DISCUSSION PAPER SERIES

IZA DP No. 7810

Motherhood Wage Penalty in Times of Transition

Olena Y. Nizalova
Tamara Sliusarenko

December 2013

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Motherhood Wage Penalty in Times of Transition

Olena Y. Nizalova
Kyiv School of Economics,
University of Kent and IZA

Tamara Sliusarenko
Technical University of Denmark

Discussion Paper No. 7810
December 2013

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 7810
December 2013

ABSTRACT

Motherhood Wage Penalty in Times of Transition[1]

Motherhood is usually associated with lower wages due to a number of reasons such as career interruptions, potentially decreased productivity/effort, and discrimination. Earlier literature provides a range of estimates from an up to 20% wage penalty in economies with more flexible labor markets to virtually zero in more family-supportive settings. We focus on a country with de jure family supportive labor laws, which de facto has developed very flexible pro-employer hiring and firing practices. We seek to understand whether this status quo has any implication for the country's concern related to lowest low fertility. Ukrainian Longitudinal Monitoring Survey provides the data to estimate the motherhood wage penalty in Ukraine during the period from 1997 to 2004. Controlling for individual unobserved heterogeneity we find that the wage penalty is approximately 6.5% per one child and 13.2% for two or more children. In addition, we find that the level of education and the timing of first birth has an impact on the motherhood wage penalty. It is smallest for females with vocational/professional education, and virtually disappears if female in this group gave first birth after 20 years old. Females with low educational level even receive wage premium of 15% if they delay first birth until after 30 years.

JEL Classification: J31, J13, J71

Keywords: motherhood wage penalty, pro-natalist policy, discrimination

Corresponding author:

Olena Y. Nizalova
University of Kent
N.117 Cornwallis Building
Canterbury, Kent, CT2 7NF
United Kingdom
E-mail: O.Nizalova@kent.ac.uk

[1] The authors are thankful to Nataliia Shapoval for her excellent research assistance, and to the participants of the KSE Master Thesis workshops for their valuable comments and suggestions.

1. Introduction

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 greater involvement in the child caring 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 associated with 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 lower salary to both women with children as well as to childless women. The presence of children may signal to employers about females' potentially lower productivity. While absence of children may signal about a woman's future separation from the workplace with the purpose of raising a child.

After the collapse of the USSR, the total fertility rate has dropped in Ukraine dramatically reaching the lowest level of 1.1 in 2001-2002. Figure 1 shows the crude birth rate dynamics of the entire period considered. Combined with the significant out migration following the demise of iron curtain, this has led to a negative rate of population growth throughout the 1990s and onwards. This inspired the ongoing policy debate within the country calling for government measures to address the issue of the lowest low fertility. In spite of the complexity of the fertility decision

mechanisms, the one and only pro-natalist policy pursued by the Ukrainian government has been the so-called baby bonus.[2]

This bonus over the course of 1990s had been set at the extremely low level, but had been increased several times to a considerable degree over the course of 2000s. Table 1 shows the evolution of this policy. The significance of the increases and the burden for the state budget called for the analysis of the impact of these fiscal measures on the fertility decisions. Yet, no rigorous evaluation of this pro-natalist policy has been undertaken. Albeit a recent study by Sologoub (2013) shows virtually no effect of income on fertility decisions in Ukraine. At the same time this study finds some evidence in support of the importance of child-related infrastructure, such as childcare availability.

Another kind of pro-natalist policies is the maternity leave – an employee benefit which provides paid or unpaid leave from the job and guarantees the job place availability at the end of it. The changes to this benefit in Ukraine are described in Table 2.

Both the baby bonus and the maternity leave benefit are intended to decrease the cost of raising a child and it is important to understand the degree of the compensation by taking into account not only actual costs of baby's food and clothes, education and healthcare, but also the opportunity cost of parental time, especially that of mothers. 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. Clearly, even after adjustment for the cost-of-living and income differences, the amount of the baby bonus cannot fully compensate families for the childbirth. Moreover, this may not be needed. Most people decide to have children taking into account other aspects of this matter, not only

[2] http://en.wikipedia.org/wiki/Baby_bonus

material considerations. Similarly, the way the government pursues its pro-natalist goal should probably also include some non-material measures. From the point of view of an employer, mothers who stay at home with their small children may be unproductive, but from the point of view of the society and the whole economy, by educating and rearing their children mothers contribute to the human capital that will be important for future economic growth. These are the concepts, which are difficult to quantify, but ignoring them may lead to substantial inefficiencies in the labor markets, when equally qualified and motivated females with children are paid less than their childless counterparts.

The literature on the motherhood wage penalty has been quite rich, estimating the effect of children on female wages in various countries and/ or contexts. The largest motherhood wage penalty of about 20% has been estimated for the United States (Waldfogel 1997, 1998a, 1998b; Baum 2002, Budig and England 2001, Loughran and Zissimopoulos 2009, Lundberg and Rose 2000, and others). This followed by the estimates for UK (Waldfogel 1995, 1998a), Canada (Drolet 2002), Germany (Buligescu et al. 2009), and Australia (Livermore, Rodgers, and Siminski 2010), with the lowest or zero effect found in Denmark (Gupta and Smith 2002) and Sweden (Albrecht et al. 1999). These previous findings suggest the importance of institutional settings in the direct impact of children on female wages after controlling for various human capital characteristics, such as experience, tenure, and education, which are related to child-bearing decisions. It seems like the overall focus on family values and promotion of equal family roles between genders may be contributing to the decrease in the direct motherhood wage penalty, and, thus, to a decrease of true cost of having children.

Understanding the existence and extent of the motherhood wage penalty in Ukraine is important for several reasons. One is that Ukraine represents an academically interesting context where to study the motherhood wage penalty. On the one hand, it has probably the most de facto

liberal labor market environment where the employers do not bear any responsibility for discriminating against women/mothers, even though there is a de jure provision for secured rights of pregnant women and mothers. This is achieved through an informal arrangement either as a promise taken at the start of a job to leave the position once a woman is pregnant, or a provision of an undated letter requesting quit at "own will", which the employer uses once the "threat of pregnancy" becomes a reality. The second reason is that it is very policy relevant. Over the course of late 90s – 2000s several attempts have been made to increase the baby bonus dramatically, yet resulting in no noticeable impact on overall fertility with some evidence pointing to the shifting of the timing of birth by those who would have the same number of children no matter what the policy is. Potentially, this indicates that there is a factor not taken into account by policy makers, which may be misleading their choices of policy measures. Finally, due to the change in the economic system and the following devaluation of previously accumulated human capital, Ukraine provides an interesting case study to document whether this human capital is useful in protecting against the adverse impact of having a child. Combined with the timing of the first birth effect, these findings could inform further pro-natalist policy making concerning better targeting of the government initiatives.

This paper is devoted to the analysis of the effect of children on women's earnings, investigating whether motherhood has significant negative impact on labor market performance in Ukraine. We specifically choose to control for various human capital characteristics and study the direct impact of having a child and the number of children on female hourly wages. Partially this is to avoid the issue of endogenity arising from the choice between continued working and leaving the job being related to the hourly wages. And partially to draw attention to the need for policy measures promoting motherhood as socially valuable and providing infrastructure for women to successfully combine jobs and child caring responsibilities, as this setup leaves two explanations

for the direct effect of children – effort allocation and discrimination, which can be addressed by corresponding policy measures.

Constructing the panel data from the Ukrainian Longitudinal Monitoring Survey (ULMS) for the period 1997-2004 and estimating the fixed effect model, we find motherhood wage penalty of approximately 20%. Females with only one child earn 6.5% less than females without children, and females with two or more children earn approximately 13.3% less. Thus, the wage penalty for each additional child is approximately 6.5%. This is close to the US estimates by Waldfogel (1997, 1998a, 1998b).

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. However, the variation in the penalty across the education groups differs depending on the timing of first birth. Thus, low educated females receive 15% wage premium if they delay motherhood until the age of 30, and suffer the most if they give 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 age 20. For highly educated females, the evidence is mixed because the effects of high education and timing have different directions.

The remainder of the paper is organized as follows. Section 2 provides an overview of the previous literature concerning family wage gap and women's performance in the labor market following the childbirth. The underlying methodology is presented in Section 3, and data description – in Section 4. Estimation results as well as econometric issues pertinent to the current analysis are discussed in Section 5, followed by the Conclusions.

2. Literature Review

Labor market aspects of motherhood are reflected in economic literature in terms of theories of time allocation (Becker, 1965) and human capital (Mincer, 1958). These economic approaches build on the contemporary aspects of the woman`s life-time surrounding pregnancy, childbirth, and further child rearing. Motherhood is associated with re-allocation of time, lower investment in human capital, and even with deterioration of human capital due to career interruptions, changes in productivity and work effort, and changes in preferences for specific job amenities. Moreover, it is often claimed that in addition to objective constraints of motherhood, there is still an evidence of discrimination, mostly statistical.

Motherhood is usually associated with lower investment in human capital. Changes in time allocation within the household have given rise to a wide set of literature, which measures cost of children in terms of time and money (Millimet 2000, Craig 2007). This idea is simply illustrated by Becker`s theory (1965) – after a childbirth, women substitute labor market production into time spent with family. Such re-allocation of time shortens educational period and prevents females from further on-the-job investments in human capital when this option competes for the time with children. Life-cycle investment profiles of mothers are not monotonic. Therefore, this distinguishes them from men and childless women during pre-maternal, childbearing and child rearing periods. Mothers, on average, invest less, and, child rearing may have an effect on the rate of depreciation of human capital (Mincer and Polachek, 1974). As a result, the experience-wage profile may differ between mothers and non-mothers as suggested in Figure 2.

With a global upward trend in the age at first birth, researchers started investigating the impact of this on human capital accumulation and wages. Pregnancy in young years lowers investment in education (Fletcher and Wolfe 2008, Lang and Ashcraft 2010) and experience. Mature motherhood, while having less severe impact (Blackburn, Bloom and Neumark, 1990),

still leads to shorter work experience. On the other hand, career interruption for females who have accumulated sufficient work experience before becoming mothers imply higher opportunity cost of time out of the labor market (Anderson, Binder and Krause 2002). Drolet (2002) finds that women who have first childbirth later in life earn 6% more than those who have first child earlier. Almuendo-Dorates and Kimmel (2004) investigate the importance of education and delaying of childbirth in the US and find that college-educated women who delayed motherhood beyond 30 earned 21% more.

Every now and then researchers mention one more component of the wage penalty for motherhood – the decrease in productivity – rooted in Becker's theory of "Human Capital, efforts and sexual division of labor" (1985). Becker claims that marriage and children have an important impact on career performance of women. In particular, "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". Empirical testing of this hypothesis is rather difficult due to the lack of cases when productivity can directly be measured. In professional sports, however, earnings are determined by performance, that is, by productivity. Kalist (2008) study of The Ladies Professional Golf Association support the human-capital explanation and Becker's effort hypothesis of the family gap by showing that, indeed, productivity of women starts falling as soon as they become mothers. On the contrary, no significant difference is found between mothers and non-mothers in academia in terms of publishing (Cole and Zuckerman 1987, Fox 2005). These two results concerning scientists and sportswomen provide an illustration of potentially possible outcomes, but can hardly be generalized to the whole population.

Another labor market aspect is that due to objective constraints tied to childcare period, women search for jobs with special amenities, and therefore, may agree to lower wages. Studies based on German data (1984-2005) show that motherhood wage penalty decreases by almost 10%

if the question is considered in the framework of Compensating Wage Differentials Theory (Felfe 2006).

An interesting set of literature is focusing on the direct impact of children on female wages after controlling for various human capital characteristics. This specification when finding motherhood wage penalty can be consistent with both Becker's effort allocation theory and discriminations against mothers. This literature is vast with the motherhood wage penalty found in USA (Anderson, Binder and Krause 2002, 2003, Baum 2002, Budig and England 2001, Loughran and Zissimopoulos 2009, Lundberg and Rose 2000, Taniguchi 1999, Waldfogel 1997; 1998a), in Britain (Waldfogel 1995, 1998a, Viitanen 2004), Canada (Drolet, 2002) and Germany (Buligescu et al. 2009). These approaches give merely consistent estimate of penalty ranging from two per cent (Baum 2002; Loughran and Zissimopoulos 2009) to nine per cent (Waldfogel 1995, 1998a) for one child. Some studies observe rather high (up to 20%) wage penalty for the first child (Kunze and Ejrnaes 2004). However, studies in Denmark (Gupta and Smith 2002) and Sweden (Albrecht et al. 1999) find that motherhood have little no direct effect on wages. Generous parental leave programs and powerful labor unions most probably explain this finding. For example, in Sweden mothers are paid up to 85% of theirs salary during the maternity leave. Australian studies provide mixed results: no wage penalty found by Whitehouse (2002) and Krepp (2007), but nearly four percent penalty for the first child found in the recent study by Livermore, Rodgers and Siminski (2010), who suspected that previous findings were biased by unobserved heterogeneity and the omission of key controls.

Some researchers have undertaken cross-country comparisons of motherhood wage penalties. Analyzing surveys (1999 – 2000) for eight industrialized countries, Sigle-Rushton and Waldfogel (2007) conclude that mothers in Nordic Countries (Norway, Finland, Sweden) at age 45 earn 82-89% of what non-mothers earn. At the other extreme, mothers in the Netherlands and

Germany earn 56-74 % of non-mothers' earnings. UK is closer to Continental Europe – with 67-75 % of non-mothers` earnings, while other Anglo-American countries, USA and Canada, are more similar to Nordic countries – 81-89%.

Performance of mothers in labor markets in the CIS countries have not received enough attention so far. Only few tangentially relevant estimates are available. Gerry, Kim and Li (2004) examine the gender wage gap in Russia using Russian Longitudinal Monitoring Survey and find rather stable 27% average gender wage differential for the period 1994-1996. However, the gap becomes wider after the financial crisis of 1998. The difference in wages of mothers and childless women in Russia comprised nearly 8% (Arzhenovskiy and Artamonova 2007) in 2003-2005 years. Another Ukrainian neighbor, Poland, is shown to be the only country in the European Union without gender wage differential (Sile Padraigin O'Dorchai 2008). While the same study finds a negative motherhood penalty in several countries: Estonia, Luxembourg, the UK, the Netherlands, Italy, Hungary and Greece. It ranges from 1% in Poland, Greece and Hungary to 12% in Estonia.

We are not aware of a single paper on the performance of mothers in Ukrainian labor market. In Ukraine the gender gap was 41% in 1991 and fell to 34% in 2003, according to the results by Ganguli and Terrell (2005) from the analysis of the first wave (2003) of ULMS data set. This finding indicates the potential existence of motherhood wage penalty as the differential is averaged across all women – mothers and childless women.

This paper adds to the literature by providing the analysis of labor market performance of mothers in a country with de jure very family friendly policies but de facto arrangements which allow for discrimination. The existence and magnitude of motherhood wage penalty is importance to know for Ukraine a country with the lowest low fertility and a continuing policy struggle to fight de-population. We specifically focus on the impact of children on female wages after controlling for various human capital characteristics, such as education, actual experience, and

time out of the labor market. Although, knowing the pathways through which having a child affects female wages is very important, the focus on the direct effect allows us to draw policy recommendations which may be more efficient than the currently used pro-natalist baby bonuses.

3. Methodology

We start with female wages determined by the human capital model:

$$\ln W_{it} = \beta_0 + \mathbf{X_{it}}\boldsymbol{\beta} + (u_i + v_{it}) \quad , \qquad (1)$$

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 are divided into three main groups. The first group is children-related variables, such as number of children, number of children in a particular age category (infant child, preschool child or school child). The second group is mother specific characteristics that have an impact on her labor market outcomes, such as mother's marital status, age, experience, tenure. The third group includes family and household specific characteristics such as family non-wage income, ownership of the residence, number of adults in the household, type of settlement (urban/rural), and region dummies.

The 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 $E(\mathbf{X'_{it}}u_i) = 0$. The last equation is a restrictive assumption while the first one holds if we have a correctly specified model $E(\ln W_{it} | \mathbf{X_{it}}, u_i)$. In our particular case, the assumption of $E(\mathbf{X'_{it}}u_i) = 0$ is likely to be violated. There is a number of unobserved characteristics which affect the wage level and are also correlated with the decision to

have a child and when to have a child, such as productivity or willingness to work. To account for individual time fixed unobserved heterogeneity we use fixed effects model.

Another problem that arises in such application is the sample selection. 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.

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

where h_i - is dummy variable equal to one if a woman is employed and zero otherwise. If explanatory variables in employment status regression and wage regression are the same, the model is only identified through the fact that inverse Mills ratio is a nonlinear function. If the variation in "lambda" is small, the relationship between lambda and $\mathbf{Z}_{\mathbf{it}}$ is close to linear. Therefore inclusion 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 and individual specific unobserved heterogeneity issues occur simultaneously. Some estimators have been proposed which deal with both sources of estimation bias, producing consistent results under different assumptions. Wooldridge (1995) proposes 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 the error terms (Rochina-Barrachina 1999) and the fixed effects (Kyriazidou 1997)

in the equation of interest. Dustmann and Rochina-Barrachina (2000) apply the three methods mentioned above to the estimation of wage equation for female labor market participants, verifying the impact of actual labor market experience on wages. The 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. Given the data availability, we use the estimation procedure proposed by Wooldridge (1995). Selection equation is estimated following the Chamberlain's random effect probit model where $Z_i = (Z_{it}, \bar{Z}_i)$. Then the inverse Mill's ratio $\hat{\lambda}_{it}$ is added to the fixed effect estimation using selected sample of employed women ($h_{it} = 1$).

One of the major concerns in most studies of the effect of children on labor market outcomes for mothers is endogeneity of such explanatory variables as marriage, motherhood, experience and tenure in the wage equation. Korenman and Neumark (1992) explore these econometric issues in a cross-sectional analysis of marriage, motherhood and earnings. They perform their analysis using the data set from the National Longitudinal Surveys 1968. Their main findings are that the OLS estimation produces biased results due to unobserved individual specific heterogeneity and they find 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. They find a 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 the mother can be used as instruments for experience and tenure.

Taking into account previous findings and suggested procedures we will proceed according to the following algorithm: (i) Pooled OLS model, (ii) OLS corrected for selectivity into labor market, (iii) FE estimation, and (iv) FE estimation corrected for selectivity into labor market. In addition, using the preferred specification, we will explore whether the estimates of the

motherhood wage penalty differ across different educational groups and depending on the age at first birth.

3. Data

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 in 2003 and contains 4,056 household and 8,621 individual observations. The second wave of ULMS was administrated in 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.

3.1 Sample construction

Using both the reference week data and retrospective information, we construct a panel data over the period from 1997 to 2004, and restrict it to female respondents aged between 15 and 69 in 2003. There are three important concerns which led us to the exclusion of earlier years from

the retrospective data. One of the concerns 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. In some 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, Ganguli and Terrel 2005). Second, 1986 wages are reported in USSR rubbles and 1991 wages – in coupons, which need to be brought to real terms, of course. There is rather precise information about inflation for 1997-2004[3], 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. Finally and most importantly, we do not have retrospective information on children in the household. We are bound to assume that the child living with the mother in 2003 lived with her all the time since he/she was born. Likewise, if the mother does not have a child living with her, we assume that even if she gave birth to a child, the child has not lived with her and thus has no effect on her wages.

To avoid a division bias, hourly wage rate is calculated following Kimmel and Kniesner (1998). Monthly wage is divided by 40 if a person reports that she works not less than 25 hours per week and divided by 20 if she works less than 25 hours per week. The obtained values must then be also divided by the average number of weeks in a month (52/12)

The ULMS data set allows constructing a data set for females that contains 31398 person-year observations, 28018 of which are for working aged (15-65 years old). Approximately one-

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

half of these females are employed. The final pooled data set contains 10413 observations, which is approximately 2300 observations per year.

3.2 Sample Description

Table 2 presents 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,[4] 35% have only one child, 18% have two children and only 2.7% of the sample have more than 2 children.

Approximately 28% in 1997 and 18% in 2004 of the sample have not finished high school. This is not a surprising result, because due to the World War II older women could have had left school earlier. The largest share of the sample – 33% in 1997 and 42% in 2004 – are females with professional secondary education, while only 14-16% have at least 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 the overall unemployment increased significantly. Figure 3 shows the percentage of employed females in the sample over 1997-2004. The lowest employment, 42%, is observed in 2002. While monthly wages reach minimum in 2001 with a recovery trend after 2002 (Figure 4). The average monthly wage is 330 hryvnias (in 2004 hryvnias) in 1997, 315 hryvnias in 2004, and the lowest average wage was 245 hryvnias in 1999. AS could be seen, female wages in different educational groups follow similar time trend with a clear upward shift by education.

[4] 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.

Descriptive statistics for the pooled sample is provided in Table 3. 83% of the entire sample ever had a child, 51.4% of which are employed, and 89% of employed mothers are employed full time. The average age is 41 years, while the average age of ever mothers is 44 years. Mothers have on average higher potential work experience as well as actual work experience and higher tenure. However, mothers on average receive lower wages than women who never gave birth to a child. This can be explained by the fact that the subsample of the childless women is younger. So these females are childless not because of their decision but because they are rather young to become mothers. Only 17% of childless females are married, while 71% of mothers are married.

It should be pointed out that the average number of children living with their mothers is equal to 0.8. That can be explained by the fact that our sample is built from the retrospective part of the 2003 ULMS wave. The problem is that if a particular child does not live with his/her mother in 2003 there is no way to know when he/she left the home. Therefore, for a mother whose children do not live with her in 2003 we assumed that they did not live with her in 1997. And, vice versa, if a woman has a child living with her in 2003, we assume that this child has lived with her since 1997. This could bias results both ways. So, we return to this matter later when discussing the results.

The first wave of the ULMS data set contains a retrospective part, which allows constructing the measure of actual experience. Among females in the sample the average actual experience of working age women equals to 15.2 years and is much less than potential work experience[5] which is equal to 23.7 years. Years out of the labor force are on average almost 10 years among all mothers and almost 3 years among non-mothers. At the same time among those who are employed mothers have 5.5 years out of the labor force and non-mothers – 2.2.

[5] Usually potential experience is calculated as age minus years of education minus 6. However the 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.

4. Results

4.1. Estimation of the wage penalty of motherhood

Estimates from the basic model for working age females (15-65 years old) are shown in Table 4. Explanatory variables of interest are dummy variables for number of children in household. No children is omitted category. The estimated motherhood wage penalty from the pooled OLS regression (Column 1) is virtually zero, both in terms of magnitude and in terms of statistical significance. However, the coefficients have the expected negative sign, which may be consistent with Becker's theory of time allocation or with the presence of discrimination, as additional control include all of the available measures of human capital. The coefficients on marital status variables are jointly insignificant (p - value=0.3357).

The sample we use includes only those individuals for which we observe wages, i.e. employed individuals, which might produce biased results (Heckman 1979). For example, a woman who is less productive in the job market, but more productive in the household, will face lower wages and will be more likely to have more children. So, these women choose not to work. Not taking them into account may lead to the underestimation of the motherhood wage penalty (find it being less negative). Column (2) presents the second stage results from the Heckman Selection procedure. This Inverse Mills Ratio comes from the first stage based on the probit regression of female participation in the labor market with the same explanatory variables as in the OLS regression plus a dummy for the presence of an infant in the family, all marital status variables and excluding tenure in order to improve the identification of the second step (Verbeek, 2004, p. 217). After adding of inverse Mills ratio into the pooled OLS regression, the estimated effect children almost does 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,

which is consistent with the findings in Gupta and Smith (2001), Waldfogel (1998), and Korenman and Newmark (1990)

Heterogeneity bias

The OLS and Heckman Selection Procedure allow controlling only for observable characteristics, while there might be individual specific time invariant unobserved characteristics (such as ability, work-related preferences, wiliness to work, etc.) that also have an impact on females' wages. As a result, the OLS estimates may be biased because of other omitted variables. We exploit the panel nature of the data and turn to the fixed effects procedure to account for the time invariant unobserved individual heterogeneity. Results from this regression are provided in Column (3). The coefficients on variables of interests are of the expected sign and now statistically significantly different from zero. The negative effect of having one child is 6.5%, and that of two children or more children is 13.3%. With respect to human capital characteristics, returns to education are estimated to be of 16% for higher education and insignificant for vocational/professional education, which is consistent with the overall literature on returns to education. The effect of experience and tenure becomes virtually zero after controlling for unobserved heterogeneity. At the same time, years out of the labor force now have significant and sizeable effect on wages. Basically, four cumulative years out of the labor force completely reverse the premium from university education. The effect of marital status variables are still negative insignificant and jointly insignificant ($p - value = 0.9860$). The formal 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). In addition to theoretical justifications for the appropriateness of the fixed effect procedure we have run a formal Hausman model specification

test of fixed effects versus random effects which has suggested that random effects is not appropriate (chi-sq statistics = 48.61).[6]

Although the test with the OLS model has provided no evidence of selection bias, this may be different in the panel setting. Therefore, we apply sample selection correction procedure to the fixed effects estimator (Wooldridge 2002, Chapter 17.7) in order to address the issue of the bias associated with self-selection into labor market controlling for unobserved individual heterogeneity. Column (4) of Table 4 presents results of fixed effect estimation with additional term – "lambda" (Inverse Mills Ratio). IMR is estimated from the Chamberlain's random effect probit model with the same explanatory variables as in fixed effect regression excluding tenure and adding dummy variable for the 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. Therefore, we choose FE estimation procedure without correction for selection as the most preferred one for the remainder of the analysis.[7]

Table 5 presents the results from various specifications with respect to variables of interest. As Column (1) shows the average wage penalty for ever being a mother in Ukraine is 19.9% which is close 22% in the USA (Waldfogel 1995). The wage penalty for each additional child is equal to 6.5%, (Column 2) which is again similar to the US estimate (Hill, 1979). Moreover, Column (3) shows that the effects of one child and two or more children in Ukraine

[6] Both fixed effect and first difference estimators address 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 results of fixed effect and first difference estimation are found to be similar.

[7] We also estimate a specification where the variables of interest are 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 than two children. From this we can conclude that the wage penalty for each additional child is approximately 6.5%.

are almost the same as in the US (Waldfogel 1995). Column (4) of Table 5 summarizes the effects of children of different ages on mothers performance (Age of child is referring to the age of the youngest child in case of two or more). All coefficients for one child appear to be insignificant as well as jointly insignificant (p-value = 0.2272). This may be a sign of the evidence that the 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 the age of the youngest child is between 6 and 18, than for the case if smallest child is of preschool age.[8]

Endogeneity concerns

As mentioned in the methodology section, our analysis may still be subject to endogeneity problem related to such human capital characteristics as experience and tenure (Korenman and Neumark 1992). Unfortunately, this issue cannot be addressed with the ULMS data set. Korenman and Neumark (1992) implement 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 cannot be used for the panel data estimation. In case of panel data, such family background variables as husband's and partner's years of education, experience, and 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 the ULMS data set information about partners is available only for half of married females.

[8] Being concerned with the fact that the presence of children in the sample is constructed from the retrospective part of the ULMS without formal information on the presence of the child in the household over the period from 1997 to 2003, we have performed a test focusing only on the two years of the ULMS data. Unfortunately, FE estimations have not resulted in any meaningful estimates mainly due to the fact that over the course of one year very few women have given birth to a child. Therefore, while acknowledging the weakness of our approach, this is the best a researcher can do to address the question.

4.2. 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 motherhood wage penalty for subsamples of women with different levels of education.

We find the highest wage penalty 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 results contradicts the hypothesis that leaving the work does 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 workers it is hard to find a good paid job after spending some years out of the 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 at least bachelor's degree experience 11.4% wage penalty for one child and 16% for two or more children. These results differ somewhat from the previous literature. For example, Taniguchi (1999) find that education significantly reduces wage penalty for females who had at least 12 years of education, while Anderson, Binder and Krause (2002) show that college graduates experience higher costs of motherhood, due to higher opportunity costs of the time spent out of the labor market. However, this may be due to the fact that we are explicitly controlling for years out of the labor market.[9]

[9] Estimates for the full set of controls are available upon request. We should mention, though, that the 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.

4.3. Importance of timing of first birth

Blackburn, Bloom and Neumark (1990) suggest that a delayed first childbirth is associated with higher wages. 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 it can only be estimated using simple OLS which does not takes into account unobserved individual specific effects. Moreover, age at first birth is endogenous variable; females who earn higher wages tend to postpone first birth. Therefore, we use our preferred specification adding dummy variables for the age at first birth as controls (Taniguchi, 1999). The obtained coefficient will give estimates of wage differentials between mothers who had her first birth at a certain age range and female who has no children.

Figure 5 shows that the crude birth rate in Ukraine has been the highest among 20-24 year olds. But this is also the age group with the highest observed decline over the whole period. While the crude birth rate among 25-29 year olds and 30-34 year olds is on the increase after year 2000. The distributions of age at first birth of the entire ULMS sample and by educational groups are 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 if the childbirth is delayed till 25.

Table 7 presents the results from the analysis of how the effect of children on wages differs depending on the age of the first birth. For females whose level of education is not higher than high school the effect of each child on wages is -12%, the most frequent age at first birth for such females is 19-21 years old (Figure 6). For low educated females, those who had their first birth before age 20, suffer from 12% wage penalty, and females who postpone first birth slightly, suffer from 21% wage penalty. Further postponing of first birth is associated with no wage penalty and low-educated females who had their first birth after 30 years old experience even a

15% wage premium from becoming mothers. Females with vocational/professional education have their first birth slightly later (at the age 20-23, Figure 6) 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 a mother before age 20 (-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 most frequently have first birth later in their life than the two previous categories (see Figure 6), the wage penalty estimates suggest are virtually zero, if these women have their first child born when they are 25-29 year olds. This is most likely being the period shortly after they finish university. And the penalty is slightly higher for the late starters than for those who had the first child born after 20 but before 25, probably reflecting higher opportunity cost of time after graduation.

5. Conclusions

This paper addresses very important policy question in the country with the lowest low fertility in Europe. Over the course of transition period, Ukraine has witnessed a number of policy debates on how to stop the population decline. One of the solution was to promote greater fertility, which has been addressed by the introduction and consequent increases in the baby bonuses. This paper is the first in Ukrainian context which shows that the direct cost of child-bearing is not the only barrier to having more children, calling for policy options beyond the direct lump-sum payment conditional of child birth.

We find that even after controlling for human capital characteristics, i.e. effectively underestimating the effect of having a child, and the unobserved time-invariant heterogeneity, such as taste for children and individual relative productivity in the job market, motherhood wage penalty in Ukraine is comparable to the US one – probably the largest estimate in the world. In particular, the average wage penalty for being a mother in Ukraine is approximately 20%. Females with only one child earn 6.5% less than females without children, and females with two or more children earn approximately 13.3% less. Thus, the wage penalty for each additional child is approximately 6.5%. This is close to the US estimates by Waldfogel (1997, 1998a, 1998b). Marital status 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. This contradicts previous findings for other countries, which may be related to the fact that the human capital accumulated through the period of Socialism may be receiving a different pay-off over the course of transition and after. In spite of this fact, females with vocational/professional education experienced the lowest wage penalty. However, 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, and there is a connection to education level in this regard. Thus, low educated females receive 15% wage premium if they delay motherhood until the age of 30, and suffers the most if they give 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 age 20. For highly educated females, the evidence is mixed because the effects of high education and timing have different directions.

These findings from a country with generous family support policies and existing anti-discrimination laws provide strong evidence that these policies are not enforced. If the government is concerned with the lowest low fertility, then the baby bonuses are not the only measure it has to pursue. Each additional year out of the labor force has a wage penalty of 4%, which is very significant given the 16% premium for a university degree. These suggests that maybe initiatives tackling the maintenance of human capital while taking care of the child are needed. Existence of the direct effect of a child on wages after controlling for human capital characteristics maybe related to two things, both of which can be dealt with to certain degree by respective policies. One is the effort-allocation story, and this can be improved by greater availability and better quality of child care facilities. The other – (most likely statistical)

discrimination and prejudice against women with children, which can be dealt with better enforced affirmative action laws and maybe the promotion campaign targeting employers and managers. In all these case, more research is needed to identify the appropriate mix of policies.

References

Almuendo-Dorates, Catalina and Kimmel, Jean. (2004). *The Motherhood Wage Gap for Women in the United States: The Importance of Collage and Fertility Delay*. Working Paper E2004/07.

Anderson, Debora, Melissa Binder and Kate Krause. (2002). *The Motherhood Wage Penalty: Which Mothers Pay It and Why?* American Economic Review. Vol. 92(2): 354-358.

Arzhenovskiy, Sergey and Darya Artamonova. (2007). *Econometric Estimation of the Wage Penalty for the Motherhood. Applied Econometrics.* Publishing House "SINERGIA PRESS". Vol. 7(3): 66-79.

Becker, Gary. 1965. *A Theory of the Allocation of Time*. The Economic Journal. Vol. 75 (299): 493-517

Becker, Gary. 1985. *Human Capital, Effort, and Sexual Division of Labor.* Journal of Labor Economics. University of Chicago Press. Vol. 3(1): 33-58.

Blackburn, McKinley, David Bloom and David Neumark. (1990). *Fertility Timing, Wages and Human Capital.* NBER Working Paper No. 3422.

Cole, Jonathan and Harriet Zuckerman. (1987). *Marriage, motherhood, and research performance in science.* Scientific American. Vol. 256(2): 119-125.

Craig, Lyn. (2007) *Contemporary Motherhood: The Impact of Children on Adult Time*. Aldershot: Ashgate Publishing. 187pp.

Dorates, Marie. (2002). *Wives, Mothers and Wages: Does the Timing Matter?* Research Paper 11F0019 No. 186. The paper available on Internet (www.statcan.ca)

Dustmann, Christian and María Engracia Rochina-Barrachina. (2000). *Selection Correction in Panel Data Models: An Application to Labour Supply and Wages*. IZA DP No. 162.

Felfe, Christina. (2006).*The Child Penalty – A Compensating Wage Differential?* ENEPRI Research Reports No. 22.

Fletcher, Jason and Barbara Wolfe. (2008). *Education and Labor Market Consequences of Teenage Childbearing: Evidence Using the Timing of Pregnancy Outcomes and Community Fixed Effects*. Journal of Human Resources. Vol. 44(2): 303-325.

Fletcher, Jason. (2011). *The effects of teenage childbearing on the short- and long-term health behaviours of mothers.* Journal of Population Economics. Vol. 25(1): 201-218.

Fox, Mary Frank. (2005). *Gender, family characteristics, and publication productivity among scientists*. Social Studies of Science. Vol.35: 131-150

Ganguli, Ina and Katrine Terrell. (2005). *Wage Ceilings and Floors: The Gender gap in Ukraine's Transition.* IZA Discussion Paper No. 1776.

Gerry, Christopher, Byung-Leon Kim and Carmen Li. (2004). *The Gender Wage Gap and Wage Arrears in Russia: Evidence from RLMS*. Journal of Population Economics. Vol. 17(2): 267-288.

Gorodnichenko, Yuriy and Klara Sabirianova Peter. (2004). *Returns to shooling in Russia and Ukraine: A Semiparametric Approach to Cross-Country Comparative Analysis*. Journal of Comparative Economics. Vol.333: 324-350.

Gupta, Nabanita Datta and Nina Smith. (2001). *Children and Career Interruptions: The Family Gap in Denmark.* Economica. London School of Economics and Political Science. Vol. 69(276): 609-29.

Heckman, James .J. (1979). *Sample selection bias as a specification error.* Econometrica. Vol. 47: 153-162.

Kalist, David (2008). Does Motherhood Affect Productivity, Relative Performance, and Earnings? Journal of Labor Research. Vol. 29(3): 219-235.

Kimmel, Jean and Thomas J. Kniesner. (1998). *New evidence on labor supply: Employment versus hours elasticities by sex and marital status.* Journal of Monetary Economics. Vol.42: 289-301.

Korenman, Sanders and David Newmark. (1990). *Marrige, Motherhood and Wages*. The Journal of Human Resources. Vol. 27(2): 233-255.

Kunze, Astrid and Matte Ejrnaes. (2004). *Wage Dips and Drops around First Birth*. IZA Discussion Paper No. 1011.

Kyriazidou, Ekaterini. (1997). *Estimation of a Panel Data Sample Selection Model. Econometrica*, Vol. 65(6): 1335-1364.

Lang, Kevin and Adam Ashcraft. (2013). *The Consequences of Teenage Childbearing: Consistent Estimates When Abortion Makes Miscarriage Non-random. The Economic Journal.* Vol.123 (571): 845-905.

Lundberg, Shelly and Elaina Rose. (2002). *The Effect of Sons and Daughters on Men's Labor Supply and Wages.* The Review of Economics and Statistics. Vol. 84(2): 251-268.

Millimet, Daniel. (2000). *The Impact of Children on Wages, Job Tenure, and Division of Household Labor.* The Economic Journal, Vol. 110(463): 130-157.

Mincer, Jacob and Solomon Polachek. (1974). *Family Investment in Human capital: Earnings of Women.* The Journal of Political Economy. Vol. 82(2): 76-108.

Mincer, Jacob and Solomon Polachek. (1974). *Schooling, Experience and Earnings*. New York: National Bureau of Economic research.

Mroz, Thomas. (1987). *The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions*. Econometrica. Vol. 55(4): 765-799.

O'Dorchai, Sile Padraigin. 2008. *Pay inequality in 25 European countries*. DULBEA Working Papers 08-06rs.

Rochina-Barrachina, María Engracia. (1999). A new estimator for panel data sample selection models. Annals of Economics and Statistics. No. 55/56: 153-181.

Sigle-Rushton, Wendy and Jane Waldfogel. (2007). *Motherhood and women's earnings in Anglo-American, Continental European, and Nordic Countries*. Feminist Economics. Vol. 13(2):55-91.

Sologoub, Ilona. (2013). *Fertility Determinants in Ukraine*. EERC Working Paper Series 13/13^{e}. EERC Research Network, Russia and CIS.

Taniguchi, Hiromi. (1999). *The timing of Childbearing and Women's wages*. Journal of Marriage and Family. Vol. 61: 1008-1019.

Verbeek, Marno and Theo Nijman. (1992). *Testing for Selectivity Bias in Panel Data Models*. International Economic Review. Vol. 33(3): 681-703.

Verbeek, Marno. (2000). *A Guide to Modern Econometrics*. John Wiley & Sons, LTD.

Viitanen, Tarja. (2004). *The Impact of Children on Female Earnings in Britain*. Discussion Paper. DIW Berlin and University of Warwick.

Waldfogel, Jane. (1997). *The Effect of Children on women's wages*. American Sociological Review. Vol. 62(2): 209-217.

Waldfogel, Jane. (1998). *Family gap for Young women in United States and Britain: Can Maternity leave make a difference?* Journal of Labor Economics. Vol. 16(3): 505- 545.

Wooldridge, Jeffrey M. (1995) *Selection corrections for panel data models under conditional mean independence assumptions*. Journal of Econometrics. Vol.68: 115- 132.

Wooldridge, Jeffrey M. (2002). *Econometric Analysis of Cross Sectional and Panel Data*. The MIT Press. Cambridge. Massachusetts.

Figures

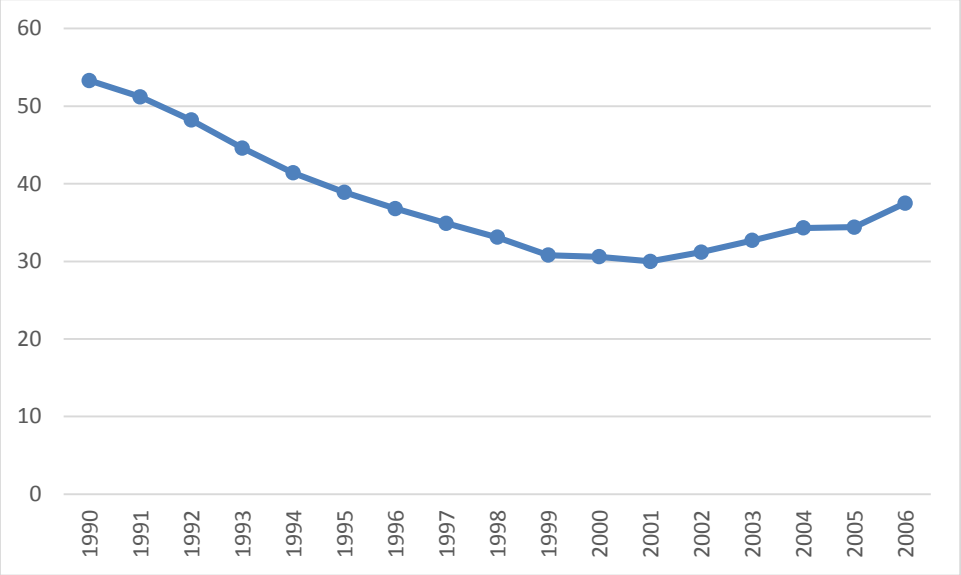

Figure 1: Birth rate coefficients in Ukraine 1990-2006. Source: State Statistical Committee (http://www.ukrstat.gov.ua)

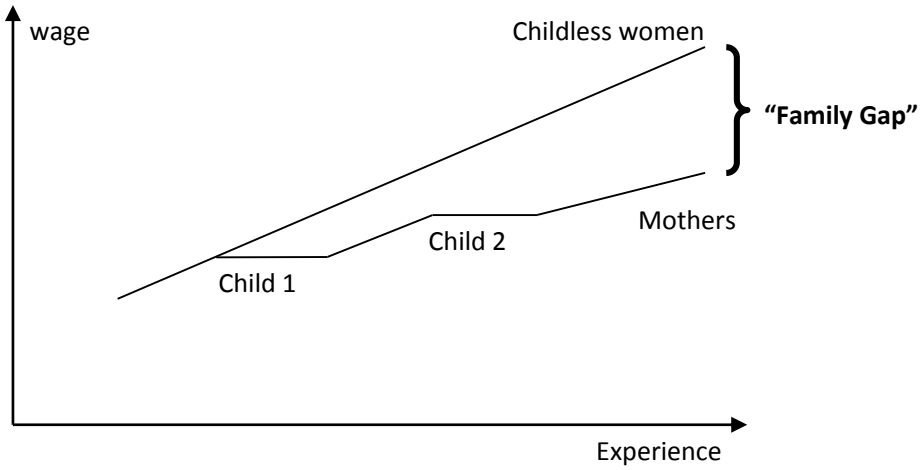

Figure 2: Illustration of the motherhood penalty concept. Source: Viitanen (2004)

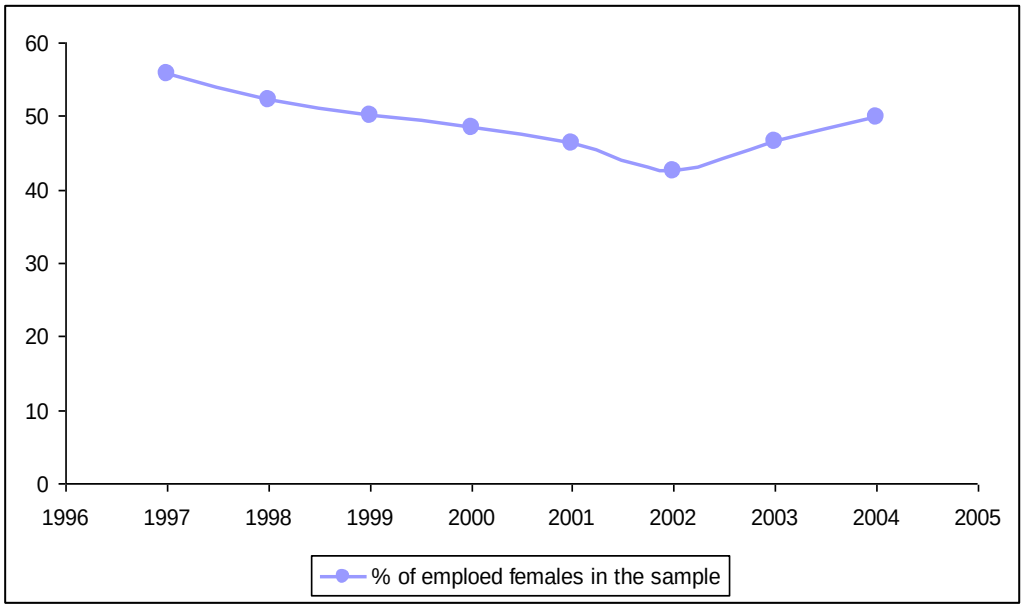

Figure 3: Percentage of employed females in the ULMS sample 1997-2004.

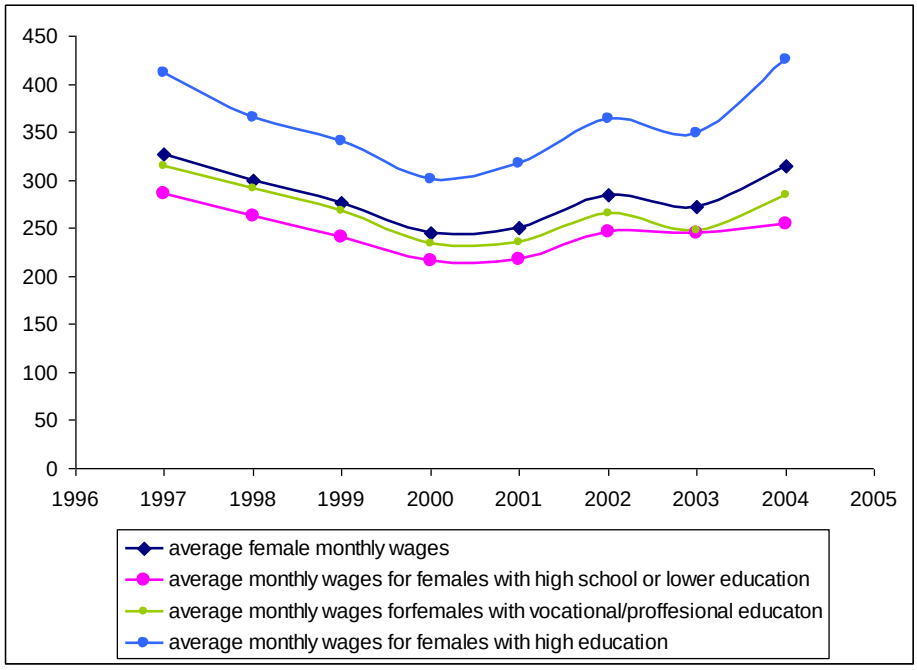

Figure 4: Average wage of females in the ULMS sample 1997.

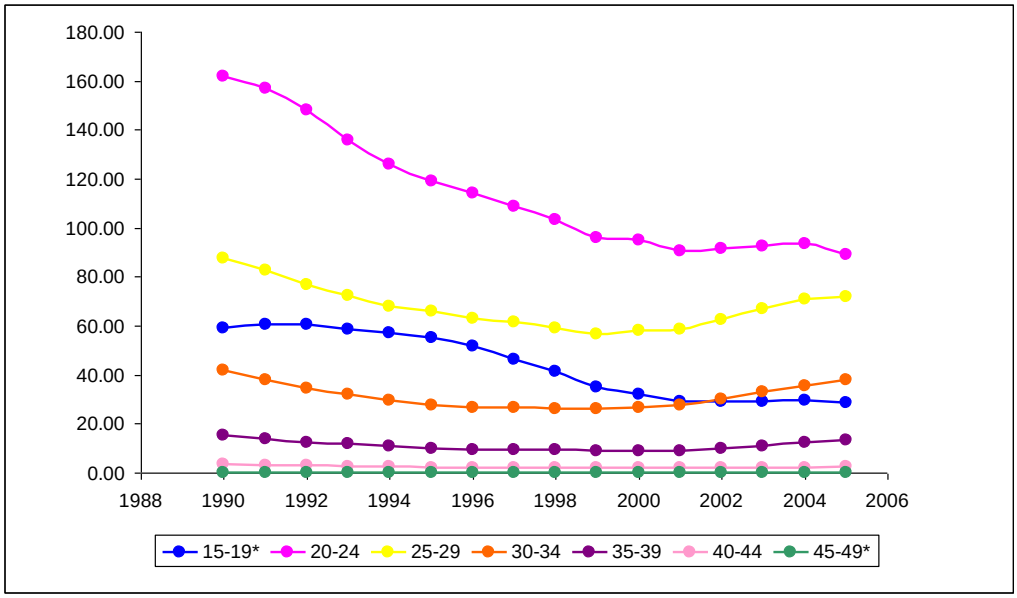

Figure 5: Birth rate coefficients in Ukraine by age of mothers (number of newborns per 1000 of females of correspondent age [10]) in 1990-2005 Source: State Statistical Committee (http://www.ukrstat.gov.ua)

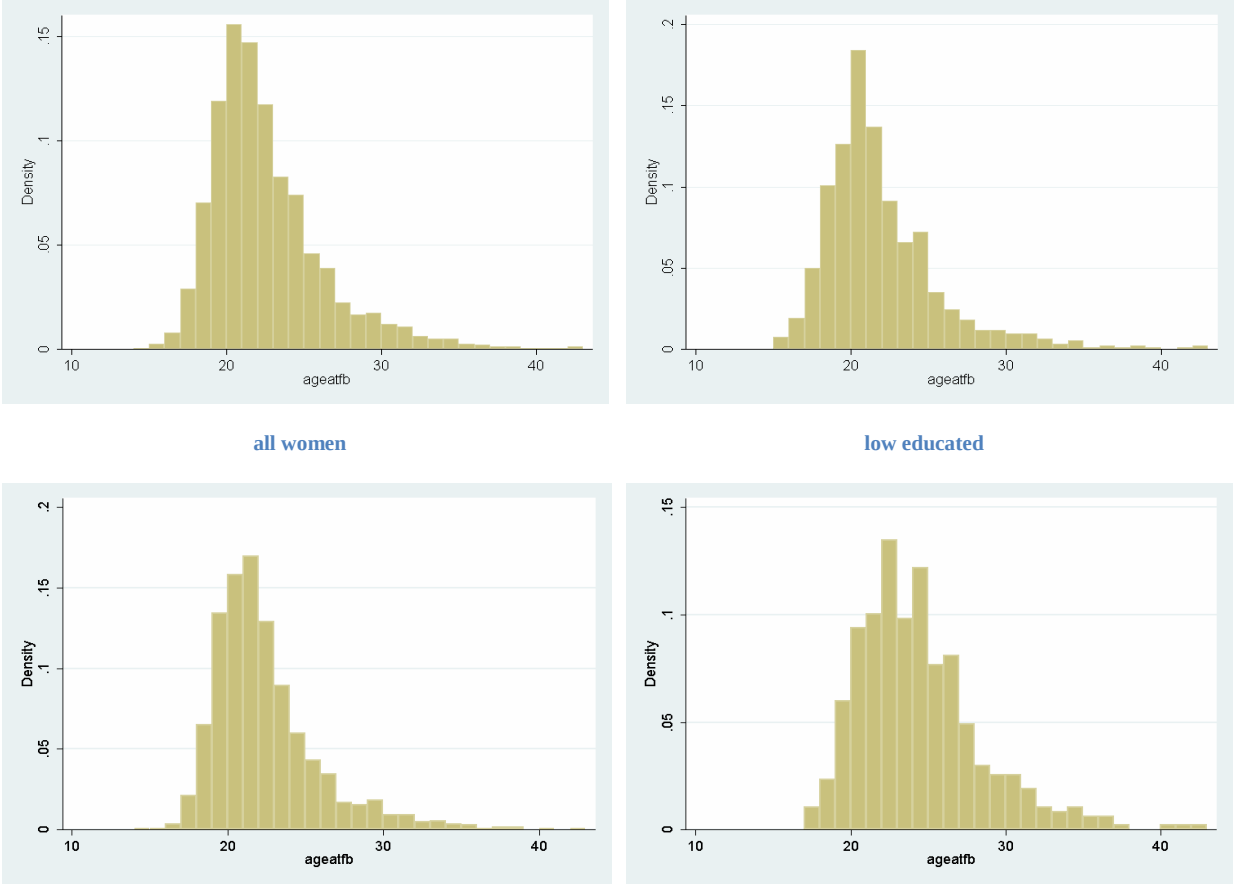

Figure 6: Distribution of Age at First Birth.

[10] Number of newborns from mothers younger than 15 and older than 49 are included into these groups.

Table 1: The amount of Baby bonus in Ukraine, USD

Year	Size of the first payment					
	1st Child		2nd Child		3rd Child	
2001	32		32		32	
2002	38		38		38	
2003	60		60		60	
2004	127		127		127	
2005	287		287		287	
2006	1574		1574		1574	
	Full amount	*1st payment*	*Full amount*	*1st payment*	*Full amount*	*1st payment*
2008	2423	950	4950	958	9901	990
2011	2469	1010	5049	1010	10098	1010
2012	3829	1276	7659	1276	15317	1276
2013	4172	1391	8344	1391	16688	1391

Table 2: Duration of Maternity Leave for employed females

Year	Duration of 100% paid leave		Length of voluntary leave	Conditions
	1 child	2 children/ complications		
1983	112	126	<1 year	>1 year of experience
1991	126	140	<2 years	Insured
1998	126	140	<3 years	Insured
2001	126	140	<3 years	Insured
2013	126	140	<3 years	Insured

Note: Paid leave is compensated at 100% of average wage

Table 3: Selected results on the wage penalty of motherhood from the previous literature

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

Table 4: Descriptive statistics of working age females (ULMS 1997, 2004 and 1997-2004)

Variable (%)	1997		2004		Pooled (1997-2004)	
	all	employed	all	employed	all	employed
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[11]	41.26	27.49	31.52	17.26	39.02	23.22
vocational	44.23	52.66	50.79	57.36	45.79	54.15
university	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

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

Table 5: Descriptive statistics female sub - sample of ULMS data set (Pooled)

VARIABLES	all females				mothers				never mothers[12]			
	all		employed		all		employed		all		employed	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Mother (%)	83.13		86.68									
No child(%)	44.19		34.43		33.07		24.60		98.99		98.41	
1 child(%)	34.98		39.81		41.88		45.68		1.01		1.59	
2 children(%)	18.14		23.07		21.83		26.61					
>2 children(%)	2.69		2.70		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	45.79		54.15		48.8		54.39		30.98		52.63	
University	15.15		22.62		16.11		22.55		10.45		23.07	
Married (%)	62.00		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**	

[12] 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

Table 6: Results of estimation of log-wage regression. ULMS 1997-2004.[13]

Logarithm of hourly wage	Pooled OLS (1)	OLS selection (2)	FE[14] (3)	FE selection (4)
One child	-0.0133	-0.0113	-0.0648*	-0.0674*
	[0.0243]	[0.0242]	[0.0319]	[0.0323]
Two or more children	-0.0193	-0.0226	-0.1326**	-0.1371**
	[0.0282]	[0.0286]	[0.0371]	[0.0389]
Age	0.0090	0.0178	0.0681**	0.0694**
	[0.0100]	[0.0137]	[0.0199]	[0.0203]
Age squared	-0.0001	-0.0003	-0.0005*	-0.0005*
	[0.0001]	[0.0002]	[0.0002]	[0.0002]
vocational/professional education	0.0856**	0.1014**	0.0549	0.0612
	[0.0267]	[0.0303]	[0.0472]	[0.0509]
High education	0.3813**	0.4131**	0.1692**	0.1780**
	[0.0324]	[0.0446]	[0.0614]	[0.0657]
experience	0.0085	0.0158	-0.0271	-0.0241
	[0.0071]	[0.0103]	[0.0194]	[0.0210]
Experience squared	-0.0002	-0.0004+	-0.0001	-0.0002
	[0.0002]	[0.0002]	[0.0003]	[0.0003]
Years out of labor market	-0.0045	-0.0072	-0.0464**	-0.0462**
	[0.0053]	[0.0060]	[0.0121]	[0.0121]
tenure	0.0086*	0.0085*	-0.0046	-0.0046
	[0.0038]	[0.0038]	[0.0054]	[0.0053]
Tenure squared	-0.0001	-0.0001	-0.0002	-0.0002
	[0.0001]	[0.0001]	[0.0002]	[0.0002]
Married	-0.0203	-0.0236	0.0094	0.0089
	[0.0304]	[0.0306]	[0.0366]	[0.0367]
Widowed, divorced or separated	-0.0376	-0.0325	0.0069	0.0080
	[0.0349]	[0.0352]	[0.0336]	[0.0336]
Lambda		0.0993		0.0133
		[0.0971]		[0.0355]
Observations	10413	10413	10413	10413
R-squared	0.16	0.16	0.03	0.03
Number of id			2268	2268

Notes: Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

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

[14] 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

Table 7: Fixed effect estimates for wage penalties for different model specifications. ULMS 1997-2004.

	(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]

Notes: Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Numbers in brackets are clustered standard errors. All regressions include controls as in Table 4. Child(age) here means the smallest child .

Table 8: Fixed effect estimates of wage penalty for motherhood by education level. ULMS 1997-2004.

	All	high school or lower	vocational/ professional education	bachelor degree or higher
	(1)	(2)	(3)	(4)
One child	-0.0648*	-0.1570*	-0.0607	-0.1136+
	[0.0319]	[0.0754]	[0.0430]	[0.0660]
Two or more children	-0.1326**	-0.2244**	-0.1245*	-0.1593**
	[0.0371]	[0.0731]	[0.0550]	[0.0590]

Notes: Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Numbers in brackets are clustered standard errors. All regressions include controls as in Table 4.

Table 9: Fixed effect estimates of wage penalty: Importance of timing of the first birth. ULMS 1997-2004

	all		High school or less		Vocational/ professional		University or higher	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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]
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

Notes: Standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Numbers in brackets are clustered standard errors. All regressions include controls as in Table 4.