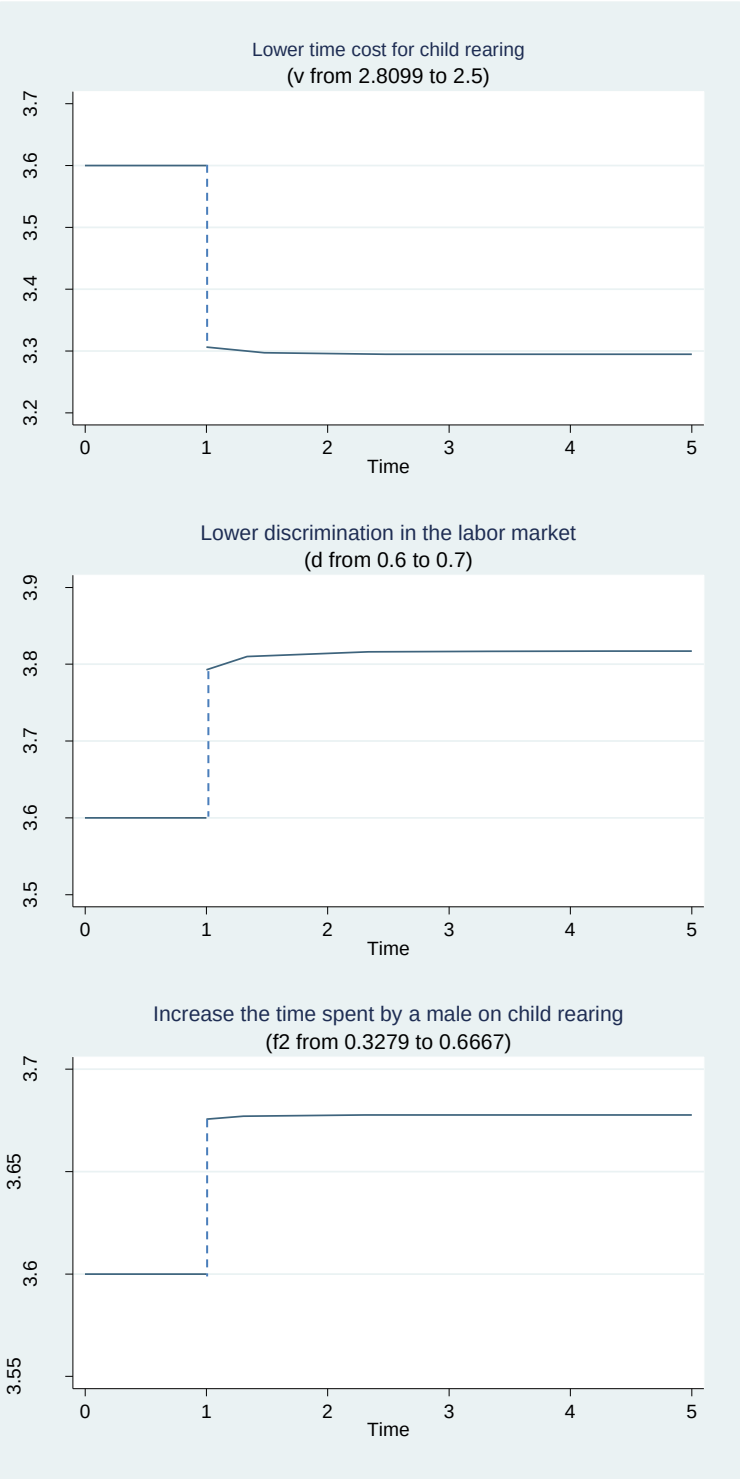


Table 1. The Global Gender Gap Index Ranking in 2013

Country	Overall	Economic participation and opportunity	Educational attainment	Health and Survival	Political empowerment
Iceland	1	22	1	97	1
Finland	2	19	1	1	2
Norway	3	1	1	93	3
Sweden	4	14	38	69	4
Philippines	5	16	1	1	10
Germany	14	46	86	49	15
United States	23	6	1	33	60
Sri Lanka	55	109	48	1	30
Singapore	58	12	105	85	90
Thailand	65	50	78	1	89
China	69	62	81	133	59
Vietnam	73	52	95	132	80
Bangladesh	75	121	115	124	7
Indonesia	95	103	101	107	75
India	101	124	120	135	9
Malaysia	102	100	73	75	121
Japan	105	104	91	34	118
Korea, Rep.	111	118	100	75	86
Pakistan	135	135	129	124	64

Source: Bekhouch, Y., Hausmann, R., Tyson, L. D., & Zahidi, S. (2013, September). *The Global Gender Gap Report 2013*.

Table 2. Distribution of Workers by Employment Types

Sex	Year	Total	Employer	Own account workers	Unpaid family workers	Regular	Temporary	Daily
Female	1990	100.0	2.7	16.0	24.5	21.4	22.5	12.9
	1995	100.0	3.3	16.0	21.1	25.5	24.2	9.8
	2000	100.0	3.0	16.2	19.2	19.1	28.5	13.9
	2005	100.0	3.5	15.4	14.0	25.6	30.2	11.3
	2010	100.0	3.3	12.9	10.9	34.5	30.0	8.4
	2011	100.0	3.2	12.4	10.7	37.1	28.7	7.9
Male	1990	100.0	9.0	25.4	2.5	40.7	14.1	8.3
	1995	100.0	10.2	22.4	1.7	44.4	13.1	8.1
	2000	100.0	9.6	24.1	2.0	38.1	17.1	9.2
	2005	100.0	10.0	22.8	1.3	41.1	16.4	8.5
	2010	100.0	8.4	20.3	1.3	47.9	15.1	7.0
	2011	100.0	8.4	20.3	1.2	49.5	15.0	6.8

Source: Statistics Korea, *Annual Report on the Economically Active Population Survey*.

Table 3. Calibrated Parameters

Parameter	Value	Description
Households		
ρ	0.5982	Annual discount rate
σ	0.8	Inverse of elasticity of substitution
P_A	0.987	Survival probability
δ	1.05	Preference parameter for number of children
η_e	0.2	Preference parameters for children's education
η_q	12	Family preference parameter for home production output
η_c	3.5	Preference parameter for consumption
v	2.8099	
Home output		
γ	0.122	Curvature of production function
f_1	0.5897	Bargaining power of a female in home production
f_2	0.3279	Bargaining power of a female in child rearing
f_3	0.3077	Bargaining power of a female in child rearing
$\bar{q}$	23.6313	
χ	0.8	
Market output		
α	0.4	Elasticity with respect to (wrt) labor input
d	0.6	Gender bias in the workplace
$\bar{Y}$	1	
Human capital		
υ_1	0.4	Elasticity wrt public spending in education
υ_2	0.3	Elasticity wrt public-private ratio
$\bar{e}$	4.2797	
Government		
τ	0.163	Tax rate on marketed output
μ	0.39	Education spending efficiency parameter
∅	3	Factor of unproductive, exogenous government expenditure to educational expenditure

Source: Authors' calculation

Table 4. Steady State Solutions

Variables	Value	Description
$p_c n$	1.17	Fertility rate (n = 1.17)
h^m	0.7592	Labor force participation rate of males
h^w	0.5443	Labor force participation rate of females
θ	0.1610	Net private savings rate
$\gamma_{Y/N}$	1.889	Per capita growth rate (= $1.0360^{30} - 1$)

Source: Authors' calculation

Table 5. Steady-state Values for the Hypothetical Cases with Gender Equality

	Fertility	Female labor participation rate (%)	Per capita output growth rate
Current level	*1.17*	*54.43*	*0.0360*
New steady-states			
Complete gender equality			
$d = 1, f_1 = f_2 = f_3 = 1$	0.98	67.51	0.0406
Gender equality by category			
$d = 1,$	0.97	59.30	0.0434
$f_1 = 1$	1.29	62.24	0.0346
$f_2 = 1$	1.10	56.50	0.0378
$f_3 = 1$	1.08	55.43	0.0345
$d = 1, f_1 = 1$	1.04	64.84	0.0420

Source: Authors' calculation