How Workplace Resources Impact Women's Fertility in East Asian Countries: Taiwan as an Example

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Abstract

Compared to men, women encounter more difficulties in pursuing career success and having children simultaneously. Research shows that women are often forced to trade the decision to become a mother for career success. This paper focuses on examining whether jobs which provide more resources assist working mothers in balancing their work and family lives. Answering this question may shed light on how various resources in different occupations affect women's willingness to having children. From the policy perspective, determining the relationship between women's work and childbearing plans is the key to deferring or reversing fertility decline. Most intriguingly, the results of this paper show that although women in the public sector in Taiwan have more employment related resources, they tend to have fewer births than their counterparts in other sectors. This implies that generous labor policies may sometimes fail to encourage female workers to have more children in East Asian countries.

Keywords: work, family, childbearing, fertility decline, labor policies, East Asia

Introduction

In recent decades, most East Asian countries have experienced rapid population aging issues due to low levels of fertility. Since severe population aging causes an increase in old age dependency ratio as a result of aggravating social burden of pension systems and medical programs, it is important to capture the dynamics of fertility decline. As economy developments in these countries, female labor force participation rates (FLFPR) raised but total fertility rates (TFR) declined. This macro-level negative association between FLFPR and TFR echoes micro-level observations in western developed countries. For instance, Amalia Miller (2009) argued that compared to men, women encounter more difficulties in pursuing career success and having children simultaneously. She adopted data from the U.S. Bureau of Labor Statistics and demonstrates that motherhood[2] delay leads to a significant increase in wages (3%) and work hours (6%). Thus, it appears that women are forced to trade the decision to become a mother for their career success.

In order to distinguish the relationship between FLFPR and TFR in Western developed countries from the relationship in East Asia, this paper first compares the relationship among European countries with East Asian countries. Results show that FLFPR is positively associated with TFR among European countries, whereas the association has been negative in East Asian countries. By examining an individual survey data in Taiwan, the relationship between women's employment status and fertility decisions resemble the overall pattern in East Asian countries.

For the purpose of identifying mechanisms underlying women's work and fertility, this paper focuses on examining whether jobs which provide more generous maternity leaves and childcare subsidies assist working mothers in balancing their work and family lives. Answering

[2] By definition, motherhood begins when a woman has her first live birth in her life.

this question may shed light on how various resources in different occupations affect women's willingness to having children. From the policy perspective, especially for countries which are below replacement level[3], to figure out the relationship between women's work and childbearing plans is the key to deferring or reversing fertility decline. However, at the same time, policy makers and stakeholders ought to be cautious about whether generous monetary benefits provided within employment sectors will lead to abuse of resources.

Literature Review

The main theme of this paper stems from a theoretical research question: How do workplace resources impact women's fertility? The two primary concepts comprising the question are workplace resources in different occupations (indicated by types of employment sectors) as well as women's fertility. Women tend to strategize how they utilize accessible resources and strike a balance between their work engagement and fertility plans (Miller 2009). It appears that the level of employment related resources, such as monetary benefits, flexibility of working schedules and supportive peer environment for working mothers, lie in a spectrum across jobs in diverse industries or different employment sectors.

The empirical entry point for this paper at the macro level is be to examine the relationship between women's labor force participation[4] and fertility rate in different countries across time. For industrialized countries, Karin Brewster and Ronald Rindfuss (2000) summarize the association between women's employment and fertility in four possible causal relationships: "women's fertility influences their labor force behavior" (Ogasawara 1998, Pyle 1990, Deasi &

[3] Typically, the total fertility rate (TFR) of replacement level for a population is 2.10. A population would become older (the proportion of the elderly increases) when its TFR is below 2.10.
[4] According to the Bureau of the Labor Statistics, labor force includes people classified as employed and unemployed. Labor force participation rate is the ratio of labor force to the total civilian non-institutional population.

White 1991, Jensen 1996, Klerman & Leibowitz 1994, 1999), "women's labor force behavior influences their fertility" (Waite & Stolzenberg 1976, Hout 1978, Smith-Lovin & Tickameyer 1978, Becker 1981, Willis 1973, Bielby 1992, Rinfuss et al 1999, Rosenfeld 1992, Rosenfeld & Spenner 1992), "a reciprocal relationship exists between the two variables", and "the association is spurious, reflecting other factors" (Cramer 1980, Weller 1977). Additionally, Amalia Miller (2009) points out that motherhood delay leads to a significant increase in wages and an increase in work hours. Apparently, women are confronted with a dilemma between becoming a mother and engaging more fully in the workforce. As economic development has proceeded over time, the opportunity costs of childbearing and childrearing have risen and led to a fertility decline (Becker, 1981). Therefore, women's labor force participation is expected to be negatively associated with their fertility and childbearing practices.

Myrskyla *et al* (2009) argue that industrialized countries whose Human Development Index (HDI) are higher than 0.9[5] reveal a positive association between female labor force participation and fertility. However, further research is needed determine whether the positive association can be observed only in most developed countries. Figure 1 illustrates how fertility has changed along with the increase in female labor force participation among 18 developed countries in Western and Northern Europe. The figure explicitly shows that female labor force participation is positively associated with the total fertility rate among these countries between 1990 and 2010. Figure 2 further indicates that the positive association among these 18 countries also resembles the situation within each country.

[5] An HDI of 0.9 roughly indicates a country with a life expectancy at birth of 75 years, a GDP per capita of USD 25,000 in year 2000 purchasing power, and an education index of 0.95.

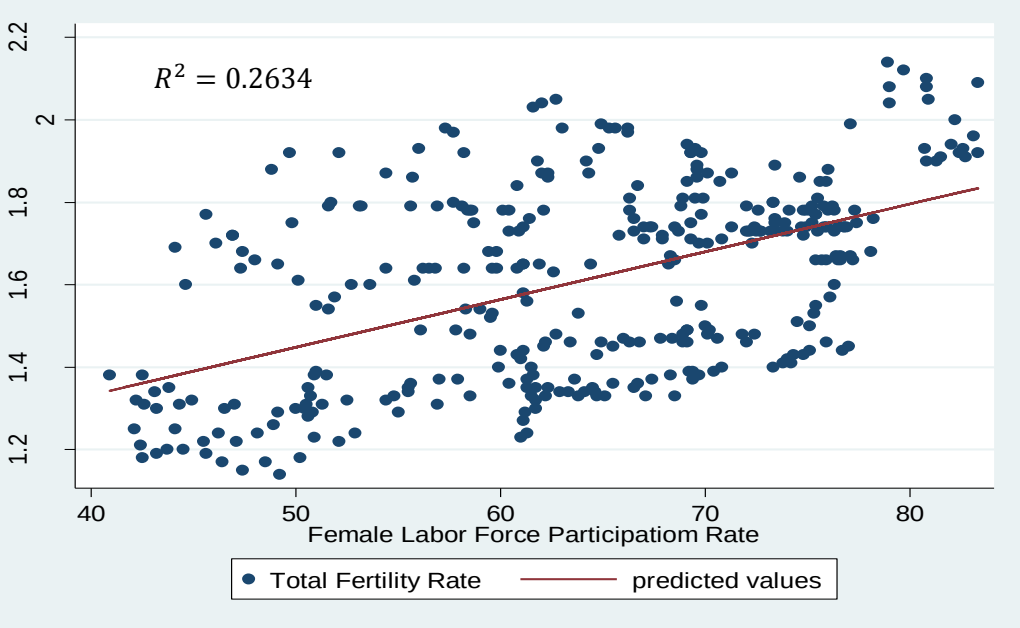

Figure 1. Total Fertility Rates and Female Labor Force Participation Rates across European Countries, 1990-2010. (Data are from theInternational Labour Organization and the International data base of the US Census Bureau)

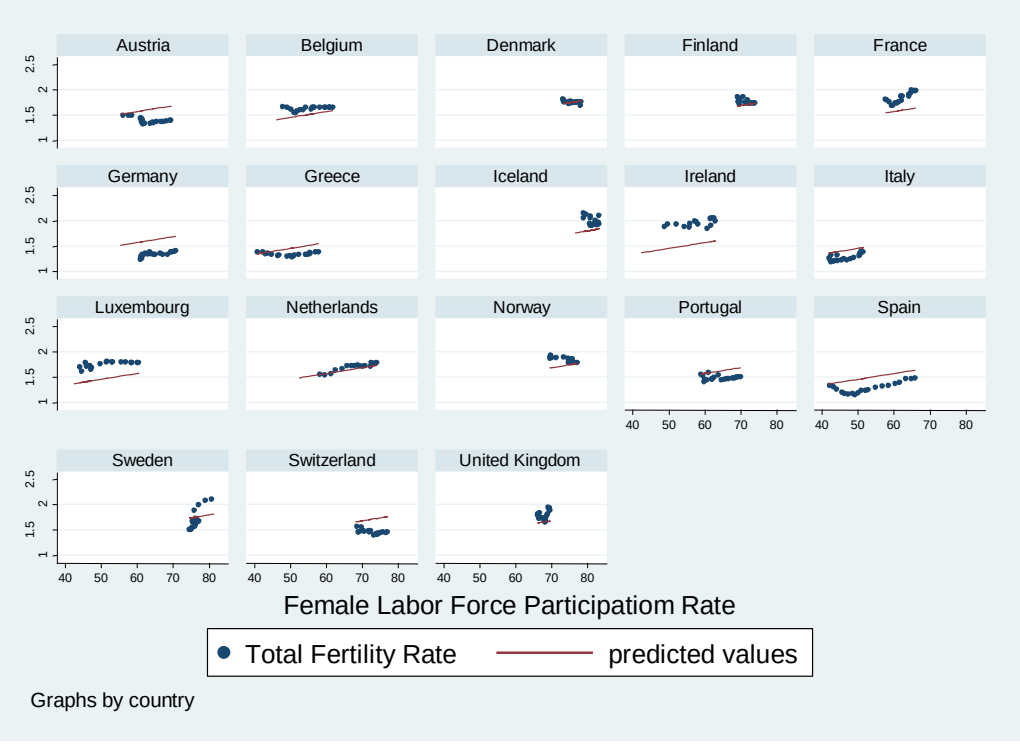

Figure 2. Total Fertility Rates and Female Labor Force Participation Rates by European Country, 1990-2010. (Data are from the International Labour Organization and the International data base of the US Census Bureau)

Most intriguingly, when examining industrialized countries in East Asia, the same association between female labor force participation and fertility seems to hold only for Japan[6]. The relationship between female labor force participation and fertility in East Asian countries is shown in Figure 3. The overall association is apparently opposite to what it is in European countries if Japan is excluded. The negative association between female labor force participation and fertility within each of the five East Asian countries is evidenced by Figure 4. Since past studies paying little attention to newly industrialized East Asian countries in recent decades (Brewster and Rindfuss, 2000), it is particularly valuable to further examine the relationship between women's workplace resources and childbearing practices in these countries.

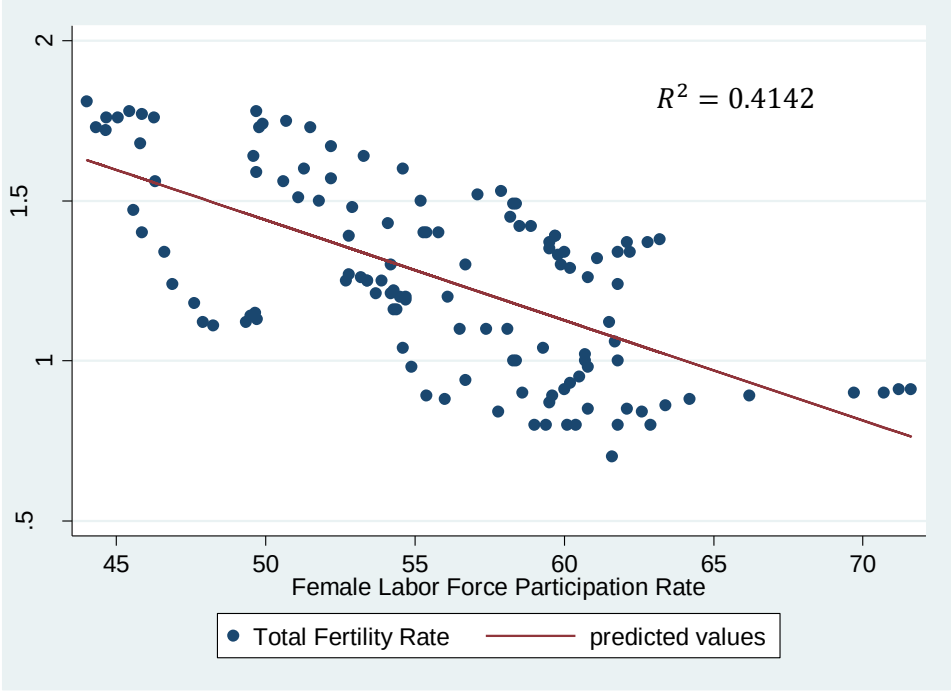

Figure 3. Total Fertility Rates and Female Labor Force Participation Rates across East Asian Countries, 1990-2010. (Data are from the International Labour Organization, Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan and the International data base of the US Census Bureau)

[6] In Japan, along with the steady increase of female labor force participation, total fertility rate first gradually declined and reached 1.25 in 2005 and then bounced back to 1.40 in 2010.

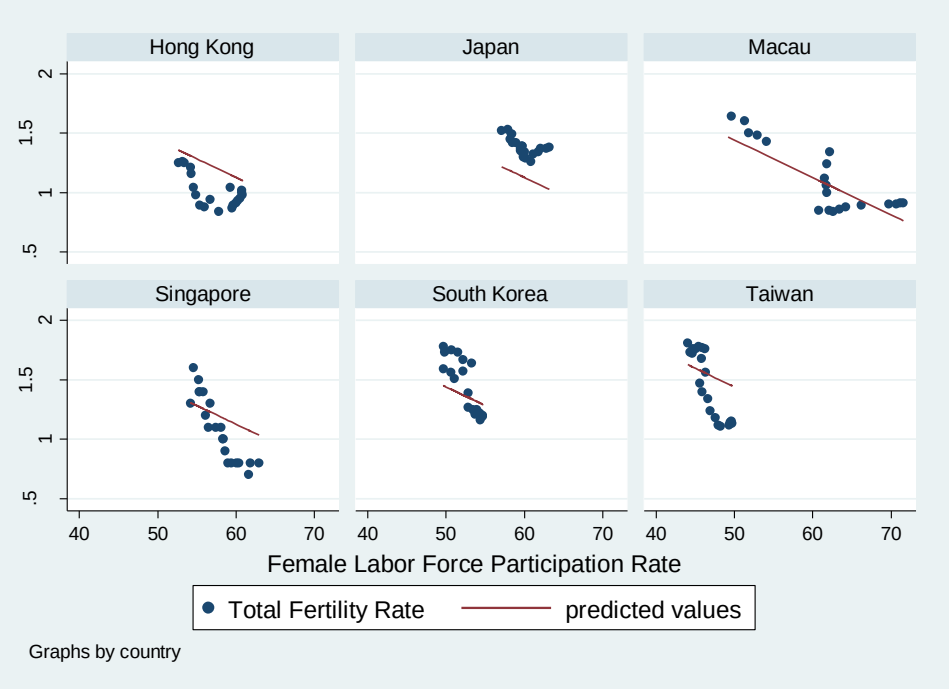

Figure 4. Total Fertility Rates and Female Labor Force Participation Rates by East Asian Country, 1990-2010. (Data are from the International Labour Organization, Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan and the International data base of the US Census Bureau)

China, Mongolia, and North Korea are not included in Figure 3 and 4 but are incorporated into Figure 5 and Table A (see appendix). Mongolia experienced a dramatic fertility transition between 1990 and 2010, while its FLFPR maintained at a relatively stable level. On the other hand, China and North Korea, the two major communist countries in East Asia, demonstrated a similar pattern of correlation between FLFPR and TFR. Compared to other East Asian countries, both China and North Korea have a relatively high FLFPR (even higher than Japan, the most developed country in this area). The total fertility rates in China and North Korea are suspect to some extent because these two communist countries place severe restrictions on their citizens, media, as well as governmental agencies. The statistics provided by these two countries may be artificial or may reflect fraud information. For the sake of capturing the overall

pattern of fertility and FLFPR in East Asian countries, these three countries are excluded from the analysis.

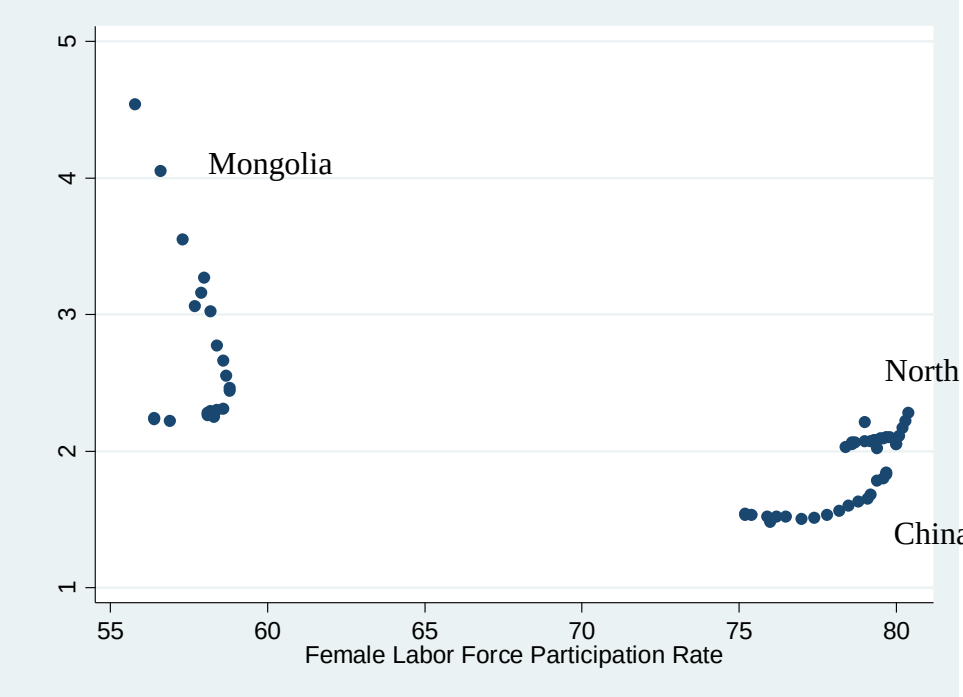

Figure 5. Total Fertility Rates and Female Labor Force Participation Rates in Mongolia, North Korea, and China, 1990-2010. (Data are from the International Labour Organization and the International data base of the US Census Bureau)

The obvious difference in patterns of correlation between fertility and FLFPR in European and East Asian countries suggest that, it may be worthwhile to further probe the relationship at the micro level. Therefore, the other empirical entry point for this paper is focus on the micro-level relationship between women's workplace resources (indicated by types of employment sectors) and their fertility outcomes. In order to capture the underlying mechanisms of women's behavior around fertility, it is necessary to situate a site and determine the hypothetical causal relationship from the four types of causal relationships between women's employment and fertility. For many social scientists (economists, political scientists), the instrumental variable (IV) is a powerful tool to measure "net" causal associations. IV is a

particular variable that only directly affects the explanatory (independent) variable while having no effects at all on the outcome (dependent) variable. By adopting the two-stage regression procedure, IVs can be used as good indicators to gauge the causal effects of independent variable(s) on dependent variable(s) (Pearl 2000). Many researchers have chosen to begin with the hypothesis "women's fertility influences their labor force behavior" because it is more likely to find an IV that only influences fertility but does not have any direct effects on women's labor force behavior. For example, Bloom *et al.* (2009) adopt abortion legislation as an IV and Ebenstein (2007) uses a preference for sons to examine the causal effects of fertility on female labor force participation. Although it is fairly difficult to find an appropriate IV to illustrate the potential causal effects of women's employment on women's fertility, this paper incorporates diverse and exhaustive control variables to assure that the association between women's employment and fertility is neither spurious nor driven by any intervening factors. For the representation of Taiwan among the five East Asian countries and the accessibility of available data at the individual level, this paper adopt The Survey on Women's Marriage, Fertility and Employment (SWMFE) in Taiwan, and examine the association between women's workplace resources and their fertility outcomes.

Methods

According to Alford's *The craft of Inquiry*, the multivariate paradigm is adequate for research which focuses on an individual's behavior and intends to explain causal relationships between variables (Alford, 1998). The main theme of this paper lies in explaining relationships between women's employment related resources (indicated by their types of employment sectors) and their fertility and childbearing practices. Therefore, the multivariate paradigm is undoubtedly the most appropriate approach to addressing the issue. Since the dependent variable, fertility, at

the micro (individual) level is an interval/ratio measurement, an Ordinary Least Squares (OLS) regression model is appropriate for analyzing the data. A respondent's type of employment sector is the primary explanatory variable to explain the variance in women's fertility. However, in order to eliminate spurious or intervening factors in the analysis, special attention needs to be paid to including several important control variables in the model, such as age, age-squares, socioeconomic status, education, and marital status.

The Labor Theory of Value (LTV) was introduced in one of Karl Marx's most influential books, *Das Kapital: A critique of political economy* (Marx, 1867). According to the LTV, if women's value of time goes up, the "opportunity cost" of having children increases. As a consequence of the rise in opportunity costs of childbearing and childrearing, fertility may decrease. However, workplace resources may leverage the negative association between women's workforce engagement and the opportunity costs of having children. For example, jobs which provide more generous maternity and childrearing leaves, accessible monetary benefits for supporting childbearing and childrearing practices, and a more mother-friendly working environment, can lower women's opportunity costs of having children while engaging in the workforce. Therefore, this paper hypothesizes that the average number of children among women whose employment sites provide numerous workplace resources is expected to be higher than it is among women whose jobs offer fewer resources.

This paper uses empirical evidence, such as official statistics and survey data (secondary data) to verify the research hypothesis. According to David de Vaus's *Surveys in Social Research*, secondary analysis apparently can reduce researchers' anxiety of sampling through its relatively large sample size and comprehensive range of variables. However, there are some drawbacks to secondary analysis, such as the variables being incompatible with the research

questions and the data being limited by structured questions which are relevant to particular issues in these surveys or censuses (David de Vaus 1990).

Data

Secondary data about women's fertility and occupations can be found in most countries' official vital statistics. For the macro level of analysis, TFR and female labor force participation rates in various countries for different years are easily accessible from the ILO and the International data base of the US Census Bureau. Scatter plots can be used to demonstrate the association between women's fertility and labor force participation in various countries across different time periods[7]. The data quality is relatively high due to the rigorous design of data collection through canonical international organizations, such as the UN, ILO, and the World Bank. Additionally, most of the aggregate (national) data sets are censuses which are capable of averting sampling issues such as sampling errors and imperfect response rates. However, one of the most common drawbacks for this type of data is that the limited information cannot explain nuances of variance at the individual level.

On the other hand, surveys complement censuses in the sense that more information about variance at the individual level is disclosed through them. A survey on women's employment and fertility could provide valuable evidence for examining the relationship between women's workplace resources and their behavior around fertility. The Survey on Women's Marriage, Fertility and Employment (SWMFE) in Taiwan is an annual survey from 1979 to the present (It was conducted yearly from 1979 to 1989. Because of budget constraints, it was executed in response to policy demands afterwards in 1990, 1993, 2000, 2003, 2006, and 2009). Each survey wave has a sample size between 23,000 to 27,000, and the questionnaire

[7] Macro level data for this paper is provided in the Appendices A and B.

includes questions about women's marital status, fertility, working status, and occupations. Furthermore, the unit of analysis in this survey is the "household," which means the survey also includes information about married women's spouses.

The SWMFE is conducted by the Directorate-General of Budget, Accounting and Statistics of Executive Yuan in Taiwan, which is the highest hierarchical executive branch in Taiwan. Compared to surveys administered by other private agencies or organizations in Taiwan, the data quality of SWMFE is relatively high. The SWMFE is a face-to face interview that targets women aged 15 and above who are defined as part of the civilian population in Taiwan, which includes non-labor force, labor force, employed, and unemployed. In addition, the survey questionnaires encompass a larger variety of issues, attitudes to various topics, and perspectives about certain policies. Although the survey data are valuable for their high quality and comprehensiveness, cross country comparisons may be difficult if similar surveys do not exist in other nations or if language barriers are found in similar surveys across countries. However, due to the explicitness of operationalized definitions of the questions in this survey, it would be feasible for others to duplicate this research by using the same data set.

For the dependent variable in this paper, the SWMFE respondents were asked how many live births they had had when surveyed. The answers to this question are coded in integers including zero. As for independent variables, respondents' types of employment sectors include the following: employed in private companies, employed in the public sector, employers, self-employed, stay at home mothers. Regarding control variables, marital status is categorized into never married, married, divorced/separated, or widowed. Educational attainment is represented by a spectrum from illiterate to above a college degree. For the purpose of testing the hypothesis in this paper, a series of nested OLS regression models would be applied. By taking into account

all the possible intervening factors, the paper aims at explaining the differences in the number of children among individuals by the diversity employment sectors.

In order to examine the relationship between fertility and FLFPR over time, the total 15 waves of the SWMFE are compiled into a single data set. The non-labor force population is excluded for not providing any valid information about their labor force behavior, such as working hours per week and occupational types. The data contain only women defined as part of the labor force population. In addition, women aged 65 and above are most likely to be excluded from the female labor force population. Therefore, this paper aims to examine women who are defined as part of the labor force population and aged between 15 and 64. Table 1 lists some primary descriptive variables of the SWMFE data. Qualified observations (women aged 15 to 64 who are deemed as labor force population) are in the range of 9,000 to 13,000 in each survey year. The overall unemployment rate between 1979 and 2006 was only 2.5%, which suggests that most respondents were on the job market when they were interviewed. Furthermore, the majority of female workers are self-employed. The proportion of self-employed female workers is almost three times the proportion of the second highest occupational type (57.6% self-employed; 20% stay at home mom). As for married women, self-employed is also the biggest proportion their husband's occupational types. However, the proportion of self-employed husbands is only 9% higher than the proportion of the second highest occupational type (40% self-employed; 31% in private sectors). This special characteristic of the labor market in Taiwan partly reflects that small business and family-owned enterprises have been the major components in the economy in recent decades. As for educational attainment, despite women having a slightly higher proportion of illiteracy and a lower proportion of "some college and above" than do men, women and men share a similar distribution of educational attainment between the

lowest and highest levels. This similar pattern of educational attainment for women and men confirms the effects of expanded compulsory education in 1968 (from 6 years to 9 years of preliminary education).

Table 1. Descriptive variables in SWMFE, 1979-2006

Variable	*Counts*	*%*
Survey Year		
1979	9,138	5.74
1980	9,302	5.84
1981	9,602	6.03
1982	10,019	6.29
1983	11,066	6.95
1984	10,877	6.83
1985	11,559	7.26
1986	10,118	6.35
1987	9,819	6.16
1988	9,255	5.81
1990	12,456	7.82
1993	11,811	7.42
2000	12,309	7.73
2003	12,757	8.01
2006	9,191	5.77
Working Status		
unemployed	3,893	2.44
employed	155,386	97.56
Marital Status		
Never married	61,763	38.78
Married	88,479	55.55
Divorced/Separated	3,471	2.18
Widowed	5,566	3.49
Education		
illiterate	12,595	7.91
self-educated	3,132	1.97
primary school	45,270	28.42
junior high	25,864	16.24
senior high	46,047	28.91
some college	14,344	9.01
college and above	12,027	7.55
Occupational Type		
employee in private sectors	16,663	10.57
stay at home mom	31,213	19.80
self-employed	90,793	57.59
employee in the public sector	16,586	10.52
employer	2,394	1.52
N	159,279	

SOURCE: SWMFE 1979-2006 from the Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan

Table 1. (*continued*)

Variable	*Counts*	*%*
Ideal Numbers of Children		
1	19,594	13.46
2	81,402	55.91
3	29,341	20.15
4	13,365	9.18
5+	1,891	1.30
Husband's Education		
illiterate	2,852	3.37
self-educated	2,201	2.60
primary school	31,190	36.85
junior high	13,161	15.55
senior high	18,915	22.35
some college	7,983	9.43
college and above	8,341	9.85
Husband's Occupational Type		
employee in private sectors	24,419	31.35
stay at home dad	5,184	6.66
self-employed	31,212	40.07
employee in the public sector	11,526	14.80
employer	5,547	7.12
N	84,635	

SOURCE: SWMFE 1979-2006 from the Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan

Table 1. (*continued*)

Variable	*Mean (std. err.)*	*Minimum*	*Maximum*	*N*
Age	33.14 (11.80)	15	64	159,279
Working Hours (Per Week)	46.02 (9.54)	1	120	152,932
Husband's Age	42.70 (10.76)	15	92	84,635
Husband's Working Hours (Per Week)	48.34 (10.13)	2	120	75,988

SOURCE: SWMFE 1979-2006 from the Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan NOTE: Standard deviation in parentheses

Results

To explore the relationship between fertility and FLFPR, an OLS regression model is appropriate to show some preliminary results. In the analysis frame work, the dependent variable is the total number of children a respondent had had when she was interviewed, and the explanatory variables are demographic characteristics, such as survey year, age, age-squared, educational level, and marital status. Additionally, some variables that reflect one's labor behaviors and fertility preferences are also included, such as weekly working hours, occupational type, and ideal numbers of children. Since it is clear that women's fertility decisions as well as their labor force participation are not solely decided by themselves, it is essential to include husbands' demographic characteristics and labor behaviors into the model.

However, some important information may be omitted if all the explanatory variables are put into the model at once. Therefore, in this paper, two nested regression models are adopted to estimate how women's demographic factors and labor behaviors affect their fertility. Model 1 includes independent variables which correspond to women's information in the SWMFE data set. Model 2 is nested in Model 1 but with some additional variables that describe husbands' demographic factors and labor behaviors. The major difference between these two models lies in the target of analysis in that, Model 1 predicts the relationship between fertility and female labor behaviors for women in all four categories of marital status, whereas Model 2 only captures the correlation for married women. Since the SWMFE did not include spousal information for divorced or widowed women, targeting the analysis solely to married women in Model 2 enables the incorporation of husbands' effects on women's fertility.

In Model 1, $\hat{y}$ represents the estimated number of children women have had in the OLS regression model. $x_{year}, x_{age}, x_{age-square}, x_{edu}, x_{ideal\ num}, and\ x_{workhour}$ are continuous

variables which respectively represent survey years at time of interview, respondent's age, age-squared of the respondent, levels of education, ideal number of children for a respondent, and weekly working hours. Additionally, the corresponding $b_i's$ are estimated coefficients to explain how many changes in women's births could be attributed to one unit change in these $x_i's$. The remaining terms $x_{married}, x_{divorced}, x_{widowed}, x_{mom}, x_{selfemp}, x_{pub\ sec}$, and $x_{employer}$ are dummy variables derived from two variables: marital status and occupational type. If the first three dummy terms all have a value of zero, the reference group represents marital status: single. Similarly, if the last four dummy terms are all zeroes, the model refers to the reference group in occupational type, which here is employed in private sectors. Having a value of one for each of the seven dummy variables refers, respectively, to married or cohabiting women, divorced or separated women, widowed women, stay at home moms, self-employed women, women hired in the public sector, and female employers. The corresponding $b_i's$ are estimated coefficients to explain how many changes in births that women would have if they are in these specific categories ($x_i's$). The complete equation of Model 1 can be written as below:

Model 1:

$$\hat{y} = \hat{b}_0 + \hat{b}_1 \cdot x_{year} + \hat{b}_2 \cdot x_{age} + \hat{b}_3 \cdot x_{age-square} + \hat{b}_4 \cdot x_{married} + \hat{b}_5 \cdot x_{divorced} + \hat{b}_6 \cdot x_{widowed} + \hat{b}_7 \cdot x_{edu} + \hat{b}_8 \cdot x_{ideal\ num} + \hat{b}_9 \cdot x_{workhour} + \hat{b}_{10} \cdot x_{mom} + \hat{b}_{11} \cdot x_{selfemp} + \hat{b}_{12} \cdot x_{pub\ sec} + \hat{b}_{13} \cdot x_{employer}$$

Model 2 is a simple additive model derived from Model 1. The major concern here is that since this model only aims at those married women with their husbands' information in the survey data, "marital status" is omitted in this model. Excluding marital status, all the other variables in Model 1 are maintained in Model 2. The latter model also includes three more continuous variables, $x_{hus\ age}, x_{hus\ edu}, x_{hus\ hour}$, which respectively indicate husband's age,

educational level, and weekly working hours. The corresponding $b_i's$ are estimated coefficients in terms of how many changes in women's births could be attributed to one unit change in these $x_i's$ that describe the husbands' traits. In addition to these three variables, there are four more dummy variables in Model 2 which represent the husbands' occupational types. The corresponding $b_i's$ are estimated coefficients to explain how many changes in births that women would have if their husbands belong to these particular categorical $x_i's$. The full equation of Model 2 can be written as follows:

Model 2:

$$\hat{y} = \hat{b}_0 + \hat{b}_1 \cdot x_{year} + \hat{b}_2 \cdot x_{age} + \hat{b}_3 \cdot x_{age-square} + \hat{b}_4 \cdot x_{edu} + \hat{b}_5 \cdot x_{ideal\ num} + \hat{b}_6 \cdot x_{workhour} + \hat{b}_7 \cdot x_{mom} + \hat{b}_8 \cdot x_{selfemp} + \hat{b}_9 \cdot x_{pub\ sec} + \hat{b}_{10} \cdot x_{employer} + \hat{b}_{11} \cdot x_{hus\ age} + \hat{b}_{12} \cdot x_{hus\ edu} + \hat{b}_{13} \cdot x_{hus\ hour} + \hat{b}_{14} \cdot x_{dad} + \hat{b}_{15} \cdot x_{selfemp} + \hat{b}_{16} \cdot x_{pub\ sec} + \hat{b}_{17} \cdot x_{employer}$$

Table 2 shows the statistical results of the model estimation by applying the two nested models. Not surprisingly, coefficients of women's demographic variables and labor relative variables are all statistically significant. The results of Model 1 can be summarized as follows: First, with other conditions being held constant, from 1979 to 2006, a one-year increase in time period is associated with a decrease in births of about 0.04. This indicates that women's births would decrease along with time period, which matches the declining trend in fertility in Taiwan. Second, other things being equal, married and ever-married (including divorced and widowed) women tend to have more births than single women. In addition, high levels of education for women are associated with low fertility. Holding other variables unchanged, for each one unit decrease in educational level, women's births decreased by 0.18. Third, ideal numbers of

children has a clear correlation with women's births. Each additional child in the ideal numbers of children would increase women's births by 0.41.

As for variables that reflect women's labor behaviors in Model 1, other things being equal, one more working hour per week for women slightly decreases their births (coefficient = -0.006). The coefficient is significant, but the magnitude of the actual effects is literally small. One possible explanation is that women in Taiwan already work fairly long hours per week. This fact is evidenced by Table 1 in that the average weekly working hours for women is more than 45 hours (with a standard error of 9.5 hours). Consequently, there is not much room for women to increase their working hours, which then further affect their fertility. However, by incorporating women's occupational type in the equation, Model 1 presents an interesting result: In comparison with women hired in private sectors, women who work in the public sector would tend to have 0.3 fewer births. This outcome conflicts somewhat with the Labor Theory of Value (LTV) because female employees in the public sector in Taiwan have fewer working hours than their counterparts in other sectors, and the public sector provides relatively high levels of benefits for child care services and relatively flexible rules for women to have child care days off. Since on average, women in the public sector work fewer hours and have more resources supporting child care and rearing, they should tend to have more children than their counterparts. However, it turns out to be that women who hold the "Iron Rice Bowl" (Tung & Yang, 2005) jobs in Taiwan tend to have fewer births. Figure 6 clearly illustrates this scenario in Taiwan among all the women of working age (age 15 - 64). The fact that women who are likely to have more workplace resources tend to have fewer children than women having fewer workplace resources is evidenced by Figure 6.

Table 2. Determinants of numbers of children in Taiwan, 1979-2006

	Model 1		*Model 2*	
	$\hat{b}_i$	*Std. err.*	$\hat{b}_i$	*Std. err.*
Year	-0.0397***	0.0004	-0.0542***	0.0007
Age	0.0801***	0.0017	0.1928***	0.0035
Age-square	-0.0002***	0.0000	-0.0016***	0.0000
Marital status (ref. group=single)				
Married/Cohabitant	1.3847***	0.0089	-	-
Divorced/ Separated	0.7950***	0.0210	-	-
Widowed	1.2830***	0.0176	-	-
Education	-0.1839***	0.0025	-0.1299***	0.0050
Ideal numbers of children	0.4110***	0.0035	0.4323	0.0053
Working hours per week	-0.0062***	0.0002	-0.0062***	0.0004
Occupational type (ref. group= employee in private sectors)				
Stay at home mom	0.0846***	0.0110	-0.0046	0.0168
Self-employed	-0.1892***	0.0097	-0.1725***	0.0144
Employee in the public sector	-0.2986***	0.0131	-0.2607***	0.0209
Employer	-0.1172***	0.0240	0.0038***	0.0357
Husband's age			0.0078***	0.0010
Husband's Education			-0.1097***	0.0048
Husband's Working hours per week			-0.0009	0.0004
Husband's occupational type (ref. group=employee in private sectors)				
Stay at home dad			-0.0800**	0.0272
Self-employed			-0.0676***	0.0140
Employee in the public sector			-0.0788***	0.0179
Employer			-0.0615**	0.0191
Constant	77.7176	0.8675	105.8096	1.3899
R^2	0.7397		0.5399	
N	139,835		68,597	

* p<.05 ** p<.01 *** p<.001 (two-tails tests)

NOTE: Education is a variable with 7 categories, 1=illiterate; 2=self-educated; 3=primary school; 4=junior high; 5=senior high; 6=some college; 7=college and above

SOURCE: Survey on Women's Marriage, Fertility and Employment, 1979-2006 (Annual survey from 1979-1988; afterward, survey conducted in year 1990, 1993, 2000, 2003, 2006)

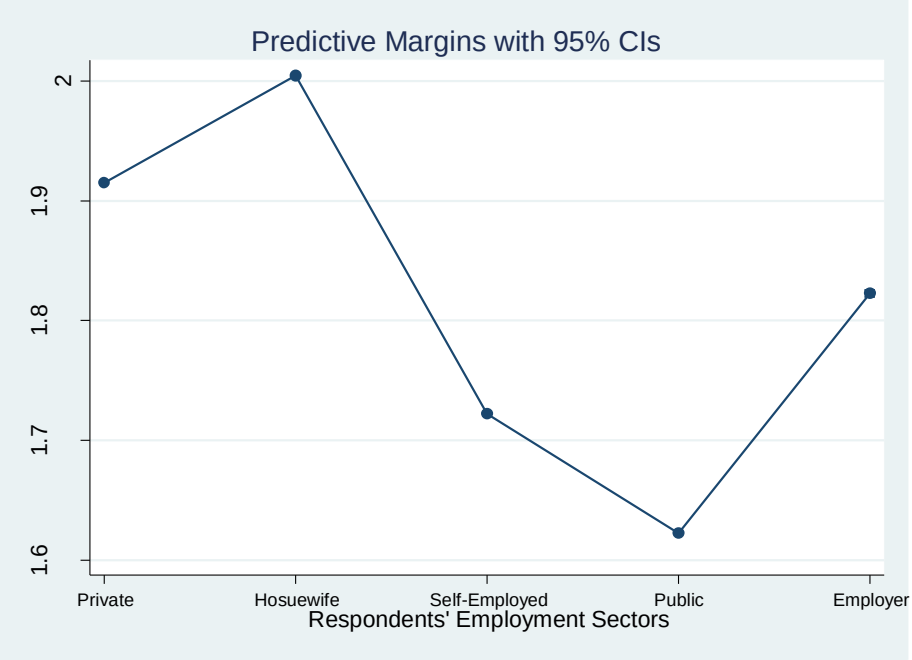

Figure 6. Predicted number of births by employment sector for women in Taiwan. (Data are from the Survey on Women's Marriage, Fertility and Employment, 1979-2006. Annual survey from 1979-1988; afterward, survey conducted in year 1990, 1993, 2000, 2003, 2006)

By examining the coefficients in Model 2, it is clear that despite including variables addressing husbands' traits in Model 1 to get Model 2, the significance and magnitude of the coefficients do not change much. This situation is clearly captured by Figure 7. For all the married women in Taiwan, when taking their husbands' traits into account, with other variables being equal, women who work in the public sector still tend to have fewer births than their counterparts. Compared to Model 1, the magnitude of this effect decreases slightly from 0.3 to 0.26. In addition to this unexpected outcome, when treating husbands' occupational types as an approximation to husbands' income levels, by holding other variables constant (including husbands' educational level), the estimated coefficients show significantly negative associations between husbands' income and their wives' fertility. This result does not correspond to the

explanation of income effects[8] on women's fertility. Figure 8 shows that the SWMFE data only includes a fraction of the demographic transition of fertility. From TFR at 2.7 in 1979 to TFR at 1.12 in 2006, the income effects on fertility cannot explain women's fertility at the individual level. Additionally, the Labor Theory of Value (LTV) is not able to explain fertility among women who work in the public sector. This implies that maybe in different time periods and regions, income effects and LTV have limited applicability.

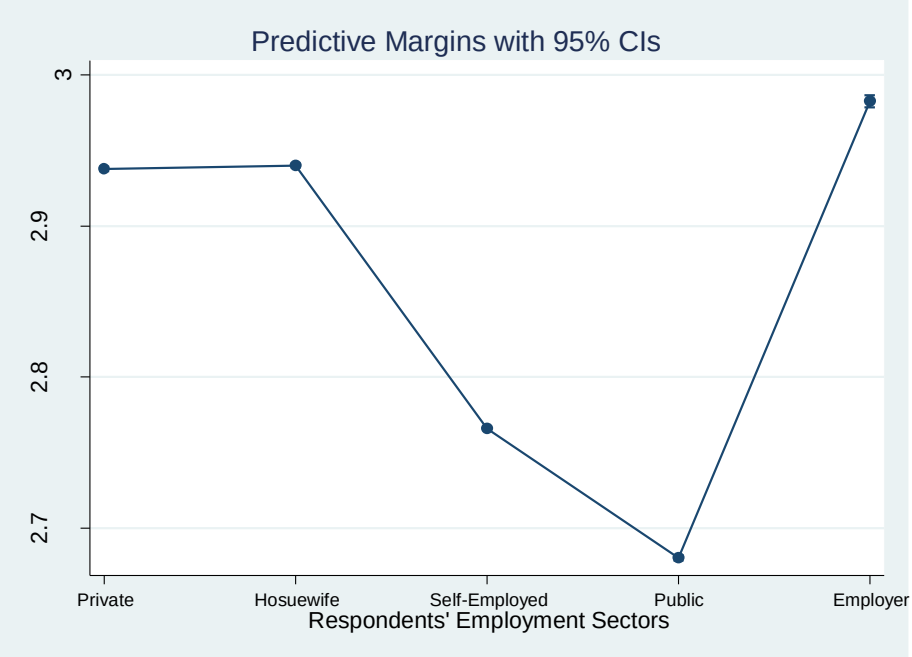

Figure 7. Predicted number of births by employment sector for married women in Taiwan. (Data are from the Survey on Women's Marriage, Fertility and Employment, 1979-2006. Annual survey from 1979-1988; afterward, survey conducted in year 1990, 1993, 2000, 2003, 2006)

[8] In Economics, the income effects means when the income of a household increases, the number of children if the household is likely to increase.

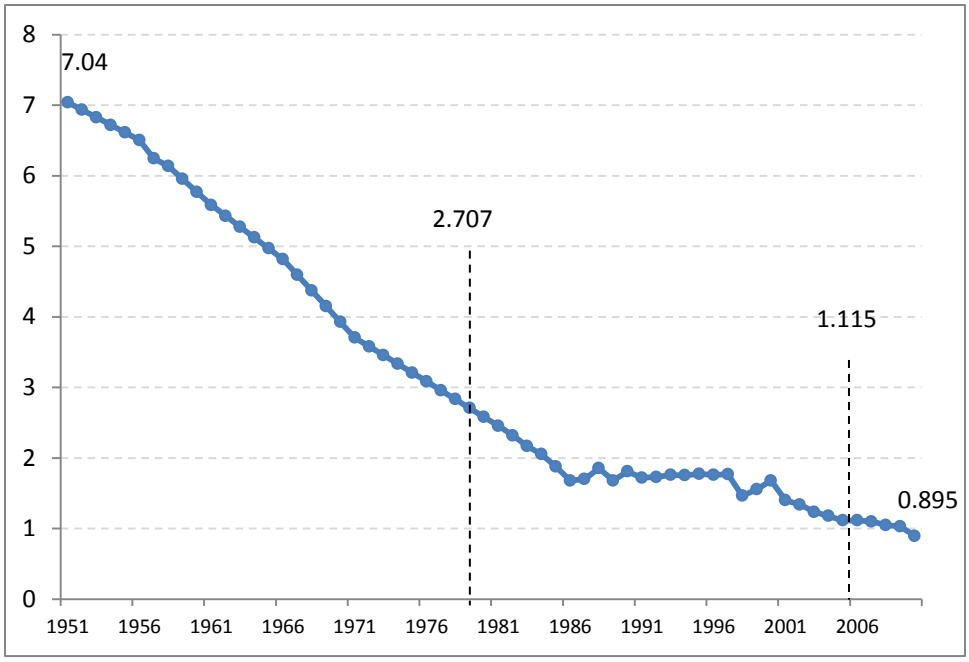

Figure 8. Total Fertility Rates in Taiwan, 1951-2010. (Data are from Dept. of Household Registration Affairs, M.O.I. *sowf.moi.gov.tw/stat/year/y02-04.xls*)

Conclusion

Compared to stay at home moms, women who contribute to the labor force (those who have work in any of the other sectors) tend to have fewer births. Therefore, we could conclude that, the relationship between women's fertility and FLFPR at the individual level closely echoes the aggregate pattern in East Asian countries (fertility was negatively correlated with FLFPR in 1990-2010). However, using individual level data from only one country, the relationship seems less strong. Thus, it would be valuable to compare individual data from other East Asian countries.

According to the statistical results obtained, the research hypothesis of this paper is not supported by empirical evidence. In other words, the Labor Theory of Value (LTV) fails to capture the phenomenon that women having more resources for childbearing and childrearing tend to have fewer births than do women who have less resources. However, the Quality-

Quantity Trade-off theory (Q-Q theory) may provide an alternative perspective to interpret this scenario. Since women working in the public sector in Taiwan have benefited from more monetary aid and relatively low working hours, they may want to trade the quantity of children for high quality of children (or child). This theoretical frame work indicates that women employed by the public sector are likely to utilize their resources, including time and monetary resources, and to invest in their children (or child). In order to examine this alterative explanation empirically, data for children's educational attainment and other performances linked to their families are necessary. The Taiwan Educational Panel Study (TEPS), which contains data of students' educational attainment, is compatible with information about their parents. Therefore, the TEPS may be a suitable data source for future research.

Discussion

There are a few restrictions that need to be addressed. First of all, the two models include ideal numbers of children in the equation. Pritchett (1994) raises a serious measurement problem of the average ideal numbers of children (AINC). That is, women tend to accord their desired number of children with their actual family size. Namely, due to the psychological phenomenon of ex-post rationalization, women are prone to deny that their desired family size was smaller than their actual family size. Additionally, the coefficient of ideal number is 0.4, which reflects that most women in the sample are still in their childbearing years. If these younger women choose to work and then decide to have fewer children, a lower ideal number of children would be shown in the data. Therefore, incorporating ideal family size in the model may lead to an underestimation of the effects of workplace resources on fertility.

Similar to the above criticism, another critical issue in this paper is that the gap between intentions and behaviors is difficult to bridge. Social factors that are embedded in various

contexts affect a person's intention first, and then reflect on his or her behavior. However, an intention may not be consistent with a behavior (an observable outcome). For example, although a woman wants (intends) to have two children, taking into account economic conditions, social norms, and peer pressure, she may end up having only one child and never having a second one. On the other hand, behaviors observed by others may not represent the true intentions of an individual. For instance, in the case of a female worker who has access to abundant workplace resources but who ends up having only one child when surveyed, we cannot assure that the amount of resources has shaped her intention of having only one child. It is possible that she decided to postpone her childbearing so that she could temporarily engage more fully in her career. Adding variables which are able to reflect an individual's fertility intentions in the models may help in decreasing the discrepancies between women's intentions and behavior around fertility.

In terms of the data set adopted in this paper, respondents to the SWMFE vary over time periods, cohorts and ages. Therefore, by examining all the women in different time periods and in various ages at once, it may be difficult to tease out the cohort or the period effects. Consequently, the results of the two models may tend to be inaccurate. To narrow down the target group to a specific age range of women at a particular time, or focus on some special cohorts from a historical perspective would be a good way to re-examine the relationship between workplace resources and women's fertility.

Another possible shortcoming of this paper is related to the assumption of the linear regression model. A stable correlation between the two variables, employment sectors and fertility, may not hold over time. Multiple years of official statistics would need to be included in the analysis. The primary assumption in a multivariate paradigm is that all variables are

independent from each other and the "net" relationships between any two or multiples of them are constant across all the time periods. However, this assumption is not always accurate. Historical evidence often demonstrates the uniqueness of events at different times and places. It is not plausible to assume that a correlation between two concepts has no changes over a certain length of time. Longitudinal data sets can solve parts of this problem. By tracking the same group of individuals across time, the data generated can eliminate intervening factors such as time and geographical locations.

Furthermore, family size may not be determined solely by the mother. The decision making process of how many children a couple would like to have is somehow implicit. If the power relationship between husbands and wives is not introduced into the analysis, the analysis is likely to be distorted when explaining how workplace resources influence a woman's decision of how many children to have. After all, most people agree that the economy and governmental policies are major concerns for a couple in deciding its family size. Also, a man is often the one who provides the income (or provides the larger portion of income for a double income family). Therefore, overlooking husbands' occupations and actual incomes may lead to a biased conclusion in explaining how women's workplace resources affect their behavior around fertility. Thus, including important information of husbands' occupations and incomes or incorporating this information with the description of power relationships between couples in qualitative interviews are both plausible ways to dilute the bias.

Overall, this paper aims at understanding the association between women's workplace resources and fertility so that a nation can sustain a stable population by implementing adequate policies. Meanwhile, policy makers and stakeholders have to consider whether certain labor policies and welfare will fail to attract their target, female workers who trade off childbearing for

career success, and result in abusive utility by other sub-populations. Policy evaluation research and pilot programs are the most common strategies for coping with this situation.

This paper contributes to further investigating the relationship between workplace resources and women's fertility among industrial countries in East Asia. It is hoped that this paper, along with other studies focusing on other regions which also take into account discrepancies between fertility intentions and fertility behaviors, invalidity of mathematical model assumptions, determination of family size, and effects of labor policies on fertility, serves to enrich the literature and shed more light on how to help women achieve a work-family balance.

Appendix

Table A. Total Fertility Rates and Female Labor Force Participation Rates in East Asian Countries, 1990-2010

country	Hong Kong		Japan		South Korea		Macau		Taiwan		Singapore		North Korea		Mongolia		China	
Year	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR
1990	-	53.3	1.52	57.1	1.59	49.7	-	49.2	1.81	44.03	1.6	54.6	-	80.7	4.54	55.8	2.21	79.0
1991	1.21	54.2	1.53	57.9	1.73	49.8	1.64	49.6	1.72	44.66	1.5	55.2	-	80.6	4.05	56.6	2.02	79.4
1992	1.26	53.2	1.49	58.3	1.78	49.7	1.60	51.3	1.73	44.32	1.4	55.8	-	80.5	3.55	57.3	1.84	79.7
1993	1.25	52.7	1.45	58.2	1.74	49.9	1.50	51.8	1.76	44.68	1.4	55.3	2.28	80.4	3.06	57.7	1.83	79.7
1994	1.25	53.4	1.49	58.4	1.75	50.7	1.48	52.9	1.76	45.06	1.4	55.4	2.22	80.3	3.16	57.9	1.80	79.6
1995	1.16	54.3	1.42	58.5	1.73	51.5	1.43	54.1	1.78	45.44	1.3	54.2	2.17	80.2	3.27	58.0	1.78	79.4
1996	1.04	54.6	1.42	58.9	1.67	52.2	1.34	62.2	1.76	46.28	1.3	56.7	2.11	80.1	3.02	58.2	1.68	79.2
1997	0.98	54.9	1.39	59.7	1.64	53.3	1.24	61.8	1.77	45.86	1.2	56.1	2.05	80.0	2.77	58.4	1.65	79.1
1998	0.89	55.4	1.39	59.7	1.56	50.6	1.12	61.5	1.47	45.57	1.1	56.5	2.05	80.0	2.66	58.6	1.63	78.8
1999	0.88	56.0	1.35	59.5	1.51	51.1	1.06	61.7	1.56	46.32	1.1	57.4	2.10	79.8	2.55	58.7	1.60	78.5
2000	0.94	56.7	1.37	59.5	1.57	52.2	1.00	61.8	1.68	45.82	1.1	58.1	2.10	79.7	2.46	58.8	1.56	78.2
2001	0.84	57.8	1.34	60.0	1.39	52.8	0.86	63.4	1.40	45.87	1.0	58.3	2.09	79.6	2.44	58.8	1.53	77.8
2002	0.87	59.5	1.33	59.8	1.25	53.4	0.84	62.6	1.34	46.61	1.0	58.4	2.09	79.5	2.31	58.6	1.51	77.4
2003	0.89	59.6	1.30	59.9	1.27	52.8	0.85	60.8	1.24	46.88	0.9	58.6	2.08	79.4	2.30	58.4	1.50	77.0
2004	0.91	60.0	1.29	60.2	1.25	53.9	0.85	62.1	1.18	47.61	0.8	59.0	2.08	79.3	2.29	58.2	1.52	76.5
2005	0.93	60.2	1.26	60.8	1.16	54.4	0.88	64.2	1.12	47.91	0.8	59.4	2.07	79.2	2.28	58.1	1.52	76.2
2006	0.95	60.5	1.32	61.1	1.19	54.7	0.89	66.2	1.11	48.26	0.8	60.1	2.07	79.0	2.26	58.1	1.48	76.0
2007	0.98	60.8	1.34	61.8	1.20	54.7	0.90	69.7	1.12	49.35	0.8	60.4	2.06	78.7	2.25	58.3	1.52	75.9
2008	1.00	60.7	1.37	62.1	1.20	54.5	0.90	70.7	1.13	49.72	0.8	61.8	2.06	78.6	2.24	56.4	1.53	75.4
2009	1.02	60.7	1.37	62.8	1.21	53.7	0.91	71.2	1.14	49.50	0.7	61.6	2.05	78.6	2.23	56.4	1.53	75.2
2010	1.04	59.3	1.38	63.2	1.22	54.3	0.91	71.6	1.15	49.66	0.8	62.9	2.03	78.4	2.22	56.9	1.54	75.2
2011	1.07	-	1.38	-	1.23	-	0.92	-	1.15	-	0.8	-	2.02	-	2.21	-	1.54	-
2012	1.09	-	1.39	-	1.23	-	0.92	-	1.16	-	0.8	-	2.01	-	2.19	-	1.55	-

SOURCE: Female labor force participation rates are from the International Labour Organization website: http://kilm.ilo.org/kilmnet/; data forTaiwan are from the Directorate-General of Budget, Accounting and Statistics, Executive Yuan in Taiwan: http://www.dgbas.gov.tw/public/data/dgbas04/bc4/mpwutility/100/mtable1.xls
Annual total fertility rates between 1990 to 2010 are from the International data base on the US Census Bureau website: http://www.census.gov/population/international/data/idb/informationGateway.php

Table B. Total Fertility Rates and Female Labor Force Participation Rates in European Countries, 1990-2010

country	Austria		Belgium		Denmark		Finland		France		Germany		Greece		Iceland		Ireland	
Year	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR
1990	-	55.3	-	46.1	-	77.6	-	73.4	1.8	57.7	-	55.4	-	43.1	-	76.6	-	42.4
1991	1.49	56.1	1.66	48	1.68	78.1	1.79	72	1.79	58.1	1.33	61.5	1.38	40.9	-	76.7	-	43.2
1992	1.49	57.8	1.65	49.1	1.76	78.2	1.85	70.7	1.75	58.7	1.29	61.2	1.38	42.5	-	77.7	-	43.2
1993	1.48	58.5	1.61	50.1	1.75	77.4	1.81	69.9	1.68	59.4	1.27	61.1	1.34	43.1	-	78.2	-	45.1
1994	1.44	61.1	1.55	51	1.8	73.3	1.85	69.1	1.68	59.8	1.23	61	1.35	43.8	2.14	78.9	-	46.5
1995	1.4	61.5	1.54	51.6	1.8	73.3	1.81	69.5	1.73	60.4	1.24	61.3	1.32	44.9	2.08	80.8	-	47.1
1996	1.42	61	1.57	51.9	1.75	73.4	1.77	69.8	1.74	61.1	1.3	61.7	1.3	46.5	2.12	79.7	1.88	48.8
1997	1.37	61.3	1.6	52.7	1.75	73.9	1.75	69.3	1.73	60.9	1.35	62.3	1.31	47	2.04	79	1.92	49.7
1998	1.35	61.3	1.6	53.6	1.72	74.8	1.7	69.7	1.76	61.4	1.34	62.9	1.29	49.1	2.05	80.9	1.92	52.1
1999	1.32	61.7	1.61	55.8	1.73	75.5	1.74	71.3	1.78	62.1	1.34	63.3	1.28	50.6	2	82.2	1.87	54.4
2000	1.35	61.7	1.64	56.5	1.77	75.4	1.73	72.1	1.87	62.3	1.37	63.6	1.29	50.8	2.09	83.3	1.86	55.7
2001	1.33	62.2	1.64	54.4	1.75	75.2	1.74	72.4	1.87	62	1.34	64.1	1.3	50	1.96	83.1	1.93	56
2002	1.33	63.8	1.64	56.2	1.74	74.9	1.73	72.7	1.86	62.3	1.33	64.7	1.31	51.3	1.94	82	1.98	57.3
2003	1.34	64.6	1.64	56.8	1.74	74.7	1.73	72.2	1.87	64.3	1.33	65.1	1.32	52.5	1.93	82.6	1.97	57.7
2004	1.35	64.5	1.64	58.2	1.74	75.9	1.73	72	1.9	64.2	1.35	66.5	1.32	54.4	1.93	80.7	1.92	58.2
2005	1.36	65.5	1.64	59.6	1.74	75.8	1.73	72.7	1.93	64.8	1.33	67.1	1.33	54.8	1.92	82.4	1.84	60.8
2006	1.36	66.7	1.64	59.8	1.74	76.8	1.73	73.2	1.99	64.9	1.33	68.5	1.34	55.5	1.92	83.3	1.9	61.8
2007	1.37	67.4	1.64	60.8	1.74	76.5	1.73	73.8	1.98	65.3	1.37	69.4	1.35	55.5	1.91	82.7	1.98	63
2008	1.38	68.3	1.65	61.1	1.74	76.8	1.73	74	1.98	65.6	1.38	69.7	1.36	55.6	1.91	81.5	2.05	62.7
2009	1.39	69.4	1.65	61.1	1.74	76.9	1.73	73.5	1.98	66.2	1.39	70.4	1.37	57	1.9	80.8	2.04	62
2010	1.39	69.2	1.65	61.9	1.74	75.9	1.73	72.5	1.97	66.2	1.4	70.8	1.37	57.9	1.9	81.3	2.03	61.6
2011	1.4	-	1.65	-	1.74	-	1.73	-	1.96	-	1.41	-	1.38	-	1.89	-	2.02	-
2012	1.41	-	1.65	-	1.74	-	1.73	-	1.96	-	1.41	-	1.39	-	1.89	-	2.01	-

SOURCE: Female labor force participation rates are from the International Labour Organization website: http://kilm.ilo.org/kilmnet/; Annual total fertility rates between 1990 to 2010 are from the International data base on the US Census Bureau website: http://www.census.gov/population/international/data/idb/informationGateway.php

Table B (cont.) Total Fertility Rates and Female Labor Force Participation Rates in European Countries, 1990-2010

country	Italy		Luxembourg		Netherlands		Norway		Portugal		Spain		Sweden		Switzerland		UK	
Year	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR	TFR	FLFPR
1990	-	43.6	-	42.4	-	52.4	-	69.8	-	59.2	-	41.6	-	81.5	-	68.1	-	66.8
1991	1.31	44.3	1.6	44.6	-	53.5	1.92	69.8	1.58	61.1	1.32	42.2	2.1	80.8	1.56	68.6	1.84	66.7
1992	1.31	42.6	1.64	47.3	-	55.2	1.89	69.6	1.54	59	1.3	43.2	2.08	79	1.55	69.8	1.81	66.3
1993	1.25	42.1	1.7	46.1	-	55.9	1.86	69.6	1.52	59.5	1.25	44.1	1.99	77.1	1.48	70.1	1.78	66.3
1994	1.21	42.4	1.72	46.9	-	57.3	1.87	70.1	1.44	60	1.19	45.6	1.88	76	1.46	68.9	1.76	66.5
1995	1.18	42.5	1.69	44.1	1.54	58.3	1.87	71.3	1.4	59.9	1.17	46.4	1.73	76.3	1.46	69.1	1.73	66.5
1996	1.19	43.2	1.77	45.6	1.53	59.6	1.89	73.4	1.43	60.8	1.15	47.4	1.6	76.3	1.49	70.2	1.74	67
1997	1.2	43.7	1.72	46.9	1.56	61.3	1.86	74.6	1.46	62.2	1.17	48.5	1.53	75.3	1.47	70.6	1.74	67.4
1998	1.2	44.5	1.68	47.4	1.63	62.6	1.81	75.5	1.45	62.1	1.14	49.2	1.51	74.5	1.46	72	1.74	67.3
1999	1.22	45.5	1.75	49.8	1.65	64.4	1.85	75.6	1.48	62.7	1.18	50.2	1.5	75.1	1.48	72.4	1.71	67.9
2000	1.24	46.2	1.8	51.7	1.72	65.8	1.85	75.9	1.53	63.8	1.22	52.1	1.55	75.4	1.48	71.8	1.67	68.3
2001	1.22	47.1	1.79	51.6	1.71	67	1.79	75.8	1.43	64.7	1.23	50.9	1.57	76.1	1.4	73.3	1.65	68.2
2002	1.24	48.1	1.79	53.1	1.72	67.9	1.79	76.2	1.45	65.5	1.24	52.9	1.66	75.9	1.41	73.8	1.66	68.5
2003	1.26	48.9	1.79	53.2	1.73	68.7	1.79	75.2	1.46	66.3	1.29	55	1.66	75.7	1.41	74.2	1.74	68.5
2004	1.31	50.5	1.79	55.6	1.71	69.3	1.78	75.1	1.46	66.8	1.31	56.9	1.66	75.4	1.42	74	1.79	68.8
2005	1.3	50.4	1.79	56.9	1.7	70.1	1.78	74.8	1.47	67.8	1.33	58.5	1.66	76.5	1.43	74.3	1.81	68.9
2006	1.33	50.7	1.78	58.5	1.71	70.8	1.78	74.9	1.47	68.4	1.36	60.4	1.66	76.6	1.43	74.8	1.88	69.6
2007	1.35	50.6	1.78	58.6	1.7	72.3	1.78	76	1.48	68.9	1.38	61.6	1.66	77.2	1.44	75.1	1.94	69.1
2008	1.38	51.5	1.78	58.4	1.76	73.4	1.78	77.3	1.49	69.1	1.46	63.4	1.67	77.1	1.44	76.7	1.93	69.5
2009	1.38	50.9	1.78	60.4	1.78	74.1	1.78	76.3	1.49	69.1	1.46	64.9	1.67	76.4	1.45	77	1.92	69.3
2010	1.39	51	1.78	60.1	1.78	72.6	1.77	75.4	1.5	70	1.47	66	1.67	76.6	1.46	75.9	1.92	69.3
2011	1.39	-	1.77	-	1.78	-	1.77	-	1.5	-	1.47	-	1.67	-	1.46	-	1.91	-
2012	1.4	-	1.77	-	1.78	-	1.77	-	1.51	-	1.48	-	1.67	-	1.47	-	1.91	-

SOURCE: Female labor force participation rates are from the International Labour Organization website: http://kilm.ilo.org/kilmnet/; Annual total fertility rates between 1990 to 2010 are from the International data base on the US Census Bureau website: http://www.census.gov/population/international/data/idb/informationGateway.php

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