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ABSTRACT

Capital Market Integration and Gender Inequality

This study explores the effects of globalization on gender inequality. Specifically, we depict that, in terms of capital market integration, globalization alters the gender gap in wage rates through changes in labor demand for capital-intensive sectors. Consequently, globalization leads to opposite effects on the couple's labor supply and fertility decisions in capital-importing and capital-exporting countries, via changes in the bargaining positions of men and women. Moreover, by considering the properties of the industrial structures of capital-importing and capital-exporting countries, our result shows that globalization induces empirically observed declines in fertility rates throughout the world.

JEL Classification: F15, F21, F66, J12, J13, J16

Keywords: globalization, capital market integration, gender inequality, domestic production

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1 Introduction

Globalization affects gender empowerment and fertility outcomes all over the world through many labor market-related factors. Emergence of a new globalized labor market directly changes the way of working styles of mothers and fathers as well as their fertility decisions (Rees and Riezman, 2012). Social remittance by immigrants to their home countries is also a direct effect of the integration of the labor market attributed to globalization. For example, if the women are relatively empowered and family size is relatively small in the destination country, the immigrants may bring its culture or social norms back to their home countries, and spread them in the communities there (Fargues, 2011; Beine et al., 2013, Ferrant and Tuccio, 2015, and Bertoli and Marchetta, 2015). Moreover, globalization characterized by market integration in production factors and final goods also causes indirect effects. For instance, the capital inflow accompanied by the capital market openings will benefit workers who are complementary to capital in production, while it may harm workers who have a less complementary relationship with capital by widening the wage gap with the former. If either female or male workers tend to be complementary to capital in production, the capital flows affect outcomes such as the wages and employment of men and women in the labor market, leading to changes in gender relationships and household decisions.

Since the influential work by Galor and Weil (1996), many studies have explored the role of capital accumulation on gender empowerment and household production, focusing on fertility decisions.[1] These studies consider the situation in which the men and women are affected asymmetrically by capital accumulation in the process of economic development. If we assume an economy where female labor is relatively complementary to capital, capital accumulation leads to a relatively higher female wage. This results in a higher opportunity cost of having children, followed by a decline in fertility.

Analyzing an increase in the level of capital from the viewpoint of an economy composed of multiple countries, rather than that of one country, allows us to shed new light on the relationship between change in capital stock and gender empowerment. The total capital in the world for a certain period is fixed, implying that an increase in the capital of one country is possible only when the capital elsewhere, that is, the rest of the world, is reduced. As such, the effects become more complicated. If a country experiencing capital inflow enjoys higher female wage and lower fertility rate, the country with capital outflow may experience the opposite: The capital outflow causes the drop in female wage rates, leading to a rise in fertility rate. In this case, the effects of changes in the level of capital in each country as well as the economy as a whole are not easy to determine. This study tries to answer this question by exploring the effects of changes in capital levels on the said aspects.

For our purpose, we develop a model with three distinct features. First, to examine capital mobility, we utilize a model of capital tax competition originally presented by Zodrow and Miezskowski (1986) and Wilson (1986). The model analyzes the effects of market integration of an economy consisting of multiple countries (e.g., EU integration). It succeeded in contributing to analyses of the impacts of globalization on each country. The theory predicts that globalization, in terms of capital market integration, allows

[1] Here, we define gender empowerment as the difference in economic power between men and women.

countries with higher returns from investment to attract capital from all over the world, resulting in asymmetric effects on individuals with heterogeneities such as the level of skills, employment status, and capital endowments (Gerber and Hewitt, 1987; Lai, 2010; Ogawa et al. 2016). However, these studies define workers and households only as rational "individuals", and they are often assumed to be homogenous within the household.

Second, we refer to heterogeneity among workers: male and female workers constitute different production labor inputs in accordance with the degree of complementarity to capital. Galor and Weil (1996), Abio et al. (2004), and Saure and Zoabi (2009), among others, assumed that women are complementary to physical capital. However, the degree of complementarity of workers and the main industry of the country vary, especially in accordance with the degree of economic development. So far, the manufacturing and services sectors represent the main industries in developed countries, while developing countries are more likely to rely on manufacturing and agriculture rather than the service industry. Moreover, a large portion of female employment in developing countries is combined with machines owing to the automation of production processes and their lower wages than that of male (Juhn et al. 2014), while in developed countries, women tend to engage in the service sector, and men are the main workers in the manufacturing industries.[2] Thus, new factories built using mobile capital do not necessarily create employment for workers of a specific gender. Therefore, it is worth investigating this issue without characterizing both countries with the same production technology.

The growing literature on globalization and women's empowerment continues to study this issue, but the results as to which gender is complementary to physical capital seem inconclusive. For example, opposing the view that female labor alone is likely to be affected by globalization, Fontana and Wood (2000) pointed out that international trade affects male as well as female labor demand. Seguino (2000) found that globalization influences gender wage gaps in the manufacturing industries in Korea and Taiwan in opposite directions, while Wood (1991) observed that trade attributed to an increase in female employment in the manufacturing industry in developing countries may reduce male employment in the same industry in developed countries. Mayer (2006) explained that this difference arises from the trade between countries at different development stages. Standing (1999) also confirmed that the three decades characterized by globalization induced increased female labor participation in both developing and developed countries and decreased male participation in developed countries. Following the literature that distinguishes between male and female labor inputs, we conduct basic analyses in which, first, men are more complementary to physical capital, and second, the existing opposite case, without limiting either.

The third feature is heterogeneity within a household: we assume that a male and a female form a couple, but they have different preferences for household production. One possible example can be the number of children. As a thoughtful work on globalization and family by Rees and Riezman (2012) noted, a couple negotiates over their common consumption and the number of their children following the bargaining rule characterized by the labor market outcome (e.g., relative wages or labor income). According

[2] Juhn et al. (2014) constructed a model to examine how automation of production processes affects gender inequality in the labor market, and applied the model to the panel data for Mexico.

to the comprehensive survey by Doepke and Kindermann (2014), men in both developed and developing countries tend to prefer a larger family size than their partners, and fertility bargaining exists. In order to discuss domestic work, including childcare, which is an inseparable part of gender empowerment, we consider the effect of globalization on the intra-household allocation, including household production.

Using a model with these features, we make two contribution to the literature. First, we clarify the effects of increased capital mobility on the power balance within a family and intra-household resource allocation. Many studies examine the effects of globalization of the labor and goods markets on workers' decisions and inequality. Among labor, goods, and money, it is believed that money moves the fastest across countries, so the impact of increased capital mobility on the economy is also quite large. For example, while labor mobility has been increasing, labor migration across countries is still relatively low. According to the United Nations Population Division (2018), the proportion of international migrants relative to the world population remained relatively stable at around 3% over the last 25 years. In contrast, foreign direct investment (FDI), net outflows (BoP, current US dollars), increased rapidly from 13.04 billion dollars in 1970 to 3.196 trillion dollars until 2007, and its value is 1.525 trillion dollars in 2017, the latest available year (World Bank, 2018).[3] Although capital mobility increased substantially, few studies investigate the indirect effects through the capital market on intra-household decision making. To our knowledge, this study is a pioneering attempt to explore the effect of capital market integration on gender inequality and intra-household resource allocation in a family. The study allows us to understand how increased capital mobility affects domestic workers, which is a frequent occurrence in the context of globalization.

The second contribution is to explore the impacts of globalization on both capital-exporting and capital-importing countries using a general equilibrium model with two countries. Prior studies tend to focus on the partial effects of globalization by looking at the consequences of globalization within one country. Autor et al.'s (2018) influential work examines the effects of a trade shock caused by the emergence of the Chinese economy on family formation and the children's environment through the change in domestic workers' employment. While they provide insights into its impact from the view of one country (the United States), the event also influences the economies of counterpart countries because globalization does not occur in isolation. The emergence of China, which had a large impact on the US labor market, began with a great increase in FDI. Two events triggered this trend: Deng Xiaoping's 1992 Southern Tour Lectures, in which he spoke of reforms toward a market economy, and China joining the World Trade Organization in 2001. Many scholars point out that these capital inflows contributed to China's remarkable growth since the 1990s. According to Bosworth and Collins (2008), in China's economic growth of 9.7% from 1993 to 2004, population growth contributed 1.2%, while the growth per capita contributed 8.5%. Of this latter figure, growth in physical capital, education, and TFP contributed 4.2%, 0.3%, and 3.9%, respectively. Since infrastructure formation is included in TFP, the role of the increase in physical capital through FDI was quite large. Krugman (1994) also states that

[3] World Bank Databank, accessed on August 19, 2018.

the increase in physical capital and labor input rather than technological advances explains nearly all of the rapid economic growth in Asian countries. We therefore analyze qualitative results for both capital importing and exporting countries that participate in the globalized economy to offer a complementary understanding of the consequences of globalization with a general equilibrium model.

Our main results are as follows. When two countries have the same production technology, globalization results in opposite effects on household production in capital-importing and capital-exporting countries. This result is natural when we consider globalization as the integration of two individual economies into a large one overall. Following Saure and Zoabi (2009), for example, suppose that both countries employ a production technology in which female labor is more complementary to physical capital. In this case, the market integration reduces the female wage rate of the capital-exporting country but increases it in the capital-importing country, and then lowers a wife's bargaining power in the capital-exporting country and raises it in the capital-importing country. Since relative economic positions affect the autonomy in a marriage, household demand for domestic production (fertility) reflects the changes in their bargaining power, resulting in a larger (smaller) family size in the capital-exporting (importing) country. Then, considering that the capital complementarity of labor differs between the machinery-based and other industries, and that the capital-importing and exporting countries have different major industries at the global level, we show that fertility declines occur in every country.

The rest of this paper is organized as follows. First, Section 2 introduces a simple model of the economy where men provide a higher complementary labor input to the physical capital compared to women. In Section 3, we extend the basic model in the various ways to reflect more realistic situations. In line with the existing studies, Section 4 argues in favor of the alternative production technology, in which female labor is more complementary to physical capital. Moreover, we argue about the effects of capital market integration of countries with heterogeneous technology in terms of the relative complementarity of labor inputs to physical capital. Finally, Section 5 concludes this paper.

2 Model

The economy consists of two countries $i(=1,2)$. In each country, competitive firms and households exist. The number of households in each country is normalized to unity, and they maximize their household's welfare function through intra-household resource allocation. The firms produce goods using capital and labor inputs to maximize their profit. In the model, we assume that workers cannot migrate across countries, while capital can move from one country to another if the capital market is integrated.

Following Galor and Weil (1996), we develop a model of the firm to distinguish male and female labor as different production inputs. We start with the case in which male labor provides higher complementary input to capital than female labor. Let us hereafter refer to this as the MK technology. In this situation, male workers are more likely to be engaged in manufacturing industries, where male labor and machinery are combined for production (e.g., as in the automobile industry), while women tend to be engaged in the services industry, which is relatively labor-intensive compared to the former. It is also feasible

that female labor is more complementary to capital than male labor. We refer to this case as the FK technology. As Galor and Weil (1996) indicated, however, this case is more applicable to describe the situation in the developing world, which places high weightage on the agricultural industry. Besides, when we focus on the machinery industry, a typical example of an industry related to capital mobility, whether male or female labor is more complementary to physical capital depends on the type of labor the industry demands. Thanks to the automation of production processes with machines, the industry does not necessary require physical labor, which mainly relies on males. As Standing (1999) and Anderson (2005) suggested, when specific skills are not required because of these automations, since male and female labor can substitute each other, firms are more likely to employ female labor at lower wages for light tasks combined with the use of machines. In this case, we can regard that female labor is implicitly more complementary to the country's physical capital. However, as in developed countries, if women can access the labor markets of industries that require much lighter tasks and if they are more likely to apply to these labor markets, male labor can be more complementary to the capital for the country as a whole. Given these complexities, the results of empirical studies have been inconclusive with regard to the question of which labor (male or female) provides higher complementary input to capital, since they differ across industries, countries, and ages. This study, thus, considers both cases and begins with the analysis of the MK technology, which assumes that male labor is complementary to capital and female labor is not, deferring the opposite case (the FK technology) until later.

2.1 Firms

Firms produce the private good as the numéraire using the inputs of male and female workers and capital. The production technology is formulated as $Y_i = F(K_i, M_i, F_i)$, where K_i, M_i and F_i are capital input, male labor input, and female labor input, respectively. We assume $F(.)$ is homogenous of degree one with respect to three inputs. To obtain a clear result, we specify the MK-type production function as

$$Y_i = \left(A - \frac{K_i}{M_i}\right) K_i + bF_i, \tag{1}$$

where $A(> 0)$ represents the technical productivity associated with capital and male labor and $b(> 0)$ is the marginal productivity of female labor. Prior studies on capital tax competition often use the quadratic specification of the first term to make the analysis more tractable. This specification gives a linear marginal product, which is useful to obtain clear analytical solutions in a model with capital mobility (Keen and Konrad, 2013). In (1), we follow the quasi-linear specification of the production function in Abio et al. (2004, p.54), who examine the effect of public pensions on the behaviors of two-earner households. We agree that this specification is extreme in that firms regard male and female labor as different inputs in the degree of complementary to physical capital. In the sense of generality, it represents a strong assumption, but it significantly eases the analytical resolution and provides clear-cut results and a mechanism. If we employ a more general production function, we may obtain results that the change in physical capital affects both gender groups. However, it is still possible that the level of

capital is more likely to influence the workers in a specific gender group due to its complementarity. For instance, Seguino (2000) and Nuewmayer and Soysa (2011) provide evidence that the outflow and inflow of FDI influences male and female workers differently in both developed and developing countries, leading to the change in gender gap in employment and wages.[4]

The profit of firms in country i becomes

$$\pi_i = \left(A - \frac{K_i}{M_i}\right) K_i + bF_i - m_i M_i - f_i F_i - r_i K_i.$$

m_i and f_i define male wage rate and female wage rate respectively, while r_i represents the price of capital in country i. When the capital is mobile across the countries, $r_1 = r_2 \equiv r$ holds. When capital is immobile, on the other hand, the price of capital differs between countries in accordance with the level of capital existing in each country ($r_1 \neq r_2$).

Profit maximization gives the following:

$$m_i = \frac{K_i^2}{M_i^2}, \tag{2}$$

$$r_i = A - \frac{2K_i}{M_i}, \tag{3}$$

$$b = f_i. \tag{4}$$

Note that a change in the level of capital in country i, K_i, influences the male wage rate, m_i, but not the female wage rate, f_i. A number of studies have examined the effects of globalization on the gender gap in terms of labor outcomes. For instance since Wood (1991), some empirical studies have found asymmetry in the effects of globalization, in that men are more likely to be affected by globalization of the manufacturing industry in developed countries. This can be interpreted as male labor being more complementary to physical capital in some economies. Section 4 also provides an analysis of the production function in which female labor input is more complementary to physical capital. We can thus analyze the heterogeneous production function in the two countries to compare the consequences of capital market integration.

2.2 Household

Budget constraints. Suppose that each gender group is populated in each country, and a couple forms a family under the monogamy system. Each individual is endowed with one unit of time and they supply positive level of their time in the labor market. The couple in country i benefits from private goods consumption, c_i, and household public goods, n_i. The private goods are obtained from the market, but

[4] Qian (2008) also shows that that policy has heterogeneous effects on each gender group using the post-Mao reform as a natural experiment that increased the prices of two goods. In this period in China, women had a comparative advantage in producing tea, while men did in producing orchard fruits. She found the areas in which tea grew well experienced an increase in female income followed by better quality of children, while areas suitable for growing orchard fruits saw an increase in male incomes followed by a decrease in children's quality. See also Braunstein and Brenner (2007) for an excellent review.

the household public goods are produced by the female labor: one unit of their time spent at home can produce one unit of household public goods. We take the number of children as the household public good, for instance. Although we provide fertility as an example of domestic production goods due to its relatively high observability, n_i can be any good produced with an individual's time spent within the household, such as the outcomes of cleaning, elderly care, and cooking.

If the mother has the comparative advantage in childrearing and they do not use an alternative production technology, such as sufficient childcare purchased in the market, then the number of children and the mother's time for childcare has a positive relationship. The relationship between the number of children and the maternal time needed to raise the children (the production function of children) is $n_i + F_i = 1$, implying that the relationship between the number of children and female labor supply, F_i, is negative.[5] ease the assumption of complete substitution between their time, (i) and (iii), which are relatively supported in the literature, can allow to obtain the substantially same results with some restrictions on the parameters. We assume that men supply their entire time to market-related work and a couple in country i has an initial endowment of capital of κ_i. Then, the couple's budget constraint is $m_i + bF_i + r_i\kappa_i = c_i$. The first two terms on the left-hand side refer to the couple's labor income and the third term represents the capital income, while c_i represents the couple's level of (common) consumption.

Preferences. The utility function of each individual in country i is defined in the quasi-linear function as $U_{fi} = c_i + \delta \ln n_i$ and $U_{mi} = c_i + \ln n_i$, where $\delta > 0$ denotes the women's preference parameter as to family size.[6] Based on some evidences, we assume that $0 < \delta < 1$, which indicates that women prefer a smaller family size than men (Ray and Riezman 2012; Doepke and Kindermann 2014).

To describe the situation where the couple negotiates over household resource allocation, we follow the collective model developed by Apps and Rees (1988) and Chiappori (1988,1992). We follow their analytical framework and assume that the couple will maximize the weighted average of the husband and wife's welfare. The welfare function of the couple is then given as[7]

$$W_i = \theta_i U_{fi} + (1 - \theta_i) U_{mi} = c_i + (1 - \theta_i + \theta_i \delta) \ln n_i,$$

where θ_i is the bargaining power of women in country i relative to their husbands. Note that, when $\theta_i = 1$, the objective function of the household becomes the wife's utility, while in the opposite extreme case, if $\theta_i = 0$, it corresponds to that of her husband.

[5]The assumption that only women produce the domestic public goods is justified if the three conditions hold; (i) $m_i > b$, (ii) the time of husband and wife for producing domestic production goods is complete substitute and that (iii) they decide on allocation based on negotiation. Even if we drop (ii) and

[6]There is no income effect under this specification. However, we confirmed that the results are not affected, even if we base the analysis on a model with an income effect assuming the Cobb-Douglas utility function.

[7]The alternative specification of intra-household bargaining is based on the Nash bargaining model (Browning et al., 2014, chapter 3). Excluding the possibility of a breakdown in negotiations and assuming that the couple has a long-run relationship, we can make use of the tractable specification of the collective model for intra-household bargaining, which assumes that family members can always achieve efficient allocation within the household.

Bargaining power. We characterize the bargaining power of women as a function of the female-male wage gap: $\theta_i = \theta_i(f_i - m_i; \gamma_i)$, where the constant parameter γ_i includes other determinants of bargaining power, such as the level of disposal assets, education, health conditions, and cultural or legislation systems. We assume $\theta_i' \equiv \partial\theta_i/\partial f_i = -\partial\theta_i/\partial m_i \geq 0$, where the prime symbol denotes the first-order derivative. If $\theta_i' = 0$ holds, the bargaining power is fully determined by exogenous factors, γ_i. On the other hand, if $\theta_i' > 0$, the bargaining power is influenced by the gender wage gap.

Women's status is characterized by many factors besides the relative economic power between men and women (Duflo 2012). The literature on the economics of gender inequality document factors that can affect women's status: delegation of autonomy to women (Doepke and Tertilt 2009), the institution of the marriage market and legal systems (Chiappori et al. 2002), acquisition of property rights (Fernandez 2014), improving the level of education and health conditions (Thomas, 1990; Jayachandran and Lleras-Muney 2009), and participation in politics (Chattopadhyay and Duflo 2004). Specifically, as Duflo (2012) shows, the gap in educational attainment sometimes matters in developing countries because girls' education plays an important role in improving gender inequality through many channels: richer knowledge and higher productivity, lower child and maternal mortality, and obtaining more leadership. In practice, The Global Gender Gap Index, which is an index designed by the World Economic Forum to measure gender equality in each country, is calculated as the gender gap between women and men in four key areas: health, education, economy, and politics. Among the economic factors, we here focus on the economic power determined by labor outcomes such as earnings and wages. We consider the other determinants of the power balance within a couple as exogenous and include it in γ_i. We begin by describing the bargaining power when it is influenced by the wage gap, deferring the extension in which it is determined by the income gap until later.

Using (4), the bargaining power of women is rewritten as

$$\theta_i = \theta_i(b - m_i; \gamma_i). \tag{5}$$

Since the household cannot control the wage rates, bargaining power is exogenous for them. However, as the wage rates are determined in the market, the bargaining power is endogenous for the whole economy.[8]

Optimization. Given the budget constraint, the household chooses the level of consumption c_i and the level of the wife's labor supply (or, equivalently, the number of children), F_i, to maximize their welfare function.[9] The problem of the household is defined as

[8] Our analysis focuses on the one-way direction from gender inequality in the labor market on household decisions to intra-household allocation and do not address why firms differentiate male and female workers. However, these variables are known interdependent so that the fertility decisions themselves can influence the gender inequality in labor market outcomes. Komura (2013) also analyzes the interdependency of fertility decisions and gender bargaining power. See Lips (2013) for the excellent survey on the gender wage gap.

[9] Here, we implicitly assume that the family has a nuclear family structure. If we ease the assumption of a nuclear family, we expect two modifications in our analysis. First, the results may be mitigated partially if other family members help with

$$\begin{aligned} \max \quad & W_i = c_i + (1 - \theta_i + \theta_i \delta) \ln(1 - F_i) \\ \text{s.t.} \quad & c_i = m_i + bF_i + r_i \kappa_i. \end{aligned}$$

Solving the problem gives the female labor supply as

$$F_i = \frac{(1-\delta)\theta_i}{b} + \frac{b-1}{b}. \tag{6}$$

2.3 Equilibrium

In the first part of this section, we consider autarky, wherein the capital market is not integrated, that is, the capital is immobile. In the second part, we analyze the impacts of capital market integration on the female labor participation, power balance within a couple, and fertility.

Autarky. We have assumed that each country is initially endowed with capital κ_i. As we normalize the number of households in each country to unity, the initial endowment of capital in the household corresponds to the initial endowment of capital in that country. Denoting the total capital in the whole economy as κ, $\kappa_i + \kappa_j = \kappa$ holds. Since the capital remains with its country in autarky,

$$K_i = \kappa_i. \tag{7}$$

Moreover, there is one unit of male worker in country i, $M_i = 1$. Substituting (7) and $M_i = 1$ into (2) gives $m_i = \kappa_i^2$, which is used with (5) to get $\theta_i = \theta_i(b - \kappa_i^2; \gamma_i)$. Then, from (6), we have the equilibrium value in the autarky:

$$F_{ia} = \frac{(1-\delta)\theta_{ia}}{b} + \frac{b-1}{b}, \quad \text{where } \theta_{ia} = \theta_i(b - \kappa_i^2; \gamma_i). \tag{8}$$

We refer to the case of autarky in which capital market is not integrated as subscript a in each variable.

Since $\theta_i' \geq 0$ and $\delta < 1$, the following relationship is satisfied: $\theta_{ia} > (<) \theta_{ja} \leftrightarrow \kappa_i < (>) \kappa_j$, which shows that women's bargaining power in the capital-rich country is relatively low in the autarky (before the capital market integration). This is because the high male wage from the higher initial level of capital contributes to the higher bargaining power of men.

From (8), we derive the property of female labor supply as

$$\frac{\partial F_{ia}}{\partial \kappa_i} = -\frac{2(1-\delta)\theta_i' \kappa_i}{b} \quad \text{and} \quad \frac{\partial F_{ia}}{\partial b} = \frac{(\delta\theta_i + 1 - \theta_i)}{b^2} + \frac{(1-\delta)\,\theta_i'}{b}.$$

The first equation implies that if $\delta < 1$ holds, an increase in women's bargaining power, accompanied by the decrease in the initial capital stock in country i, increases their labor supply, thereby decreasing the

the wife's domestic production. The other possible modification is to ease the budget constraints by allowing other family members to have incomes. However, as long as wives (mothers) have a comparative advantage in domestic production and heterogeneous preference on household production, our results are robust qualitatively.

family size. This is because women prefer to have fewer children, and thus increase their labor supply to maintain a smaller family size because they are endowed with more power to determine the intra-household allocation. The second equation means an increase in the female wage rate has a positive impact on the female labor supply. Basically, an increase in the female wage simply increases the female labor supply (price effect). At the same time, when women prefer a smaller family size, $\delta < 1$, a rise in their wage rates reduces the number of children since they have a weak preference for family size and their bargaining power is enhanced (bargaining power effect). Thus, this effect also increases their labor supply. Thus, in this case, an increase in the female wage rate always increases the female labor supply, leading to a fall in fertility.[10]

Capital Market Integration. We now lift the curbs on capital mobility between the two countries. Recalling that $M_i = 1$, the difference in capital returns is eliminated under the integrated capital market, and the net return on capital is equalized in equilibrium:

$$r = A - 2K_1 = A - 2K_2. \tag{9}$$

Moreover, since the capital is utilized in either of the two countries in the integrated capital market, the condition of market equilibrium holds as

$$K_1 + K_2 = \kappa_1 + \kappa_2 = \kappa. \tag{10}$$

Then, from (9) and (10), $K_1 = K_2$ holds, which indicates that

$$K_i = \frac{\kappa_1 + \kappa_2}{2} = \frac{\kappa}{2}. \tag{11}$$

Comparing (7) and (11), we obtain the following lemma.

Lemma 1. *Suppose that $\kappa_i > \kappa_j$ and that capital moves freely when the capital market is integrated. Then, capital market integration causes capital to move from country i to country j.*

Since country j has a smaller amount of initial capital, the net return of capital investment in country j is higher than that in country i. Once the capital market is integrated, the capital flows from country i to country j to seek higher rents.

Substituting (11) into (2) and using $M_i = 1$ gives the male wage rate after the capital market integration as $m_i = \kappa^2/4$. Denoting the bargaining power of women after the market integration as θ_{io}, where the subscript o represents that the capital market is *opened*, from (5), (6), and $m_i = \kappa^2/4$, we have the female labor supply after the integration of the capital market as

[10] In contrast, if women want more children than men do, $\delta > 1$, then the sign of an increase in the woman's wage rate on their labor supply depends on the relative magnitudes between the positive price effect and the negative bargaining power effect because women are not only encouraged to supply their time in the market due to the increase in their wage rate, but to reflect their intention to have a larger family size in the household fertility decision.

$$F_{io} = \frac{(1-\delta)\theta_{io}}{b} + \frac{b-1}{b}, \quad \text{where} \quad \theta_{io} = \theta\left(b - \frac{\kappa^2}{4}; \gamma_i\right). \tag{12}$$

2.4 Comparison

Comparison of (8) and (12) reveals how the capital market integration impacts the female labor supply and the power balance within a couple:

$$n_{ia} \lesseqgtr n_{io} \Leftrightarrow F_{ia} \gtreqless F_{io} \Leftrightarrow \theta_{ia} \gtreqless \theta_{io} \Leftrightarrow \kappa_j \gtreqless \kappa_i. \tag{13}$$

From (13), we obtain the following proposition:

Proposition 1: *Suppose that $\kappa_i > \kappa_j$. Capital market integration increases the bargaining power of women in country i while it reduces that in country j, $\theta_{ia} < \theta_{io}, \theta_{ja} > \theta_{jo}$, followed by a decline in the fertility rate of country i and a rise in that of country j, $n_{ia} > n_{io}, n_{ja} < n_{jo}$.*

The mechanism behind the results is as follows. Initially, country i is endowed with a high level of capital while that of country j is low. Since male labor is complementary to capital, the male wage rate is higher in country i than country j (i.e., the wage gap in country i is larger than that in country j), leading men in country i to have more autonomy compared to those in country j. Since men prefer a larger family size ($\delta < 1$), ceteris paribus, the fertility rate is higher in country i than country j.

Now, let us suppose that the capital market integration occurs. The capital flows from country i, which is endowed with abundant capital, to the other country, equalizing the capital rent prices (i.e., interest rates) of the two countries. Accordingly, the price of male labor, which is complementary to capital, decreases in country i, while it increases in country j, narrowing the international wage gap in male wage rates. As a result of the capital market integration, the fertility rate of country i decreases through a rise in the bargaining power of women, whose ideal family size is small compared to their husbands. Conversely, the fertility rate of country j increases.

As the studies suggesting that the international factor mobility affects family forms, two formal and insightful works by Autor et al. (2015, 2018) presented rich empirical analyses on trade shocks from 1990 to 2010, finding that they influenced family structures in the US. According to the studies, the emergence of China in import competition damaged the US manufacturing industry, and the male workers were likely to be affected. This lowered their evaluation in the labor market and the attractiveness of marriageable men in the marriage market, followed by lower marriage and fertility rates. This result can be attributed to the consequences of globalization on a capital-exporting country with MK technology. The emergence of China in the import competition can be interpreted in that China became an attractive destination for investment, thus leading to capital outflow from the US to China. The result of the competition over the manufacturing functions resulted in a shrinking of male employment in the US, which is more complementary to physical capital than female labor. Our theoretical result can be a possible explanation of the mechanism causing the observed facts.

3 Extension

This section extends the basic model to check the robustness of our main results. By extending the model, we also assess a more realistic situation and deepen our discussions. Specifically, we consider cases in which (i) the gender bargaining power is determined by earnings, and (ii) the production technology differs across countries.

3.1 Bargaining power determined by gender income gap

In this subsection, we show that the essential mechanism does not change under the different specification of bargaining power. Specifically, we consider the case where the bargaining power is determined by the gender income gap or earnings, rather than wage rates. One strand of literature on family economics, marital bargaining power is considered determined by the productivity (e.g., wage rates) and that the couple can make an enforceable contract for their entire lives or can negotiate it upfront. Pollak (2005) pointed out that bargaining power determined by wage rates has the advantages of their observability and the role of determinants of well-being. The other strand, however, considers that the bargaining power is determined by earnings. One reason for this is writing an enforceable contract for life is bit difficult, and achieving the efficient solution accompanied by domestic specialization may result in the hold-up problem (Cigno, 2012). Moreover, under this situation, women become more and more vulnerable once they agree to specialize in domestic tasks due to the possibility of renegotiation after the specialization (Basu, 2006; Komura 2013). Based on the two arguments, we here also carry out the analysis with a bargaining power in an endogenous manner, wherein it is affected by the choice of labor supply. The formulation of bargaining power is then modified as $\theta_i = \theta(f_i F_i - m_i; \gamma_i)$, where $\theta_i' > 0$ and $\theta_i'' < 0$ are assumed.

In this setting, we need to consider the effects of households' control over F_i on bargaining power. The optimization problem of the household yields the following first-order condition.

$$\frac{\partial W_i}{\partial F_i} = b - \frac{1-\theta_i}{n_i} - \frac{\delta\theta_i}{n_i} + \frac{\partial(1-\theta_i)}{\partial F_i}\ln n_i + \delta\frac{\partial\theta_i}{\partial F_i}\ln n_i = 0. \tag{14}$$

In (14), the first term denotes the increase of the family's income. The second term denotes the reduction of the husband's benefit, weighted by the bargaining power, from reducing the number of children, and the third term is that of wife's. The fourth and fifth terms represent the changes in the couple's welfare by way of a change in the bargaining power; the couple's welfare depends on the bargaining power, and thus, these terms reflect the effect of a change in the female labor supply on welfare through the change in the bargaining power.

Recalling that, in (14), $\theta_i = \theta(bF_i - K_i^2; \gamma_i)$ since $m_i = K_i^2$, total differentiation of (14) with respect to F_i and K_i yields

$$\frac{dF_i}{dK_i} = \frac{(1-\delta)n_i}{\Delta}\left(\frac{\partial\theta_i}{\partial K_i} - \frac{\partial\theta_i/\partial F_i}{\partial K_i}\ln n_i\right), \tag{15}$$

where $\Delta \equiv 1-(1-\delta)\theta_i-(1-\delta)n_i\theta_i'+(1-\delta)n_i(\theta_i''n_i\ln n_i-\theta_i') > 0$ from the second-order condition for the maximization. The first term within the parentheses of (15) is negative as before. This is because as the amount of capital increases in the country, the male wage increases, which raises the bargaining power of the male. Since the male prefers a larger family size than the female, the empowered husband conduces to the decrease in female labor supply to increase the number of children. The second term within the parentheses of (15) is newly added owing to a change in the equation of bargaining power, where $\partial^2\theta_i/\partial F_i\partial K_i = -2K_i\theta_i'' > 0$, meaning that the increase in capital located in the country strengthens the marginal effects of a change in F_i on θ_i. This occurs because we assume that the extra bargaining power that women can earn from a marginal increase in F_i, $\theta' \equiv \partial\theta/\partial F_i$, declines as the gender income gap shrinks, $\theta'' < 0$. That is, we assume that an increase in women's income significantly strengthens their bargaining power when the gender income gap is large. In this scenario, an increase in K_i raises male incomes and expands the income gap between men and women, which means that the extra power that women can gain with the marginal increase in F_i becomes large, $\partial^2\theta/\partial F_i\partial K_i > 0$. In this case, a couple can lower the female labor supply to keep a certain level of bargaining power that maximizes their welfare when the amount of capital in the country increases. Hence, even with the newly added term, the sign of (15) is still negative, and therefore, the modification of the bargaining power equation reinforces our results.

3.2 Productivity differential

The analysis in Section 3 is conducted by assuming that two countries have identical production technology. This assumption is well justified if we acknowledge international technology spillover in the long run. However, some studies on capital tax competition have pointed out the effects of technological asymmetry in production on the equilibrium outcome between two countries.[11] In this section, we provide an outcome that is useful for examining the effects of asymmetric production technology on capital market integration.

The basic setup and notation of the previous sections, except for the production function, can be preserved here. We here assume that the production function is given by $Y_i = (A_i - K_i/M_i)K_i + bF_i$, where A_i is the country-specific parameter representing the productive efficiency. If $A_i > A_j$, country i is a more attractive venue for investment than country j for given capital per male labor. Note here that, under autarky, since capital is fixed in each country, the equilibrium is the same as that presented in the previous section. In contrast, when capital is mobile, the technology differential affects the equilibrium characteristics through capital mobility. Since the analysis is based on the model in section 2, we here simply present the key outcomes to show the effect on our results.[12]

In the integrated capital market, capital allocation satisfies $K_i + K_j = \kappa$ and $A_i - K_i = A_j - K_j$, indicating that the total amount of capital located in country i is given by

[11] See, for example, the initial work of Bucovetsky (1991).

[12] The complete results of the formal analysis are available upon request.

$$K_i = \frac{\kappa}{2} + \frac{A_i - A_j}{4}. \tag{16}$$

To ensure $K_i \geq 0$ in equilibrium, we make the following assumption:

Assumption 1. $-2\kappa < A_i - A_j < 2\kappa$

Substituting (16) into (2), the wage rate of male labor under capital mobility is given by

$$m_{io} = \left(\frac{\kappa}{2} + \frac{A_i - A_j}{4}\right)^2. \tag{17}$$

Under the modified production function, from (6) and (17), the labor supply of women and women's bargaining power are given by

$$F_{io} = \frac{(1-\delta)\theta_{io}}{b} + \frac{b-1}{b}, \quad \text{where } \theta_{io} = \theta\left[b - \left(\frac{\kappa}{2} + \frac{A_i - A_j}{4}\right)^2; \gamma_i\right]. \tag{18}$$

A comparison of (8) and (18) gives the following:

$$F_{ia} \gtreqless F_{io} \Leftrightarrow \theta_{ia} \gtreqless \theta_{io} \Leftrightarrow \frac{(A_i - A_j + 2\kappa + 4\kappa_i)(A_i - A_j + 2\kappa - 4\kappa_i)}{16} \gtreqless 0. \tag{19}$$

Under Assumption 1, $A_i - A_j + 2\kappa + 4\kappa_i > 0$. Hence, the sign in (19) depends on the sign of $A_i - A_j + 2\kappa - 4\kappa_i$, which is depicted in Figure 1.

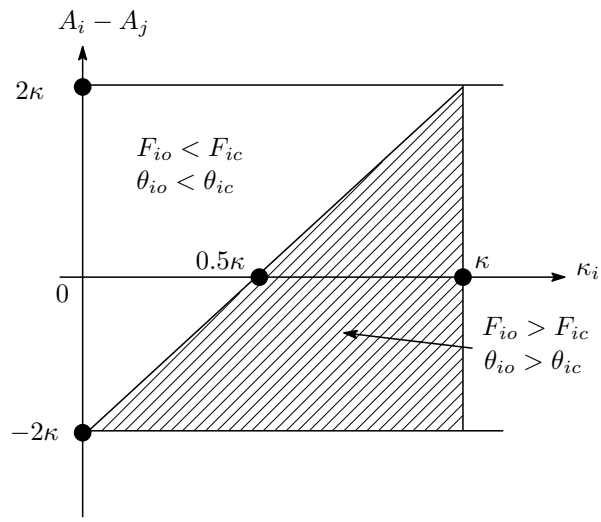

Figure 1. Impacts of market integration when countries differ in technology and endowment of capital.

In the shaded area, $F_{io} > F_{ia}$ and $\theta_{io} > \theta_{ia}$ hold while the sign is reversed in other area. That is, if country i has a relatively sufficient quantity of initial capital to invest abroad, $\kappa_i > 0.5\kappa$ ($\kappa_i > \kappa_j$), and if it is not attractive enough for the investment because of inferior technology, $A_i < A_j$, then the capital market integration always increases the bargaining power of women, thereby increasing female labor supply and reducing the fertility in country i. This implies Proposition 1 still applies if $A_i \leq A_j$.

However, when $A_i > A_j$, the capital market integration may decrease the bargaining power of women, resulting in a decrease in the female labor supply if $\kappa_i > 0.5\kappa$, but country i is a considerably attractive place for capital investment, that is, $A_i - A_j$ is sufficiently large.

4 Discussion

This section explores the effects of globalization on intra-household allocation in household production in the case of the FK technology, where the female labor is a more complementary input to physical capital than male labor, as in Galor and Weil (1996). Since the analysis is parallel to that in section 2, the description of the model will be brief.

4.1 When female labor and capital are complements in both countries

Firms. In this case, since female labor is a more complementary input than male labor, the specifications of the firms' production activities differ from those in the basic model. The FK-type production function in country i is defined as $Y_i = (A - K_i/F_i)K_i + bM_i$. The parameter A now represents the technical productivity associated with capital and female labor and b indicates the marginal productivity of male labor. The profits of firm in country i becomes

$$\pi_i = \left(A - \frac{K_i}{F_i}\right) K_i + bM_i - m_i M_i - f_i F_i - r_i K_i.$$

The profit maximization gives the following.

$$f_i = \frac{K_i^2}{F_i^2}, \tag{20}$$

$$r_i = A - \frac{2K_i}{F_i}, \tag{21}$$

$$m_i = b. \tag{22}$$

Note that a change in the level of capital in country i, K_i, influences the female wage rate, f_i but not the male wage rate, m_i.

Household. While firms differ in terms of the production function, households are modeled identical to the basic model. Thus, the optimization of the household is summarized as

$$\begin{aligned} \max \quad & W_i = c_i + (1 - \theta_i + \theta_i \delta) \ln(1 - F_i) \\ \text{s.t.} \quad & c_i = m_i + f_i F_i + r_i \kappa_i. \end{aligned}$$

Solving the problem, we have the female labor supply as

$$F_i = 1 - \frac{1 - \theta_i(1 - \delta)}{f_i}. \tag{23}$$

Substituting (20) and (22) into (23), we have the equilibrium amount of female labor, which satisfies $F_i^2 + K_i^2(F_i - 1) - (1-\delta)F_i^2\theta_i = 0$, where $\theta_i = \theta(K_i F_i^{-2} - b; \gamma_i)$. To see how it relates with the amount of capital located in the country, we differentiate this equation with respect to F_i and K_i to get

$$\frac{dF_i}{dK_i} = \frac{n_i + (1-\delta)F_i\theta_i'}{K_i^2 + 2F_i[1-(1-\delta)\theta_i] + 2(1-\delta)f_iF_i\theta_i'}.$$

Since $1-(1-\delta)\theta_i > 0$ and $\theta_i' \geq 0$, we have $dF_i/dK_i > 0$. Hence, we derive the following relationship:

$$K_i \gtreqless K_j \Leftrightarrow F_i \gtreqless F_j \Leftrightarrow n_i \lesseqgtr n_j.$$

Intuitively, when the initial endowment of capital is large, the female wage rate is high. Since women prefer smaller family size than their husbands, $\delta < 1$, a higher female wage rates increases the labor supply of women through the positive price effect and the positive bargaining power effect, resulting in a lower fertility rate.

Autarky. Before capital market integration, $K_{ia} = \kappa_i$ holds because capital does not move across countries. Without any loss of generality, we assume again that country i is endowed with more capital; $\kappa_i > \kappa_j$. Then, we have the following lemma.

Lemma 2. *When $\kappa_i > \kappa_j$, in the autarky, $F_{ia} > F_{ja}$ and $n_{ia} < n_{ja}$.*

Market integration. Using the economic property that the price of capital (the return from capital) of each country is equalized after market integration, we have the following equations:

$$r = A - \frac{2K_i}{F_i}, \tag{24}$$

implying that $K_i/F_j = K_j/F_j$. Since $f_i = (K_i/F_i)^2$, we have $f_i = f_j$ when the capital market is integrated. Hence, from (5), we have $\theta_{io} = \theta_{jo}$. Since the amount of female labor is given by (23), we have $F_{io} = F_{jo}$, showing that $K_{io} = K_{jo}$ holds in the equilibrium. We summarize these results in the following two Lemmas.

Lemma 3. *Assume that $\kappa_i > \kappa_j$ holds. Once the capital market is integrated, the capital moves from capital-rich country i to capital-poor country j; $K_{ia} = \kappa_i > K_{io}$ and $K_{ja} = \kappa_j < K_{jo}$.*

Lemma 4. *In the open-market equilibrium, $F_{io} = F_{jo}$ and $n_{io} = n_{jo}$.*

From Lemmas 2 and 4, we have the following result.

Proposition 2. *Suppose that $\kappa_i > \kappa_j$. $F_{ia} > F_{io}$, $F_{ja} < F_{jo}$, $n_{ia} < n_{io}$, and $n_{ja} > n_{jo}$. That is, once the capital market is integrated, capital moves across countries and* the amount of female labor in country j increases and the fertility declines. In contrast, in country i, the woman tends to work less and the fertility rate increases.

The result of Proposition 2 is explained with the opposite mechanism of Proposition 1 intuitively. As a result of market integration, physical capital flows from country i having larger capital endowment to country j with smaller capital endowment. Here, as both countries produce goods under FK technology, capital mobility affects female labor due to its complementarity. In country i which experiences the capital outflow, the female wage rate decreases. Fertility decision of family in country i is influenced by this change in female wage rate through two channels. One is from the decrease in the opportunity cost of mother's time spent for them, inducing an increase in the number of children. The other is from a reduction in women's bargaining power. As men (women) tend to have larger (smaller) ideal family size than their partners, the number of children rises reflecting more intention of the husbands. Consequently, globalization has positive impacts on fertility of country i in total. In the capital importing country (i.e., country j), female wage rate rises with an increase in the demand of female labor accompanied by the capital inflow. This causes two negative effects on fertility from the same channels of changes in opportunity cost and gender bargaining power: The capital inflow raises the female wage, resulting in the increase in the female bargaining power and the opportunity cost of mother's time to spend for children. These induce couples to have fewer incentives to have larger family size.

The result obtained in Proposition 2 is partially consistent with the incisive empirical result of Seguino (2000), in which globalization caused opposite effects on female employment in South Korea and Taiwan as capital exporting countries. The paper attempts to explain the opposite trend in the gender gap in Taiwan and Korea from 1981 to 1992. The gender gap in Taiwan widened while it narrowed in Korea. The author examines the effects of capital mobility on the gender wage gap inspired by the fact that these two countries experienced a large amount of capital outflow in this period. Among the three definitions of capital mobility, the analysis with the index of Outward FDI (i.e., the degree of capital exporting) showed interesting results. Outward FDI had a positive (but insignificant) coefficient on gender gap in Taiwan, but a significant negative effect on that in Korea. The author concludes that outward FDI damaged the Taiwanese industries in which female workers were engaged. On the other hand, in Korea, the outward FDI affected the capital-intensive industries in which more male workers were engaged. Her interpretation corresponds to Taiwan with FK technology and South Korea has MK technology in our model. If we suppose that the two countries experienced capital outflows in this environment, then in our model, we can predict the change in the gender gap in earnings that actually occurred in these countries.

4.2 When two technologies coexist

We now consider the case of the two production technologies, MK and FK, coexisting. Taking account of these different production technologies between capital-importing and capital-exporting countries, we can explore the effects of delocalization in the following four cases.

1. Capital-exporting country with MK technology v.s. capital-importing country with MK technology
2. Capital-exporting country with FK technology v.s. capital-importing country with FK technology

3. Capital-exporting country with FK technology v.s. capital-importing country with MK technology

4. Capital-exporting country with MK technology v.s. capital-importing country with FK technology

The first and second combinations have already been examined in Sections 2 and 4, respectively. On the other hand, we can expect the following consequences in the remaining two combinations, where not only capital endowments but also production technologies differ between the two countries.

In the third combination, once the capital market is integrated and capital is free to move across countries, the capital-exporting country with FK technology experiences a decrease in the female wage rate owing to a reduction in capital, and therefore, we would observe an increase in fertility from the bargaining outcome. For the capital-importing country with MK technology, the male wage rate rises owing to globalization with higher capital. Fertility increases as a result of a decrease in women's bargaining power.

In the fourth combination, we can expect that globalization lowers the capital and causes a decline in male wage rates in the capital-exporting country with MK technology. This leads to a rise in women's bargaining power, followed by a decline in the fertility rate. For the capital-importing country with FK technology, globalization causes a rise in female wage rates, with higher capital, reducing the fertility rate of the country. Specifically, the following analysis formally demonstrates that household production goods, e.g., fertility, decrease globally with capital market integration in the presence of heterogeneous production technology, as seen in the fourth case. Suppose that country i has MK technology, and country j, FK technology. From the household's optimization problem, the female labor supply in country i, F_i, satisfies $F_i = (b - 1 + (1-\delta)\theta_i)/b$, where $\theta_i = \theta(b - m_i; \gamma_i)$. The female labor supply in country j, F_j, satisfies $[1-\theta_j(1-\delta)]F_j^2 + K_j^2 F_j - K_j^2 = 0$, where $\theta_j = \theta(f_j - b; \gamma_j)$. From the inelastic male labor supply, $M_i = 1$, the profit maximization problem gives $m_i = K_i^2$ and $f_j = K_j^2/F_j^2$. Substituting them into functions determining the female labor supply allows us to obtain the female labor supply as functions of K_i and K_j:

$$F_i = \frac{b - 1 + (1-\delta)\theta_i}{b} \quad \text{where} \quad \theta_i = \theta(b - K_i^2; \gamma_i), \tag{25}$$

$$[1 - \theta_j(1-\delta)]F_j^2 = K_j^2(1 - F_j) \quad \text{where} \quad \theta_j = \theta\left(\frac{K_j^2}{F_j^2} - b; \gamma_j\right). \tag{26}$$

Autarky. Without capital mobility between the two countries, the capital used for production corresponds to the initial levels of capital for each country: $K_i = \kappa_i$ and $K_j = \kappa_j$, where $\kappa_i + \kappa_j = \kappa$. Note that $\kappa_i > \kappa_j$ is assumed in the fourth combination. From (25) and (26), in the closed economy, the female labor supply of the two countries in equilibrium (F_{ia}, F_{ja}) are such that both equations are satisfied:

$$1 - F_{ia} = \frac{1 - (1-\delta)\theta_{ia}}{b} \quad \text{where} \quad \theta_{ia} = \theta(b - \kappa_i^2; \gamma_i), \tag{27}$$

$$\frac{[1 - \theta_{ja}(1-\delta)]F_{ja}^2}{1 - F_{ja}} = \kappa_j^2 \quad \text{where} \quad \theta_{ja} = \theta\left(\frac{\kappa_j^2}{F_{ja}^2} - b; \gamma_j\right). \tag{28}$$

Market Integration. Since the interest rates are equalized between countries, we have $r_i = r_j$, and thereby, $A - 2K_i/M_i = A - 2K_j/F_j$. Thus, we have the capital used for production in country i as

$$K_i = \frac{K_j}{F_j}. \tag{29}$$

From $F_j < 1$, the relationship of capital for productions is $K_i > K_j$. From (29) and $\kappa = K_1 + K_2$, we obtain

$$K_i = \frac{1}{1+F_j}\kappa \text{ and } K_j = \frac{F_j}{1+F_j}\kappa. \tag{30}$$

Substituting (25) and (26) provides the female labor supply in the open economy in equilibrium (F_{io}, F_{jo}), which satisfies both equations:

$$1 - F_{io} = \frac{1-(1-\delta)\theta_{io}}{b}, \quad \text{where} \quad \theta_{io} = \theta\left[b - \frac{\kappa^2}{(1+F_{jo})^2}; \gamma_i\right]. \tag{31}$$

$$\frac{[1-\theta_{jo}(1-\delta)](1+F_{jo})^2}{1-F_{jo}} = \kappa^2, \quad \text{where} \quad \theta_{jo} = \theta\left[\frac{\kappa^2}{(1+F_{jo})^2 - b}; \gamma_j\right]. \tag{32}$$

For simplicity, to ensure that country i with the MK technology exports capital and country j with the FK technology imports capital, we analyze the extreme case in which the initial endowment is held in country i: $\kappa_i \to \kappa$ and $\kappa_j \to 0$. Substituting $\kappa_i = \kappa$ into (27) and comparing with (31), we confirm the following relationship holds.

$$F_{ia} < F_{io} \leftrightarrow \theta_{ia} < \theta_{io} \leftrightarrow b - \kappa^2 < b - \frac{\kappa^2}{(1+F_{jo})^2},$$

indicating that country i with the MK technology experiences an increase in the female labor supply and a fall in the fertility rate after capital market integration.

The intuition behind this result is as follows. Since country i has almost every initial resources, capital flows from country i to country j owing to capital market integration. Because male labor is complementary to capital in country i and their labor supply is inelastic and equals one, capital market integration causes a reduction in the male wage rate. This change in the relative wages strengthens the women's bargaining power, leading to smaller family size (more female labor supply) in country i. Conversely, we can expect that capital market integration benefits country j with the FK technology to experience capital inflow, followed by an increase in female wage rates and their bargaining power, and an increase in the female labor supply (a decrease in fertility) of country j.[13]

In sum, when capital-exporting country i employs the MK technology, and capital-importing country j employs the FK technology, the fertility rate declines and female labor participation increases in both countries, with capital flowing from country i to country j. Globalization in the real world, therefore, might apply best to the fourth case, in which the fertility rate declines worldwide.[14]

[13] This can be confirmed by taking $\kappa_j \to 0$ in (28) and $\kappa_i \to \kappa > 0$ in (32) to have $F_{ja} \to 0 < F_{jo}$.

[14] According to Autor et al. (2018), the new couple may postpone their marriage when male workers do not have sufficient income. If the woman's ideal family size is smaller and they want to postpone the age at which they give birth, then she will have fewer total children in her lifetime. In this case, we can predict that the capital flow from the country with MK technology to the country with FK technology enhances the effect of the temporal delay of birth since the capital flow lowers the male's relative wages in both countries, which delays the time at which couples get married.

4.3 The possible determinants of technologies

Since the empirical literature does not provide a definite opinion on or mechanism for gender and complementary to physical capital, in our study, we do not specify which country has the MK or FK technology. The determinants of FK or MK technology depends on the gender group employed as the major employees in the industry accompanied by the production with mobile capital. In our modern society, it applies to the manufacturing sector. Here, we review the literature and aim to suggest possible factors that generate differences in technologies across countries.

According to the literature on globalization and gender inequality, the determinants of FK or MK technology seem to interdepend mainly on three elements: the country's industrial composition, the degree of reliance on mental labor with mechanization, and the labor market segregation by gender (Fontana et al. 1998; Artecona and Cunningham 2002). The first two are intuitive: women who are relatively better at mental labor than physical labor are considered to have stronger ties with the capital that supplements their labor. The third factor suggests that whether male or female labor complement capital more strongly depends on the circumstances of labor market segregation. In considering the third factor in association with our model, note that capital is mobile, so capital here does not simply have the same properties as in the conventional story of capital accumulation. Production activities with mobile capital do not require any high skills. In reality, multinational firms or FDI represents capital mobility. They seek a destination for their production facilities to maximize their net returns, so they tend to employ the lowest wage workers (typically, low skilled workers) by mechanization, which does not require the workers to have specific knowledge or skills because training local workers is costly in terms of production flexibility (Standing 1999).

The labor market has three stages of gender discrimination: (i) lack of access to market occupation for women; (ii) gender segregation in occupations, so women have access to only lower wage jobs; and (iii) women have access to any job without discrimination. In any stage of discrimination, women and men have heterogeneous physical strength, so men have a comparative advantage in tasks requiring physical strength. In case (i), the progress of the globalization in terms of capital mobility may not easily influence gender inequality. Specifically, Neumayer and de Soysa (2011) demonstrate that FDI influences the economic rights of high- and middle-income countries, implying that globalization affects gender inequality only when women at least have right to participate in the labor market.

In case (ii), female labor is forced into the disadvantageous position in the labor market (i.e., lower wage positions and jobs). In addition, a rational human capital investment by women who know that they can only access the jobs with lower salaries, ultimately lowers their human capital (i.e., lower knowledge and skills), and thus they become the major proportion of employees in the manufacturing sector, which requires less skill. In this case, the employment of female workers in the destination country exploits women through their wages (Hellerstein et al. 2002, Black and Brainerd, 2004). Thus, globalization associated with capital inflow increases female employment and demand for female workers, improving gender inequality.

Suppose case (iii), in which there is no gender (discriminatory) job segregation, such that women can access any jobs in any sector if they are qualified. In an advanced economy, they may have more access to clerical jobs, which involve more mental labor and less physical strength. In this case, women now pay a certain cost to invest in their human capital, knowing of their comparative advantage in mental tasks and the prospects for higher wages. While some men put effort into improving their human capital to engage in jobs in the clerical sector, most male workers (compared to female workers) remain in the manicuring sector because they can earn without paying the cost to acquire skills. Consequently, male workers would make up the majority of employees in the manufacturing sector in that country (Goldin, 1992). Thus, in this case, globalization through capital mobility influences gender inequality mainly through the change in the demand for male labor.[15].

Consistent with the argument above, some empirical studies seem to identify the gender group that is more complementary to mobile capital. In line with Autor et al. (2018), Brussevich (2018) points out that male workers mainly bear the cost of production mobility because the US manufacturing industry is male intensive (MK technology). Braunstein and Brenner (2007) and Chen et al. (2013) find that in China, the counterpart country of US trade shock, the large growth in capital inflow first improved female employment in manufacturing, and then narrowed the gender wage gap in the early period of trade liberalization. This happens when we assume FK technology in our framework. Aguayo-Tellez et al. (2010) observe that the North American Free Trade Agreement (NAFTA) in 1994 also expanded female labor employment in Mexico, the other major trade partner of the US that experienced rapid growth in FDI inflow, particularly during the liberalization period. They also imply, with suggestive evidence, that this increase in the relative female wage rate induced favorable intra-household allocation for women associated with the expenditure shift toward women's clothing and education of children.

Although we do not intend to put forth a strong argument, these studies suggest that the gender that complements capital varies by country and that the differences in labor market conditions might explain the differences in production technologies.

5 Conclusion

In this study, we examine the effects of globalization on the household production by assessing the intra-household allocation of multiple family members. Specifically, we develop a two-country model where physical capital is traded in countries with different endowments and the firms distinguish between two types of labor, male and female, as production inputs. The results show that globalization in terms of capital market integration affects household production goods in opposite directions. When male labor is more complementary to the physical capital in both countries (as in the basic model in which both

[15]Studies on developing countries suggest some alternative explanations of MK technology in an economy with lower female bargaining power against the firms under severe gender job segregation, with more technology upgrading through the skills ladder or simply gender differences in productivity (Berik et al. 2004; Menon and Van der Meulen Rodgers 2009; Chen et al. 2013).

countries have MK technology), globalization results in higher household production goods in the capital-importing country, while the capital-exporting country experiences the opposite effect. This is because under MK technology, men (women) can enjoy higher wages in the capital-importing (-exporting) country after capital market integration, followed by the acquisition of higher bargaining power for men (women). Given that husbands place a weight on fertility than their wives do, households in the capital-importing (-exporting) country reflect the husbands' (wives') intention in their decisions. We also consider the case in which female labor is more complementary to capital in both countries; that is, under FK technology, and both production technologies coexist in the economy. The results show that when both countries employ FK technology, the opposite story would apply for both countries. When the two countries have different types of technology, we can predict declining fertility with increased capital mobility in all countries.

The study contributes to the literature in several dimensions. First, we treat capital market integration to explore the effects of globalization. While existing studies focus on globalization in terms of labor market integration and trade shocks, we shed new light on an alternative channel through the integrated capital market. The second contribution is to provide a more comprehensive understanding with a two-country general equilibrium model. Prior studies provide insightful implications by looking at the partial and detailed effects of globalization in one country. Our analysis with a two-country general equilibrium model enables us to see globalization from a broader perspective, which complements the understanding we have from looking at the partial effects.

Our results can also contribute to the literature on international trade by relating our model to the classic Stolper-Samuelson (1941) theorem. In their theorem with two inputs, labor and capital, labor-intensive industries expand as trade becomes possible in countries with comparative advantages in labor-intensive industries, and therefor, demand for labor increases relative to capital. This will raise the wage rather than the capital price, which affects the income distribution within those countries. Conversely, if trade is possible in a country that has a comparative advantage over capital intensive industries, the capital price increases relative to wages. Trade liberalization corresponds to the capital market integration in our model, which affects the demand for labor that complements capital. In turn, the capital flow affects the wage disparity between male and female workers, and thereby changes the balance of power within a family. Specifically, if female labor is complementary to capital, the inflow of capital increases the demand for female labor, so female wages will increase relatively. Thus, women's bargaining power becomes stronger by shrinking the gender wage gap. A contrast between the trade analyses and our approach illustrates that our paper contributes to classic international trade analyses by providing a new channel for the impact of the liberalization of capital flows. That is, factor flows accompanied by capital market integration affects not only the income distribution between male and female workers, which is a consequence that we can infer from the Stolper-Samuelson Theorem, but also changes the decision-making within a family by changing the gender bargaining power.

We derive our results within a model that follows the literature, but depends on less general assump-

tions. One such assumption is the quasi-linear production function. We agree that the specification of our analysis is extreme in that the firms regard male and female labor as different inputs in the degree of complementary to physical capital. In terms of generality, it represents a strong assumption, but it strongly eases the analytical resolution and allows us to have clear-cut results and describe a mechanism. However, we did not limit our analysis to either FK or MK technologies. Instead, our analysis assumes both FK and MK technologies as two extreme cases. We can thus predict that the results we obtain under more generalized technology lies somewhere between our results under the two extreme cases. Another assumption is that we restrict our analysis to a static framework and look at only the effects of globalization in the short term. Extending our model to a dynamic framework would highlight another interesting aspect of globalization in the demographic trends and transition. Specifically, as it changes, the fallback positions of a break down in the marriage or non-labor income such as assets, can also be an alternative endogenous determinant of bargaining power through a change in the partners' relative economic power. Schultz (1990), for example, finds that an increase in a wife's unearned income can lead a favorable household resource allocation using the household survey in Thailand. Under the static model, γ_i includes the non-labor income or assets, but it could be an endogenous variable in a dynamic framework.

Finally, we should mention the possible future research directions of our study. The first relates to the production structure. Although we assume the exogeneity of the production function, by constructing a model in which males and females select the sector in which they work, it might be interesting to analyze the factors that lead to MK and FK technology in a country. Second, we successfully present a clear theoretical hypothesis, though it requires empirical testing. While Seguino (2000), among others, observes that capital mobility can influence gender inequality, an interesting direction for future research would be to further identify a new channel of globalization that affects household decisions while controlling other cultural and economic determinants of demographic variables. Specifically, it would give a new insight into the role of capital mobility.

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