The Effect of Fertility and Abortions on Female Employment Rate

By Irina Samsonova

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Department of Economics

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Supervisor: Professor László Mátyás

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Abstract

The research scope of this thesis is to analyze the effect of fertility and abortions on female employment rate. The female employment rate is a very important economic indicator of the welfare of countries because in many developed economies, women contribute considerably to the production of the GDP. Thus, governments try to increase this participation ratio and thereby improve welfare of countries. The study is based on the data across 20 countries for the 2000-2008 time periods. The results of the estimation show positive and strong enough relationship between fertility and female employment rate and also positive, however weak, relationship between abortion rate and female employment rate. The conclusion is that both, fertility and abortions have an overall positive effect on female employment rate.

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Introduction

The scope of my study is to analyze the effect of fertility and abortions on female employment rate. The female employment rate is a very important economic indicator of welfare of countries because in many developed economies, women produce a considerable part of the GDP. Thus, governments try to increase this ratio and thereby improve welfare of countries. In order to succeed in this, it is important to understand what factors have an impact on female employment rate. Fertility rate is one of these factors and the question how and through which mechanisms it affects female employment is very popular and frequently discussed. From the natural point of view fertility can affect female employment in two different directions. On the one hand childbearing and care about small children after birth require a lot of time and work at home of mothers, thus women may be not so willing to participate in the labor force during this time. On the other hand, however, in the modern world child caring is assumed to be, and not without reason, very expensive, thus it could be a necessity for mothers to look for a job right after a birth of a child.

In the modern world, where employment is associated with paid work out of the home it is generally assumed that relationship between female employment and fertility is negative. According to Sweet (1981) it could be a casual relationship between fertility and female employment: lowered fertility as a result of more women intend to be employed. Cramer (1980) in his article, devoted to the same problem, supposed that the present female employment reduces not only real fertility but also expected one. However, since the middle of 1980 there is evidence that contradicts these theories. Countries with high female employment rates also indicate high fertility rates. This result is often explained by some authors (Rindfuss et al., 2003, Ahn and Mira, 2002) as a changing sign from negative to positive in association between female employment and fertility rate. While other authors, particularly Kögel (2004) provide evidence that there is no change in sign between these

indicators rather a reduction in the negative association between fertility and female employment after 1985.

To summarize, although there are a lot of studies in this area, it is very difficult to get a simple conclusion. First of all, because a majority of studies show a negative relationship between fertility and female employment rate there are also some studies that contradict this theory and indicate a positive relation. And the second problem is that the causality of this relationship is still not very clear, because it is assumed that either female employment or fertility influences each other in a complex way.

Another indicator that obviously has an effect on female employment is abortion rate. The relationship between female employment rate and abortions has an even more complicated form. Abortion is one of the most disputable and difficult subjects in modern society and a lot of research works have been carried out in order to understand what factors have an impact on it. In the modern world, abortion is regarded as one of the easiest ways to stop unintended pregnancies. This type of medical care has its own advantages and disadvantages. On the one hand, with the help of abortions women get a chance to choose whether to have a child or not even in a case when pregnancy has already happened. As a result, abortions allow reducing the number of unwanted births and through this process the number of orphans which parents do not care about. On the other hand, abortions can be rated as inhumane because people do not give a child a chance for a life. And obviously, abortion rates have also a great influence on female employment. Using the US data Joseph Wright (2008) argues that bearing a child has opportunity costs for women and can lead to conflict between women's career and family. In a case of unintended pregnancy a woman has to choose between child-bearing and continuation of work. It is often the case when women make a decision in favor of work and consequently incline to abortion. This means that there should be positive relations between abortions and female employment rate.

To summarize, understanding the links between labor supply of women and variations in fertility is very important in order to predict changes in both these variables in the future. Childbearing and women's labor supply generate the household maximization problem, since women jointly make their decisions about participating in labor and giving birth and also decide about the timing and number of children. If the majority of studies are right and it is a negative relationship between fertility and female employment, then taking into account that female employment is becoming the establishment trend and the quantity of working women is increasing from year to year, the problem of low fertility can arise as a social problem, connecting with so called double burden for women. On the other hand, since a number of studies found a change in sign between fertility and female employment after the 1980s, and thus associated higher female employment rate with lager fertility. This change in sign can be attributed to development of family friendly policies as well as to the increase in the availability of childcare institutions and an access for women to part-time jobs. These measures are associated with a decrease in incompatibility between two woman's roles: worker and mother.

Thus, fertility as well as childcare and female employment are the major factors integrated in individual's life cycle decisions and understanding the nature of their interconnection is crucial in order to succeed in development of positive economic and social environment in countries.

In this thesis I examine the effect of fertility and abortion rate on female employment rate using data from 20 countries. My research is based on estimation of a model with four different estimation methods, Pooled OLS (POLS), Fixed Effects (FE) and also estimation using Instrumental Variables (IV) with and without Fixed Effects. The model includes basic variables, which are male employment rate, growth rate of total employment, mean age of first marriage for women and also key variables: fertility rate and abortion rate. The

regression results show not only the sign of the relationships between fertility rate and female employment rate and also between abortion rate and female employment rate, but also the magnitude.

The thesis is organized as follows. In chapter one I discuss the theoretical framework behind the relationship between fertility rate and female employment rate and also review some relevant literature and studies which were made in this scope. The second chapter consists of description of the data which was used in my study and also the source of the data. In the third chapter I present the econometric model and its descriptions as well as four estimation methods. The fourth chapter provides estimation results. And, finally, in the Conclusion I summarize the main findings of my research.

Chapter 1. Literature review

A lot of studies were done in this field in order to understand which factors affect female employment rate and what is the nature of relationships between female employment and other economic and social indicators. One of the most interesting and frequently discussed interactions is between female employment and fertility. A large number of research works has been done in this area but there is no one definitive conclusion either about the direction in which these parameters influence each other or about the magnitude of this relationship.

The earliest studies about this issue suggested that there is a negative relationship between fertility and female employment. Thus, women's responsibility for childbearing and giving birth constrain their active participation in the labor force (Bowen and Finegan, 1969, Sweet, 1973).

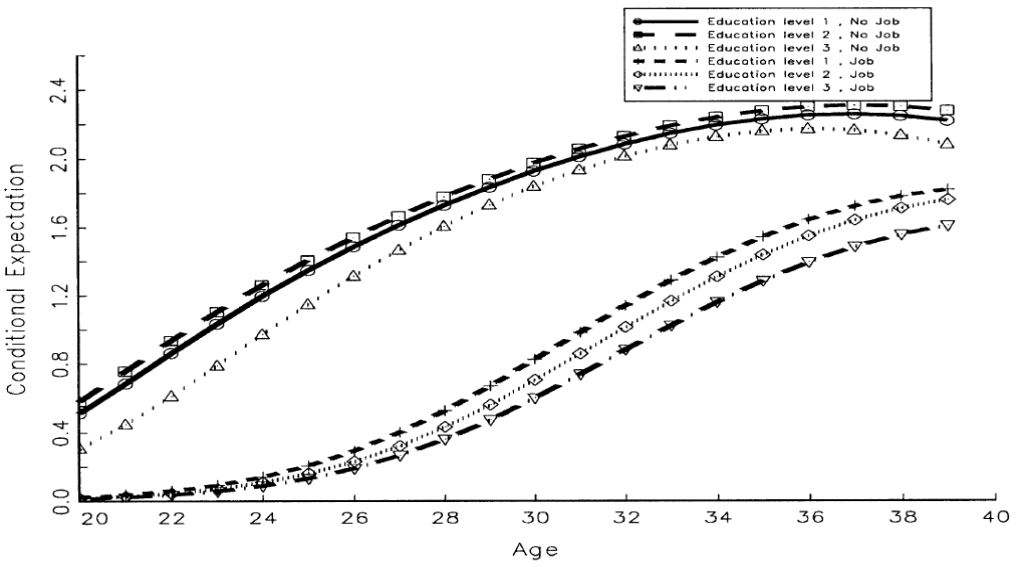
Waite and Stolzenberg (1976, 1977) studied the relationships between expected employment statuses of women and expected family size and found that employment rate affects expected fertility in a very strong way while the effect of expected fertility on employment rate is weak. However, almost at the same time another study made by Smith-Lovin and Tickamyer (1978) examined two main factors: how many years the wives worked since have got married and for how many children they gave birth to. And the results were the opposite to the ones of Waite and Stolzenberg in terms of direction of the effect. So, they found that fertility affects number of years employed in a very strong way while number of years of employment has just a weak effect on the number of childbirths.

Also, James Cramer tried to investigate the causality of the relationship between fertility and female employment using studies discussed above as an initial point. In his work "Fertility and Female Employment: Problems of Causal Direction" (1980) he analyzed the

data from the Panel Study of Income Dynamics, a large national sample of households in the US interviewed in 1968 and reinterviewed annually, using dynamic recursive model of Wife's Hours Employed in 1975, 1974, and the Year Following Childbirth and also model of Wife's Fertility Status from 1972 to 1974 ,Hours Employed before and after Having a Baby (or "Not Having a Baby in 1973"), and Hours Employed in 1975. A recursive model was used instead of non-recursive one in order to avoid the problem of multicollinearity. And the results were quite interesting. In the short run fertility has a great effect on wife's employment that coincides with the results from Lovin and Tickamyer. But in the long run it is employment that has a large effect on fertility and that replicate results obtained by Waite and Stolzenberg (Cramer, 1980).

Further, this question was discussed by Adriaan S. Kalwij who analyzed how female employment status affects the presence and number of children in the Netherlands (Kalwij, 2000). He used a micro-data from the SocioEconomic Panel (SEP) of the Netherlands from 1986 to 1994 years. The results are present in Figure 1.

Figure 1. The conditional expectation of the number of children given the employment status of the woman by age and education level.



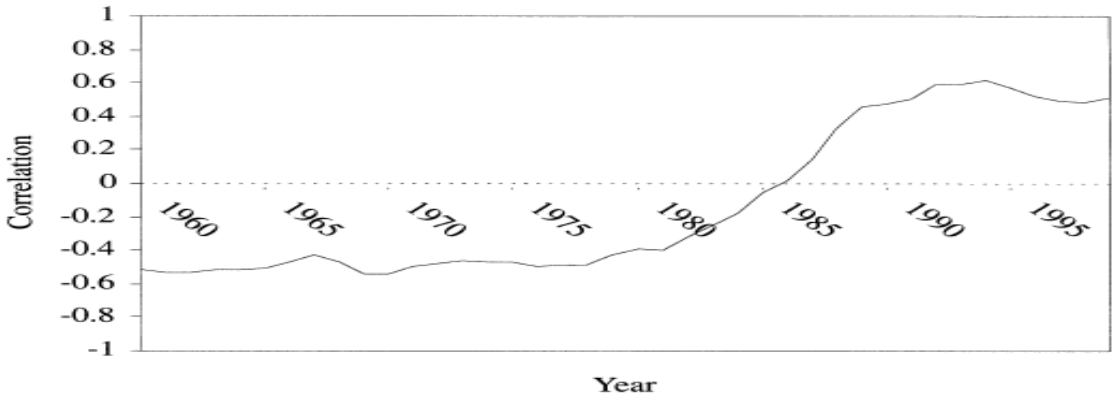
Thus, the study has showed that in female employment a key factor is the presence and number of children: employed women tend to postpone childbearing for the future and also have fewer children than unemployed women, holding education constant. Controlling for female employment, results show that highly educated women put off children later in time and also have fewer children compared to lower educated women.

Again the issue of relationship between fertility and female employment was discussed by Robert McNown and Sameer Rajbhandary. They investigated relations among fertility, labor force participation, female wages, education levels and relative male cohort size. The authors used time series methods of estimation and United States data from post WWII period, namely from 1948 through 1997 years. The analysis showed that fertility affects female labor supply, but the opposite effect is insignificant (McNown and Rajbhandary, 2003).

However, other authors presented different results. Henriette Engelhardt et al. while examined the long-run relationship between female employment und fertility, found that the causality runs in both directions namely, that fertility affects female employment and female employment, in turn, affects fertility and suggested that " previous research has tended to reject causality too often" (p.118). They used macro-series data from 1960 to 2000 for six developed countries (France, West Germany, Italy, Sweden, the UK, and the USA) and applied vector error correction models (VECM) to distinguish between long-run and short run causality. The results show the negative correlation between female employment and fertility up until the mid-1970 and insignificant or very weak negative correlation later on (Engelhardt et al., 2004). These results coincide with those found by Namkee **Ahn** and Pedro **Mira (2002) and** Rindfuss et al. (2003). **They showed that the cross-country correlation between fertility and females' participation in labor in OECD**

countries, which was negative before, turned to positive value after the 1980s. Figure 2 illustrates this change for 21 OECD countries.

Figure 2. Correlation between total fertility and female labor force participation for 21 OECD countries, 1960-1999.



(Note: List of countries and data sources are shown in Appendix (Table 10)).

One more study using VECM estimation was made by Evangelia Papapetrou (2004) who tested for the causality of relationship between fertility and female employment using annual data of the United Kingdom for the period 1958-1998. She made this research accounting for changes in the labor market and in the overall economic activity and adding two economic variables, namely real wages and real output, into the vector auto regression (VAR) model. Starting from this model, the main finding of the author is the positive relationship between fertility and female employment.

Rindfuss et al. (2003) also reported a change in the association between female levels of participation in labor force and fertility levels during 1980s. The authors compiled an annual time/country series for the period 1960 to 1995 and, where it was possible, 1996 and 1997. They used data for twenty-two low fertility countries (Note: List of countries are shown in Appendix (Table 10)) and argued that "these transformed associations reflect societal level responses that, in some contexts, have eased the incompatibility between mother and worker roles, and loosened the link between marriage and childbearing" (p.411).

As a response to these studies made by **Ahn** and **Mira (2002) and** Rindfuss et al. (2003) which were associated with a changing sign in relationship between female employment and fertility in OECD countries, paper written by Tomas Kögel (2004) shows that the time-series association between fertility and female employment does not display a change in sign after 1985 from negative to positive. Kögel argued that there are two possible explanations of the opposite sign of this correlation: "first, the presence of unmeasured country-specific factors and, second, country-heterogeneity in the magnitude of the negative time series association between fertility and female employment" (p.45). The author used data from 1960-2000 and divided it into two sub-samples with break-point in 1985 in order to check for the change in sign in the association between female employment and fertility rate after 1985 (Note: List of countries are shown in Appendix (Table 10)). Kögel used panel data techniques to pooled cross-country and time-series data from OECD countries**.** He applied an econometric model which accounted for country effects in pooled cross-country and time-series data. The paper showed that negative association between fertility and female employment reduced in magnitude and also in significance level after 1985. These results are compatible with Rindfuss et al. finding about easing incompatibility between childbearing and participation of women in the labor force.

Agreed on the point that childbirth has a strong effect on female employment and admitted that this affect changed over time Jan Dirk Vlasblom and Joop Schippers (2006) tried to explain these changes using panel data on 20 years on three countries: Germany (1984-2000), Netherlands (1983-1998) and the UK (1991-2001). For the analysis they used a multinomial logit model and included such variables as women's educational level, age at first birth, marital status at the time if birth, last birth observed, spacing between children and regional unemployment rate. The authors conclude from their study that "policy measures and

institutions such as childcare that make the costs of combining work and family lower relative to being a full-time mother seem to increase female participation rates" (p.329).

One more study in this field was done by Jose Maria Da Rocha and Luisa Fuster (2006) and aimed at understanding the role of labor market frictions in explaining positive relationship between female employment and fertility among OECD countries. They used the cross-country and time-series evidence on employment ratios and fertility rates in 1995 year and created a quantitative life cycle model of fertility and labor market decisions and found that "fertility and employment are *positively* associated across economies with different probabilities of finding a job" (p.1189). The key finding of the paper is that there is a positive association between fertility and female employment across economies where probability of finding a job is low. The authors argued that labor market frictions are the main explanatory factors for behavior of fertility rate in countries where women are active participants of the labor market and also that the positive relationship between female employment and fertility could turn into negative one if probability of finding job by women increases.

A research which tried to systematize the existing literature on the relationship between female employment and fertility was carried out by Anna Matysiak and Daniele Vignoli (2007). They created a meta-analysis in order to compare different studies in this field and concentrated on two effects: the impact of employment on fertility and the impact of children on the decision of women to enter labor force. For this reason they collected a meta-data, namely a representative sample of high quality studies published in the time-span 1990-2006. Thus, a quantitative systematization of the existing studies was made with the stress on socio-cultural and institutional setting across countries. As was expected, the study showed a big variation in fertility-employment relationship between different institutional settings. Namely, the conflict between employment and family was much smaller in countries with social-democratic and socialist welfare regimes where working mothers were strongly

supported by low competition in labor market, significant job guarantees and other mechanisms which aimed into increasing fertility together with female employment. Also, the paper showed a big reduction in magnitude of negative impact of female employment on fertility. However, a negative impact of young children on female employment entry became even stronger. It could be explained by the fact that severe competition in labor market creates a big obstacle in re-entry labor force for women who dropped out from participation in labor for the period of childbearing and childcare. The main conclusion of the paper is that various factors, such as institutional factors (childcare subsidies, taxation policies), structural factors (competition and uncertainty in labor market) and socio-cultural factors (support of working mothers) play an important role in explaining the magnitude of conflict between female employment and fertility. These results compatible with previous studies of Rindfuss et al. (2003) and Kögel (2004) discussed above in part that country-specific effects are very important in indicating the relationship between fertility and female employment.

However, another study made by Christin Hilgeman and Carter T. Butts (2008) showed results which contradicted finding of Rindfuss et al. (2003). They examined the relationship between female employment and fertility using hierarchical Bayesian model for analyzing both individual-level data (1995-1997, 1999-2000) and country-level data (1997-2000) for 20 developed countries (Note: List of countries is shown in Appendix (Table 9)). The total number of children ever born was used as a dependent variable. For individual level variables authors applied employment status, current marital status, parental co-residence, highest level of education and "an attitudinal variable – whether the respondent believes that women need children in order to be fulfilled" (p.110). Female's total labor force participation and the percentage of children up to three years involved in some form of childcare were used as macro-level variables. The results of the paper showed that country-level employment rates have a negative impact on fertility. This result differed from what was found by other authors

who told about a reversal in negative fertility-employment relations in the 1980s. However, this study found the positive relationship between fertility and childcare enrolment that means that availability of childcare institutions could smooth the decrease in fertility through the fact that mothers of young children could use childcare services and not drop out from labor force.

Again the problem of relationship between fertility and employment was raised by David E. Bloom et al. (2009). They created a simple theoretical model in order to investigate the effect of fertility on female labor supply and took country-level abortion legislation as an instrument for fertility. Their data set was an unbalanced 5-year panel covering the period from 1960 to 2000 for 97 countries (Note: List of countries is shown in Appendix (Table 10)). The analysis showed that when abortions are available for women total fertility rate decreases on average by about 0.4 children per women compared to most restrictive legal constraints where abortions are illegal. And this result is consistent with worldwide evidence that in recent decades abortion became a very popular method in stopping unintended pregnancies and that around 26 % of pregnancies end in abortion (Henshaw et al. 1999). Thus, authors conclude that fertility rate depends on the abortion low and that fertility, in turn, negatively affects participation in the labor force of women in fertile years (20-44 years). According to study this effect is about 5-10 percentage point that implies that there is a reduction in labor supply by about 1.9 years per women with each additional child.

One of the most recent studies in the field of my thesis was made by Vinod Mishra et al. (2009). This study investigated relationship between fertility and female labor force participation using annual time series data from 1960 to 2006 years for the G7 countries (Canada, France, Germany, Italy, Japan, UK, US). In their research authors applied panel unit root, panel cointegration and panel Granger causality testing. The authors also stressed some advantages of their study. Firstly, panel tests give more precise results than individual ones. Secondly, in the estimation they used fully-modified ordinary least squares (FMOLS) in order

to test is that positive or negative relationship between fertility and female employment. And finally, more recent data was collected compare to existing studies. Figures 3 and 4 provide the time series for fertility rate and female labor force participation for each of the G7 countries for the period from 1960 to 2006.

Figure 3. Time series of total fertility rate for the G7 countries, 1960–2006

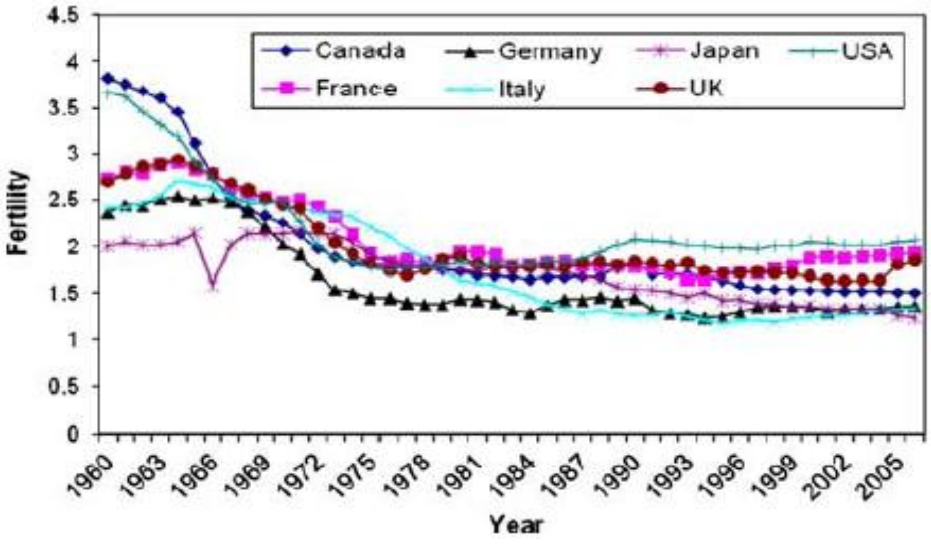
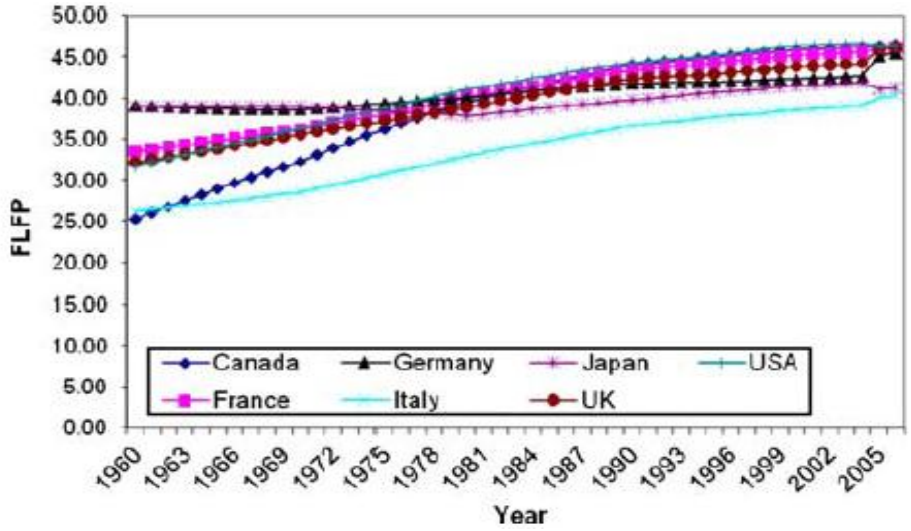


Figure 4. Time series of female labor force participation (FLFP) for the G7 countries, 1960-2006



It can be seen from the graphs and also verified by the results of the study, that there is a negative relationship between fertility and female employment. And the key finding of the

study is that "long-run Granger causality runs from the total fertility rate to the female labour force participation rate and that a 1% increase in the total fertility rate results in a 0.4% decrease in the female labour force participation rate for the G7 countries"(p.361).

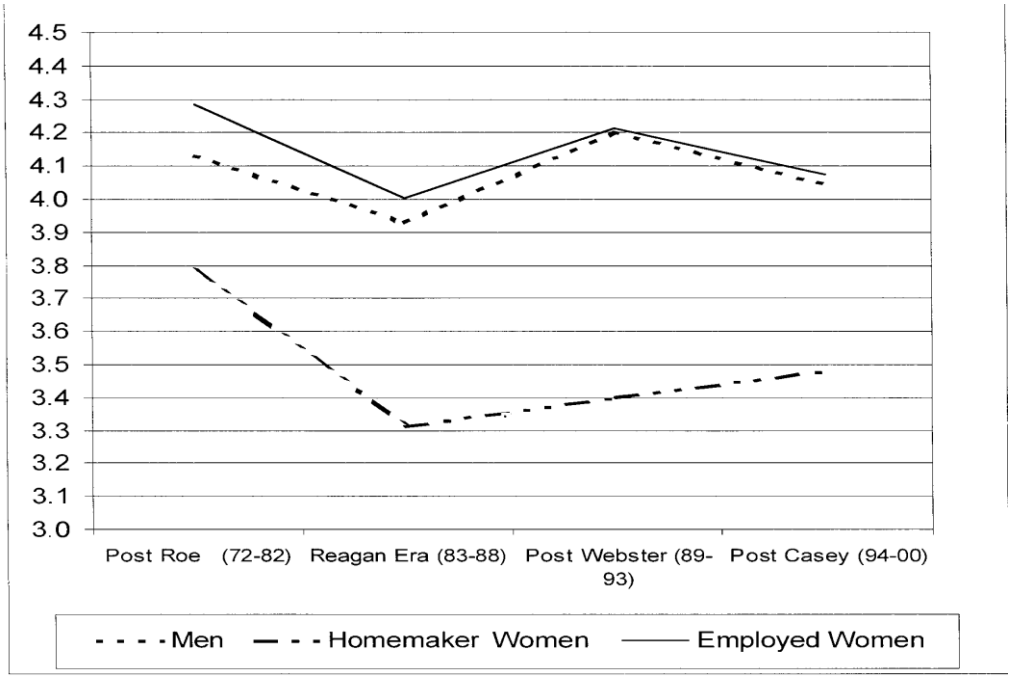
One of most recent and powerful studies connected to my topic was made by Ana Nuevo Chiquero (2010). The paper examined the impact of unplanned childbearing on female labor force participation and income. One of the most interesting things is that the author did not use the fertility rate in total, but just unplanned births, which are defined as ones which happened when women trying to avoid pregnancies through contraception use. And then an unplanned pregnancy occurs, women has no more choice whether to become pregnant or not and when to do so, but only whether to terminate the pregnancy through induced abortion or not. The data was obtained from waves III to VII of the US National Survey of Family Growth (NSFG) in 1982, 1988, 1995, 2002 and 2006-2008. Namely, it was the representative sample of women aged 15 to 44 and included labor force status, female income, pregnancies, contraception status at the time of conception and induced abortions. The findings show that an unplanned birth reduces female labor force participation by as much as twenty five percents, which is a considerably higher effect than was found in previous researches. However the negative effect reduces over the sample period 1973-2005. In addition, the effect of birth was estimated on a sample of planned pregnancies. In this case OLS estimation provides an unbiased result of the casual effect of birth because of absence of abortions. No evidence was found that planned pregnancies have a similar pattern to unplanned pregnancies.

A large number of studies were made in order to investigate the relationship between fertility and female employment; there is not so much evidence on the association between female employment and abortions. Ted G. Jelen et al. (2002) were trying to determine that effect gender and employment statuses have on abortion attitudes. They used three independent variables employed men, employed women and homemaker women in order to

check how these three groups view the abortion issue. The respondent's attitude toward legal abortion was took as a dependent variable and it was ranging from 0 (most pro-life) to 6 (most pro-choice). The data was taken from the US General Social Survey (GSS) from 1973 to 2000 years.

The authors analyzed the attitude to the abortions for each respondent's groups separately and the data was dividing into four time periods: the first from 1973 to 1982, the second from 1983 to 1988, the third from 1989 to 1993 and the fourth from 1996 to 2000. The results present in Figure 5.

Figure 5. Abortion attitudes over time (by gender and employment status).



As can be seen from the graph, men and employed women show quite similar attitudes toward abortions and have almost identical dynamic of their attitude over time, while homemaker women exhibit a much lower "pro-choice" attitude. Thus, results of the study showed that homemaker women are more "pro-life" that men or employed women and, consequently, the conclusion could be made that "the causes and effects of abortion attitudes do not appear to be gender-specific, but rather are relatively uniform across genders and employment statuses" (p.321).

To summarize, while there is a lot of empirical evidence on the issue of relationship between fertility and female employment, it is still very difficult to make any kind of final conclusion. Although a majority of studies indicate a negative relationship between fertility and female employment some of them contradict this result. Moreover, different authors implement various estimation methods and employ sundry control variables in their analyses.

As a base for my research I use the study made by Kögel (2004), who used panel data techniques to pooled cross-country and time-series data from OECD countries**.** So, I also use panel data and estimate the effect of fertility on female employment using econometric analysis and such control variables as male employment, total employment growth rate and mean age of women's first marriage. Also, as Ana Nuevo Chiquero did, I investigate the impact of planned and unplanned births on female labor force participation, however not separately but together. For this purpose I use fertility rate as my independent variable, which includes both planned and unplanned births. Unplanned pregnancies refer to ones which happen while women use some of contraception methods in order to avoid this, and planned pregnancies happen after women stop to use contraceptives in order to become pregnant. As I account for unplanned pregnancies as well, I add abortion rate in my analysis because it is a very common way of stopping unintended pregnancies and its omission can lead to biased results. Thus, I analyze the interdependence of fertility and female employment for a quite large list of countries and the main question of my paper is whether there is a negative relationship between fertility and female employment and, if so, can we accept the incompatibility hypothesis, or this relationship is positive and we can conclude that changes in social norms and attitude toward working mothers make that easier for women to re-enter the labor market. In addition, I investigate the effect of abortions on female employment using abortions as a reverse side of fertility.

Chapter 2. Data description

The analyzed sample consists of the panel data from 20 countries for which the complete data set was available (Table 1) from 2000 to 2008. Thus, the total number of observations for nine years is 180. All information I use is provided by the United Nations Economic Commission for Europe (UNECE, available at http://w3.unece.org/pxweb/DATABASE/STAT/Statistics.asp).

Here the data about six variables which I use in my analysis:

- *female employment rate;*
- *total fertility rate;*
- *legal abortion rate;*
- *male employment rate*
- *growth rate of total employment;*
- *female mean age at first marriage.*

Female employment rate

The dependent variable, which I am interested in, *female employment rate,* is the share of the employed in the population of the corresponding sex. In my analysis I use the age group of women of 15+ in order to get more extensive results. Also I include female employment rate for all marital statuses which is the legal conjugal status of each individual in relation to the marriage laws or customs of the country. Namely, all marital statuses include:

- Married;
- Never married (single);
- Widowed (and not remarried);
- Divorced (and not remarried).

Total fertility rate

The first explanatory variable is *total fertility rate* which is defined as the average number of children which would be born alive to a woman during her lifetime if she were to pass through her childbearing years conforming to the age-specific fertility rates of a given year.

Legal abortion rate

The second independent variable is the *legal abortion rate* which is defined as a number of abortions per 1000 live births during a given year. This variable refers to legally induced early foetal deaths and does not cover spontaneous abortions (i.e. miscarriages).

Male employment rate

One of the control variables is *male employment rate*. The *male employment rate* is the share of employed persons in the population of the corresponding sex. As in the case of female employment, here I also use the age group of man of 15+. I include this control variable under the assumption that male employment rate has an effect on my dependent variable - female employment rate. The more men employed in a country the better economic situation in the country. The better economic situation gives more possibilities for women to find jobs and actively participate in labor force. Thus, as far as female employment rate and male employment rate do not depend on each other but both depend on some economic and political aspects of countries and so, should move in one direction in case of some changes in these aspects, I expect male employment rate to be positively related with female employment rate.

Growth rate of total employment

The next control variable in my analysis is the *growth rate of total employment.* When the total employment is growing consequently both male and female employment are also rising. For example, in the recession periods when country suffers from financial crisis it is associated with a large rate of unemployment for both men and women. So, the decrease in

growth rate of total employment is followed by a reduction in female employment rate. And vice versa, in periods of economic growth when growth rate of total employment is increasing, the number of employed people is also increasing due the fact that more people have the opportunity to find jobs. So, it is natural to assume that the growth rate of total employment has a positive effect on female employment rate.

Female mean age at first marriage

Female mean age at first marriage is the weighted average of the different ages (limited at age 50), using as weight the age-specific marriage rates for women for first marriages only. I include this variable in my analysis as a control variable because it could be positively correlated with female employment rate. This assumption comes from the point of view that the earlier a woman gets married the more chance she has to stay at home devoting her time to housekeeping, given the fact that her husband will provide her with all the necessities. Additionally, if a woman gets married earlier it is very possible that she will give birth earlier and consequently leave the labor force and stay at home for a child. Thus, the lower the women's age at first marriage, the smaller the female employment rate in a country.

Controlling for all of these variables is required in order to obtain a ceteris paribus effect of fertility rate and abortion rate on female employment rate. The summary of variables and their statistical description is given in Table 2.

Table 1. The list of countries used for the regression

Bulgaria	Georgia	Lithuania	Slovakia
Croatia	Germany	Moldova	Slovenia
Czech Republic	Hungary	Norway	Spain
Estonia	Iceland	Poland	Sweden
Finland	Latvia	Romania	Switzerland

Table 2. Statistical description of the variables of the model

Variable	Description	Mean	St. Deviation	Number of observations
femplrate	Female employment rate at age group of 15+	48.73	9.74	180
fertilrate	Total fertility rate	1.43	0.24	180
abortrate	Number of abortions per 1000 live births	359.27	233.32	180
memplrate	Male employment rate at age group of 15+	61.17	8.75	180
emplgrowthrate	Growth rate of total Employment	0.75	2.34	180
meanagefm	Female mean age at first Marriage	27	2.5	180

Chapter 3. Model specification

As mentioned in the previous chapters, my main goal is to estimate the effect of fertility and abortions on female employment. To succeed in this I use four methods of estimation: Pooled OLS and Fixed Effect and also Instrumental Variables (IV) method with and without Fixed Effects. Pooled OLS is appropriate if there are no country specific effects. But in the case where country specific effects exist, these must be included into the model and for this reason I use Fixed Effect method. Also I use Instrumental Variables, such as lagged fertility rate and lagged abortion rate to allow for consistent estimation in the case if the explanatory variables are correlated with the error terms and ordinary linear regression produces biased and inconsistent estimates (Woodbridge, 2003).

I use the log-log model**,** i.e. a regression model where all variables enter in logarithms, so that all parameters have the advantage to be interpreted as "elasticities", eliminating measurement unit problems and reducing possible heteroscedasticity effects. Also the most of studies do likewise to study the relationship between fertility and female employment.

In order to get results which are answering the thesis's topic, I analyze one model with the help of four estimation methods. First, I start with the model, where, using pooled OLS and FE estimation methods, I regress log(fertilrate) and log(abortrate) on log(femplrate) and add the control variables log(memplrate), log(magefm) and emplgrowthrate which more precisely describe the socio-economic situation in a given country:

$$Log(femplrate)_{it} = \beta_0 + \beta_1 log(fertilrate)_{it} + \beta_2\, log(memplrate)_{it} + \beta_3\, log(magefm)_{it} + \beta_4\, emplgrowthrate_{it} + \beta_5 log(abortrate)_{it} + u_{it} \quad (1)$$

Where subscripts i and t denote country and time period respectively, β_0 is the intercept and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the coefficients on logarithmic form of independent variables and uit includes other unobserved factors.

Second, I repeat the estimation of this equation using Instrumental Variables (IV) technique with Fixed Effect specification and without this. As IV I use such variables as lagged log(fertilrate) and lagged log(abortrate).

There are several potential problems which can cause inconsistency of the regression results. The first potential problem is the presence of measurement error. It is the case when people underreport or over report information. Since I only use data from the official source and all variables represent the official figures, measurement error probably is not a problem. The second problem which may arise is heteroskedasticity. Thus, in my regression I use White method to handle it.

As was mentioned previously, different studies show different result while answering question about the relationship between fertility and female employment. I tend to believe in the theory that this relationship indeed underwent change in the sign and turn to positive one after the middle of 1980. This change in sign can be explained by development of family friendly policies or increase in availability of childcare institutions and an access for women to part-time jobs. Thus, I expect fertility positively affects female employment rate.

Concerning my second main variable, abortion rate, which I include in the regression in order to see what effect it has on female employment, I also expect it to be positively correlated with my dependent variable. And it is very easy to explain this assumption. In the case where working women became pregnant while the pregnancy was not planned, she will go out from the labor force at least for a short time period, but usually at least for few years. And it is not guaranteed that after that period she will reenter the labor market easily. But with the availability of abortions women can resort to this option and consequently do not leave labor force and continue the development of their careers. Thus, the positive effect of abortions on female employment is very predictable.

Another variable which I add to my regression is male employment rate. I expect it has a positive effect on female employment and it can be easily explained. The more men employed in country the better economic situation in country. The better economic situation gives more possibilities for women to find jobs and actively participate in labor force. Thus, as far as female employment rate and male employment rate do not depend on each other but both depend on some economic and political aspects of countries and so, should move in one direction in case of some changes in these aspects, it is very logically that male employment rate is positively related with female employment rate.

Concerning other control variable which I add to my model, namely, growth rate of total employment, I expect positive relationships between this variable and female employment rate. When the total employment is growing, consequently both male and female employment are also rising. For example, in the recession periods when country suffers from financial crisis it is associated with a large rate of unemployment for both men and women. So, the decrease in growth rate of total employment is followed by reduction in female employment rate. And vice versa, in periods of economic growth when growth rate of total employment is increasing, number of employed people is also increasing due the fact that more people have the opportunity to find jobs. So, it is natural to assume that the growth rate of total employment has a positive effect on female employment rate.

And one more control variable in my regression is women mean age at first marriage. I expect positive relationship between this variable and female employment rate. And the underlying explanation of my expectation is that the later woman gets married, the more time she has to devoting to her career and participating in labor force, since marriage is often associated with becoming a housewife and consequently leaving jobsite. And one additional factor of marriage is childbearing which is also will push women out from employment. Thus,

in my model I use all variables described above in order to get more precise results of my estimation.

Chapter 5. Estimation results

This chapter presents the results obtained from the estimation of the model described in previous chapter. So, the model provides the results for the effect of fertility rate and abortion rate on female employment rate. Table 3 presents the regression results obtained using POLS Method and Table 4 presents ones obtained using Fixed Effect Method.

Table 3. Regressions coefficients for the model estimating the effect of abortion rate and fertility rate on the female employment rate using POLS Method (dependent variable is LOG(FEMPLRATE))

Variables	Coefficient	Standard Error	t-Statistic	Probability
C	1.255	0.309	4.066	0.0001*
LOG(FERTILRATE)	0.606	0.056	10.894	0.0000*
LOG(ABORTRATE)	0.011	0.004	3.085	0.0024*
LOG(MEMPLRATE)	0.913	0.057	15.897	0.0000*
EMPLGROWTHRATE	- 0.008	0.003	-3.054	0.0026*
LOG(MAGEFM)	-0.425	0.097	-4.377	0.0000*
R-squared	0.8492			
Number of observations	180			

* Significant at 99 % significance level.

Table 4. Regressions coefficients for the model estimating the effect of abortion rate and fertility rate on the female employment rate using Fixed Effect Method (dependent variable is LOG(FEMPLRATE))

Variables	Coefficient	Standard Error	t-Statistic	Probability
C	-0.429	0.406	-1.056	0.2926

LOG(FERTILRATE)	0.175	0.046	3.761	0.0002*
LOG(ABORTRATE)	0.038	0.009	4.334	0.0000*
LOG(MEMPLRATE)	0.951	0.041	23.256	0.0000*
EMPLGROWTHRATE	-0.003	0.001	-4.459	0.0000*
LOG(MAGEFM)	0.039	0.094	0.417	0.6775
R-squared	0.9811			
F-statistic	334.932			
Prob(F-statistic)	0.0000*			
Number of observations	180			

* Significant at 99 % significance level.

As can be seen from Tables 3 and 4, POLS estimation Method and Fixed Effect Method provide quite similar results for the estimation of the effect of fertility and abortions on female employment with a small difference in coefficients on variables, besides the coefficient on LOG(MAGEFM) variable. Moreover, three out of four dependent variables are significant at 99 % significance level (Fixed Effect) and all four dependent variables are significant in POLS estimation. This means that all these variables can be good explanatory factors for the changes in the female employment rate. The only one insignificant variable in Fixed Effect estimation is mean age at first marriage. I expected to get positive coefficient on this variable what can be explained by the fact that the later women get married, the more time they will participate in labor force. However, the coefficient on LOG(MAGEFM) is negative and significant in POLS estimation, so this fact would be explained later.

Also I use Instrumental Variables, such as lagged fertility rate and lagged abortion rate to allow for consistent estimation in the case if the explanatory variables are correlated with the error terms and ordinary linear regression produces biased and inconsistent estimates.

Table 5 presents the regression results obtained using POLS Method and Table 6 presents ones obtained using Fixed Effect Method.

Table 5. Regressions coefficients for the model estimating the effect of abortion rate and fertility rate on the female employment rate using POLS Method with Instrumental Variables LOG(FERTILRATE(-1)) and LOG(ABORTRATE(-1)) included into the regression (dependent variable is LOG(FEMPLRATE))

Variables	Coefficient	Standard Error	t-Statistic	Probability
C	1.796	0.358	5.017	0.0000*
LOG(FERTILRATE)	0.707	0.067	10.516	0.0000*
LOG(ABORTRATE)	0.01	0.004	2.612	0.0099*
LOG(MEMPLRATE)	0.879	0.063	13.996	0.0000*
EMPLGROWTHRATE	- 0.006	0.003	-2.071	0.0401**
LOG(MAGEFM)	- 0.556	0.113	-4.934	0.0000*
R-squared	0.8465			
Number of observations	160			

* Significant at 99 % significance level.
** Significant at 95 % significance level.

Table 6. Regressions coefficients for the model estimating the effect of abortion rate and fertility rate on the female employment rate using Fixed Effect Method with Instrumental Variables LOG(FERTILRATE(-1)) and LOG(ABORTRATE(-1)) included into the regression (dependent variable is LOG(FEMPLRATE))

Variables	Coefficient	Standard Error	t-Statistic	Probability
C	1.651	0.608	2.716	0.0075*
LOG(FERTILRATE)	0.558	0.072	7.725	0.0000*

LOG(ABORTRATE)	0.067	0.017	3.827	0.0002*
LOG(MEMPLRATE)	0.828	0.048	17.386	0.0000*
EMPLGROWTHRATE	-0.002	0.001	-2.349	0.0203**
LOG(MAGEFM)	-0.526	0.126	4.167	0.0001*
R-squared	0.977			
F-statistic	340.076			
Prob(F-statistic)	0.0000*			
Number of observations	160			

* Significant at 99 % significance level.
** Significant at 95 % significance level.

As can be seen from Tables 5 and 6 the estimation of the model with Instrumental Variables provides almost identical results for both POLS and Fixed Effect estimation methods, besides the fact that coefficient on EMPLGROWTHRATE became statistically significant at 95 % significance level. Thus, the conclusion can be made, that model estimation provides good results for the explanation of the relationships between fertility rate, abortion rate and female employment. Thus, I want to look at the coefficient of each variable separately and discuss this in details.

To start, one of the two variables of my interest, LOG(FERTILRATE) is significant at 99 % significance level using all methods of estimation. As was mentioned before, a lot of studies were made in order to check how fertility rate affects female employment rate. However, it is still difficult to make any kind of final conclusion, while some researches argue that this is a negative relationship between fertility and female employment, others tend to believe that this negative relation turned into positive one after 1980s. I expected a positive sign of the coefficient on LOG(FERTILRATE) with the underlying assumption that because of changes in social norms and attitude toward working mothers it became easier for women to re-enter the labor market after bringing a child. And, as can be seen from Tables 6, the

coefficient on LOG(FERTILRATE) is 0.558 and positive. Thus, fertility rate has a positive effect on female employment rate and this effect is big enough. Keeping all other variables constant 10 % increase in fertility rate predicts an increase at female employment rate by almost 5.6 %. On the one hand, this can be seemed contradictory, because it is very natural to think that the more time women devote to childbearing and raising children, the less time they have to concentrate on their careers and consequently, the fewer women will actively participate in labor force. On the other hand, in the modern world, where governments of countries understand the importance of demographic problems and also try to increase the employment level in their countries, the development of family friendly policies as well as an increase in availability of childcare institutions and an access for women to part-time jobs can be view as a necessary measures that should be done. These measures are associated with decrease in incompatibility between two woman's roles: worker and mother. And, as regression's result show, for examined data period and for this examined list of countries, the relationship between fertility and female employment is in reality positive, which means that countries with higher fertility rate also have higher female employment rate.

The second variable of my interest, LOG(ABORTRATE) is also significant at 99 % significance level in all estimation methods. The coefficient on this variable is positive one as I expected but very small. The coefficient on LOG(ABORTRATE) is 0.067 and that means that keeping all other variables constant 10 % increase in abortion rate predicts an increase at female employment rate by 0.67 %. The positive sign of the coefficient can be explained very easily. However, on the one hand, this seems contradictory, because it is very natural to think that the more time women work, the more earnings they have and consequently, the more possibilities they have to bring up a child. Still, on the other hand, the more time women work, the less time they have to devote to their families and therefore a lot of women tend to postpone child-bearing and choose abortions in case of unintended pregnancy in order to

continue their career path. As a result, countries with higher abortion rates have higher index of female employment rate.

Concerning one of my control variables namely, LOG(MEMPLRATE), it has a biggest effect on female employment rate and the sing of the coefficient is one that I expected. The coefficient on LOG(MEMPLRATE) is 0.828 and that means that keeping all other variables constant 10 % increase in male employment rate predicts an increase at female employment rate by 8.28 %. These results can be easily explained. The more men employed in country the better economic situation in country. The better economic situation gives more possibilities for women to find jobs and actively participate in labor force. Thus, as far as female employment rate and male employment rate do not depend on each other but both depend on some economic and political aspects of countries and so, should move in one direction in case of some changes in these aspects, it is very logically that male employment rate is positively related with female employment rate. And, as results show, these two variables not only move at the same direction but also almost at the same speed.

The next variable is EMPLGROWTHRATE. The coefficient on this variable is small and the sign is different from one that I expected. The coefficient is - 0.002. Since the program which I use (EViews) calculates natural logarithms, in order to interpret this coefficient I should transform it into 10 based log. After simple mathematical calculations, the coefficient became - 0.000868, which means that keeping all other variables constant 10 % increase in the growth rate of total employment predicts a decrease in female employment rate by about 0.87 %. I expected a positive sign of the coefficient on this variable because of the fact that when the total employment is growing it is natural to assume that both, male and female employment are also rising. However, the result obtained from the regression can be explained by the assumption that if there is a period of economic growth when growth rate of total employment is increasing, number of employed people is also increasing due the fact

that more people have the opportunity to find jobs. However, it is very possible that there are more men than women become employed in these periods of economic growth. Thus, the growth rate of total employment has more effect on men than on women. Checking for correlation between growth rate of total employment and male employment rate (Table 7) and also between growth rate of total employment and female employment rate (Table 8), we can actually see that correlation between male employment and growth rate of total employment twice bigger that one between female employment and growth rate of total employment. Thus, the growth rate of total employment affects male employment rate much more than female employment rate and this why the coefficient on this variable has a negative sign.

Table 7. Correlation between the growth rate of total employment and the male employment rate.

VARIABLES	EMPLGROWTHRATE	MEMPLRATE
EMPLGROWTHRATE	1.00	0.24
MEMPLRATE	0.24	1.00

Table 8. Correlation between the growth rate of total employment and the female employment rate

VARIABLES	EMPLGROWTHRATE	FEMPLRATE
EMPLGROWTHRATE	1.00	0.11
FEMPLRATE	0.11	1.00

The last variable in my regression, LOG(MAGEFM) is not statistically significant in Fixed Effect estimation method, however significant at 99 % significant level in POLS

estimation method and also in estimations using Instrumental Variables. Moreover, the sign on this variable is different from one which I expected. The coefficient on LOG(MAGEFM) is - 0.526 and that means that keeping all other variables constant 10 % increase in abortion rate predicts a decrease at female employment rate by 5.26 %. This negative relationship between female employment and female mean age at first marriage can be explained with the assumption that, the later women get married, the more time they devote to their studies before marriage in order to become more educated and skilled. So, usually people who are studying do not have a lot of free time and consequently do not participate in the labor force. Moreover, this negative relationship between female employment and female mean age at first marriage can also be explain from the different side such as the earlier women get married, the more time they participate at the labor force. The underlying idea is that married women are expected to help their husbands in providing necessities for family and children's needs. Thus, in this case, the marriage is not an obstacle to work and married women participate in labor force in order to make their contribution to the family income.

Conclusion

In this thesis I have examined the effect of fertility and abortion rate on female employment rate using the data from 20 countries for 2000-2008 time periods. The research was based on estimation of the model with four estimation methods, Pooled OLS, Fixed Effects and also Instrumental Variables (IV) method with and without Fixed Effects. Although a lot of studies were made in this area, it is very difficult to get any kind of final conclusion about the relationship between fertility and female employment rate. However, while the majority of studies show a negative relationship between fertility and female employment rate, there are also some studies that contradict this theory and indicate a positive relation. In the model specification I found out that there is in reality positive and strong enough relationship between these two variables. Thus, the increase in fertility rate predicts an increase in female employment rate. This finding can be attributable to several reasons. In the modern world, governments of countries understand the importance of demographic problems and try to decrease an incompatibility between two women's roles: worker and mother. In order to do this, they are trying to develop family friendly policies as well as increase availability of childcare institutions and an access for women to part-time jobs. And these finding coincide with ones obtained by Evangelia Papapetrou (2004), **Ahn** and **Mira (2002) and** Rindfuss et al. (2003) who are also found positive relationship between fertility and female employment.

Concerning the effect of abortions on female employment rate, I found that this relationship is also positive, however the effect of abortions on female employment is very small. Still, these results coincide with ones found earlier. Joseph Wright (2008) using the US data showed that bringing a child has opportunity costs for women and can lead to the conflict between women's career and family. In a case of unintended pregnancy a woman has to choose between child-bearing and continuation of work. And it is often the case when women

make a decision in favor of work and consequently incline to abortion in order to continue their career path. As a result, countries with higher abortion rate have higher index of female employment rate.

Although, this study provides quite clear results on the question about the effect of fertility and abortions on female employment rate, there are still some model improvements that can be done. Since the data used for analysis only covers nine years, it is possible to extend the model by increasing number of time periods as well as number of countries used for the analysis. Most probably the richer data set will provide more precise results and explain the relationships between fertility, abortions and female employment rate more fully.

References

Ahn N. and P. Mira (2002). "A note on the changing relationship between fertility and female employment rates in developed countries", *Journal of Population Economics* 15(4): 667-682

Bloom David E., Canning D., Fink G., Finlay Jocelyn E. (2009). "Fertility, female labor force participation, and the demographic dividend" (Published online: 5 May 2009. Springer Science+Business Media, LLC 2009)

Bowen, William G., and T. A. Finegan , (1969). "The Economics of Labor Force Participation". Princeton: *Princeton University Press*

Chiquero, Ana Nuevo (2010). "The labor force effects of unplanned childbearing". Job market paper, Boston University, November 2010. (Accessed from: http://economics.ceu.hu/events/2011-02-02/job-talk-ana-nuevo-chiquero-boston-university-the-labor-force-effects-of-unplanned) (unpublished)

Cramer J. (1980). "Fertility and Female Employment: Problems of Causal Direction*",* *American Sociological Review,* April, pp. 167-190.

Da Rocha Jos'e Maria and Luisa Fuster (2006). "Why are fertility rates and female employment ratios positively correlated across O.E.C.D. countries?". *International economic review, Vol. 47, No. 4,* November 2006, pp. 1187-1222.

Engelhardt H., Kögel T., Prskawetz A., (2004). "Fertility and Women's Employment Reconsidered: A Macro-Level Time-Series Analysis for Developed Countries, 1960-2000". *Population Studies, Vol. 58, No. 1* (Mar., 2004), pp. 109-120 (Published by: Population Investigation Committee. Stable URL: http://www.jstor.org/stable/4148251. Accessed: 27/02/2011 12:55)

Henshaw S., Singh S., Haas T. (1999). "The Incidence of Abortion Worldwide*",* *International Family Planning Perspectives, Vol. 25, Supplement* (Jan., 1999), pp.

S30-S38 (Published by: Guttmacher InstituteStable. URL: http://www.jstor.org/stable/2991869 .Accessed: 04/03/2011 14:29)

Hilgeman C. and Butts C. (2008). "Women's employment and fertility: A welfare regime paradox", Department of Sociology and Institute for Mathematical Behavioral Sciences, University of California, Irvine, USA (Available online 30 August 2008)

Jelen T., Damore D., and Thomas Lamatsch (2002), "Gender, Employment Status, and Abortion: A Longitudinal Analysis", *Sex Roles, Vol. 47, Nos. 7/8,* October 2002

Kalwij A. (2000). "The Effects of Female Employment Status on the Presence and Number of Children", *Journal of Population Economics, Vol. 13, No. 2* (Jul., 2000), pp. 221-239 (Published by: Springer Stable URL: http://www.jstor.org/stable/20007712 .Accessed: 27/02/2011 12:54)

Kögel T. (2004). "Did the Association between Fertility and Female Employment within OECD Countries ReallyChange Its Sign?", *Journal of Population Economics, Vol. 17, No. 1* (Feb., 2004), pp. 45 -65 (Published by: Springer Stable URL: http://www.jstor.org/stable/20007894 .Accessed: 27/02/2011 12:56)

Matysiak A. and Vignoli D. (2007). "Fertility and Women's Employment: A Meta-analysis", Received: 10 June 2007.Accepted: 5 November 2007. (Published online: 5 December 2007. Springer Science+Business Media B.V. 2007)

McNown R. and Rajbhandary S. (2003). "Time Series Analysis of Fertility and Female Labor Market Behavior", *Journal of Population Economics, Vol. 16, No. 3* (Aug., 2003), pp. 501-523 (Published by: Springer Stable URL: http://www.jstor.org/stable/20007869 .Accessed: 27/02/2011 12:52)

Mishra V., Ingrid Nielsen and Russell Smyth (2009), "On the Relationship Between Female Labour Force Participation and Fertility in G7 Countries: Evidence from Panel Cointegration and Granger Causality", *Empirical Economics* (2010) 38(2): 361-372.

Papapetrou Evangelia (2004), “Does female employment affect fertility? Evidence from the United Kingdom”, *The Social Science Journal 41* (2004) 235–249

Rindfuss, R.R., K.B. Guzzo, and S.P. Morgan (2003). "The Changing Institutional Context of Low Fertility." *Population Research and Policy Review* 22:411–38

Sweet, James A. (1973) “Women in the Labor Force”. New York: Seminar Press

Sweet, James A. (1981). “Work and Fertility”. In *Decision-Making, Family Planning and Child-Bearing*, edited by G.L. Fox. First edition. New York: Sage.

Smith-Lovin, Lynn, and Ann R. Tickamyer (1978). "Labor force participation, fertility behavior, and sex role attitudes”, American *Sociological Review* 43:541-56.

Stolzenberg, Ross M., and Linda J. Waite (1977). "Age, fertility expectations, and plans for employment**.**" *American Sociological Re-view* 42:769-82.

Vlasblom Jan Dirk and Joop Schippers (2006), “Changing dynamics in female employment around childbirth : Evidence from Germany, the Netherlands and the UK”, *Work Employment Society* 2006 20: 329

Waite, Linda J., and Ross M. Stolzenberg (1976), "Intended childbearing and labor force participation of young women: insights from nonrecursive models." *American Sociological Review* 41:235-51.

Wright, J. 2008. “Reducing Abortion in America: The Effect of Socioeconomic Factors”. *Catholics in alliance for the common good*. November 1. Available at (http://www.catholicsinalliance.org/files/CACG_Final.pdf) (accessed March 19, 2010).

Woodbridge, J. 2003. *Introductory Econometrics*. *Mason*, OH: *Thompson* South Western.

United Nations Economic commission for Europe. 2010. (http://w3.unece.org/pxweb/DATABASE/STAT/Statistics.asp) (accessed March 4, 2011).

Appendix

Table 9. List of countries used for the study by Christin Hilgeman and Carter T. Butts (2008)

Australia	**Germany**	**Portugal**
Belgium	**Great Britain**	**Slovakia**
Czech Republic	**Greece**	**Slovenia**
Denmark	**Ireland**	**Spain**
Finland	**Italy**	**Sweden**
France	**Netherland**	

Table 10. List of countries used for the study by David E. Bloom et al. (2009)

Afghanistan	Guinea-Bissau	Panama
Algeria	Haiti	Papua New Guinea
Argentina	Honduras	Peru
Australia*	Hungary	Philippines
Austria*	Iceland	Poland
Bahrain	India	Portugal*
Bangladesh	Indonesia	Rwanda
Barbados	Iran, Islamic Rep.	Senegal
Belgium*	Iraq	Sierra Leone
Benin	Ireland*	Singapore
Botswana	Israel	South Africa
Brazil	Italy*	Spain*
Cameroon	Jamaica	Sri Lanka
Canada*	Japan*	Sudan
Central African Republic	Jordan	Swaziland
Chile	Kenya	Sweden*
China	Korea, Rep.	Switzerland*
Colombia	Kuwait	Syrian Arab Republic
Congo, Rep.	Lesotho	Tanzania
Costa Rica	Liberia	Thailand
Cyprus	Malawi	Togo

Denmark*	Malaysia	Trinidad and Tobago
Dominican Republic	Mali	Tunisia
Ecuador	Mauritius	Turkey
Egypt, Arab Rep.	Mexico	Uganda
El Salvador	Mozambique	United Kingdom*
Fiji	Nepal	United States*
Finland*	Netherlands*	Uruguay
France*	New Zealand	Venezuela, RB
Gambia	Nicaragua	Zambia
Ghana	Niger	Zimbabwe
Greece*	Norway*	
Guatemala	Pakistan	

* Also used for the studies by **Ahn** and Pedro **Mira (2002) and** Tomas Kögel (2004) and **Luxemburg and West German and for the study by** Rindfuss et al. (2003) and **Luxemburg, West German and New Zealand.**