

Population Review

Volume 54, Number 1, 2015

Type: Article pp. 27- 52

A Comparative Analysis of Determinants of Birth Rates in East Asian and Western Countries

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Abstract

Japan, South Korea and Taiwan are known to have extremely low fertility rates that are lower than the level to reproduce their populations. In this study, we discuss how and why this happened, utilizing a comparative analysis among the three East Asian countries (Japan, South Korea and Taiwan) and six Western countries (the U.S., the U.K., France, Germany, Italy and Spain). Different economic structures and social systems might explain why East Asian countries generally have lower fertility rates than their Western counterparts. We first attempt to show that even among the six Western countries and three nations in East Asia, the differences in social and economic circumstances have led to different trends in fertility rates in the past 30 years. We then argue that women's welfare in all nine countries is the key factor to explain differences in fertility rates among these societies.

Keywords

Fertility rate, comparative study, East Asia, labor force participation of women, fixed-effect model

Introduction

The Taiwanese government reported astounding statistics: its total fertility rate for 2010 was only .895, the lowest in the world (Ministry of the Interior 2014a). Taiwan is not an exception. Other East Asian countries, including Japan and South Korea, have experienced extremely low fertility rates for some time. These rates are much lower than what sustains stable populations, and therefore without sufficient immigrants or reverse trends these countries will lose their respective populations.

On the other hand, France, Germany, Italy and Spain experienced low fertility rates in the 1990s, but they seem to have rebounded somewhat. The United Kingdom recorded its lowest fertility rate in the early 2000s but made a healthy recovery. The United States has had relatively stable fertility rates since early 1990s. In general, with the exception of a few countries, fertility rates in Europe are all higher than those in East Asia (World Bank 2014a).

People in Asian countries, however, generally cherish family relationships and are concerned with family continuities more than people in European countries, mostly due to the emphasis placed on family in the ethics of Confucianism, which prevails in many East Asian countries. As such, they all experienced high fertility rates during the early to mid twentieth century. Their “low fertility rate problems” are of a relatively recent nature. What then makes a distinct difference in birth rates between Asian and European countries in recent years? Though we don't directly examine this question, we try to shed some light on it. Based on data from three East Asian societies (Japan, South Korea and Taiwan), three Western countries of relatively high fertility rates (the U.S., the U.K., and France) and three Western countries of lower fertility rates (Germany, Italy and Spain), we try to identify factors explaining fertility in these three groups of countries. The distinctiveness among East Asian countries might produce different sets of determinants that may explain their extremely low birth rates.

Background

Western countries have experienced two demographic transitions (Lesthaeghe and Neels 2002). Although fertility rates declined each time, they occurred for different reasons. Modernization and urbanization caused the first transition around the 19th century in the United States (Lesthaeghe and Wilson 1986; McNicoll 2001). The center of production was transferred from individual, small

families to large factories. Parents did not consider children as cheap laborers any more, since they were not allowed to work in factories. Instead, they invested resources in offspring. More children meant more costs, so fertility rates naturally began to decline.

The second demographic transition occurred around the late-20th century to 21st century, resulting from individualism and materialism (Van de Kaa 1987; Lesthaeghe and Surkyn 1998). During this period, people placed more emphasis on individual accomplishments and personal needs (Van de Kaa 1987). Marriage rates came down, and divorce rates went up. Cohabitation and premarital pregnancy became common in many Western societies.

The second demographic transition symbolizes the demise of traditional marriages and families. While the fertility rates in Western countries have not declined as much, fertility rates in East Asia, including Japan, South Korea and Taiwan, have fallen rapidly (Jones 2007). As stated earlier, in 2010, the total fertility rate in Taiwan was less than 1.00, which means that on average each woman gave birth to fewer than one child over her lifetime. Similarly, South Korea's total fertility rate in 2010 was only 1.15. The figure in Japan was a little high, if not much, at 1.41 in 2012 (Ministry of Health, Labour and Welfare 2014a). All fertility rates in these three nations are far from the replacement level of 2.1. Japan started to lose its population around 2007 (Ministry of Internal Affairs and Communications 2013), and Korea and Taiwan will soon experience population decrease.

Scholars offer several reasons to explain why fertilities vary by countries. One of them centers on the gender equality in a given society, which affects professional women's interests in childbearing and marriage (Feyrer, Sacerdote, and Stern 2008). Female education and female labor force participation are critical indicators of gender equality. Education is not a privilege for men any more. According to the World Bank data, in East Asian countries the ratios of female to male tertiary enrollment have dramatically increased in recent years. Women now enjoy quite a few opportunities to study in college (Lee 2008; Suzuki 2008; World Bank 2014c). In college, women learn not only necessary skills and knowledge in life but also new ideas, including gender equality. In addition, more women are in the job market, not only in Western countries but also in East Asian countries. With the increase of well-educated and employed women, the traditional gender roles of men as breadwinners and women as homemakers have changed. While the proportion of adult women in the labor force in Italy is about .4, it has reached approximately .5 in East Asia, France, Germany and Spain, and it is close to .6 in the U.S. and the U.K. (World Bank 2014b).

Unfortunately, many women still encounter family and job challenges. While employed women spend time and energy on the job like their male counterparts, they are still responsible for family-related matters, particularly in East Asia. Most household chores continue to be done by women (Bianchi, Sayer, Milkie and Robinson 2012). As a result, the cost of childbearing (including opportunity cost) increases with their education and labor market experience (Engelhardt and Prskawetz 2004; Kögel 2004). Thus, we expect a negative relationship between average education levels and labor force participation rates of women, on the one hand, and fertility rates, on the other.

There are two possible causal mechanisms that explain the negative relationship between female labor force participation and fertility (Brewster and Rindfuss 2000). On the one hand, once women decide to stay in the labor force after getting married, they often plan to have fewer children or are forced to give up childbirth in some societies. On the other hand, the effect of fertility on labor force participation needs to be considered. The effect of labor force participation on fertility, however, has been found to be stronger than the other way around. The impact of fertility on female labor force participation also tends to be short-term and disappears after the youngest child reaches school age. Therefore, in this article, we assume that women's labor force participation affects fertility.

Early studies confirmed the negative effects of female education and female labor force participation on fertility (Engelhardt and Prskawetz 2004; Osili and Long 2008). Nevertheless, adequate family and governmental supports, such as more advanced family policies and child-care systems, may lessen women's burdens and curb the fertility decline (Adsera 2004). For instance, Chesnais (1996, 1998) argued that the fertility in Sweden remained at a relatively high level, while it decreased in Italy, Germany, and Spain due to a lack of family support (e.g. parental leave and pension benefits favoring parents). McDonald (2000) further argued that the combination of gender equity in individual-oriented institutions and inequity in family-oriented institutions resulted in low fertility. McDonald's contention attributed low fertilities in East Asia and some European countries (Italy, Spain and Germany) to "inequity" in family-oriented institutions regarding household maintenance (e.g. unequal division of household labor by gender) and caring and nurturing (e.g. lack of appropriate daycare facilities).

Other studies have reported similar findings. Cross-country correlations between female labor force participation and fertility rate have changed from negative to positive in many Organisation for

Economic Co-operation and Development countries (Ahn and Mira 2002; Brewster and Rindfuss 2000). Although the time-series correlation in certain countries was mostly negative (Kögel 2004), Engelhardt, Kögel and Prskawetz (2004) found that the relationship turned insignificant in some countries after some specific time points. We, therefore, argue that female labor force participation rates might not negatively affect fertility rates in some Western countries, considering more recent progress in family-related welfare provisions.

Most social scientists agree that the relevant social welfare and laws have improved the compatibility between families and jobs for women (Cooke 2008; Rindfuss, Guzzo and Morgan 2000; Suzuki 2008). Not every Western country, however, provides women with enough accommodation for families and jobs (e.g. Germany, Italy and Spain). Mayer (2001) classified Western European and North American countries into four ideal types. According to Mayer, Germany belongs to the Continental Conservative Welfare Societies, and Italy and Spain are Southern European Familistic Residual Welfare States. These two types are in contrast to the Social Democratic Welfare States (Scandinavian countries) and the Liberal Market Societies (the U.S. and the U.K.), where employment conditions and family support policies are generally more favorable toward women. As a result, the fertility rates in Germany, Italy and Spain are lower than those in most other European countries (Dorbritz 2008).

Germany is experiencing a low fertility rate with a rapidly aging population (Dorbritz 2008). The design of parental leave and the public day care in Germany does not necessarily foster the compatibility between the mother and worker roles (Drobnic, Blossfeld and Rohwer 1999; Hank and Kreyenfeld 2003; Ondrich, Spiess, Yang and Wagner 2003). For instance, the public day care is designed for children's early education. German schools usually are only open in the morning hours and do not start/end at the same time every day. As a result, the German public school system, unlike systems in other industrialized countries, cannot offer child care for school-age children (Gornick, Meyers and Ross 1998).

Similarly, the governments in Italy and Spain provide insufficient child care support, and women have to rely on their family networks for child care (Del Boca 2002; Stier, Lewin-Epstein and Braun 2001; Tobio 2001). For example, small tax allowances and direct transfers are offered for families with children in Italy and Spain (Esping-Anderson 1990). The lack of child care forces many employed women to delay childbirth and discourages them from having large families (Cooke 2008). Relatively poor welfare systems fail to protect female workers from economic downturns (Adsera 2004).

Furthermore, governmental budgets in Italy and Spain focus on retired people, instead of children and young adults, and thus, young families need to devote their resources to their children and to help them to form new families. Compared to many other European and North American countries, rearing children is a serious investment for families in Italy and Spain (Garrido and Malo 2005). Without enough supports, more young adults in Italy and Spain choose to live with their parents (Billari and Kohler 2002; Newman 2012), leading to delayed childbirth.

Countries in East Asia are more conservative in terms of gender relationships than those in Western countries. The cultural heritage of Confucianism has greatly shaped the customs in East Asia, which are characterized by patriarchal family system (Park and Cho 1995; Lee 2009). For a long time, women have been required to be perfect wives and mothers, and social roles for men and women are clearly differentiated in East Asia. For example, in 2002, a survey conducted in Japan and Taiwan showed that over 30% and 40% of women, respectively, thought that a woman's job was to look after the home and family (Yu 2009).

Owing to the traditional culture, women in East Asia are often forced to give up their jobs once they get married or become pregnant (Eun 2007; Lee 2008; Yu 2009). To stay in jobs, women often need to remain single or childless. Besides, just like Germany, Italy and Spain, East Asian governments have not created friendly environments for women to take on the responsibilities associated with being both employees and married women simultaneously (Nemoto 2008; Suzuki 2008). Professional women have to sacrifice more due to the lack of adequate daycare facilities, rigid work schedules (including long work hours), longer commuting hours, more rigid division of household work, and generally higher standards of family chores (cooking, cleaning, childcare, etc.). Studies show that East Asian women have more negative attitudes toward marriages than do American women (Retherford, Ogawa and Sakamoto 1996; Tsuya and Mason 1995; Tsuya and Bumpass 2004). As a result, the negative effect of female labor force participation on fertility probably remains in East Asia.

Consequently, although women have made great economic and/or educational achievements in these societies, their achievements have indirectly resulted in the decrease in fertilities in East Asia. In order to achieve higher education and job careers, many women in Asia postpone marriage and childrearing. This temporary delay is considered to have caused recent declines in fertility rates in East Asia, and many scholars have predicted that once the delay slows down, fertility rates will go up, at least a little. This has already happened in Japan, Taiwan and South Korea. The rate went up from 1.26 in 2005 to

1.41 in 2012 in Japan, from 1.08 (2005) to 1.30 (2012) in Korea (Ministry of Health, Labour and Welfare 2014a), and from .895 in 2010 to 1.065 in 2013 in Taiwan (Ministry of the Interior 2014a). However, the reproductive age for women is limited. For most better-educated and employed women, their reproductive spans are largely shortened, and a large number of them will end up childless, resulting in continuously low fertility rates.

Very low fertility rates are common in Japan, South Korea and Taiwan, but the rates differ. All three countries have similar developments regarding compatibility between marriages and jobs, low marriage rates, and increasing female education. How does the difference occur? Taiwanese women generally encounter more difficult environments than their counterparts in Japan and South Korea. While Taiwanese women are encouraged to have full-time jobs (Lu 2011) and are less likely to leave the job market because of marriages and childbirth, the interruption from work is more common in Japan and South Korea because women in these countries perceive their employment as a voluntary choice. Thus, the influence of female labor force participation on fertility may be stronger in Taiwan than in Japan or South Korea.

Moreover, the pro-natalist policies were introduced later in Taiwan than in Japan and South Korea (Jones, Straughan and Chan 2009). Since 1990, Japan and South Korea have made a series of policies to improve welfare provisions for women. For example, the government supplemented childcare services in Japan (Angel Plans in 1994) and South Korea (Childcare Act in 1991), while the first childcare bill was proposed in 2006 in Taiwan (Universal Infant and Childcare System Plan). Without the support from governments, Taiwanese professional women encountered great challenges until the early 2000s.

Even though many welfare policies regarding women's issues passed in East Asia, Taiwanese women were not released from their family and work burdens. Compared to their counterparts in Japan and South Korea, Taiwanese women benefit less from those policies because of the unique economic structure in Taiwan. It requires a lot of resources for companies to offer childcare services, maternity leaves, and family friendly workplaces. Because small and medium companies play more important roles in Taiwan, especially for women (Ishida 2004; Lu 1992; Yu 2001; Yu and Su 2004), their employment conditions are worse on the average than their Japanese or Korean counterparts, when measured by salaries and other benefits (Lu 2009).

When the rates of female labor force participation decrease in Japan and South Korea, that is often a result of older women not going back to work. Whether older women, after they completed their child-bearing careers, are in the labor force or not has nothing to do with the number of children they will have, and therefore, at the macro-level, the relationship between the two variables is expected to be weak in Japan and South Korea.

Besides female education and female labor force participation, there is another potential issue regarding low fertilities in South Europe (Spain and Italy) and particularly in East Asia: a strong connection between marriages and childbearing. In the United States, 41% of children were born to unmarried women in 2009 (Hamilton, Martin and Ventura 2010). The rates are also high for the United Kingdom and France, followed by Germany, Spain, and Italy (OECD 2013). Now, the rates for those Western countries are all above 20%. Large percentages of non-marital children in the West, in conjunction with rapidly increasing premarital cohabitation, mitigate the negative effect caused by the lack of or delay in marriages (Kohler, Billari and Ortega 2002).

On the contrary, due to their cultural backgrounds, East Asian countries still have few births out of wedlock and less premarital cohabitation. Hence, the decreasing marriage rates in East Asian countries lead to fertility rates lower than those in most Western countries. Non-marital births in Taiwan and Japan stood at 4.00% and 2.21% respectively in 2013 (Ministry of the Interior 2014b; Ministry of Health, Labour and Welfare 2014b). Marriages are thus the prerequisite for child bearings in East Asia, if not in the West. And therefore, low marriages rates naturally induce lower fertility rates (Atoh, Kandiah, and Ivanov 2004; Jones and Gubhaju 2009). We thus expect a larger relationship between marriages and fertility rates in East Asian countries.

Hypotheses

First, childbearing can be considered a type of investment. The level of economic development in a given society influences people's willingness on childbirth (Mocan 1990; Hondroyiannis 2010). When the economic situation is unfavorable, people tend to expect that giving birth to a child will become an expensive, long-term investment. Hence, people become more conservative about having children. The GDP growth and unemployment rates should be good indicators of economic circumstances in each country. We expect, therefore, that the higher the GDP growth % and/or the lower the unemployment rate, the higher the fertility.

Second, the level of education is critical for fertility. With more people achieving higher education, the price of childbearing increases for women due to higher opportunity costs and higher standard of spending on childcare for educated women. Also, the increase in educational attainment is known to postpone the timing of childbirths (see Ní Bhrolcháin and Beaujouan 2012 for France and the United Kingdom during the 1980s and 90s). Therefore, fertility rates should decline as more women pursue a college education. Nonetheless, studies show that some Western countries have created more amicable environments for professional women and improved welfare provisions regarding women, so the cost for professional women to give birth has been reduced. Moreover, professional women with high degrees often have high salaries. They thus can afford to raise more children whether they are married or not. Overall, the negative effect is still expected to prevail in East Asia, Germany, Italy, and Spain, but not in the U.S, the U.K., and France.

Third, the effect of female labor force participation on fertility rates is expected to be non-negative in the West and negative in East Asia. Why? The reason is that in Western countries the improved compatibility between jobs and marriages for women effectively reduces the cost of childbearing. However, due to relatively unfavorable institutional supports, the improvement in Germany, Italy and Spain may not be sufficient.

The reduction of opportunity cost for women has not yet occurred in East Asia. Women often have to leave the job market after getting married or becoming pregnant. On this point, Taiwanese women are unique. Although they are more likely to stay in positions compared to their counterparts in Japan and South Korea, unlike in the West, Taiwanese society has not created friendly environments to increase the level of compatibility between jobs and marriages. As previously stated, the female labor force participation rates are often determined by the labor market behavior of older women after raising their children in Japan and South Korea. Hence, the negative effect of female labor force participation rates on fertility rates in Taiwan is stronger than in Japan and South Korea.

Finally, non-marital births in Germany, Spain and Italy are more common than those in East Asia, and those in the U.S, the U.K., and France are even higher. Hence, we expect that marriage rates do not affect fertility rates in the U.S, the U.K., and France, but they positively affect fertility rates in East Asia, with Germany, Spain and Italy in-between.

Methods

Data and variables

We conduct a comparative analysis of six Western countries and three East Asian countries. The Western countries are the U.S., the U.K., France, (West) Germany, Italy and Spain; they are all “developed countries” with GDPs per capita over \$30,000 (US dollars). We then divide the six Western countries into two groups. The first three countries, the U.S., the U.K., and France show higher fertility rates and higher birth rates outside marriage than the last three, Germany, Italy and Spain. The three East Asian nations examined here, Japan, South Korea and Taiwan, are strongly affected by the Chinese culture, in particular Confucianism. All of them embrace democracy and have similar economic developments. Thus, the nine nations under study should provide us with a useful opportunity to examine childbearing behaviors; specifically, how social and economic factors affect fertility rates.

In the analysis, we only include a set of critical variables: GDP growth, female labor force participation, ratio of female to male tertiary enrollment, marriage rate, and unemployment rate. These variables are expected to affect fertility, both theoretically and empirically, on the macro-level as suggested by the literature (Blossfeld and Huinink 1991; Engelhardt and Prskawetz 2004; Hondroyiannis; 2010; Jones 2007 Kögel 2004). In addition, because of the lack of consistent data, most time series and cross sectional studies on fertility are unable to include all relevant variables. Our analysis is not an exception. We, however, include all available variables, hoping to cover most relevant aspects of fertility determination at the macro-level.

The data come from the official websites of the World Bank, OECD, the governments of Taiwan and Japan. We collected critical information from 1981 to 2010 that was predicted to affect fertility rates. The definitions of variables included in our analysis are as follows:

1. **Total fertility rate:** the expected number of children that would be born to a woman over her lifetime. This is the dependent variable.
2. **GDP growth (%):** the percent increase in the GDP in a given year over that in the past year.
3. **Female labor force participation (%):** the proportion of the women aged 15 and older who are economically active.
4. **Ratio of female to male tertiary enrollment (%):** the ratio of the female to male gross enrollments in tertiary schools.

5. **Marriage rate:** the number of persons getting married per one thousand people in a given year.
6. **Unemployment rate:** the share of the labor force that is without work but available for and seeking employment.

Model

The data we use include both cross-sectional and time series information, which helps us to examine how independent variables affect dependent variables in the long term in different units, such as countries. However, the OLS regression is not suitable for cross-sectional time series analysis because the data produce estimation problems. For example, different unit data will cause heteroscedasticity, and time series data will induce dependence among errors. In this research, we employ the fixed effect model in dealing with cross-sectional time series analysis.¹ First of all, relevant tests can be used to detect potential statistical problems in the model. Second, the researchers are allowed to further fix the model if the assumptions of models are violated. By Breusch-Pagan LM test and Pasaran CD test, there is no cross-sectional dependence for the three models.

We run three separate models: the first for East Asia, the second for Germany, Spain, and Italy, and the last for the U.S., the U.K., and France. Considering the possibility of delayed effects of marriages and the ratio of female to male tertiary enrollment, we induced lagged values for the two variables.² In addition, an interaction term (female labor force participation rates*Taiwan) was included in the East Asia model. We tried to see whether the effect of female labor force participation in Taiwan is different from that in Japan and South Korea.

The basic equation in our analysis is expressed as:

Y_{it} (total fertility rate) = $\beta_1 X_{1it}$ (GDP growth) + $\beta_2 X_{12t-1}$ (the lagged value of marriage rates) + $\beta_3 X_{13t}$ (female labor force participation rate) + $\beta_4 X_{14t-1}$ (the lagged value of the ratio in tertiary enrollment) + $\alpha_i + u_{it}$, where Y_{it} is the dependent variable (i = country and t = time), α_i is the unknown intercept for each country, and u_{it} is the error term.

In addition, for the model for the U.S., the U.K., and France, we added $\beta_5 (X_{14t-1})^2$ because the preliminary analysis indicated that the tertiary enrollment showed a non-linear relationship with the

¹ According to the result of Hausman test for the data, the fixed effect model is more appropriate than the random effect model in our data (Greene 2008).

² Once marriage rates change, their influences probably show in the following year or two years later. The ratio of female to male tertiary enrollment might show the effect for a certain duration after the year of measurement.

fertility. We also added $\beta_6 X_{15t}(\text{FLFP} * \text{Taiwan})$ to examine the interaction.

Findings

Table 1 (see annex I to the present document) shows the summary statistics of the variables included in the three models. The average total fertility rate of the U.S., the U.K., and France is 1.86, which is higher than the average in the other three European countries (1.37) and East Asia (1.54). Undoubtedly, the fertility problem is more serious in Germany, Italy, Spain, and East Asia though the rates are all under the replacement level. The U.S., the U.K., and France, on average, show higher female labor force participation rates (52.18%) than the rest (39.97% for Germany, Spain, and Italy, and 47.42% for East Asia, respectively), the average ratio of female to male tertiary enrollment is 117.85 in the U.S., the U.K., and France, 111.06 in Germany, Italy, and Spain, and much lower at 70.78 in East Asia. East Asian countries boast the higher GDP growth average than the West (5.41 for East Asia compared to 2.31 for the U.S., the U.K., and France and 1.95 for Germany, Italy, and Spain). The mean marriage rate is higher in East Asia (7.21) than that in the West (6.42 and 5.16 respectively). Finally, unemployment rates vary quite a lot by regions and years, but on average they are the lowest in Asia, followed by the U.S. the U.K., and France, and by Germany, Italy and Spain.

We can see how fertility rates change in the nine nations (figure 1). In 1981, the total fertility rates in

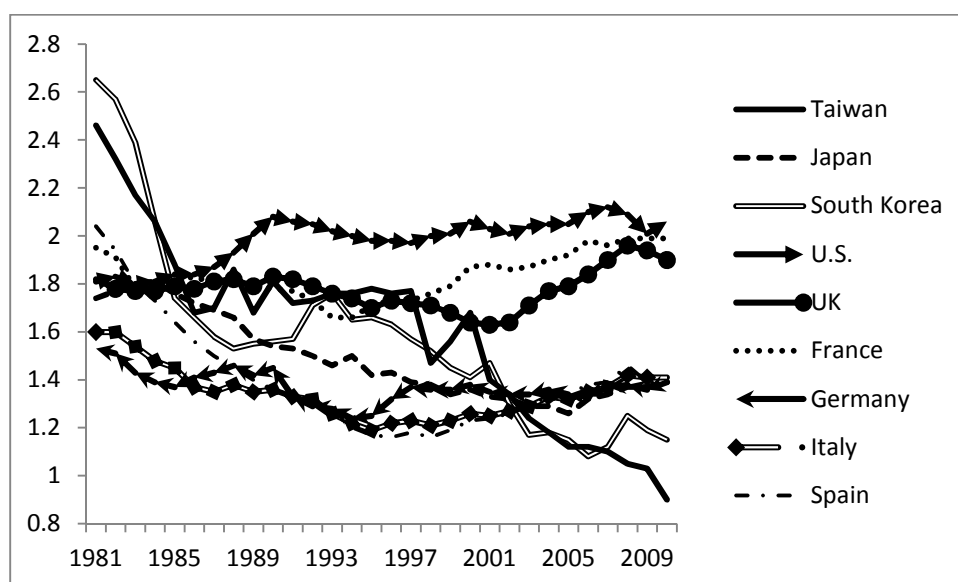


Figure 1. The trend of fertility rates in the nine countries, 1981-2010

South Korea and Taiwan were higher than those in other countries, at around 2.5. However, after 1981,

the total fertility rates rapidly declined in these countries. In addition, since around 2000, the declining speed has been faster. At the same time, the total fertility rates in the U.S., the U.K., and France became fairly stable or even increased since around 2000. The trend of total fertility rates in Japan is similar to that in Germany, Italy, and Spain though the total fertility rates in Japan were higher in the earlier periods.

Figure 2 shows how female labor force participation rates changed in all nine countries. The United

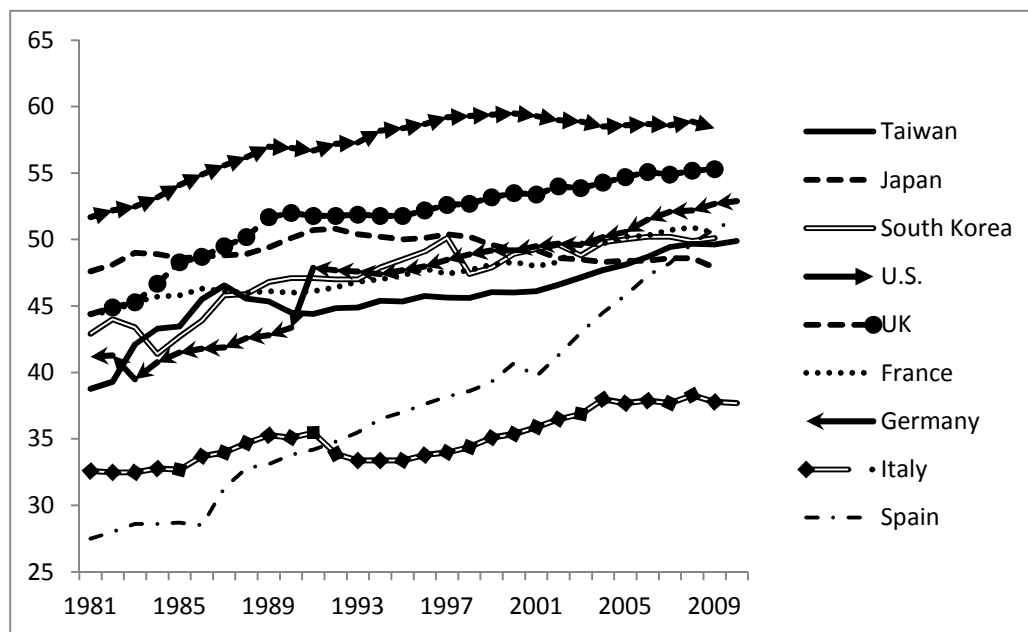


Figure 2. The trend of female labor force participation rate in the nine countries (%), 1981-2010

States kept the highest rates among them. While the rates in the U.K. were lower than those in Japan in the early 1980s, they recorded the second highest rate after 1987. South Korea and Taiwan had lower rates than Japan, but their rates increased gradually and are now higher than Japan's and close to France's, which follows the U.S., the U.K., and Germany. Italy and Spain recorded the lowest rates of female labor force participation in the early 1980s, but the rates rapidly increased in Spain. The rates in Italy, however, remained quite low, around 35%.

As shown in figure 3, all countries show rapidly decreasing marriage rates, except Japan. It seems that marriages are losing grounds in most societies, especially in the West. Although the United States keeps the highest marriage rate for most years, the decrease is considerably large, from around 10.5 to 7.0.

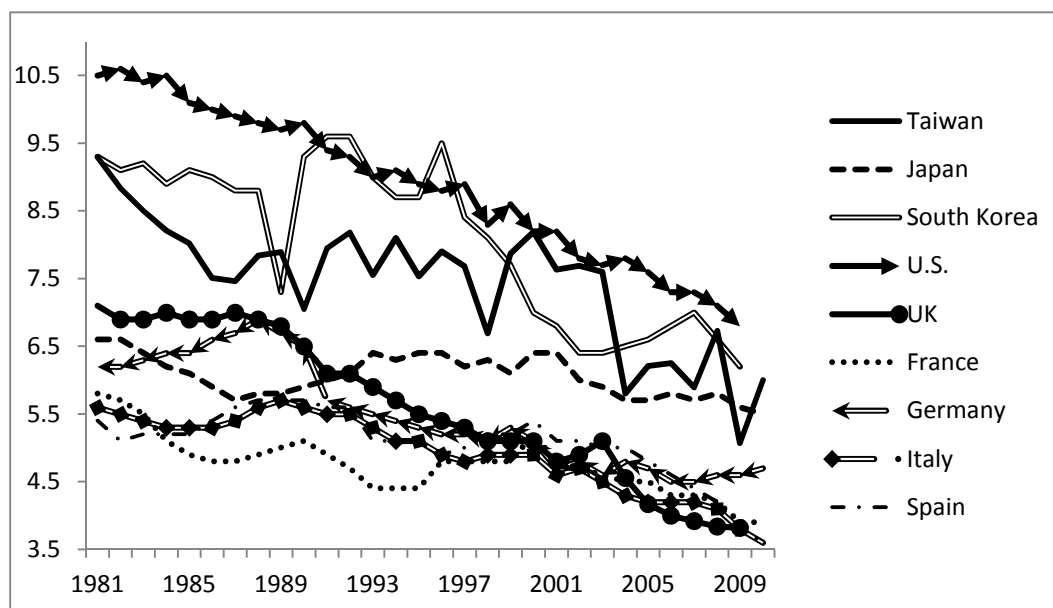


Figure 3. The trend of marriage rate in the nine countries (%), 1981-2010

Table 2 (see annex II to the present document) helps us to identify the relationships between total fertility rates and independent variables. Without controlling for other indicators, we can see that total fertility rate is positively related to female labor force participation and ratio of tertiary enrollment only in the U.S., the U.K., and France while it is negatively related in Germany, Italy, Spain and East Asia. While marriage rate is not related to the total fertility rate only in Germany, Italy and Spain, GDP growth shows a positive relationship with the fertility rate only in East Asia. Unemployment rate is negatively related to fertility rate in the U.S., the U.K., France and East Asia.

Unlike the correlation matrix, the Fixed Effect model introduces the corrections of correlated errors and/or heteroscedasticity. Then, the results are somewhat different from those in the correlation matrix. The findings of the Fixed Effect model are summarized in table 3 (see annex III to the present document). Table 3 illustrates that female labor force participation rates are positively related to total fertility rates in the U.S., the U.K., and France, where women enjoy better institutional supports. In South Korea and Japan, female labor force participation rates are not related to fertility rate (table 3 with the interaction), probably because women in these countries work primarily in the secondary labor market jobs and they leave their jobs temporarily for child-rearing. The increase in female labor force participation rates in these countries may result from younger employed women and women who return to jobs after children are grown, neither of who contributes much to fertility. Compared to South Korea and Japan, the influence of female labor force participation rate on the total fertility rate in Taiwan is significantly more negative, as we predicted. The mechanism is similar in Germany, Italy,

and Spain where the effect is negative and significant. Professional women in Germany, Italy and Spain (also in Taiwan) face more difficult situations of combining families and jobs without the possibility of leaving the labor force, raising children, and returning to jobs as many women in Korea and Japan do. This difficulty results in a negative relationship between female labor force participation rates and total fertility rates.

The ratio of female to male tertiary enrollment is negatively related to the total fertility rate in East Asia, Germany, Italy and Spain, as predicted. However, the relationship is curvilinear in the U.S., U.K., and France. There, the effect of women's education has a negative effect up to a certain point, where the ratios of female to male tertiary school enrollment is around 115.49³, and then turns positive. Marriage rate has a positive relationship with fertility rate in East Asia, and in the U.S., the U.K., and France, while it has a negative relationship in Germany, Italy, and Spain. GDP growth is positively related to fertility only in Germany, Italy and Spain. Unemployment rate is negatively related to fertility in Germany, Italy and Spain, and in East Asia (when the interaction term is not included in the model).

Discussions and conclusions

In the present study, we tried to understand why the total fertility rates stopped declining in Western countries but kept dropping in East Asian countries. Also, we wanted to explain why the six Western and three East Asian nations show different trends in fertilities.

Although childbearing is an expensive investment in every country, compared to Germany, Italy and Spain, governments and private markets in the U.S., the U.K., and France provide better environments that effectively reduce the cost of childbearing for highly-educated professional women, such as readily available daycare facilities and generous maternal leave policies, among others. As a result, we see that the effect of female labor force participation on fertility rates is positive in the U.S., the U.K., and France, and is negative in Germany, Italy and Spain. The pattern in East Asia is similar: well-educated women often experience difficulty and/or hesitate getting married and bearing children. Higher obstacles in these societies may require these women to have independent minds and/or supports by their family members to overcome inequality. On the contrary, education will become an advantage for women once the society becomes relatively egalitarian (or even advantageous for

³ Y^{\wedge} is minimum when $X = -(-.03520)/(2*(.01524/100)) = 115.49$.

women) in its gender relationships, shown in a curvilinear pattern.

The results are partly consistent with Kögel's finding (2004) that the negative effect of women's labor force participation on fertility in some Western countries (e.g., the U.S., the U.K., and France) disappeared after 1980. The effect of female labor force participation rate on fertility in Germany, Italy and Spain are still negative because their institutional arrangements do not effectively lessen women's burdens. The situation is similar in East Asia. Though they now have more professional women, East Asian governments do not offer enough inducements to encourage women to bear children. For example, in France, 95% of 3- to 6-year-old children are in public preschools in 1997, while the percentage is only 19.7% in Taiwan (Fu 2010). Most East Asian women have to take care of children without the support of government, which partially explains why the ratio of tertiary education enrollment of women is negatively related to fertility due to high opportunity costs to have children for well-educated women.

On the contrary, we did not find a negative relationship between female labor force participation rate and fertility in East Asia, except in Taiwan. It is not because the working environments have improved in Japan and South Korea. Rather, in Japan and South Korea, most women leave the job market once they get married or become pregnant, while more Taiwanese women stay in their jobs when they marry. The female labor force consists of four major groups: unmarried women, married women with no children, married women with younger children, and married women with older children. In Japan and South Korea, few professional women are those with young children, but more Taiwanese professional women are in this group. Taiwanese women may be more stressed out than their counterparts in Japan and South Korea because they usually take on the responsibility of working for pay and raising children at the same time. This may be why the negative effect of female labor force participation rate is not apparent in Japan and South Korea, while it is in Taiwan.

We also found a strong, positive relationship between marriage rates and fertility rates in East Asia, probably because childbirths happen mostly in marriages in these countries. With decreasing marriage rates, the fertility rates have decreased in East Asia. On the contrary, the effect of marriage rates is weaker in the U.S., the U.K., and France, and negative in Germany, Italy and Spain. Cohabitation and premarital pregnancy have become very common in the West, so marriages are not necessary for childbirths. The decreasing marriage rates therefore do not affect fertility in the West.

In this research, GDP growth was shown to have a negative relationship in Germany, Italy and Spain and no relationship in the other countries. Governments in the U.K. and France provide people with better social welfare and the U.S. has a stronger private-sector component of childcare, so fertility rates are not affected by economic conditions in these countries. However, without sufficient institutional supports, raising children entails a large expense. The possibility exists that in Asia good economies enable women to leave the labor force and have children (particularly in Japan and South Korea) and that they increase opportunity costs of childbearing for employed women in Germany, Spain and Italy, leading to lower fertility. These explanations are admittedly of a post hoc nature.

Based on this study, Western governments and East Asian governments should adopt similar strategies to keep fertility rates at reasonable levels. Well-designed support mechanisms for married, professional women with children are critical, whether in the West or East Asia. The cases of some Western countries (i.e., the U.S., and the U.K., and France) show how a supportive working environment could successfully increase fertility rates. East Asian countries, along with Germany, Spain, and Italy, should create relevant policies to raise the fertility rates. For instance, governments may subsidize parents on childcare, establish more public kindergartens, or enforce paid parental leave. Marriages play different roles in fertility rates for Western countries and East Asia. In East Asia, marriage rates are strongly related to fertilities. Therefore, the governments should offer some benefits to attract people to marry. For instance, the income taxes could be lowered for married couples. The government may sponsor some activities for unmarried people to encourage marriages, as has been done in Singapore (Wong and Yeoh 2003). Nevertheless, owing to high percentages of children born out of wedlock, improving marriage rates may not be a useful way to increase fertility rates in the West.

As with the case with most research articles, the present article has shortcomings. The choice of the nine countries certainly comes to mind. While it may have been possible to utilize a larger number of countries, possibly with a hierarchical linear model, we made a conscious decision to choose nine countries that cover three distinct groups: developed countries in East Asia, Western countries with relatively high fertility rates, and Western countries with relatively low rates. By doing so, we tried to delineate differential effects of the same variables (e.g. female labor force participation rate, marriage rate, etc.) in the three groups in more detail, including the socio-political contexts for each country. While it is possible to expand this idea to developing countries in Africa, Asia and South America, it is beyond the focus of the present article.

The lack of data availability also needs to be mentioned. It would have been better to have age-specific fertility rates, cohort rates, or order-specific fertility data for these countries over a long span of years. Likewise, it would have been better to have proportions of women in tertiary education of all women in the applicable age rather than the gender ratio. These measures were simply not available.

This study only looks at fertility variations in countries from the macro perspective. We realize that a micro-level analysis is complementary in order to understand how national contexts affect individual childbearing and how to stop population decrease in some countries. Future research should systematically examine the features of each country because the same factor might have different impacts in different countries. Without fully knowing unique characteristics of each country regarding women's situations both in family and work, it is not possible to explain and/or predict fertility changes in different countries.

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Annex I

Table 1. Descriptive Statistics for Variables in Model

Variable	Observations	Mean	S.D.	Min	Max
The U.S., U.K., and France					
Total Fertility Rate	90	1.86	.125	1.63	2.12
Female LFP Rate	90	52.18	4.54	44.40	59.00
Marriage Rate	89	6.42	1.97	3.90	10.60
Ratio of Female to Male Tertiary Enrollment	86	117.85	18.13	60.03	141.18
GDP Growth	90	2.31	1.92	-3.97	7.19
Unemployment Rate	90	7.504	1.966	3.99	11.88
Germany, Italy, and Spain					
Total Fertility Rate	90	1.37	.15	1.16	2.04
Female LFP Rate	90	39.97	7.09	27.5	52.9
Marriage Rate	90	5.16	.68	3.6	6.9
Ratio of Female to Male Tertiary Enrollment	76	111.06	16.76	75.61	141
GDP Growth	90	1.95	2.01	-5.49	5.55
Unemployment Rate	90	11.453	4.848	4.58	24.17
East Asia					
Total Fertility Rate	90	1.54	.32	.90	2.57
Female LFP Rate	88	47.42	2.59	38.76	59.80
Marriage Rate	89	7.21	1.27	5.07	9.60
Ratio of Female to Male Tertiary Enrollment	86	70.78	15.86	36.26	95.24
GDP Growth	89	5.412	4.529	-6.85	19.14
Unemployment Rate	90	3.326	1.203	1.36	6.95

Annex II

Table 2. Correlation Matrices of the Variables Included in the Analysis

	TFR	GDP Growth	FLFP	Ratio	Marriage	Unemployment
The U.S., the U.K., and France						
TFR	1.000***					
GDP Growth	-.144	1.000***				
FLFP	.582***	.100	1.000***			
Ratio (Lagged 1)	.532***	-.198	.570***	1.000***		
Marriage (Lagged 1)	.437***	.270*	.548***	-.065	1.000***	
Unemployment	-.441***	-.154	-.686***	-.593***	-.257*	1.000***
Germany, Italy, and Spain						
TFR	1.000***					
GDP Growth	-.124	1.000***				
FLFP	-.305**	-.126	1.000***			
Ratio (Lagged 1)	-.451***	-.191	.265*	1.000***		
Marriage (Lagged 1)	.141	.355***	-.176	-.685***	1.000***	
Unemployment	.015	.133	-.432***	-.215	-.117	1.000***
East Asia						
TFR	1.000***					
GDP Growth	.515***	1.000***				
FLFP	-.744***	-.601***	1.000***			
Ratio (Lagged 1)	-.445***	-.346***	.401***	1.000***		
Marriage (Lagged 1)	.574***	.531***	-.435***	-.515***	1.000***	
Unemployment	-.490***	-.557***	.266*	.349*	-.255*	1.000***

Annex III

Table 3. Fixed Effect Model for the Effects on TFR in Nine Countries, 1981-2010

Variable	US, UK, France,		Germany, Spain		Italy, East Asia		East Asia (interaction)	
	Coefficie	Robust	Coefficie	Robust	Coefficie	Robust	Coefficie	Robust
	nt	S.E.	nt	S.E.	nt	S.E.	nt	S.E.
GDP Growth	-.005	.004	-.015**	.002	-.001	.004	.001	.003
Unemployment	.005	.005	-.023***	.004	-.058***	.013	-.021	.013
FLFP Rate	.050***	.007	-.022***	.001	-.050***	.008	-.015	.009
Ratio of Tertiary Enrollment (Lagged)	.035***	.004	-.006***	.001	-.007***	.002	-.010***	.001
Squared Ratio of Tertiary Enrollment / 100 (Lagged)	.015***	.002	--	--	--	--	--	--
Marriage Rate (Lagged)	.050**	.016	-.222***	.032	.084***	.018	.083***	.015
Taiwan*FLFP	--	--	--	--	--	--	-.065***	.015
Intercept	.860*	.263	3.384***	.300	3.955	.503	3.391	.430
N		83		73		83		83
F		25.66**		26.99**		101.80**		128.26***
		*		*		*		

*p<.05; **p<.01; ***p<.001