THE RELATIONSHIP BETWEEN FEMALE EDUCATION AND FERTILITY IN EUROPEAN COUNTRIES

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ABSTRACT

In light of the sustained low fertility rate among European countries, a large number of studies have been conducted to elaborate on this demographic issue. This paper examines how the different individual and national characteristics influence the number of children a woman has given birth to. Done by the cross-country data from France, Sweden, Norway, Poland, Italy and Spain, we draw the main conclusion that the number of children is correlated with mother's education level and household's income, with a roughly U-shaped relationship. Besides, working contract, age at first birth, GDP per capita, female labor force participation as well as family benefits are also included in our research, and demonstrate the results that are mostly consistent with previous literatures.

Keywords fertility · education · income · Second Demographic Transition · European countries

1 Introduction

As claimed in previous literature, European countries have stepped into the second demographic transition one after another since the end of World War II [Lesthaeghe, 2010]. Nevertheless, despite being generally accepted nowadays, this conception was not developed thoroughly until 1986, and even confronted with criticism early on.

Easterlin [1968] hypothesized that a small cohort of people competing in labor market would consequently hasten the founding of families and cause a time-lagged effect of a larger working population after two decades, which conjectured fertility would fluctuate in a periodical pattern. Notwithstanding the aforementioned cyclical fertility theory accounts for the phenomenon in 1960s and 1970s, a failure to specify the absence of fertility rebound in the ensuing years incubated another contemporary deduction — Second Demographic Transition — to some extent [Lesthaeghe, 2010].

Major characteristics are acknowledged as sustaining sub-replacement fertility level, more effective and widely-used contraceptives, changes in familial formation, and delaying matrimony as well as parenthood, which all in all manifest the variation in values and socioeconomic environments. SDT theorists contended that the basic material needs and relatively conservative atmosphere were revealed in the first demographic transition, whereas non-material pursuance for individual fulfillment along with the liberalization on contraception, sex and gender appear in the second. Even though there is no specific explanation to this dramatic shift in the middle of twentieth century, some speculated that the prolongation of education certainly played a significant role in this process.

Instead of being solely confined to Scandinavian and Western European countries, this trend had gradually spread to Southern, Central as well as Eastern nations since 1980s, thereafter interacting with their intrinsic culture or historical context, and finally developed unique demographic patterns. Admittedly, national fertility rates seem to be settled to a certain level in recent years, while they stabilize to varied magnitude and somehow present regional similarity [Kalwij, 2010]. Hence, we attempt to research the relationship between fertility and other variables that have been shown to correlate with childbearing in anterior studies, especially schooling years of women. Limiting our scope to six representative European countries, we utilize the survey data from European Social Survey (ESS) and construct a two-level hierarchical linear model, so as to examine the interdependency between reproduction and different features whether in a micro or macro level.

2 Literature Review

2.1 Micro-level Independent Variables

Ainsworth et al. [1996] states that higher levels of women's schooling leads to lower fertility through four main channels: wage effects, higher demand for child schooling, lower child mortality, and more effective use of contraception. From the preceding research, female's education has a significantly negative influence on total fertility in every group of women in Pakistan [Sadaqat et al., 2017] . That is, when women have higher levels of education, they tend to give birth to fewer children. Compared to the research shedding light on developing countries, Cygan-Rehm and Maeder [2013] examine the effect of women's education on fertility by exploiting a German Schooling Reform that extended compulsory education from 8 to 9 years. They find that the extension of education years leads to a birth postponement and also a decrease in fertility rate in Germany.

The correlation between income and fertility had bewildered demographic scholars for a long time. After Becker [1960] first indicates the negative relationship in between, Borg [1989] further clarifies it with the finding that income effect is significantly negative when the net price of a child is not controlled. Also, in Weeden et al. [2006], women in the general population with higher income have fewer children.

A former research from Ariza et al. [2003] shows that an adequate part-time schedule is of great importance to enhance fertility. Also, when it comes to the reproductive decision, females will consider not only the overall situation of labor market, but also whether or not themselves are in stable employments. Adsera [2011] demonstrates that women with temporary contracts, mostly prevalent in Southern Europe, are the least likely to give birth to a second child. Barbieri et al. [2015] again confirms that atypical employment experiences reduce the probability of acquiring motherhood with their empirical research on Spain and Italy.

In terms of the maternal age at first birth, Adsera [2011] illustrates that delayed childbearing has contributed to a lower completed fertility, for women entering their motherhood later tend to have fewer children, and this statement is likewise verified in Roustaei et al. [2019] that the postponement of reproduction has a negative effect on total fertility rate even though with different levels among countries.

2.2 Macro-level Independent Variables

In the research conducted by Li [2016], economic growth appears at the beginning of the high fertility rate, while with the acceleration of economic development, the fertility rate declines. Despite rich countries suffer more severely than the poor ones, GDP has a universally negative effect on the fertility rate.

According to Rindfuss et al. [2003], female labor force participation had been negatively correlated with fertility for a long time, while it changed the sign ever since 1980s and became even more statistically significant later on. This phenomenon is then interpreted as a transformation in values that people gradually accept the compatibility between mothers and their working roles, but it should be noted that this inference is only based on OECD countries that it may not be generalized to other districts.

Family policy has been shown to positively influence fertility in OECD countries, as the support, taking the form of whether paid leaves, childcare services or the financial transfers, helps boost parents' willingness to have children [Luci-Greulich and Thévenon, 2013]. Besides, Wesolowski and Ferrarini [2018] further claim that earner-carer support is associated with higher fertility level, whereas cash benefits cannot significantly facilitate reproduction.

2.3 Countries

In this research, we focus our study on six European countries. Countries with high fertility rate include France, Sweden as well as Norway, while those with low fertility rate are comprised of Poland, Italy and Spain. In the later part we will illustrate these countries' features and their trends of fertility rate.

As claimed by Toulemon et al. [2008], the total fertility rate has remained stable and high in France. In 1975, the TFR was around 1.8 children per woman, and it had a slight decrease in early 1990s followed by an increase since 1996. The French level of fertility rate has maintained the highest in the European Union despite several social and demographic changes such as increasing couple instability or higher female participation in the labor force, the reason of which is mainly contributed to the country's active family policy. Family policy has been already on the political agenda since the end of the 19th century. The long history of family policy enables the government to respond to the social changes and design new policy timely. French family policy is a mix of many tools. In order to relieve the tensions between work and family, several implements are aimed to reduce the costs of bearing and rearing children, such as significant tax deductions when giving birth to more children.

In Hoem [2005], the fertility rate in Sweden has been depicted from 1980 to 2004, and the author compares the fertility rate of Sweden with Germany, Finland and France. In Sweden, the TFR was 1.76 in 2004, and it was second only to France. Nevertheless, in the 1980s and the 1990s, the Swedish fertility had a unique roller-coaster pattern because of the whole social situation. Compared with the family policies in German, Sweden demonstrates considerable generosity and has the public health care directed to marriage couples and children. Also, the family policies in Sweden care about gender equality especially; for example, there are "daddy days", which entitles fathers to have 10 benefit days with their children. Moreover, there is a flexible education system for adults who may return to take more education after a break, perhaps after the arrival of a child. All in all, Swedish women are encourage to participate in the labor market with a flexible educational and working system. However, it also shows that the great undulations in Swedish fertility are largely self-induced by the tight links between parenthood benefits and preceding income from a woman's own labor force participation.

During the World War II, Norway experienced a baby boom with a fertility rate of 2.74, which thereafter swung up and down by the time. Until now, the fertility rate has declined to 1.53 births. The public policy expansion was implemented from 1977 to 1993, composed of leave programs, maternal and parental benefits. As shown in Rønsen [2004], fertility has been affected by socioeconomic status, the family size of the parental home during adolescence, and so on. The research confirms that the economic environment is important for the timing of births, and pinpoints that fertility is delayed among well-educated women. In Norway, there is a strong work commitment among women; therefore, female wage will affect women's selection of whether to have babies or not. In this research, the family policies expansion is also proved to have a positive effect on fertility.

Despite the Polish government's efforts to boost births in recent years, the fertility rate in Poland has remained one of the lowest among European Union. Walford and Kurek [2016] offer a comparative study of the selected fertility indicators between Poland, England and Wales. They indicate that until 1990, the TFR in Poland was above generation replacement level, which is 2.1 births, but after 1990, it declined rapidly and reached its low point at 1.2 in 2003, and followed by a slight increase afterwards. Compared to England and Wales, cultural factors are likely to play crucial roles. In Poland, the percentage of births outside marriage is lower owing to the Catholic religion, which may accordingly bring about lower fertility rate.

In light of a report in 2015, the total fertility rate of Italy had been declining and was expected to drop more strikingly afterwards, for there will be fewer Italian women at the reproductive age [East-West Center, a]. Italy emerged as one of the countries with lowest-low fertility in the 1990s and this extremely low TFR can be explained by women's low participation in the labor force, and a much tighter family bond compared to other countries [Kertzer et al., 2009]. The fertility rate in Italy has been lower than 1.5 ever since 1984, for over 35 years, and even set a historically lowest record with only 1.19. It is generally believed that deficiencies in family policies (including insufficient childcare centers provided, ill-compensated parental leaves and little tax deduction for children), unbalanced housework or childcare burden on women, and unstable labor market are the main factors resulting in the low fertility rate in Italy, as stated in the previous report.

According to Perez and Livi-Bacci [1992], at the beginning of 1990s, people in Spain were reproducing at the slowest rate of any large population in the world; the TFR for $1989-1990$ was just 1.3 lifetime births per woman, which revealed that there was an over 50% reduction when compared to the 1950s. The authors conclude the potential causes of this low fertility with the following factors: the decline of marriage rate, the increasing mean age at first birth, higher education level received, and higher female labor market participation, most of which are further confirmed by other surveys or research papers. A policy context validates the Spanish fertility is still decreasing as the enrollment in high education increases (leading to the postponement of marriage and childbearing), the percentage of dual-earner households is on the rise, and the family policies are still incomplete [East-West Center, b].

3 Data and Methods

3.1 Sources of Data

Table 1: Descriptive statistics of dependent variable.

Variable	Description	Obs	Mean	Std.Dev	Min	Max
$nbthcld$	number of children ever given birth to	7230	2.126	1.008	1	10

We use single-round and cross-national survey data in 2018 from ESS (European Social Survey). This survey is conducted every two years, and its content includes usage of media, political participation, religion and race, population statistics, and so on. Six countries are selected as our research subjects, including France, Sweden, Norway, Poland,

Table 2: Descriptive statistics of independent variables.

Variable	Description	Obs	Mean	Std.Dev	Min	Max
$gndr$	gender	5541	1	0	1	1
$eduyrs$	years of full-time education completed	10591	12.873	4.593	0	60
$hinctnta$	household's total net income, all sources	8174	5.287	2.703	1	10
$wrkctra$	employment contract unlimited or limited duration	8155	1.291	.564	1	3
$agefrch$	age of having the first child	7074	27.354	5.443	1	61
$wkhtot$	total working hours per week	8821	39.834	13.872	0	168

Table 3: Macro-level variables in six countries.

Variable	Description	French	Sweden	Norway	Poland	Spain	Italy
gdp	2018 nominal GDP per capita (thousand)	41.631	54.589	81.734	15.461	30.338	34.520
$flfp$	2018 female labor force participation (%)	0.5079	0.6116	0.6044	0.4891	0.5201	0.4084
$bene$	2017 family benefits public (%)	2.880	3.395	3.242	2.615	1.192	1.984

Italy and Spain. By merging data of these six countries, we get approximately ten thousand data which are taken as micro-level variables in our model. Among these statistics, we utilize the following columns: age of having the first child, age, female education years, working contracts, and net income.

3.2 Descriptive Statistics

In Table 1 and 2, we present the descriptive statistics of all the variables. *nbthcld* represents the number of children that a woman has given birth to. *gndr* is gender which will be eliminated when it's a man; therefore, there are only 5541 effective data left. *eduyrs* displays the total education years of a woman. *hinctnta* which is presented through deciles symbolizes the net income level of a household from all sources when compared to other families domestically. *wrkctra*, divided into no contract, limited contract and unlimited contract, describes the female's current situation of working contract. *agefrch* is the age of a woman giving birth to the first child, which is calculated by female's birth year and the year she enters motherhood. Lastly, *wkhtot* is a woman's weekly working hour, which is later removed from the regression model due to potential contradiction with female's working contract.

In Table 3, there are three macro-level independent variables used to differentiate selected countries, including GDP per capita, female labor force participation rate and family benefits public. Among them, the data of family benefits public, measured in percentage of GDP, are taken in 2017 because some of them were missing in 2018 statistics.

4 Model

We calculate the education-specific fertility rate of the six countries, and the results are illustrated in Figure 1. The figure shows that all the countries have decreasing fertility rate as the schooling years increase at first, and after their fertility rates drop to the lowest point, they climb up again. In order to catch the trend of the fertility rate more precisely, we add the square term into our regression. We expect that the coefficient of the "number of education years" should be negative, while that of the square term of it will be positive, and the turning point will fall in around eighteen to nineteen years.

Moreover, when it comes to number of children a woman has ever given birth to, the problem must be multiple levels. Number of years of education, income, working contract and age of having the first child are characteristics of individuals, but GDP per capita, female labor force participation and family benefits public are indicators of countries that they do not vary across all individuals. Therefore, we use hierarchical linear model to do the estimation. In our model, there are two nested levels: individuals and countries. For individual i in country j, the equation to be estimated is defined as

$$\begin{aligned} nbthcld_i = \beta_0 + \beta_1 eduyrs_{ij} + \beta_2 eduyrs_{ij}^2 + \beta_3 wrkctra_{ij} + \beta_4 hinctnta_{ij} + \beta_5 agefrch_{ij} \\ + \gamma_0 gdp_j + \gamma_1 flfp_j + \gamma_2 bene_j + u_{ij}, \end{aligned} \tag{1}$$

where $wrkctra$ and $hinctnta$ are categorical variables, so we use groups of dummies to represent them.

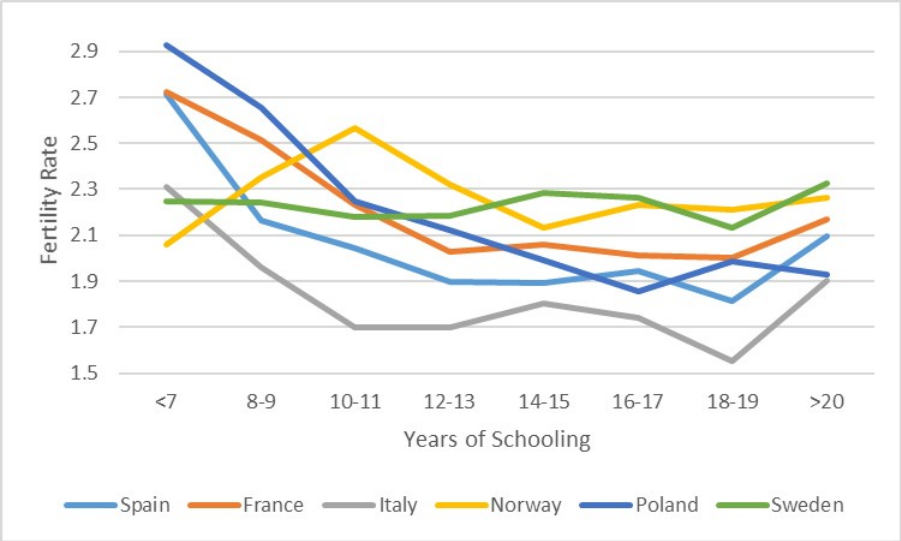

Figure 1: Education-specific fertility rate by country.

5 Results

In this section, we will not only discuss the results demonstrated by the regression model but also provide some previous references to support our arguments.

5.1 Impacts of Micro-level Variables

First we put only micro-level variables into the regression. That is to say, there is only one level in the hierarchical linear model, so it has no difference with the OLS model. The result of the simplest model is as the first row of Table 4.

In line with our expectation, years of schooling has significantly negative influence on the number of children ever given birth to, and the square term of schooling years has significantly positive impact on it. The results mean that as the education level becomes higher, woman's fertility rate will decrease in the beginning, but after the fertility rate drops to the lowest point, in our research, with 18.07 years of schooling, the effect becomes positive, and this U-shaped relationship has been explained by Hazan and Zoabi [2015]. They state that childcare will be relatively cheaper for women with college or advanced degrees, which may cause the fertility rate increase again after reaching the lowest point.

We divide the data of household net income into ten deciles and take the bottom decile as the base group. From the results, we can observe that the households with higher income will have lower fertility rate. Moreover, the fifth decile and the fourth decile are highly significant on a 1% level, which might demonstrate that the opportunity cost of quitting the job to have babies is increasing. However, there is a sudden rise in the top decile, which may be explained by the conjecture that females in the top decile do not need to worry about the opportunity cost of having children, since their household income is high enough to offset the disadvantages. The aforementioned finding is partly consistent with Borg [1989], which presents that if the net price of child is controlled, there is a positive relationship between fertility and income.

Limited working contract is shown to have a negative effect on the number of children and is significant on a 5% level. The results are consistent with a previous study [Adsera, 2011], demonstrating that women under atypical contracts will be less likely to enter motherhood, for they are afraid of not being granted a renewal if they get pregnant, or there being a higher hindrance to return to the labor market after reproduction. Notwithstanding females under no contract may belong to either housewives or those who are looking for a new job, they can be both recognized as having lower opportunity cost to deliver babies, thus causing a positive effect on the number of children, even though it does not reach the significance level. Nevertheless, this variable may not be able to thoroughly explain how this current working condition will correlate with the number of children they have given birth to, as it may relatively exert more influence on females' willingness to bear a child.

Aligned with our intuition, there exists a significantly negative effect between number of children and maternal age. In medicine, the quantity and quality of oocyte start to drop at the age of 32, and plunge even at a faster pace after age

Table 4: The association between total fertility rate and number of education years.

VARIABLES	(1) nbthcld	(2) nbthcld
eduyrs	-0.0466***	-0.0571***
	(0.00973)	(0.00987)
eduyrs2	0.00137***	0.00158***
	(0.000321)	(0.000325)
wrkctra		
limited	-0.0945**	-0.0773*
	(0.0415)	(0.0416)
no contract	0.0692	0.0855
	(0.0671)	(0.0667)
agefrch	-0.0516***	-0.0494***
	(0.00265)	(0.00268)
hinctnta		
2^{nd} decile	-0.111	-0.108
	(0.0705)	(0.0701)
3^{rd} decile	-0.160**	-0.160**
	(0.0709)	(0.0705)
4^{th} decile	-0.117*	-0.113
	(0.0709)	(0.0706)
5^{th} decile	-0.217***	-0.229***
	(0.0712)	(0.0707)
6^{th} decile	-0.180**	-0.189***
	(0.0708)	(0.0704)
7^{th} decile	-0.168**	-0.169**
	(0.0710)	(0.0706)
8^{th} decile	-0.147**	-0.175**
	(0.0748)	(0.0744)
9^{th} decile	-0.0283	-0.0509
	(0.0762)	(0.0758)
10^{th} decile	0.0855	0.0481
	(0.0776)	(0.0771)
gdp		1.49e-05
		(0.00105)
flfp		1.526***
		(0.305)
bene		0.0217
		(0.0261)
Constant	4.003***	3.181***
	(0.106)	(0.163)
Observations	4,546	4,546
R-squared	0.098	0.111

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

37 years [No, 2014]. From a biological perspective, one entering motherhood at a higher age will naturally shorten the reproductive years as well as make it harder for women to conceive, and thereby be more likely to give birth to fewer children. Over the past few decades, the mean age at childbearing among European countries has risen from 26.5 years to 29.4 years, whereas, a pronounced decline in fertility was also witnessed in the meanwhile, from 2.7 births per woman to 1.6 births [UN]. Generally speaking, there is an evident shift towards higher maternal age as more and more females postpone motherhood to their 30s, which brings about the peak births in $30-34$ years among most of our researched countries, exclusive of Poland [Family Database]. Despite the increment on fertility in women's early 30s, the descent still cannot be offset since females are indeed choosing to have fewer offsprings for whatever reason.

5.2 Impacts of Macro-level Variables

However, in order to control the differences between countries, both micro-level as well macro-level variables should be included in the hierarchical model as the second row of Table 4. Coefficients of micro-level variables in this model are all similar to those in the model without macro-level variables. The only obvious difference between the two models is that in the second model, effect of having limited working contract becomes less significant. It is because labor force markets are different in the six countries, therefore if we don't control their differences through macro-level variables, the effect of the working contract in the first model might be over-estimated. In this sub-section, we will discuss the impacts of those macro-level variables on fertility.

As we mention in the literature review section, GDP should have a negative effect on fertility rate whether it happens in rich or poor countries in general conditions [Li, 2016]. Nevertheless, the results display a positive but insignificant correlation between fertility and GDP per capita. To justify this counterintuitive finding, we utilize the demonstration from Tragaki and Bagavos [2019] that there is a positive relationship between fertility and GDP per capita among developed countries , for people will be reluctant to have babies under economic uncertainty. We thus infer that the countries we selected bring about the result that a positive relationship exists between GDP and fertility, which is referred to an inverse J-shaped pattern in recent years [Myrskylä et al., 2009, Luci-Greulich and Thévenon, 2014].

The presence of a statistically significant positive effect of female labor force participation testifies that women in a society with higher female employment rate will often have more children, and the potential reason is elaborated as follows. In the first place, countries with higher female employment rate may somehow manifest higher gender equality or better social acceptance on this phenomenon. In this view, women need not to be torn between career and family life, especially reproduction here. Mediterranean countries are well-acknowledged as having strong family bonds, that is, women are more often to be seen as caretakers in the family, and once they give birth to children, they will have a hard time getting back to the labor market, which can also be partially attributed to the lack of childcare centers [Lesthaeghe, 2010]. On the contrary, complete welfare system along with flexible and family-friendly labor force regulations are well established in Scandinavian countries as well as France, which helps females better acquire work-life balance. Nevertheless, it should be noted these inferences may just be sectional [Engelhardt and Prskawetz, 2004] that it can fail to interpret some other Asian, African, or Latin American cases.

In practice, family policies that aim to encourage fertility can be generally divided into two types — monetary subsidies and childcare assistance. The former can be in the form of either family allowance or tax deduction, which intends to alleviate parents' financial burden, while the latter includes maternity leave, parental leave as well as the provision of childcare centers, in the view of lowering women's opportunity cost of childbearing. Following this logic, it is reasonable to expect a positive effect that family policy will have on the fertility rate. Yet, this insignificant effect may be imputed to the following reasons. As stated previously, family benefits can take the form of either pecuniary compensation or practical family-friendly provisions — arguably more effective than the other — while the relative proportion varies by country. Still, in spite of the same implementation, these manners perform differently on the first birth and subsequent births [Kalwij, 2010], which cannot be controlled in our research. Last but not least, paid leaves will encourage fertility on the one hand, while slightly offset the overall reproduction since it requires parents to be employed, which is shown to somehow make men and women postpone childbirth [Luci-Greulich and Thévenon, 2013].

6 Conclusions

In this paper, we mainly estimate the effect of education on fertility in six European countries by using hierarchical model. We find that an increase in schooling years will cause the decrease on the number of children women given birth to. But the effect will be inverted when the number of schooling years becomes large enough. Also, when a country has higher female labor force participation, women in that country may be more willing to have children.

However, there are quite a few scholars point out that education may be endogenous. In our research, education level may be related to family income, therefore some bias might exist in our regression. To solve this problem, finding an instrumental variable for education will be a feasible solution.

Moreover, in the data of ESS (European Social Survey), we only have micro-level data, so we have to acquire some macro-level variables to control the differences among countries. In the survey data, the years women given birth to children range from 1950s to 2010s, but those country-level variables can only date back to 1970. Thus, for example, for a woman giving birth to her first child in 1960, it is impossible to assign GDP per capita or any other macro-level variable in 1960 to her. We now choose the values in 2017 or 2018 to simply control the countries' differences, but if we intend to go further to analyze the relationship between those macro-level variables and fertility, we may regard our data as panel data and introduce the methods of time series.

The last factor that may cause bias in our study is that some responses to this survey are merely based on the current condition, such as working contract, family income, and the number of children; yet they may vary with time. For instance, the data not being conducted at the end of women's reproductive years can fail to record the real number of children women ever given birth to, or the current working condition may not be generalized to the past. This deficiency could be partially fixed with a probit model discussing the willingness to have children instead of the actual amount. If not using probit model, regarding our data as panel data may also be a proper way.

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