WAGE PENALTY FOR MOTHERHOOD: EVINENCE FROM UKRAINE

by

Tamara Sliusarenko

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Abstract

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by Tamara Sliusarenko

Head of the State Examination Committee: Mr. Serhiy Korablin,

Economist, National Bank of Ukraine

Motherhood is usually associated with lower wages due to a number of reasons such as career interruptions, decrease in productivity of females with children, career interruptions due to maternity leave and discrimination. The magnitude of family gap in Ukraine during the period from 1997 to 2004 is analyzed in this study based on the data from the Ukrainian Longitudinal Monitoring Survey. Taking into account unobserved heterogeneity wage penalty found to be 6,5% for one child and 13,2% for two or more children. The paper attempts to determine whether the level of education and decision of timing of first birth influences wage penalty for having a child. It is found that the negative effect of children on female's wages is smaller if a mother has her first birth later in her life. The wage penalty is found to be the smallest for females with vocational/professional education, but this is mostly comes from the effect of giving a first birth before age 20.

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GLOSSARY

Family Gap. Wage difference between childless female and women with children

Gender Gap. Wage difference between male and female

Chapter 1

INTRODUCTION

After the collapse of the USSR, the total fertility rate dramatically decreased in post-soviet countries, mainly because of the political and economical instability. Combineed with the intensive out migration this has led to a negative rate of population growth throughout the past decade. During the last three years in Ukraine, according to the information of the State Statistical Committee (http://www.ukrstat.gov.ua) , the number of newborns demonstrates a growing trend (Figure 3), but the natural population growth remains negative. Possible reasons for an increase in the number of newborns are the following: (i) the stabilization of the economic situation within the country, (ii) the decrease in the cost of raising a child, relative to the total family income, (iii) the baby-boom of 1980s, (iv) the increase in the amount of financial support to families after childbirth. In 2005, the Ukrainian Government substantially increased the amount of the lump-sum subsidy for a newborn from 1500 to 8500 hryvnias. In November 2007, due to the problems with the financing of the Ukrainian budget, some political parties initiated the discussion of these changes. According to the article № 60 of the law of Ukrainian State Budget 2007 the lump-sum support per child of 8500 hryvnias will be given only for families whose average total mouthy income is less than 5000 hryvnias during the last half a year. According to the data of State Statistical Committee the average Ukrainian family has income less than 5000 hryvnias. Still, after childbirth women usually leave the labor market for some period and the family lives only on husband's income not on the total family income. Moreover, 8500 hryvnias is a small number compared with the potential future losses of mother's income. For example, as was stated by Crittenden, the author of famous book "The Price of Motherhood", in

the US an average couple that consists of two equally capable parents with high education and total income of $80,000 per year could lose more than 1 million dollars of lifetime income if they have at least one child. From the point of view of an employer, mothers who stay at home with their small children are unproductive, but from the point of view of the whole economy, by educating and rearing their children mothers contribute to the human capital that is important for economic growth. Therefore, the job of a mother, which is unpaid, may be more important for the whole society than her labor market job.

When we think about the cost of a child we usually think about goods for the child, school expenditures, health care expenditures, etc. The cost of children, however, can be considered not only in terms of expenditures on goods and services, required for a child, but also in terms of a loss of the part of total family earnings. The opportunity cost of a child may be more important for women than for men due to their deeper involvement in the childcare process. Moreover, only women can give a birth to children, therefore they are the ones who take most of the additional costs related to pregnancy and childcare. Maternity can have a negative impact on women opportunities in the labor market not only through the decrease of hours devoted to work, but also through the career interruptions, loss of human capital while child caring, and smaller mobility compared to women without children. Many theoretical and empirical papers state that children are one of the most important sources of women's inferior performance in the labor market. Another potential source of women's weaker performance at the labor market is discrimination against women. Employers can prefer to pay less salary to both women with children as well as to childless women. The presence of children signals to employer about females' lower productivity while absence of children signals about the women's future departure from the workplace with the purpose to become a mother.

This paper is devoted to the analysis of the effect of children on women's earnings, investigating whether motherhood has significant negative impact on mothers' labor force performance in Ukraine. The effect of children may vary respect to education of mother and the time of interruptions. Education may reduce the magnitude of penalty and early chil birth can increase penalty due to career interruption at the important time of career decisions. In Ukraine, according to the information of State Statistical Committee, the fertility rate for mothers aged 15 to 24 has a decreasing trend, while for mothers aged between 25 and 34 an increasing trend starting from year 2000 (see Figure 4). That is why the effect of delaying the first childbirth has to be taken into considerations. At the first stage of research the effect of children on mother's wage will be analyzed. At the second stage the effect of education and timing of the first birth will be incorporated.

The paper is organized as follows. The second chapter gives an overview of the literature concerning family wage gap and women's performance at the labor market after childbirth. The third chapter is discusses the underlying methodology. Chapter four focuses on the data description and the estimation results as well as on the econometric issues pertinent to the current analysis. Finally, the fifth chapter follows with the general conclusions and policy recommendations.

Chapter 2

LITERATURE REVIEW

As has been mentioned in the introduction, there are several possible explanations for a negative impact of childbirth on a mother's performance in the labor market, such as time devoted to children, career interruption, and productivity decline. In addition, timing of childbearing and discrimination factors may play a role. The literature overview touches upon all those matters.

The simplest source of penalty for the mother is the time she spends taking care of her newborn child during maternity leave. If other things remain constant, a mother's lifetime income loss is equal to the income she could have earned at work if she would not have been taking care of the child. In general, things are much more complicated. Members of families without children allocate their time between work, leisure, and housework only. While in families with children substantial time has to be spent (at least by one member of the family) taking care of children. Even if the family uses non - parent child care services, parents do reallocate their time use. Time devoted to household work also increases with the presence of children. Mothers usually suffer from wage penalty more than fathers do, due to their deeper involvement into child rearing. Becker (1965) developed a theory of time allocation and showed its numerous empirical applications. The key assumption of the theory is that "households are producers as well as consumers; they produce commodities by combining inputs of goods and time according to the cost minimization rules of the traditional theory of the firm". One of the applications of Becker's theory is devoted to the division of labor within the family. The main idea is that reallocation of time of any family member forces other members of these family to reallocate their time.

After a childbirth, a woman has to substitute from labor market production to house production. While a father having financial responsibility for the family tend to shift more time towards labor market. Lundberg and Rose (1999) shows that fatherhood has significant positive impact on men's wages and labor supply. Moreover, they receive such an interesting result that the effect of a birth of a son is greater than that of a daughter. It may be because birth of an heir forces father to work harder in order to accumulate more capital to hand down, so having a son can increase the importance of a family for a man.

Career interruption is another source of wage difference between mothers and childless women. Labor force withdrawal itself has a negative impact on future earnings due to a period during which one does not accumulate human capital or even loses some human capital. Mincer and Polachek (1974) find significant opportunity cost of labor force withdrawal, the so called "home time".

The third component of the wage penalty for motherhood is the decrease in productivity compared to childless women: mothers can voluntary choose less paid job, that demand less effort from them. This is consistent with the Becker's theory of Human Capital, efforts and sexual division of labor (1985). The theory suggests that marriage and children have an important impact on career performance of women. Becker claims that "married women spend less effort on each hour of market work than married men, working the same number of hours with the same market human capital". Moreover, presence of children forces women to spend even less effort at market work, invest less in human capital, that has a major effect on women's earnings and differences between men's and women's labor market outcomes.

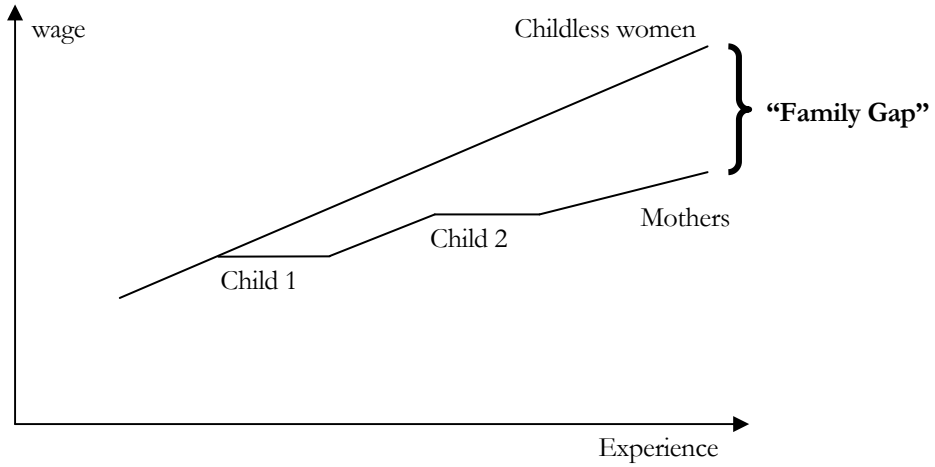

Figure 1: Illustration of the family gap concept. Source: Viitanen (2004)

The same logic can be applied to the family gap (see Figure 1), the wage difference between childless women and mother with the same level of human capital. Married women might allow themselves investing less in human capital and take a less challenging job, if their husbands earn enough to support a family. If both mothers and childless women have the same level of human capital, there may be a difference in earnings because the child care and household responsibilities force married women to search for more convenient, in terms of work schedule, and less energy-intensive jobs. Many researchers tried to test empirically Becker's view using data from different countries (see Table 1).

Table 1: Selected results on the wage penalty of motherhood

Study	Data set	Methods	Results
Budig, M.J. and England, P. (2001)	1982-1993 NLSY	FE and OLS	Wage penalty 7% per child (5% controlling for work experience)
Datta Gupta and Smith (2001)	1980-95 Danish panel data	FE, selectivity	Temporary 6-7% negative effects. Effect diapears by the age of 40
Hill, M.S. (1979)	1976 PSID	OLS	Wage penalty 6-7% per child .
Korenman, S. and Neumark, D. (1992)	1982 NLS-YW	OLS, FD,FE and IV	Wage penalty 7% for one child and 22% for two or more children
Kunze, A and Ejrnaes (2004)	1975-1997 IABS, West Germany	OLS and IV	10-20% drop in wages after first birth.
Viitanen, T (2004)	NCDS of UK	OLS, double selection	19%-22% wage penalty, 10%-13% obtained from double selection model.
Waldfogel, J. (1995)	NCDS	OLS, FD and FE	Average wage penalty for motherhood 22%
Waldfogel, J. (1997)	1968- 1988 NLS-YW	OLS, FD and FE	Wage penalty 4% for one child and 12% for two or more children.
Waldfogel, J. (1998a)	1980 NLS-YW and 1991 NLSY	OLS	Wage penalty at age 30 17% in 1980 and 25% in 1991
Waldfogel, J. (1998b)	NLSY and NCDS	OLS, FD and FE	Wage penalty 20% for US at age 30 and 20% for UK at age 33
Almuendo-Dorates, and Kimmel, (2004).	NLSY 79	OLS, FE	Wage penalty is 6,3% for one child and 12,5% for two or more

Waldfogel (1997) examined the direct effect of children on wages using data from the 1968-1988 National Longitudinal Survey of Young Women. The author tried to find the answer to the question if market experience explains lower wages for mothers. The result of both pooled and single year cross – sectional estimation suggest that even after controlling for actual market experience the effect of children on women's earnings does not disappear. Having one child is associated with a 5% loss in mothers wages, having more than one children is associated with a 10% loss. Even controlling for person-specific unobserved heterogeneity (author used both first difference and fixed effect estimation) does not decrease the effect of children on women's wages.

Becker's view has also been confirmed by Viitanen (2004) using the data from the British National Child Development Study – a longitudinal survey following all individuals born in Britain during the first week of March, 1958. The author found significant difference in wages between women with children and childless women. Using double selection model (selection for fertility and for participation in the labor force) wage differential between childless women and mothers is estimated to range between 10% and 13%. A significant and rather high (up to 20%) wage penalty for the first child has also been found for the West Germany by Kunze and Ejrnaes (2004).

Gupta and Smith (2001) have reseived slightly different result. They examine the impact of career interruptions due to having a child on mothers' wages and gender wage gap in Denmark using the sub-sample of women aged 18-40 years of Danish longitudinal database collected during the period 1980-1995. They have used panel estimation of simple log-wage equation and found that controlling for the time-constant unobserved heterogeneity and self-selectivity the negative effect of a newborn child on woman's wages disappears. Their results confirm previous Danish studies. Controlling for

missing human capital accumulation due to the period of out of labor market, they found that a childbirth leads to a slower growth in wages (6-7% wage penalty per child) than for childless women, but the effect is only temporary, an it disappears in the long-run.

The reason that can explain this result of Gupta and Smith is that in Nordic countries and in Denmark in particular parental leave programs are very generous. For example in Sweden, mothers are paid a maternity leave of up to a 85% of theirs salary. Moreover, fathers have one month of paternity leave plus one additional month of vacation. When mothers get back to work they have a statutory right to work a six-hour day (80% of the workweek. Information from the interview[1] with Ann Crittenden, the author of the book "The Price of Motherhood" to www.familyeducation.com)

As was mentioned above career interruptions have a negative effect on wages, but the effect can vary with respect to the time of interruptions. During the last 15 years, we can observe that women give first birth later in their life than it has been in 60s-80s. As a response to this observable trend, researchers started to investigate whether the timing of first birth matters. The same trend is observed in Ukraine, according to the information of State Statistical Committee, the fertility rate for mothers aged 15 to 24 has a decreasing trend, while for mothers aged between 25 and 34 an increasing trend starting from year 2000 (see Figure 4). That is why the effect of delaying the first childbirth has to be taken into considerations.

There are two views on the delayed childbirth. One view states that early childbirth reduces future wage penalty for women. Because after the early maternity leave women are still young, smart, and productive enough and have a lot of time to develop successful career, while women who delay

[1] Interview is available in Internet: http://life.familyeducation.com/working-parents/family-time/36305.html

childbirth and concentrate on career have to pay more for time away from paid work in future for maternity leave. What also matters is that women who delay their first childbirth may face more health problems than younger mothers do. Moreover, from the point of view of employers young women who already have a child have lower probability if leaving work for other child. Therefore current mothers may suffer less from wage discrimination. Alternative view states that women who delay childbirth are able to build a good foundation of their career before the childbirth while young mothers spend their "best productive years" on child caring and rearing. Wage penalty could also vary by the level of education and skills. The standard theory of opportunity costs suggests that career interruption for females that have accumulated sufficient work experience before becoming mothers involve higher price of time being out of labor market. Low skilled workers may be less affected by childbirth, because leaving the work does not impose high costs on low skilled workers (Anderson, Binder and Krause, 2002)

Millimet (2000) estimates the effect of children on household behaviour using two age sub-samples (one sub-sample contains wives between 21 and 30 years old, other is wives between 35 and 49). A simultaneous equation system of wages and hours spent at home was estimated for both sub-samples. The author found a positive effect of children on number of hours spent at home for both sub-samples, but the effect of children on wages for a "young sample" is not significant, while for "older sample" it was found to be significant.The data set for this article was taken from the 1976 wave of PSID. At that time it was common to create family first, and then build the career, while now the opposite situation can be observed.

Studies that used more recent data sets for research basically support the second view of the timing issue. Blackburn, Bloom and Neumark (1990) developed a model for female optimal human capital investment based on a

simple life-cycle model. The evidence of the model is that late child bearers tend to invest more in human capital than early child bearers do. Their empirical estimation of the model supports this evidence. This evidence has been also confirmed by some further research. Drolet (2002) found that women who have first childbirth later in the life earn 6% more than those who have first child earlier in Canada. Almuendo-Dorates and Kimmel (2004) investigate the importance of education and delaying of childbirth in the US and found that college-educated women who delayed motherhood beyond 30 earn 21% more.

All the studies that are mentioned above consider developed countries. As for transition countries, there are no results related to the area of my investigation. Therefore, this research can contribute to the study about labor market of Post Soviet countries. According to Walfogel's study (1998) 40-50% of the gender wage gap is explained by "family gap", the difference in returns from parental status. Soviet labor market built on the principle "equal pay for equal work" and was characterized by high female labor force participation rate. After the collapse of the USSR, the situation has changed dramatically. Gerry, Kim and Li (2004) examine the gender wage gap in Russia using Russian Longitudinal Monitoring Survey 1994-1998 and found rather stable 27% average gender wage differential for period 1994-1996, but it became wider following the financial crisis of 1998. In Ukraine the gender gap was 41% in 1991 and fall to 34% in 2003, according to the results by Ganguli and Terrell (2005) using the first wave (2003) of ULMS data set. Comparing obtained estimates with similar estimates for European countries indicates that the gender wage gap in the public sector in Ukraine is much higher while the gap in the private sector is at similar levels to these European countries. Due to the link between gender wage gap and family gap and rather high gender wage gap in Ukraine, a significant opportunity cost of having a child can be expected.

Chapter 3

METHODOLOGY

The human capital is difficult or even impossible to measure directly. One of the most popular models is Mincerian log-wage equation (Mincer 1974). The number and age of children will be used as a proxy for the time of childcare and housework to investigate the wage penalty.

The basic empirical model is the following

$$\ln W_{it} = \beta_0 + \mathbf{X_{it}}\boldsymbol{\beta} + (u_i + v_{it})$$

where W_{it} is hourly wage rate of an individual *i* in period *t*, X_{it} - vector of explanatory variables, u_i - individual specific time invariant unobserved characteristics (ability, morbidity, etc.) and v_{it} - idiosyncratic error. Explanatory variables can be divided into three main groups. The first group is children variables such as number of children, number of children in a particular age category (infant child, preschool child or school child), age and work experience of mother at the first birth (for investigation of importance of timing). The second group is mother specific characteristics that have an impact on her labor market decisions, such as mother's marital status, age, experience, tenure. The third group includes family and household specific characteristics such as family non-wage income, owner residence, number of adults in a household, living conditions, type of settlement, region and also husband's or partner's characteristics such as education, experience, years of education, wage.

OLS estimator is consistent only when $E(\mathbf{X'_{it}}\varepsilon_{it}) = 0$, where $\varepsilon_{it} = u_i + v_{it}$ - is the composite error. This means that $E(\mathbf{X'_{it}}v_{it}) = 0$ and

$E(\mathbf{X}'_{\mathbf{it}} u_i) = 0$. The last equation is a restrictive assumption while the first one holds if we have successfully modelled $E(\ln W_{it} | \mathbf{X}_{\mathbf{it}}, u_i)$. In our particular case the assumption $E(\mathbf{X}'_{\mathbf{it}} u_i) = 0$ is violated. If u_i is , for example, productivity of female or her wiliness to work and study, which we do not observe: if she choose whether or not to work this choice can be correlated with ability or willingness to work, consequently there exists a correlation between explicative variables and composite error term. Moreover, even if this is true, the problem of serial correlation can arise, therefore inference using pooled OLS requires the robust variance matrix estimator and robust test statistics.

To avoid unobserved heterogeneity problem several methods can be used. The first one is to take first difference in order to get rid of the unobserved individual specific fixed effect. The model becomes:

$$\Delta \ln W_{it} = \boldsymbol{\beta} * \Delta \mathbf{X}_{\mathbf{it}} + \Delta v_{it}$$

Where $\Delta \ln W_{it} = (\ln W_{it+1} - \ln W_{it})$. The OLS estimation of this equation will give unbiased results under the standard OLS assumptions for $\Delta \ln W_{it}$, $\Delta \mathbf{X}_{it}$, Δv_{it}. Therefore the OLS estimator of first difference equation if unbiased only if $\operatorname{cov}(\Delta \mathbf{X}_{\mathbf{it}}, \Delta v_{it}) = 0$

Another method is to use fixed effect estimation, where all variables are expressed as deviations from their means. The model becomes:

$$\left(\ln W_{it} - \overline{\ln W_i}\right) = \boldsymbol{\beta} * \left(\mathbf{X}_{\mathbf{it}} - \overline{\mathbf{X}_{\mathbf{i}}}\right) + \left(v_{it} - \overline{v_i}\right)$$

The OLS estimation of this equation will also give unbiased results in case of strict exogeneity of explanatory variables. In many applications the

whole point of using panel data is to allow for u_i to be arbitrarily correlated with $\mathbf{X}_{it}$. A fixed effect analysis achieves this purpose explicitly.

The problem with these two methods is that the coefficients of time invariant variables cannot be estimated. If u_i is allowed to be time constant, there is no way to distinguish the effects of time constant observables from time constant unobservable u_i. However, for the fixed effect estimation differences in partial effect on time constant variables can be identified through adding to the regression interaction of time constant variable and time dummy, it will give an answer to the question whether the effect of time-constant variables changes over time. However, in this research effect of time constant factor are not of direct interest.

If T=2 Fixed effect and First difference estimators give the same result. But it is not true when T>2. Both methods are unbiased and consistent for fixed T and $N \to \infty$, where N is number of observations. Therefore, efficiency can be used as a criterion. In particular, fixed effect estimator is more efficient under the assumption that the v_{it} are serially uncorrelated – while first difference estimator is more efficient when v_{it} follows random walk. In many cases, the truth is likely to be somewhere in between.

In cases when $\mathbf{X}_{it}$ do not vary much over time, fixed effect and first difference methods can lead to imprecise estimates. If u_i is assumed to be uncorrelated with $\mathbf{X}_{it}$ fixed effect will be inefficient estimator, the model can be estimated using random effects estimator, that is unbiased and consistent for fixed T and $N \to \infty$. However, if the model includes variables that are correlated with individual specific error term (which is true in this research), random effect estimator is inconsistent. However, random

effect estimation gives an opportunity to estimate coefficients of variables that are constant over time.

Another problem that arises is the sample selection problem. Sample of workers may not be a random sample of the whole population, and non-workers should be taken into account too (Heckman 1979). The traditional approach to correct for self-selectivity bias due to not observing information about wages of non-working women is the Heckman sample selection model (Tobit II model). The idea of this methodology is to include the inverse Mill's ratio as an additional explanatory variable into regression. The inverse Mill's ratio ("lambda") is computed based on the probit regression of the probability of women's participation in the labour force for each year separately.

$$h_{it} = \mathbf{Z}'_{\mathbf{it}}\beta_2 + \varepsilon_{2i}$$

Where h_i - is dummy variable equal to one if a woman is employed and zero otherwise. If explanatory variables in probit regression and tobit regression are the same, the model is only identified through the fact that inverse Mills ratio is a nonlinear function. If variation in the "lambda" is small, the relationship between lambda and $\mathbf{Z}_{\mathbf{it}}$ is close to linear. Therefore including of additional variables in $\mathbf{Z}_{\mathbf{it}}$ can improve the identification of the second step. (Verbeek, 2000, p. 217)

In many applications sample selection problem and individual specific unobserved heterogeneity problem occurs simultaneously. Recently, some estimators have been proposed which deal with both sources of estimation bias, producing consistent results under different assumptions. Wooldridge (1995) proposed an estimator that requires specifying the functional form of the conditional mean of the individual effects in the equation of interest. The other two estimators impose some distributional

assumptions on error terms (Rochina-Barrachina, 1999) and the fixed effects (Kyriazidou, 1997) in the equation of interest. Dustmann and Rochina-Barrachina (2000) apply three above methods to the estimation of wage equation for female labour market participants, verifying the impact of actual labour market experience on wages. Authors also provide an extensions of these estimators to face other econometric problems such as non-strict exogeneity and/or time constant non-linear errors in variables. Estimation procedure proposed by Wooldrige will be used in this paper. The idea of procedure is following: Selection equation is estimated with the Chamberlain's random effect probit model where $Z_i = (Z_{it}, \overline{Z}_i)$, then the inverse Mill's ratio $\hat{\lambda}_{it}$ is saved. And finally added to the fixed effect estimation procedure using the selected sample where $h_{it} = 1$.

One of the major problem in most analyse of the effect of children on labor market outcomes for mothers is endogeneity of explicative variables in the wage equation. Korenman and Neumark (1992) explore some econometric problems of cross-sectional analysis of marriage, motherhood and earnings. Those problems include endogeneity of marriage and motherhood, experience and tenure, heterogeneity and selectivity. They did their analysis using the data set from the National Longitudinal Surveys 1968. Their main findings are that the OLS estimation give biased results due to unobserved individual specific heterogeneity and they found an evidence that experience and tenure are endogenous while marital status and number of children are exogenous in the wage equation. Moreover, in their research standard sample-selection estimation shows no evidence of selection to labor market bias. As the result they found 7% wage decrease for one child and 22% for two or more children. The authors suggest that family background variables such as parent's occupation and parent's years of education or level of education of mother can be used as instruments for experience and tenure.

Therefore, in order to address all possible econometric problems the following algorithm of estimation will be used:

- ⇨ Obtain results from simple Pooled OLS regression
- ⇨ Correct OLS for selectivity into labor market bias
- ⇨ Run FD regression
- ⇨ Obtain results from the FE estimation procedure, test for FE vs. Pooled OLS
- ⇨ If Pooled OLS estimator is rejected correct FE for selectivity into labor market bias
- ⇨ Obtain result from RE estimation procedure. Test for RE vs. FE

Chapter 4

DATA DESCRIPTION

For the investigation of a child impact on mothers labor performance in Ukraine the panel data from Ukrainian Longitudinal Monitoring Survey (ULMS) is analyzed. The sample consists of two waves of the ULMS which is a nationally representative sample of Ukrainian households. The first wave of the survey had been administrated from April until June 2003 and contains 4,056 household and 8,621 individual observations. The second wave of ULMS was administrated from May until October 2004 and contains 3823 household and 7200 individual observations. The ULMS household questionnaire contains information about the structure of the household, housing conditions, household assets, income, and expenditures. The ULMS individual questionnaire contains information on individual characteristics of household members, individual's main and additional jobs, non-employment periods, main and secondary jobs in a reference week, unemployment and job search in the reference week, education and skills, changes in residence, attitudes, health and ecology. Additionally, 2003 ULMS individual questionnaire contains retrospective data on job characteristics in 1986, the year of Chernobyl catastrophe, 1991, the year in which Ukraine became independent, and for the period from 1997 till 2003. The information about the main job has been taken from both retrospective and reference week sections.

Sample construction

In order to investigate the impact of children on mothers performance in the labor market the cross sections data (1986, 1991, 1997-2004) of female individuals aged between 15 and 69 in 2003 has been created. One of the problems of this sample is survival bias, because the data for 1986 and 1991 has been obtained from the retrospective section of 2003 questionnaire. It means that samples for these years are not representative due to the absence of older people. One way to solve this problem is to restrict the 2003 sample to 15-55 years old individuals; another way is to use data only for 1997-2004. Another reason to restrict the sample to 1997-2004 is that for this period most people reported their wages in hryvnias while for 1986 wages are reported in USSR rubbles and for 1991 in coupons. One more argument in favour of using only information for 1997-2004 is that the wage information must be corrected for inflation. There is rather precise information about inflation for 1997-2004[2] obtained from State Statistical Committee (http://www.ukrstat.gov.ua), while inflation between 1986, 1991 and 2004 is hard to measure correctly. Moreover, the basket of goods and services for calculation of CPI changed several times during this period. In other studies with the ULMS data set authors weighted the 1986 and 1991 samples using weights for 2003 and the information on the age and gender structure from 1987 and 1991 Statistical Yearbooks of the USSR (Gorodnichenko and Sabirianova 2004 and Ganguli and Terrel 2005)

To avoid a division bias hourly wage rate is calculated in the following way (Kimmel and Kniesner 1998). Monthly wage is divided by 40 if person reports that she works not less than 25 hours per week and divide

[2] Consumers Price Index (CPI) available from State Statistical Committee of Ukraine (http://www.ukrstat.gov.ua) will be used as a measure of inflation.

by 20 if individual works less than 25 hours per week. Obtained values must be also divided by the average number of weeks in a month (52/12)

The ULMS data set allows constructing of the pooled data set for females that contains 31398 observations, 28018 of which are for working aged (15-65 years old) females (Table A.1). approximately one half of these females are employed. The final pooled data set contains 10413 observations which is approximately 2300 observations per year of panel.

Sample Description

Table 2 shows the descriptive statistics for female sub-samples for year 1997 (first year of panel), 2004 (last year of panel) and pooled sample. Approximately 45% of females in the sample do not have children,[3] 35.% have only one child, 18% have two children and only and only 2,5% of the sample have more than 2 children.

Approximately 41% in 1997 and 31% in 2004 of the sample have just high school education or lower, but this is not a surprising result, because due to the World War II older women could have had left school. The largest share of the sample 44% in 1997 and 50% in 2004 are females with professional secondary education, while only 14-16 % have at least university bachelor degree. Approximately 62% of female respondents are married. Among all respondents 55,7% and 49,9% in 1997 and 2004 respectively are employed, however the percentage of employed females for the pooled sample is only 48,9%, which is lower than in both first and last years of the panel. This phenomenon can be explained by the crisis in 1998, when unemployment within the country also increased. Figure 5 shows the

[3] Through all this paper a child is a person aged between 0 and 18 years old who lived in the household with a particular female, not necessary her own children, or her own children of any age.

percentage of employed females in the sample 1997-2004, the lowest employment 42% of the sample were employed in 2002. Similar tendency is observed within the sample for monthly wages (Figure 6). Average monthly wage is 330 hryvnias (in 2004 hryvnias) in 1997, 315 hryvnias in 2004, and the lowest average wage was 245 hryvnias (in 2004 hryvnias) in 1999.

The detailed descriptive statistics of the pooled sample is shown in Table 3. Approximately 83% of the entire sample ever had a child, 51.4% of which are employed, and 89% of employed mothers are employed full time. Average age of the entire sample is 41 years, while average age of ever mothers is 44 years. Mothers have on average higher potential work experience as well as actual work and higher tenure, however mothers on average receive lower wages then never mothers. This can be explained by the fact that subsample of the childless women is "young", average age is only 24.7 years old, so we can consider that these females are childless not because of their decision but because they are rather young to become mothers. Only 17% of childless female's are married, while 71% of mothers are married. It should be pointed out that average tenure in the sample is only 5 years lower than actual work experience. That is the sigh of the fact that Ukrainian females rarely change the place of their job. Average age at first birth in sample is 22.66 years, which slightly is smaller compared to developed countries (23,5 years in US, Blackburn, Bloom, and Neumark 1990). However, it is not surprising, because in post Soviet countries people finish high school 2 years earlier, and therefore start their career earlier and may tend to create family earlier.

It should be pointed out that the average number of children lived with their mothers is equal to 0.8, that can be explained by the fact that our sample is build from the retrospective part of 2003 ULMS wave. The problem is that if a particular child did not live with his/her mother in 2003 there is no way to indicate when he/she left the home house. Therefore, for

mother whose children did not live with her in 2003 are also considered as such that did not live with her in 1997. This fact may lead to incorrect results. One of the solutions of the problem is to restrict the sample for 16-45 years old (fertility age) females or exclude such mothers from the sample. However, such restriction can also lead to incorrect results, because mothers who live with their adult children may afford to work at lower effort job or not to work at all. Partner's not own children are assumed to live with particular female since marriage date

Table 2: Descriptive statistics of a working age females (ULMS 1997, 2004 and 1997-2004)

Variable(%)	1997		2004		Pooled (1997-2004)	
	all	**empl.**	**all**	**empl.**	**all**	**empl.**
age						
<25	17.65	14.05	17.90	10.30	18.36	11.58
25-35	18.35	22.70	15.73	20.23	16.52	21.29
35-45	23.32	32.28	21.23	30.96	22.41	33.20
45-55	19.16	23.40	24.03	31.33	20.91	27.10
55-65	21.52	7.57	21.11	7.18	21.79	6.83
children						
none	43.73	35.83	53.11	43.94	44.19	34.43
one	36.29	41.00	28.89	34.16	34.98	39.81
two	17.51	20.54	15.52	19.51	18.14	23.07
more than two	2.47	2.63	2.48	2.39	2.69	2.70
education						
High School[4]	41.26	27.49	31.52	17.26	39.02	23.22
vocational/professional education	44.23	52.66	50.79	57.36	45.79	54.15
university bachelor degree and higher	14.48	19.77	17.69	25.38	15.15	22.62
marital status						
married	64.50	68.42	60.57	63.45	62.00	65.92
widowed	5.03	4.32	10.24	7.25	6.54	5.07
divorced	7.85	9.19	10.96	15.52	9.22	12.16
separated	0.47	0.46	1.99	2.54	0.98	1.28
employed	**55.66**	**100.00**	**49.91**	**100.00**	**48.89**	**100.00**
Wage(monthly)		**326.47**		**315.00**		**283.77**
# observations	**3439**	**1295**	**3312**	**1379**	**27694**	**10413**

[4] This category also includes those females who did not finished their vocational/professional or high education

Table 3: Descriptive statistics female sub - sample of ULMS data set (Pooled)

	all females				mothers				never mothers[5]			
	all		employed		all		employed		All		employed	
Variable	Mean	S. Dev	Mean	S. Dev	Mean	S. Dev.	Mean	S. Dev.	Mean	S. Dev.	Mean	S. Dev.
mother(%)	83.13		86.68						0		0	
No child(%)	44.19		34.43		33.07		24.6		98.99		98.41	
One child(%)	34.98		39.81		41.88		45.68		1.006		1.586	
Two children(%)	18.14		23.07		21.83		26.61					
More than two children(%)	2.69		2.7		3.23		3.11					
Infant(%)	1.69		0.57		2.01		0.63		0.107		0.144	
# of preschool children	0.11	0.35	0.08	0.3	0.13	0.38	0.1	0.32	0.003	0.058	0.004	0.066
# of school age children	0.38	0.69	0.52	0.73	0.46	0.73	0.6	0.75	0.005	0.068	0.010	0.100
# of adult children	0.31	0.56	0.34	0.59	0.37	0.6	0.39	0.62	0.002	0.044	0.001	0.038
# of children	0.8	0.85	0.95	0.84	0.96	0.85	1.09	0.81	0.010	0.100	0.016	0.125
Age of smallest child	9.81	5.17	11.01	4.6	9.82	5.17	11.03	4.59	6.75	4.38	7.56	4.52
Age at first birth					22.66	3.73	22.66	3.77				
age	41.5	14.55	40.17	10.8	44.91	12.37	41.98	9.62	24.7	12.73	28.36	10.61
High School	39.02		23.22		35.08		23.07		58.45		24.22	
vocational/professional	45.79		54.15		48.8		54.39		30.98		52.63	
bachelor degree and higher	15.15		22.62		16.11		22.55		10.45		23.07	
Married (%)	62		65.92		70.97		71.52		17.81		29.49	
Widowed (%)	6.54		5.07		7.64		5.73		1.13		0.79	
Divorced (%)	9.22		12.16		10.16		12.79		4.58		8.07	
Separated (%)	0.98		1.28		1.06		1.3		0.58		1.15	
Actual experience	15.26	11.39	17.2	9.55	17.31	10.74	18.47	9.04	5.13	8.77	8.92	8.64
Potential exp	23.68	14.62	21.94	11.01	26.91	12.83	23.69	10	7.77	12.25	10.54	10.46
Years out of labor market	8.6	10.07	5.09	6.59	9.77	10.27	5.54	6.79	2.84	6.44	2.15	4.03
Employed (%)	48.89	49.99	100		51.36	49.98	100		36.72	48.21	100	
Monthly wage			283.77	182.46			281.92	181.88			302.65	226.76
Hours worked per week			39.97	9.6			39.92	9.6			39.95	9.75
Tenure			11.74	10.22			12.51	10.33			6.82	7.72
# observations	**27694**		**10413**		**23023**		**9026**		**4671**		**1387**	

[5] Note: values no equal to zero for childless women mean that there are females in the sample who have never had own children but live in household with partner's child or have an adopted child

Chapter 5

RESULTS

1. Estimation of the wage penalty of motherhood

The first wave of the ULMS data set contains a retrospective part, which allows construction actual experience. Among females in the sample average actual experience of working age women equals to 15,2 years and is much less then potential work experience[6] which is equal to 23,7 years. A model controlling for actual work experience of working age females (15-65 years old) is shown in Table 4, explanatory variables of interest are dummy variables for number of children in household. No children is omitted category.

The pooled OLS estimation (column 1) shows that there is no wage penalty for motherhood for one child as well as for two or more children, the coefficients are statistically insignificant. However, they have the expected negative sign, which is consistent with Becker's theory of time allocation. The coefficients of marital status variables are negative and statistically insignificant and jointly insignificant (p - value=0.3357). This result contradicts the predictions of human capital theory, which states that married females spend less effort at market job and more effort in household, and consequently earn less, which means that at least the sign of coefficient of marriage is correct.

[6] Usually potential experience is constructed as potential experience=age- years of education-6. However ULMS data set has an information about the date(month, year) at which individual had started his/her career. So, this information was used to calculate potential experience.

Table 4: Results of estimation of log-wage regression. ULMS 1997-2004. Logarithm of hourly wage is dependent variable[7]

	Pooled OLS	FD	FE[8]	RE	OLS selection	FE selection
	(1)	(2)	(3)	(4)	(5)	(6)
One child	-0.0133 [0.0243]	-0.0965** [0.0354]	-0.0648* [0.0319]	-0.0387+ [0.0217]	-0.0113 [0.0242]	-0.0674* [0.0323]
Two or more children	-0.0193 [0.0282]	-0.1481** [0.0398]	-0.1326** [0.0371]	-0.0990** [0.0238]	-0.0226 [0.0286]	-0.1371** [0.0389]
age	0.0090 [0.0100]		0.0681** [0.0199]	0.0324** [0.0096]	0.0178 [0.0137]	0.0694** [0.0203]
Age squared	-0.0001 [0.0001]		-0.0005* [0.0002]	-0.0003** [0.0001]	-0.0003 [0.0002]	-0.0005* [0.0002]
vocational/professional education	0.0856** [0.0267]	0.0597 [0.0473]	0.0549 [0.0472]	0.0761** [0.0244]	0.1014** [0.0303]	0.0612 [0.0509]
High education	0.3813** [0.0324]	0.1153* [0.0547]	0.1692** [0.0614]	0.3217** [0.0313]	0.4131** [0.0446]	0.1780** [0.0657]
experience	0.0085 [0.0071]		-0.0271 [0.0194]	0.0023 [0.0069]	0.0158 [0.0103]	-0.0241 [0.0210]
Experience squared	-0.0002 [0.0002]		-0.0001 [0.0003]	-0.0003+ [0.0002]	-0.0004+ [0.0002]	-0.0002 [0.0003]
Years out of labor market	-0.0045 [0.0053]	-0.0422* [0.0170]	-0.0464** [0.0121]	-0.0168** [0.0052]	-0.0072 [0.0060]	-0.0462** [0.0121]
tenure	0.0086* [0.0038]	-0.0042 [0.0076]	-0.0046 [0.0054]	-0.0030 [0.0038]	0.0085* [0.0038]	-0.0046 [0.0053]
Tenure squared	-0.0001 [0.0001]	-0.0004 [0.0003]	-0.0002 [0.0002]	0.0000 [0.0001]	-0.0001 [0.0001]	-0.0002 [0.0002]
Married	-0.0203 [0.0304]	-0.0109 [0.0384]	0.0094 [0.0366]	-0.0074 [0.0268]	-0.0236 [0.0306]	0.0089 [0.0367]
Widowed, divorced or separated	-0.0376 [0.0349]	-0.0709* [0.0326]	0.0069 [0.0336]	-0.0152 [0.0280]	-0.0325 [0.0352]	0.0080 [0.0336]
Lambda (for FE)						0.0133 [0.0355]
Lambda(for pooled OLS)					0.0993 [0.0971]	
Observations	10413	7703	10413	10413	10413	10413
R-squared	0.16	0.01	0.03		0.16	0.03
Number of id			2268	2268		2268
+ significant at 10%; * significant at 5%; ** significant at 1%						

[7] Numbers in brackets are clustered standard errors. Regression also includes controls for region and urban type.

[8] F-test suggests that the null of whether all unobserved individual specific variables equal to zero is rejected (F(2267, 8133) = 9.54 , Prob > F = 0.0000) Consequently FE is more appropriate estimation procedure than Pooled OLS

The sample we use includes only those individuals for which we observe wages, i.e. employed individuals and those who did not refuse to report their wages, which might produce biased results (Heckman 1979). Explain why So, non-working females should also be take into account. Column 5 includes an additional selection correction term – lambda (the Inverse Mills Ratio). This ratio has been calculated based on the pooled probit regression of female participation in labor market with the same explanatory variables as in the pooled OLS regression plus a dummy for the presence of an infant in the family, all marital status variables and excluding tenure (which is available only for employed females) in order to improve the identification of the second step (Verbeek, 2004, p. 217). After the addition of inverse Mills ratio into the pooled OLS regression, the estimated effect children almost did not change. Moreover, coefficient of inverse Mills ratio is insignificant (p-value = 0.370). That means that there is no evidence of a sample selection bias, with is consistent with the findings by Gupta and Smith (2001), Waldfogel (1998), and Korenmans and Newmark (1990)

Heterogeneity bias

The OLS and Sample selection analysis control only for observable characteristics, while there might be individual specific time invariant unobserved characteristics (such as ability, sickness, wiliness to work, etc.) that also have an impact on females wages. As the result of presence of such an omitted variable OLS estimator is biased, and estimation procedures that take into account this unobserved effect should be used. Results from first difference estimation approach are given in column 2, coefficient for children variables are much higher than in case of pooled OLS and are statistically significant. The evidence of the first difference estimation is that wage penalty of one is 9,4% and for two and more children 14,7%. Effect of education

decreases sharply from 38% to 11% for high education and became insignificant for the case of vocational/professional education; negative effect of years out of labor market increased sharply in absolute value and became significant, while effect of tenure became insignificant.

Results of fixed effects or within group estimation are presented in column 3. Comparing them with the first difference estimates, we see that the negative effect of having one child falls from 9,4% to 6,5% while the effect of two children falls from 14,7% to 13,3%. Comparing with the Pooled OLS estimates the returns to education decrease sharply from 36% to 16% for high education and becomes even insignificant for vocational/professional education. The effect of marital status variables are still negative insignificant and jointly insignificant (p – value = 0.9860). This contradiction to Becker's theory of time allocation may be explained by the fact that most people in the sample grew up during the time of the USSR, where all the people were treated equally and received the same wage for the same position all over the country. Both fixed effect and first difference estimates give different results from the Pooled OLS, which is a sign of possible heterogeneity bias in OLS. Moreover, formal F-test suggests that the null of whether all unobserved individual specific variables equal to zero can not be accepted (F(2267, 8133)=9.54 , Prob>F=0.0000). Consequently, FE is more appropriate estimation procedure than Pooled OLS.

The fixed effect estimator is consistent even if explanatory variables are correlated with the unobserved time invariant term, but random effect is more efficient if explanatory variables vary only little over time. Column 4 presents results of random effect estimator, which gives efficient and consistent results if the composite error term and explanatory variables are not correlated, otherwise if the model includes variables that are correlated with individual specific error term, random effect estimator is biased and inconsistent. The results of the random effect estimation show that the wage penalty for motherhood is equal to 4,0% for one child and 9,7 % for two and

more children. The Breusch and Pagan Lagrange multiplier test for Pooled OLS versus random effect estimator suggests that the variance of unobserved effects in not equal to zero (see Table A.2). Therefore, random effect is better than Pooled OLS in our case. However, formal Hausman model specification test of fixed effects versus random effects (Table A.3) suggests that random effects is not an acceptable method of estimation (chi-sq statistics = 48.61).

Consequently, fixed effect or first difference estimation method is the most appropriate for the purpose of current research. Therefore, to finish with specification tests sample selection correction procedure should be applied for fixed effect estimator (Wooldridge 2002, chapter 17.7) in order to avoid bias associated with self - selectivity into labor market. Column 6 of Table 4 presents results of fixed effect estimation with additional term – "lambda" (Inverse Mills Ratio). IMR is calculated based on Chamberlain's random effect probit model with same explanatory variables as in fixed effect regression excluding tenure and adding dummy variable for presence of infant in the family, all marital status variables and all averages (over individual) of all variables involved. The coefficient of "lambda" is positive but insignificant that means that there is no sample selection bias (p-value = 0.664) in fixed effects estimation of log wage equation. Both fixed effect and first difference estimators eliminate the problem of unobserved heterogeneity bias in case when this unobserved effect is correlated with one or more explanatory variable and both are asymptotically efficient but under different assumptions. First difference estimator is the most efficient under the assumption that error term follows random walk, while fixed effect estimator is more efficient under the assumption of strict endogeneity of explanatory variables. In many cases, the truth is likely to be somewhere in between. The difference between estimates may be due too endogeneity problem, which will be discussed later. The results of fixed effect and first difference estimation are close to each other except for the coefficient for widowed, divorced or separated dummy variable, which is not of the particular interest. Therefore fixed effect

estimation without sample selection correction will be used in the rest of the paper.

Appendix Table A.4 shows the results of the same estimation methods as Table 4, but with only difference that the children-related explanatory variables are now dummy variables for one child, two children and more than two children. The conclusions about the most proper estimation procedure are the same. All children coefficients are statistically significant. Estimated by fixed effect wage penalty for motherhood is 6,2% for one child, 12,4% for two children and 23,7% for more tan two children. For the first difference estimation wage penalties are slightly different 9,2%, 13,9% and 21,1% respectively. From this we can conclude that the wage penalty for each additional child is approximately 6,5%. To investigate this issue regression where explanatory variable is number of children in household was estimated. The results are presented in table 5.

Column 1 of Table 5 shows that the wage penalty of ever being mother in Ukraine is 19,9% which is close to the same effect for US that is equal 22% (Waldfogel 1995). Wage penalty for each additional child is equal to 6,5%, (column 2) which coincides with prediction that follows from Table A.4 and is the same as in US in 1979 (Hill, 1979). Moreover, according to Waldfogel (1995) the effects of one child and two or more children in Ukraine are almost the same as in the US economy. Column 4 of the Table summarizes the effects of children of different ages on mothers performance. All coefficients for one child appeared to be insignificant as well as jointly insignificant (p-value = 0.2272). This may be a sign of the evidence that wage penalty for one child does not depend on the age of child. However for the case of two or more children the wage penalty is higher if age of smallest child is between 6 and 18, than for the case if smallest child is of preschool age.

Table 5: Fixed effect estimates for wage penalties for different model specifications. ULMS 1997-2004[9]

	(1)	(2)	(3)	(4)
Ever mother	-0.1998**			
	[0.0754]			
Number of kids		-0.0650**		
		[0.0167]		
One child			-0.0648*	-0.0536
			[0.0319]	[0.0373]
One child* Child(0-6)				-0.0201
				[0.0485]
One child* Child(6-18)				-0.0172
				[0.0335]
Two or more children			-0.1326**	-0.0633
			[0.0371]	[0.0461]
Two or more child*Child(0-6)				-0.0825
				[0.0540]
Two or more child*Child(6-18)				-0.0920*
				[0.0357]
age	0.0790**	0.0683**	0.0681**	0.0685**
	[0.0201]	[0.0198]	[0.0199]	[0.0199]
Age squared	-0.0005**	-0.0005**	-0.0005*	-0.0005**
	[0.0002]	[0.0002]	[0.0002]	[0.0002]
vocational/professional education	0.0599	0.0543	0.0549	0.0572
	[0.0467]	[0.0473]	[0.0472]	[0.0471]
High education	0.1836**	0.1688**	0.1692**	0.1699**
	[0.0605]	[0.0614]	[0.0614]	[0.0609]
experience	-0.0352+	-0.0272	-0.0271	-0.0269
	[0.0194]	[0.0193]	[0.0194]	[0.0194]
Experience squared	-0.0001	-0.0001	-0.0001	-0.0002
	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Years out of labor market	-0.0466**	-0.0463**	-0.0464**	-0.0461**
	[0.0121]	[0.0121]	[0.0121]	[0.0121]
Years out of LM squared	0.0015	0.0019	0.0019	0.0018
	[0.0014]	[0.0013]	[0.0013]	[0.0014]
tenure	-0.0040	-0.0046	-0.0046	-0.0047
	[0.0053]	[0.0053]	[0.0054]	[0.0053]
Tenure squared	-0.0002	-0.0002	-0.0002	-0.0002
	[0.0002]	[0.0002]	[0.0002]	[0.0002]
Observations	10413	10413	10413	10413
R-squared	0.03	0.03	0.03	0.03
Number of id	2268	2268	2268	2268
+ significant at 10%; * significant at 5%; ** significant at 1%				

[9] Numbers in brackets are clustered standard errors. Regression also controls for marital status. Child(age) here means the smallest child .

As was mentioned in the Chapter 4 the sample used in this research is build from the retrospective part of first the 2003 wave of ULMS data set. Building the sample from the retrospective has negative impact on the quality of the data. For this research, the main problem is that 2003 questionnaire does not have information about when children left their home, therefore our results may overestimate the true wage penalty. To address this problem somehow Table A.5 summarizes the results of Pooled OLS, first difference, fixed and random effect and sample selection for both pooled OLS and fixed effect for just two years (2003-2004) of conducting of first and second wave of ULMS data set. The results for Pooled OLS are almost the same as for the case of 1997-2004 sample – coefficients are negative and insignificant. For first difference and fixed effect estimated coefficients for children variables are also insignificant and even positive. However the simple explanation of such result is that during just one year only a little fraction of females in the sample give a new birth, therefore the time variation of the variables is really small. In cases when there is a small variation in the explanatory variables, random effect estimator can perform better than both, fixed effect and first difference estimators. As the outcome of random effect estimation wage penalty for motherhood was found to be 4,8% for one child and 8,2% for two of more children. The result for one child is higher than for that for 1997-2004 sample and the result for two or more children is slightly lower. No sample selection bias was found for both OLS and fixed effect estimation. Despite results for random effects looks reasonable, the formal tests suggests that random effect is inappropriate estimation procedure, fixed effect and first difference should be used instead.

Endogeneity bias

As was mentioned in the methodology section there is a problem of endogeneity of experience and tenure (Korenman and Neumark (1992)). However, this issue can not be addressed with ULMS data set. Korenman and Neumark did their research for cross sectional data and suggested family background variables (occupation and education of parents, dummy of whether individual lived with parents at the age of 18, etc) as instruments. All proposed instruments are time invariant variables, therefore they can not be an appropriate instruments for the panel data estimation. In case of panel data such family background variables as husband's and partner's years of education, experience, tenure can be used as instruments for female experience and tenure (Mroz, 1987). However, it restricts the sample to only married females in addition in ULMS data set information about partners is available only for half of married females. So adding this variables to the regression will dramatically decrease the number of observations (from 10413 to 5472 for pooled OLS), and therefore degrees of freedom, that will lead to insignificant estimates.

2. Importance of education

An interesting question that arises after investigation of the wage penalty for motherhood is whether this penalty is the same for all females. Table 6 summarizes the results of fixed effect estimation of wage penalties for sub-samples of females with different levels of education. The logic behind the division of the entire sample on sub-samples is that labor markets are different for individuals with different education and skills level. The highest wage penalty is for those females whose highest level of education is high school or lower 15,8% and 22,6% for one child and two or more children respectively. This result contradicts the hypothesis that leaving the work do not impose high costs on low skilled workers (Andersnon, Binger and Krause, 2002). However, it may be the case in Ukraine that for low skilled female worker it is hard to find a good paid job after spending some years out of labor market and, therefore, they may suffer the most. For those females who have complete vocational/professional education (the largest share of the sample) there is no significant penalty for one child and wage penalty for two or more children is 12,5%, which is slightly lower than for the entire sample. Females with al least bachelor degree experienced 11,4% and 16% wage penalty for one child and two or more children respectively. This is consistent with the previous literature and follows the fact that high skilled workers should face high cost of being out of the labor force.

Moreover, effect of an additional year out of the labor market is the highest for females with high education (-8.8%), rather high and significant (-6,1%) for females with professional education and is insignificant for low skilled workers. The effect of age is positive and approximately two times higher for females with high education than for females with lower education level.

Table 6: Fixed effect estimates of wage penalty for motherhood by education level. ULMS 1997-2004[10]

	All	High school or lower	vocational/ professional education	bachelor degree or higher
One child	-0.0648* [0.0319]	-0.1570* [0.0754]	-0.0607 [0.0430]	-0.1136+ [0.0660]
Two or more children	-0.1326** [0.0371]	-0.2244** [0.0731]	-0.1245* [0.0550]	-0.1593** [0.0590]
age	0.0681** [0.0199]	0.0818* [0.0400]	0.0603* [0.0279]	0.1530** [0.0510]
Age squared	-0.0005* [0.0002]	-0.0006+ [0.0003]	-0.0005+ [0.0003]	-0.0008+ [0.0005]
vocational/professional education	0.0549 [0.0472]			
High education	0.1692** [0.0614]			
experience	-0.0271 [0.0194]	-0.0603 [0.0422]	-0.0235 [0.0260]	-0.0674 [0.0456]
Experience squared	-0.0001 [0.0003]	0.0003 [0.0005]	-0.0001 [0.0004]	-0.0004 [0.0005]
Years out of labor market	-0.0464** [0.0121]	-0.0005 [0.0256]	-0.0607** [0.0167]	-0.0882* [0.0389]
Years out of LM squared	0.0019 [0.0013]	0.0004 [0.0026]	0.0018 [0.0020]	0.0075 [0.0078]
tenure	-0.0046 [0.0054]	0.0080 [0.0113]	-0.0120 [0.0075]	0.0043 [0.0102]
Tenure squared	-0.0002 [0.0002]	-0.0005 [0.0004]	-0.0000 [0.0003]	-0.0002 [0.0003]
Married	0.0094 [0.0366]	0.0644 [0.0687]	0.0255 [0.0512]	-0.0183 [0.0910]
Widowed, divorced or separated	0.0069 [0.0336]	0.0488 [0.0473]	0.0101 [0.0542]	0.0030 [0.0777]
Observations	10413	2418	5639	2355
R-squared	0.03	0.04	0.03	0.04
Number of id	2268	628	1296	492
+ significant at 10%; * significant at 5%; ** significant at 1%				

[10] Numbers in brackets are clustered standard errors.

3. Importance of timing the first birth

Blackburn, Bloom and Neumark (1990) who developed the theoretical model that suggests that a delay in childbirth corresponds to higher wages than those who gave first birth earlier in their life. They investigate Mincerian wage equation adding age-at-first-birth variables as additional controls. However, adding age-at-first-birth variables are time invariant, therefore effect of them may be estimated through OLS estimation which does not takes into account unobserved individual specific effects. Random effect estimation takes into account this unobserved heterogeneity and can estimate the effects of variables that do not vary over time. However, this technique is extremely inefficient in case when unobserved effect is correlated with explanatory variables, which is the case in this study. Moreover, age at first birth is endogenous variable; females who earn high wages tend to postpone first birth. Therefore, in order to capture unobserved effect of ability or willingness to work cross terms between number of children and dummy variable, that corresponds to certain age at first birth will be incorporated into the fixed effect estimation of log-wage equation (Taniguchi, 1999). The obtained coefficient will give the wage penalty for each child for mother who gave her first birth in corresponding age.

The distribution of age at first birth of the entire ULMS sample is shown in Figure 6, the most frequent age at first birth is 19-22 years old. For the entire sample it appears to be that there is no wage penalty of each additional child of the childbirth is delayed till 25. For females whose level of education is not higher than high school effect of each child on wages is -12% (see Table 8), the most popular age at first birth for such females is 19-21 years old (Figure 7). Considering the timing effect for low educated females reveals that females who had their first birth at teen age, suffer from 12% wage penalty, females who postpone first birth slightly, suffer from 21% wage penalty. Which can follow the story that teen age mothers are skilful

enough to be able to reduce wage penalty, while females who did not receive education and did use their chance of early motherhood suffers the most. Further postponing of first birth is associated with no wage penalty and females who had their first birth after 30 years old experience even 15% wage premium from becoming mothers. Which means that low skilled females devote to work more effort if they become mothers after 30 years old, that can be due to a lot of accumulated job and life experience. Females with vocational/professional education have their first birth slightly later (at the age 20-23, Figure 8) than just high school graduates and the wage penalty for each child appeared to be 6,1% which is twice lower than for low educated females. Timing of the first birth is significant only for the cases of becoming mother at teenage (-7,6%), for later childbearing this effect is insignificant and even positive for the late first birth. Therefore, for this group of females timing of the first birth clearly reduces wage penalty for motherhood. Finally, for females with high education, who the most frequently have first birth later in their life that two previous categories (see Figure 9), there is no strong evidence that timing of first birth decreases wage penalty. This is due to the fact that effects o education and timing have different directions in the case of Ukraine. As was found above highly educated females can face higher opportunity costs for being out of labor market.

Table 7: Fixed effect estimates of wage penalty: Importance of timing of the first birth. ULMS 1997-2004[11]

	All females		High school		Vocational/professional education		High Education	
Number of kids	-0.0650**		-0.1198**		-0.0610*		-0.0794**	
	[0.0167]		[0.0349]		[0.0238]		[0.0291]	
(Number of kids) *(a1b<20)		-0.0783**		-0.1200**		-0.0764*		-0.0761
		[0.0269]		[0.0399]		[0.0355]		[0.0705]
(Number of kids) *(20≤a1b<25)		-0.0694*		-0.2075**		-0.0497		-0.0950**
		[0.0270]		[0.0695]		[0.0403]		[0.0355]
(Number of kids) *(25≤a1b<30)		-0.0274		0.0756		-0.0540		-0.0275
		[0.0442]		[0.1286]		[0.0613]		[0.0727]
(Number of kids) *(a1b≥30)		-0.0483		0.1560**		0.0430		-0.1309+
		[0.0554]		[0.0218]		[0.0764]		[0.0682]
agei	0.0683**	0.0678**	0.0812*	0.0827*	0.0607*	0.0598*	0.1524**	0.1532**
	[0.0198]	[0.0198]	[0.0398]	[0.0397]	[0.0278]	[0.0277]	[0.0511]	[0.0513]
ageisq	-0.0005**	-0.0005*	-0.0006+	-0.0006+	-0.0005+	-0.0005+	-0.0008+	-0.0008+
	[0.0002]	[0.0002]	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0005]	[0.0005]
PROF	0.0543	0.0531						
	[0.0473]	[0.0473]						
HE	0.1688**	0.1680**						
	[0.0614]	[0.0614]						
Observations	10413	10413	2418	2418	5639	5639	2355	2355
Number of id	2268	2268	628	628	1296	1296	492	492
R-squared	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.04
+ significant at 10%; * significant at 5%; ** significant at 1%								

[11] Numbers in brackets are clustered standard errors. Regression also controls for marital status variables and for such human capital variables as experience, tenure and number of years out of labor market as well as for squared terms of these variables

Chapter 6

CONCLUSIONS

During the soviet times no gander or wage gap in Ukraine was observed due to the governmental policy of equal wages to individuals with equal positions. After the collapse of USSR and during the period of transition rather high 37% gender wage gap appeared. One of the major parts of this gander wage inequalities between males and females is children, and all the additional costs that mother experience after becoming mother.

There is a strong theoretical evidence for significant wage penalty for motherhood due to decrease in labor productivity of females who become mothers (Becker 1965, 1985). The research estimates the size of this wage penalty for Ukrainian females in 1997-2004 using data from the Ukrainian Longitudinal Monitoring Survey, a national representative data set.

Due to the high gander wage gap in Ukraine and strong linkage between gender wage gap and family gap the magnitude of wage penalty for motherhood was expected to be valuable. Estimation results indicates significant negative effect of children on women's wage, even after controlling for individual specific time invariant unobserved heterogeneity. The wage penalty for motherhood in Ukraine is found to be approximately 20%. Females with only one child are found to earn 6,5% less than females without children, and females with two or more children earn approximately 13,3% less, the wage penalty for each additional child is approximately 6,5%. Comparing results with similar studies for other countries it can be concluded that results are closed to those obtained for the US economy in studies by Waldfogel (1997, 1998a, 1998b). Marital stat us was not found to be the determinant of female's lower wages in Ukraine even after controlling for individual specific time invariant unobserved heterogeneity.

The evidence suggests that the wage penalty for motherhood is different for females with different levels of education, and is the highest for low skilled females, which contradicts previous findings for other countries, which may be due to imperfections of Ukrainian labor market during the period under considerations. However females with vocational/professional education experienced the lowest wage penalty. And females with high education have the highest opportunity costs of each year of being out of labor market, which is consistent with previous findings by Anderson, Binder and Krause (2002).

Timing of the first childbirth reduces family wage gap. An interesting result was found for low educated females, they can even receive 15% wage premium if they delay motherhood till age of 30, and suffers the most if they gave first birth between 20 and 25 years old. The wage penalty for motherhood for females with vocational/professional education disappears if they have first birth after 20. For highly educated females evidence is mixed because effects of high education and timing have different directions.

Further research should be done to investigate the effect of maternity leave program on the mother's performance at labor market and whether it can reduces the wage penalty for motherhood. However, there is evidence (Harkness and Waldfogel, 1999) that even in developed countries with good parental leave system wage penalty for motherhood does not disappear.

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APPENDIX

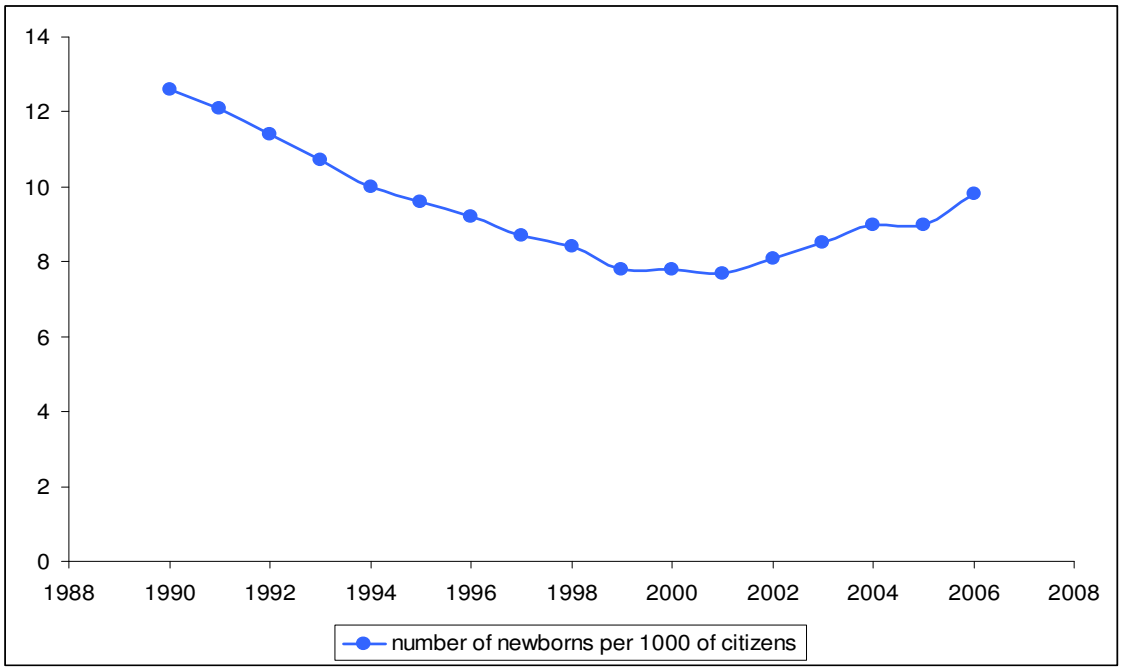

Figure 2: Birth rate coefficients in Ukraine 1990-2006. Source: State Statistical Committee (http://www.ukrstat.gov.ua)

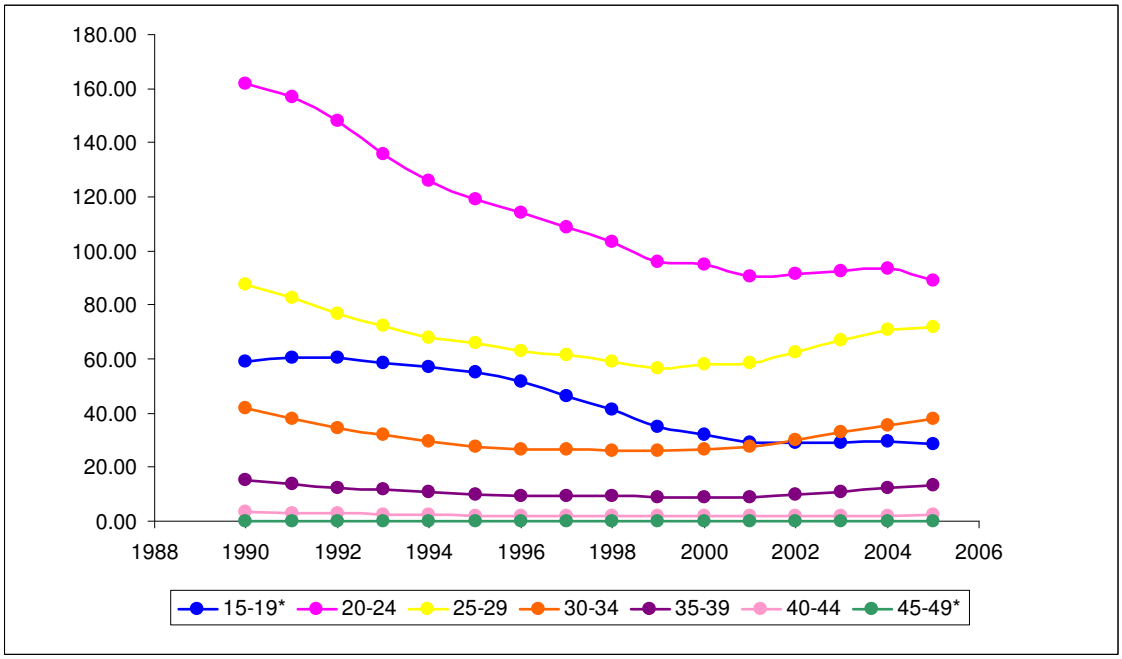

Figure 3: Birth rate coefficients in Ukraine by age of mothers (number of newborns per 1000 of females of correspondent age12) in 1990-2005 Source: State Statistical Committee (http://www.ukrstat.gov.ua)

[12] Note: * number of newborns from mothers younger than 15 and older than 49 are included into these groups.

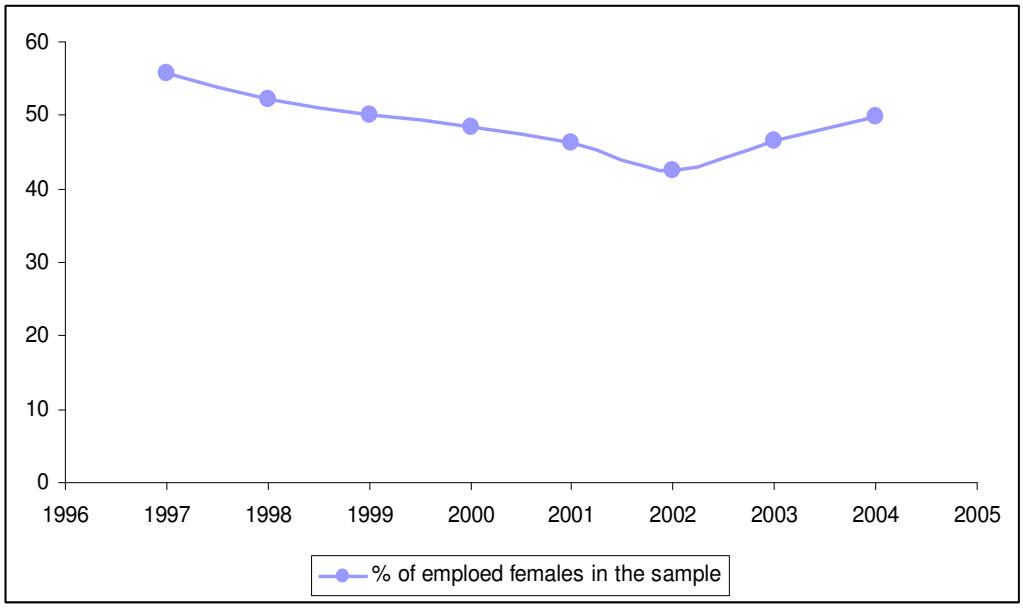

Figure 4: Percentage of employed females in the ULMS sample 1997-2004

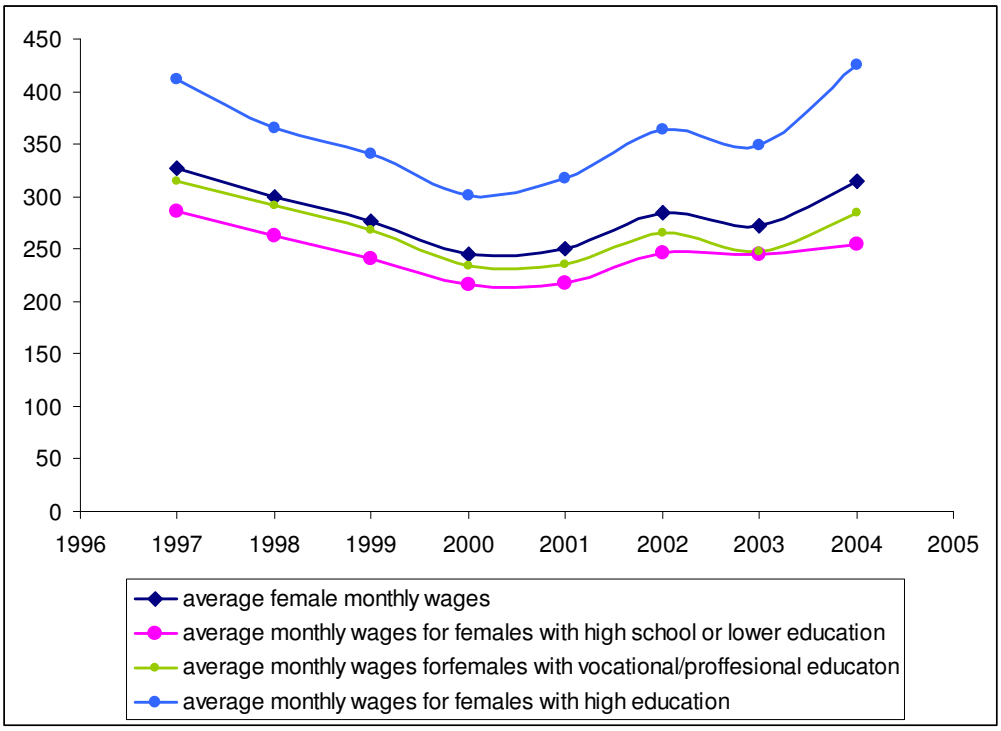

Figure 5: Average wage of females in the ULMS sample 1997-2004

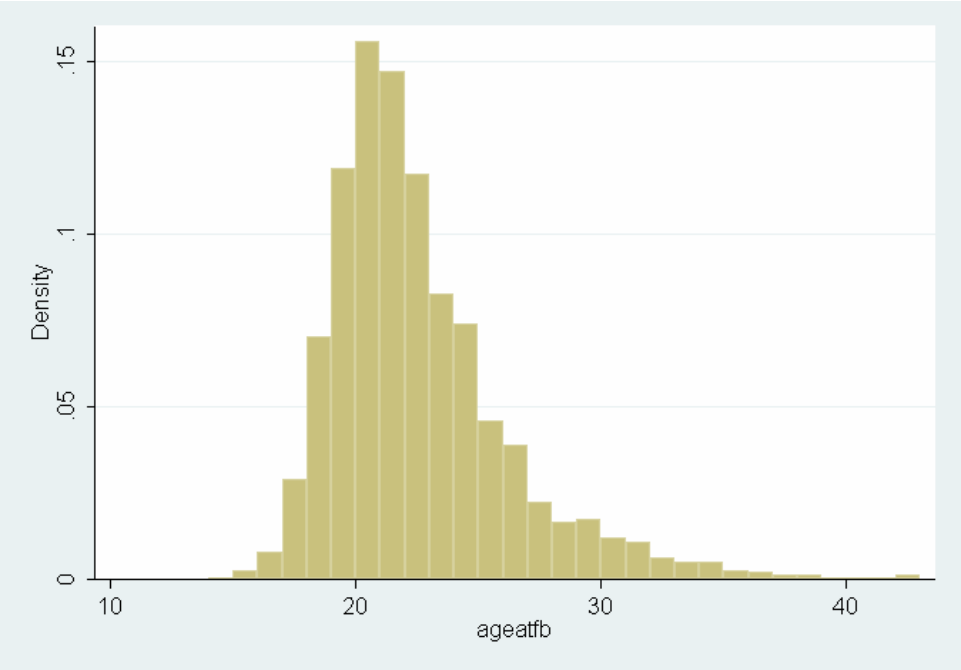

Figure 6: Frequency of age at first birth in ULMS sample

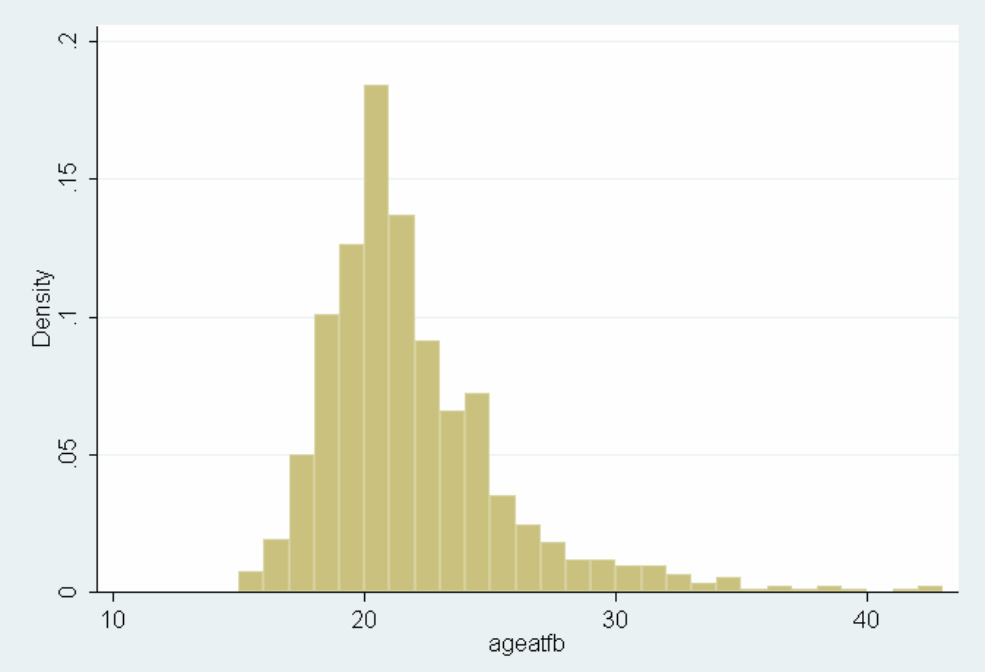

Figure 7: Frequency of age at first birth in ULMS sample for low educated females

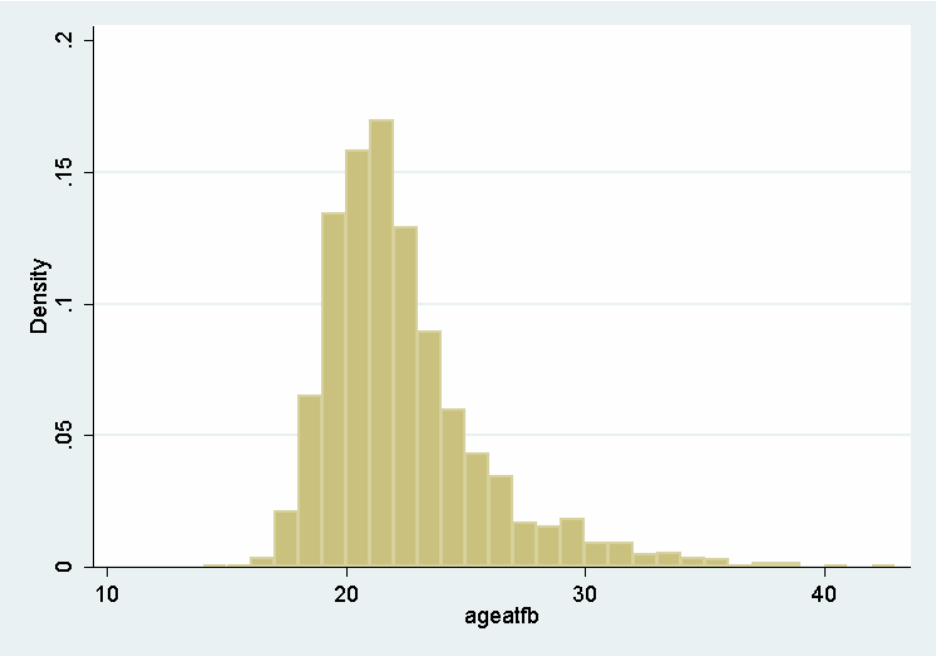

Figure 8: Frequency of age at first birth in ULMS sample for females with vocational/professional education.

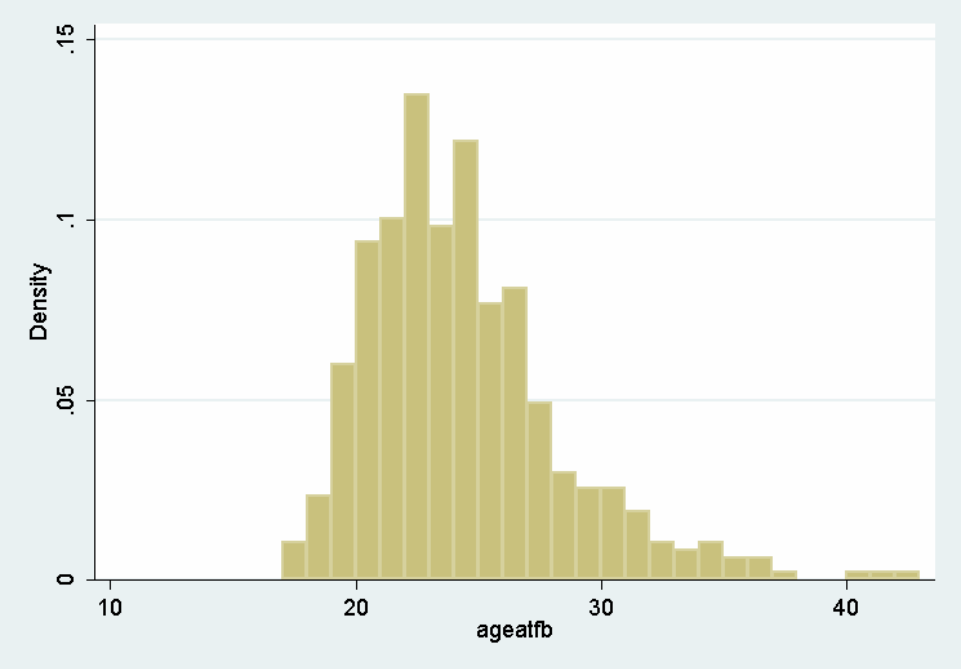

Figure 9: Frequency of age at first birth in ULMS sample for highly educated females

Table A.1 Sample construction

Restriction	**# of observations in Pooled sample**
All females in sample	31398
Working age (15-65)	28018
Employed	13539
With valid wages13	10706
Other restrictions	10413

Table A.2: Breusch and Pagan Lagrangian multiplier test for Pooled OLS vs. RE:

lh_wage[id,t] = Xb + u[id] + e[id,t]

Estimated results:	Var	sd = sqrt(Var)
lh_wage	0.3216196	0.5671152
e	0.1060515	0.3256555
u	0.2022207	0.4496895

Test: Var(u) = 0 chi2(1) = 8447.44
Prob > chi2 = 0.0000

[13] With valid wages means that for employed females hourly wage rate is available (which means that data about hours worked per week is available in order to calculate hourly wage rate) and monthly wage is higher than 10 hryvnias (in 2004 hryvnias)

Table A.3 Hausman model specification test for FE vs. RE

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	FE	**RE**	**Difference**	**S.E.**
One child	-.0645632	-.0399214	-.0246418	.0235703
Two or more children	-.1327242	-.0967228	-.0360015	.0284702
age	.0677154	.0338983	.0338171	.0173682
Age squared	-.0005058	-.0003262	-.0001796	.0001628
vocational/professional education	.05481	.0665148	-.0117048	.0406343
High education	.169102	.3004348	-.1313328	.0530937
experience	-.0263867	.0012959	-.0276826	.0180769
Experience squared	-.0001479	-.0002702	.0001223	.0002066
Years out of labor market	-.0466175	-.0170206	-.0295969	.0108893
tenure	-.0046505	-.0026762	-.0019743	.0038008
Tenure squared	-.0001776	.0000126	-.0001902	.0001449
Married	.0094281	-.0006943	.0101224	.0249614
Widowed, divorced or separated	.0071787	-.0142063	.021385	.0184859

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2(13) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 48.61
Prob>chi2 = 0.0000

Table A.4: Estimation of log-wage equation. For female sub-sample of 1997-2004 ULMS (explanatory variables of interest: dummies or one child, two children and more than two children) [14]

	Pooled OLS	**FD**	**FE**	**RE**	**OLS selection**	**FE selection**
One child	-0.0134 [0.0242]	-0.0945** [0.0354]	-0.0622+ [0.0320]	-0.0378+ [0.0217]	-0.0110 [0.0242]	-0.0648* [0.0324]
Two children	-0.0156 [0.0288]	-0.1409** [0.0394]	-0.1240** [0.0376]	-0.0899** [0.0243]	-0.0183 [0.0291]	-0.1284** [0.0393]
More than two children	-0.0525 [0.0674]	-0.2110+ [0.1130]	-0.2374* [0.0939]	-0.1806** [0.0575]	-0.0664 [0.0675]	-0.2416* [0.0952]
age	0.0092 [0.0100]		0.0683** [0.0199]	0.0328** [0.0096]	0.0194 [0.0135]	0.0695** [0.0202]
Age squared	-0.0001 [0.0001]		-0.0005** [0.0002]	-0.0003** [0.0001]	-0.0003 [0.0002]	-0.0005* [0.0002]
vocational/professional education	0.0858** [0.0267]	0.0589 [0.0474]	0.0540 [0.0473]	0.0762** [0.0244]	0.1039** [0.0307]	0.0602 [0.0509]
High education	0.3813** [0.0323]	0.1147* [0.0547]	0.1685** [0.0614]	0.3215** [0.0313]	0.4178** [0.0448]	0.1772** [0.0657]
experience	0.0083 [0.0071]		-0.0273 [0.0194]	0.0020 [0.0069]	0.0168 [0.0103]	-0.0243 [0.0210]
Experience squared	-0.0002 [0.0002]		-0.0001 [0.0003]	-0.0003+ [0.0002]	-0.0004+ [0.0002]	-0.0002 [0.0003]
Years out of labor market	-0.0045 [0.0053]	-0.0422* [0.0170]	-0.0463** [0.0121]	-0.0166** [0.0052]	-0.0076 [0.0060]	-0.0460** [0.0121]
tenure	0.0086* [0.0038]	-0.0042 [0.0076]	-0.0045 [0.0054]	-0.0029 [0.0038]	0.0084* [0.0038]	-0.0045 [0.0054]
Tenure squared	-0.0001 [0.0001]	-0.0004 [0.0003]	-0.0002 [0.0002]	0.0000 [0.0001]	-0.0001 [0.0001]	-0.0002 [0.0002]
Married	-0.0204 [0.0304]	-0.0105 [0.0384]	0.0093 [0.0366]	-0.0074 [0.0268]	-0.0242 [0.0306]	0.0089 [0.0367]
Widowed, divorced or separated	-0.0370 [0.0349]	-0.0706* [0.0326]	0.0069 [0.0336]	-0.0150 [0.0280]	-0.0311 [0.0352]	0.0079 [0.0336]
Lambda (for selection to LM for OLS)						0.0131 [0.0355]
Lambda (for selection to LM for FE)					0.1139 [0.0963]	
Observations R-squared Number of id	10413 0.16	7703 0.01	10413 0.03 2268	10413 2268	10413 0.16	10413 0.03 2268
+ significant at 10%; * significant at 5%; ** significant at 1%						

[14] Numbers in brackets are clustered standard errors. Regression also controls for regional dummies and urban type

Table A.5: Estimation of log-wage equation. For female sub-sample of 2003-2004 ULMS [15]

	Pooled OLS	FE	RE	OLS selection	FE selection
One child	0.0100 [0.0272]	0.0173 [0.0365]	-0.0415+ [0.0249]	0.0113 [0.0272]	0.0133 [0.0363]
Two or more children	-0.0210 [0.0346]	0.0505 [0.0471]	-0.0812* [0.0321]	-0.0248 [0.0347]	0.0461 [0.0465]
age	0.0112 [0.0128]		0.0224+ [0.0131]	0.0238 [0.0171]	
Age squared	-0.0002 [0.0001]		-0.0003+ [0.0001]	-0.0004 [0.0002]	
vocational/professional education	0.0838** [0.0317]	-0.0588 [0.0628]	0.1044** [0.0315]	0.1096** [0.0391]	-0.0689 [0.0642]
High education	0.4274** [0.0364]	-0.0999 [0.0944]	0.4243** [0.0371]	0.4738** [0.0569]	-0.1213 [0.0968]
experience	0.0077 [0.0080]	0.0912 [0.0591]	-0.0030 [0.0084]	0.0171 [0.0114]	0.0962 [0.0632]
Experience squared	-0.0002 [0.0002]	0.0021+ [0.0011]	-0.0000 [0.0002]	-0.0004+ [0.0002]	0.0009 [0.0013]
Years out of labor market	-0.0101 [0.0063]	0.0206 [0.0555]	-0.0106 [0.0068]	-0.0163+ [0.0085]	0.0221 [0.0635]
tenure	0.0101* [0.0045]		0.0142** [0.0046]	0.0098* [0.0045]	
Tenure squared	-0.0001 [0.0001]		-0.0003* [0.0001]	-0.0001 [0.0001]	
Married	-0.0413 [0.0401]	0.0201 [0.0713]	-0.0442 [0.0385]	-0.0481 [0.0408]	0.0216 [0.0712]
Widowed, divorced or separated	-0.0344 [0.0418]	0.0067 [0.0550]	-0.0312 [0.0378]	-0.0252 [0.0424]	0.0053 [0.0547]
Non wage income	0.0001+ [0.0001]	0.0000 [0.0001]	0.0002** [0.0000]	0.0001+ [0.0001]	0.0000 [0.0001]
Household size	-0.0189+ [0.0104]	0.0016 [0.0169]	-0.0143 [0.0100]	-0.0184+ [0.0104]	0.0024 [0.0168]
settlement	0.2258** [0.0227]	0.0585 [0.0511]	0.2036** [0.0230]	0.2263** [0.0227]	0.0610 [0.0510]
Lambda (for OLS)					-0.0011 [0.0746]
Lambda (for FE)				0.1437 [0.1301]	
Observations R-squared Number of id	2691 0.20	2693 0.15 1668	2691 1666	2691 0.20	2691 0.16 1666

[15] Numbers in brackets are clustered standard errors. Regression also controls for regional dummies and urban type. First difference estimation in case of two time periods gives the same result as fixed effect estimation and therefore is not presented in the table.