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SHE CARES AND HE EARNS? THE FAMILY GAPS IN POLAND

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She Cares and He Earns? The Family Gaps in Poland

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Abstract

This paper deals with parenthood induced inequalities in the labour market outcomes of men and women in Poland. It extends the existing framework of research by providing a joint analysis of parenthood impact on working hours and wages for men and women for a transition economy. Using propensity score matching and fixed effects estimation this paper reveals that parenthood is associated with longer working hours and greater wages for men and shorter working hours and lower wages for women. The gaps in working hours may be however partially attributed to unobserved differences between parents and childless individuals. For men, unobserved heterogeneity also explains their greater wages. Mothers are however found to receive significantly lower wages even if their unobserved characteristics and self-selection into employment are accounted.

Keywords:

family gap, wage inequality, fatherhood premium, motherhood penalty, specialization

JEL:

J13, J22, J31

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1. Introduction

Nowadays, most of the European countries are experiencing the fertility rates that are below the population replacement level, which leads to the acceleration of the population aging and has severe implications for the functioning of health, care and retirement systems. In the post transition Central Eastern European (CEE) countries the situation is even worse, as these countries are now facing one of the lowest fertility rates among the European and EU countries. Based on Eurostat data for 2013 the lowest fertility rates of women were observed in Poland (1.29), Slovakia (1.34) and Hungary (1.35).

The aim of this research is to document economic effects of fertility, which are understood as changes in males' and females' labor market outcomes that appear with parenthood. The focus of this research is Poland, a country that is currently experiencing one of the lowest fertility rate in Europe.

The existing literature concerning the effects of parenthood on the labor market outcomes is already considerably well-developed. For example, the fertility effects on women's wages have been analyzed for numerous economies, though mainly Western European countries, such as Sweden, Norway, Belgium, France (Datta Gupta and Smith, 2002; Davies and Pierre, 2005), Denmark (Simonsen and Skipper, 2006; Nielsen et al., 2004) Spain and Portugal, UK and Germany (Davies and Pierre, 2005; Gangl and Ziefle, 2009), as well as the United States (Waldfogel, 1997, 1998). Numerous papers also deal with the impact of children on women's labour supply (for the review see Browning (1992)). Great majority of these studies reports that fertility negatively affects women's remuneration, working hours as well as labour market attachment. In the case of wages, these negative effects have been termed as 'motherhood penalty'. More generally the inequalities in the market outcomes due to the parenthood are referred to as the 'family gaps'. The existing research also reports that labour market outcomes of men and women, who do and do not have children, fairly differ and in the case of men, the parenthood is associated with an increase in the average wage. Such 'fatherhood premiums' are reported for example for Germany (Rosenfeld and Trappe, 2000), Denmark (Simonsen and Skipper, 2006), Norway (Petersen, Penner and Høgsnes, 2007), Britain, Italy, Netherlands, France, Greece, Portugal (Koslowski, 2011), and the United States (Glauber, 2008; Budig and Hodges, 2010; Killewald, 2013; Lundberg and Rose, 2000, 2002). Some research also finds that fathers tend to work more than childless men (Lundberg and Rose, 2000, 2002).

However, despite the recent evolution of the literature on the family gaps, there are three main research areas, which are not fully developed and that should be properly addressed. First, the research mainly focuses on Western economies, ignoring transition economies, for which the fertility statistics are much lower. Second, most of the empirical research on labour market parenthood-based inequalities focus either on women (more often) or men but not on both the groups simultaneously. Given the differences in the data, samples and time coverage, the results cannot be compared. Third, the existing research lacks a throughout analysis of both the effects – i.e. labour supply and wages - and very often limits the analysis to the investigation of one of them. In the case of the wage effects such approach will however not fully identify the underlying relation because the size of the effect is closely tied to the changes in employment and working hours that occur following the childbirth.

In this paper, existing framework of research on the family gaps is extended by providing a joint analysis of parenthood impact on working hours and wages for men and women in post-

transition Poland – country that has one of the lowest fertility rates in Europe. By doing so this research fills the gap in the existing literature and provides a comprehensive study of the labour market consequence of parenthood in Poland.

This research also adds to the existing state of knowledge in the analytical dimension. Previous literature on the family gaps has proved that the estimation of the required effect is analytically complex task as women's fertility is likely to be endogenous with respect to wage and working hours. For the wage models, in addition to endogeneity, the bias of the estimates may be caused by the non-randomness of the observed sample of working individuals. To address the bias of the estimates that relates to the endogeneity of children variable, this research applies propensity score matching and fixed effects estimation. Moreover, to assess the validity of the results with respect to parent's selection to employment, this research shows which group of parents - high/low earners - are subject to selection.

The findings of the paper reveal that parenthood in Poland is associated with longer working hours and greater wages for men and shorter working hours and lower wages for women. In the case of men the gap in working hours partially stems from men's unobserved characteristics that relate both to working time and parenthood. As a result, no significant gap is present when unobserved heterogeneity is eliminated. Similarly, greater wages of fathers result from their unobserved characteristics as well as working hours adjustments. Once these factors are taken into account, no significant family wage gap is found for men. For women the negative gap in working hours is slightly lower when individual unobserved factors are taken into account. There is however high 'motherhood penalty' in a form of lower wages even when these factors as well as selection into employment are considered.

The paper is structured as follows. The next section provides theoretical relevance for the existence of the family gap. It also reviews existing literature in this topic. Section three presents the data used in the empirical analysis together with the description of the transformations performed in order to obtain relevant variables. Next, the estimation strategy is described in detail. Section five presents the main findings and section six gives concluding remarks.

2. Literature Review

2.1. Children and the labour supply of men and women

2.1.1. Existing theoretical framework

Male and female labour supply may be analyzed from three distinct perspectives. First, it can be viewed as isolated individually based decision. In this case, the supply is modeled using unitary labour supply model, in which individuals are optimizing their utility function over hours worked and consumption subject to the budget constraint. Second, male and female labour supply may be analyzed jointly by the 'unitary' family labour supply model, in which the earnings and hours worked are pooled over two individuals. This so-called 'neoclassical' approach however treats household as a single optimizing unit and ignores the within household allocations. The third approach of the labour supply modeling departs therefore from the unitary perspective to the collective one. This approach considers the household as a set of individuals with their own preferences, who decide on sharing their overall resources.

The collective household labour supply model in a rigorous framework has been provided by Chiappori (1988, 1992), who showed that household decisions regarding the labour supply

may be modeled through two utility functions – male's and female's. Individuals first share their non-labour income and then maximize their utility functions subject to individual budget constraint. Fortin and Lacroix (1997) empirically confirm that this model provides better fit of household labour supply data than the unitary framework. However, as noted by Apps and Rees (1997) the model is still simplified because it implicitly assumes that non-market work is equal to leisure, which may not be true for the family, and particularly for the family with children.

Children constitute a third party of the model that changes the relation of men's and women's preferences as they additionally need to decide on how many resources should be devoted to children. Blundell, Chiappori and Meghir (2005) therefore develop a model of collective labour supply with caring parents. The model assumes that parents' individual preferences depend on their own leisure, private consumption and children's welfare, which is treated as a public good produced by the expenditures spent on children and parental time invested in them. The empirical results of the model provided by Cherchye, De Rock and Vermeulen (2010) show that higher number of children is associated with men's lower average cost share and women's higher cost shares of time spend with children. The important conclusion of the theoretical collective family supply models is thus the interdependence of the labour supply of men and women that are forming the family/household and the recognition that in the case of the presence of children these relation and interdependence becomes even stronger.

Apart from the labour supply models, there exist two main theoretical explanations of the interdependence of within couple preferences regarding paid work. First, in accordance with Becker's work (Becker, 1985) the theory of specialization tells that in the household consisting of wife, husband and a child, women tend to specialize in the home production, whereas men tend to specialize in the production delivered at the labour market (Lundberg and Rose, 2000, 2002).¹ Women thus spend more of their time at home, taking care of children, whereas men work more at the labour market in order to ensure financial stability. On the other hand there also arises a 'home-intensity effect' (Lundberg and Rose, 1999). This effect is reflected in an increased value of parent's time at home that takes place following the appearance of a child. In the case of women, it is apparent that both of the above described effects are likely to be negative, so that when a child appears mother's labour supply declines. However, as noted by Lundberg and Rose (2002) in the case of men, the first effect is positive, whereas the second one is negative, so that it may not be *a priori* recognized which effect dominates.

2.1.2. Empirical evidence

In general, there are two main approaches of the empirical research related to fertility effects on women's labour supply. The first group of research focuses on the fertility effects on the probability of women's employment and the second group of research tends to focus on the number of hours worked. This means that while the first set of studies rather concentrates on the labour market activity, the second approach looks at working hours adjustments that relate to children.

Regardless the definition of the dependent variable in the econometric model, the explanatory variable measuring the number of children, which effect is of the main interest, is very likely to be endogenous (Angrist and Evans, 1998 following Schultz, 1981). Many researchers interested in estimating the true casual effect of fertility on women's employment and hours

¹ For the rigorous mathematical framework of this model see Appendix.

worked have been therefore trying to overcome the endogeneity problem by adapting adequate econometric methods.

First, in most of research on labor supply childrearing consequences, the endogeneity of children variable is addressed by applying fixed effect panel data method. Using fixed effect estimation one may account for unobserved time invariant factors that are correlated with the family size (number of children) and the number of hours worked. These unobserved factors may include for example individual value of the family or a commitment to children and family. The findings of Lundberg and Rose (2002), who used this method to analyze the impact of children on working hours, reveal that while in case of women the presence of a child leads to fewer hours worked, in case of men the effect is positive.²

On the other hand, Angrist and Evans (1998) use instrumental variable estimation to deal with the endogeneity bias. This approach however requires valid instrumental variable that has two main properties: 1) it is correlated with the fertility (number of children) and 2) has not direct effect of the outcome variable and is uncorrelated with unobservable factors related to fertility (Wooldridge, 2003). Angrist and Evans (1998) proposed two instruments that incorporate the variation in the family composition: 1) having twins in the second birth; and 2) siblings sex composition.³ Other instruments of fertility include for example women's experience of miscarriage (Li, 2005). The findings of Angrist's and Evans's influential analysis reveal that children lead to a decline in women's probability of working, number of hours worked and labour income. The findings for men show that there is no significant impact of children on their average hours worked and labour income.

2.2. Children and the wages of men and women

2.2.1. Theoretical framework

There exists several theories that aim to explain why children may affect parent's wages. In the case of women, the lower wages of mothers are however mainly explained by three processes that are taking place following the childbirth, which are: 1) the loss in the human capital; 2) the loss in the efforts exerted at work; 3) and the choice of mother-friendly jobs. First, for some time following the childbirth women become absent from the paid work, which leads to lowering of their labour market experience. Additionally, during the time absent from work, some of the skills rewarded at the labour market depreciate. Second, even after returning to work, women's efforts exerted in the workplace may be lower than that of childless women. According to Becker (1985) lower productivity of mothers may be thus attributed to their lower efforts exerted at the labour market due to the home-related responsibilities. Third, the drop in women's wages related to motherhood may be associated with the fact that mothers tend to stay in the jobs that are more "mother-friendly", i.e. jobs, which allow for a greater work flexibility and adjustments.

Lower wages of women with children may however stem from wrongly identified process, as women that are more likely to get higher pay may be also more likely to have children. This

² They also find that the effect differs based on the sex of a child. Higher positive response in the average hours worked of men is found in case of a birth of a son than a daughter.

³ It has been argued that due to the definition of the instruments the estimated effect rather represents the effect of a third child on the labour supply. To overcome this problem, some researchers try to capture exogenous measure of fecundity by estimating fertility productions functions (e.g. Rosenzweig and Wolpin, 1980; Kim and Aassve, 2006). Such approach requires however detailed data on birth control behavior (such as reproductive calendars).

‘spurious relation’ is usually accounted by the adequate estimation methods that eliminate the correlation between parenthood and other factors that affect wages, such as ability, career and business orientation (e.g. Budig and England, 2001). Most of the studies agrees however that there is a significant drop in mothers’ wages even after controlling for the underlying explanations described above. In consequence, the decline in wages caused by motherhood is also assigned to the possible labour market discrimination against mothers (Budig and England, 2001).

In the case of men, the fatherhood premium in a form of greater earnings is mostly explained within the specialization theory. Following Lundberg and Rose (2002) it is important to recognize that the more likely it is that a father shares the parenting responsibilities with a woman, the more likely it is that there is no premium from parenthood found for him.⁴ Besides that, similarly to women, whose unexplained motherhood penalty is associated with the productivity loss or employer’s discrimination against mothers, father’s premium may be also assigned to their unobserved gains in the productivity induced by fatherhood or positive discrimination by the employers (Glauber, 2008).

2.2.2. Empirical evidence

In the analysis of the wage effects of parenthood the problem of the endogeneity of fertility measure is also present. There is however also an additional problem, which relates to the fact that not all the individuals are observed working and some of them may drop following the childbirth. It is especially important constraint in the case of women. If for example women, who face high/low penalty of being mothers, tend to exit labour market following the childbirth, the estimates might be under/overestimated. This means that in order to provide reliable and truly unbiased estimates of the wage effect of parenthood not only the endogeneity of children but also the problem of labour market selection should be properly addressed.

Most of the existing research deals however with only one source of identification problem and ignores the remaining one, providing the results that still carry substantial bias and misinterpretation. When the employment selection is accounted for, it is mainly corrected using Heckman correction (Heckman, 1976, 1979) and the linear regression model that ignores the endogeneity problem. On the other hand, research that ignores the bias resulting from the labour market selection most commonly uses fixed effects applied to panel data (e.g. Waldfogel, 1997, 1998, Budig and England, 2001, Anderson et al., 2002, Lundberg and Rose, 2002, Davies and Pierre, 2005; Nielsen et al., 2004, Gangl and Ziefle, 2009, Petersen, Penner and Hogsnes, 2012). Some studies also use instrumental variable estimation (Angrist and Evans, 1992, Korenman and Neumark, 1992). Recently, propensity score matching methods were also adapted (e.g. Simonsen and Skipper, 2006).

In general, there exist vast empirical research looking at wage effects of parenthood and their causes. For example, Budig and England (2001) and Gangl and Zielfe (2009) using fixed effects estimation, look whether lost experience of women that have children explains some of the family gap in wages. They show that after controlling for actual experience, the motherhood wage penalty declines by around one quarter to one third. On the other hand, Simonsen and Skipper (2006) that use propensity score matching and estimate the average treatment effect of motherhood report that differences in the labour market experience of women with and without children account for approximately three-quarters of the raw wage

⁴ Consistently with the collective labour supply model.

gap. On contrary, Korenman and Neumark (1992) using instrumental variable find no significant effect of labor market experience.

Some of the studies focus on the work-effort theory to explain female family wage gaps but the evidence is rather limited. For example, Anderson et al. (2003) assess the theory by differentiating the motherhood penalty by the level of education, claiming that jobs which require higher education also demand greater effort. Their findings reveal however that the highest drop in wages occurs among high school graduates, not among women with tertiary of higher education.

Finally, the set of the studies focusing on work-related adjustments related to childrearing analyze the family gap controlling for various job characteristics, such as sector of work (public, private), working hours, unionization, gender (occupational) segregation and irregular shifts. The findings show that controlling for a part-time job leads to a decline of the motherhood penalty (e.g. Anderson et. al, 2003; Waldfogel, 1997). Similarly, greater wage inequality between mothers and childless women may be attributed to sectoral allocation since women in private sector experience greater costs of motherhood (Nielsen et al., 2004, Simonsem and Skipper, 2006). Recently, Felfe (2012) looked how motherhood impacts job's dimensions other than wages, such as working hours and working conditions. Her findings reveal little evidence that motherhood gap may be explained by mothers' adjustment in work conditions.

The empirical research related to the effect of children on men's wages is considerably less developed. For example, Lundberg and Rose document family gaps in working hours and wages of men in the US (2000, 2002). Using fixed effects estimation they find that fatherhood significantly increases hourly wage rates of men. Similarly, Killewald and Gough (2013) using fixed effects models confirm the existence of a positive fatherhood premium. They also show that the premium is higher for married than not married men.

While reviewing existing empirical research on family gaps, it is worth noting that most of the studies focus however on Western European economies. Some results are present for transition countries but they have certain limitations. For example, recently, a policy related analysis that also accounts for transition countries has been provided by Budig et al. (2012). Their research is however based on the linear regression model and Heckman correction, which results have been proved to be biased as they do not account for children's endogeneity. For Poland, Cukrowska-Torzewska (2015) provides motherhood penalty estimates using fixed effects model. Karbownik and Myck (2011) also analyze family gaps for Poland and perform similar to Angrist's and Evans's analysis using instrumental variable approach. Both papers however focus on monthly earnings from paid work and ignore the number of hours work, which significantly reduces the reliability and interpretation of the results, as the estimated gaps in earnings may stem from differences in hours of work between those, who have children and those, who do not.

3. Data description

Reliable quantitative identification of the family gaps requires a complex econometric analysis that places relatively high demands on the data. The relation between the labour supply and the family gap implies that the analysis of the wage gaps should be based on the hourly wage rather than monthly earnings that are usually reported in the case of Polish national datasets. The lack of the analysis of hours worked and hourly wages limits the

interpretation of the results, as the negative effect on monthly earnings of women and positive effect on monthly earnings of men may be a pure result of gender differences in the number of working hours.

For the empirical analysis this research uses data coming from the longitudinal EU SILC database (*European Union Statistics on Income and Living Conditions*). This dataset collects information on several socio-economic dimensions, such as poverty, well-being, social exclusion, housing and income. It covers a broad set of European countries, including 28 EU Member States as well as Iceland, Norway, Switzerland and Turkey. It also covers transition economies, including Poland, for which the availability of panel data is largely limited. In the case of Poland the available time span of the dataset covers years 2005-2012.

For the empirical analysis of the labour market outcomes the sample is restricted to working age population, which consists of individuals who are at least 16 and no older than 60 years old. The upper age bound is further limited to 45 to reflect the fertility period.⁵ The sample is also restricted to individuals, who are either working for a wage but are not self-employed and are not family workers, or are inactive. In addition - in line with the specialization model - a subsample of the individuals that are living with a partner (either married or cohabiting with the partner) is also defined.

The primary variables involved in the analysis are parenthood related variables. The status of parenthood is not directly identified in the dataset but it is derived from the variables indicating the ID of a mother or a father. Parenthood is thus understood as having a child that is living in the same household and is below 25 years old.⁶ To derive the parenthood identifier, a new variable *child* is defined, which is equal to 1 if a given individual indicates ID of a mother or a father and 0 otherwise. Then, using the IDs of parents, personal IDs and a new variable *child*, the IDs of parents are matched with the personal IDs and the variables *parent* as well as *number of children* are derived. To obtain the age of children, the information on the household composition and the age of its members is used.

Besides parenthood related variables, the key variables involved in the analysis, are variables measuring labour market outcomes. In the longitudinal EU-SILC there are two variables that measure labour income: gross and net employee cash or near cash income received during the *income reference period*, which for the Polish data is fixed 12 month defined as the previous calendar year. There is also an information on current usual hours worked per week. Since the yearly income refers to previous year and average hours of work refer to current status, to make the measures refer to the same period, all variables except for income variables are lagged one year.^{7,8} Then, monthly salary is derived using the data on yearly labour income and the number of months spent in full-time employment or part-time employment. Individuals, who switched from full-time to part-time (or the other way around) within the income reference period are excluded from the sample as for them usual working hours per month cannot be derived. Then for the sample of full and part-time workers, the hourly wage is calculated based on the monthly salary and the average number of hours worked per week.

⁵ Based on the data, I can only identify children, who are living in the same household as their parents. Children who moved to other household, are not observed anymore in the dataset. Since it is likely that children of older individuals move to other household, the age restriction aims to reduce the bias stemming from the possible incorrect assignment of parenthood status.

⁶ Parents of children with the oldest child aged 26 years or above are dropped from the analysis.

⁷ This means that the observations for the last year (2012) have to be dropped.

⁸ This procedure has been described in detail in Engel and Schaffner (2012).

In line with the Eurostat definition that is used for the calculation of the gender wage gap, the hourly wage is derived by dividing the gross monthly salary by the quadruple of the average hours worked per week.

The summary statistics on the selected measures used in the empirical analysis are shown in Table 1. The panel sample consists of 16 415 men and 13 798 women observed over the years 2005-2011. Around 59% of men and 66% of women have children. Parents have on average fewer than two children (app. 1.8). The panel sample consists of individuals, who are either married or single; divorced, separated or widowed individuals are not considered as for these individuals it is not straightforward whether they actually have children since children are living with only one parent.⁹ Gender specific summary statistics also show that women in Poland are generally better educated than men. They do however work significantly fewer hours: 38.5 hours per week in the case of women against almost 43 hours per week for men. Based on the data, when compared to men, women in Poland tend to receive by app. 5% lower hourly wages.

Table 1. Summary statistics for the final sample; individuals aged 25-45, who are not studying and are not self-employed and family workers.

Variable	Men	Women	Men - parent	Men - childless	Women - parent	Women – childless
Parent	0.59	0.66				
No. of children			1.83		1.81	
Age	33.11	33.72	36.54	28.16	36.54	28.23
Married	0.65	0.71	0.98	0.19	0.95	0.26
No education, less than primary, Primary education and lower secondary education	0.07	0.04	0.06	0.09	0.04	0.03
Upper secondary education	0.70	0.53	0.73	0.66	0.56	0.47
Post-secondary non-tertiary education	0.03	0.07	0.03	0.04	0.07	0.08
Tertiary education	0.19	0.36	0.18	0.21	0.33	0.42
Hours of work (per week)	42.88	38.45	43.42	42.10	38.42	38.48
Yearly salary	33510.21	27382.12	37890.44	27193.40	28309.73	25623.86
Monthly salary (PLN)	2848.29	2339.77	3200.09	2341.06	2412.21	2202.79
Hourly wage (PLN)	16.98	16.12	18.89	14.23	16.63	15.17
Parent in the household	0.36	0.29	0.09	0.74	0.11	0.64
Age partner (only when living with a partner)	33.90	38.35	34.54	29.57	39.19	32.87
Non labour income - financial assets	58.86	49.88	44.66	79.44	47.71	54.30
Non labour income - benefits	306.96	260.20	348.42	203.47	300.94	182.07
No. Observations	16415	13798	9701	6714	8351	4202

Notes: *Salary and wages* are expressed in PLN (constant 2005 prices).

4. Methodology – estimation strategy

4.1. Estimating the family gaps in the labour supply and wages of men and women

This research tests several hypotheses formulated based on the existing theories reviewed in Section 2:

⁹ Since in Poland the child custody following the divorce is mostly given to mothers, male individuals who are divorced and who do have children would be classified as childless individuals.

1. In line with the theoretical model of specialization, parenthood is associated with a decline in women's working hours and an increase in men's number of hours worked in the main job;^{10,11}
2. The associations between working hours and parenthood is stronger for individuals that are living in the same household;
3. Parenthood is associated with an increase in earnings for men and a decline in earnings for women;
4. The wage premium from parenthood – both for women and men - results from individual's selection into parenthood as well as working hours adjustments;
5. The wage premiums are greater for individuals that are living in the same household.

To account for the endogeneity of children this research applies two estimation methods that were previously used in the similar empirical works. These methods include: 2) propensity score matching and 2) fixed effects estimation.¹²

Though widely used, each of these methods has certain drawbacks. Fixed effect panel data estimation accounts for the endogeneity of children by eliminating time invariant unobserved effects that are correlated with parenthood and also affect labour market outcomes. The results may be still biased if the timing of the decision regarding parenthood is correlated with labour market outcomes, e.g. when those individuals who are expecting significant reduction in hours worked/wages decide to have children. On the other hand, in the case of propensity score matching and the estimation of the average treatment effect, individuals are matched and compared based on observable characteristics only, so that there can still arise the bias due to the unobserved differences. To eliminate the bias stemming from the endogeneity of children in the most plausible way, this research therefore simultaneously uses propensity score matching and fixed effects estimation. This means that in the first step individuals are matched using propensity score matching and in the second step fixed effects estimation is performed using the matched sample.

The procedure of the propensity score matching has been developed by the evaluation literature, which aim is to identify the impact of a treatment (W_i) on the outcome (Y_i). In the context of family gaps the treatment is parenthood, while the outcome are wages/hours of work. Because at one time an individual can be either treated or not, but not both, treatment effect cannot be straightforward estimated. It is however possible to estimate so-called average treatment effect on the treated, defined as a difference in outcomes of those, who were actually treated. For the estimation of this effect it is necessary to derive the unobserved (counterfactual) mean outcome, i.e. the mean outcome for the group of treated in the event they remained untreated. This is done by matching the treated with the untreated individuals based on characteristics, X . To minimize the dimension of the set of conditioning characteristics, matching is based on the propensity score, i.e. the conditional probability of

¹⁰ One can also argue that there is so-called 'home-intensity' effect, which is reflected by an increased value of time spent at home with the family. In the case of men, the home-intensity effect is negative with respect to the wage, and the specialization effect is positive, so that it cannot be determined a priori which effect dominates. However, due to dominance of traditional division of labour and family roles in Poland (Fodor et al., 2002, Pascall and Kwak, 2005) it is expected that specialization effect prevails and children positively affect men's labour supply.

¹¹ The formal model is presented in the Appendix.

¹² The literature review presented in section 2.1.2 suggests that other methods that could be used include instrumental variable estimation. However, existing instruments that are suitable for the identification of the model, which are defined as the sex composition of the first two children or the twin birth (Angrist and Evans, 1992) rather report the effect of a third child, which significantly reduces the interpretation of the results.

being treated: $e(x) = \Pr(W_i = 1 | \mathbf{X})$; (Rosenbaum and Rubin, 1983). Once matched, their mean outcomes are compared.

Formally, in the first step of the analysis childless individuals are matched with individuals that have children based on the propensity score estimated using a probit model.¹³ Simple nearest neighbor with replacement is used in the matching procedure and the ‘common support’ is assured when matching is performed.¹⁴ Since the dataset has a panel structure, to avoid time effects and matching the same individual with a different individual each year, individuals are matched based on the characteristics from the first year they are observed in the sample. Once matched, individuals remain in the sample for all the subsequent years they are observed in the dataset. The final sample is constructed by merging the subsamples of treated and their matched untreated counterparts.

Following Simonsen and Skipper (2006), to estimate the propensity score defined as a probability of having children, probit model of the following form is used:

$$\begin{aligned} \text{parent}_{i,j} = & \alpha_{1,j} + \sum_k^{k+4} \alpha_{k,j} \text{age_d}_{i,j} + \sum_l^{l+4} \alpha_{l,j} \text{level of education}_{i,j} + \\ & \sum_m^{m+2} \alpha_{m,j} \text{urbanisation}_{i,j} + \sum_n^{n+5} \alpha_{n,j} \text{region}_{i,j} + \sum_o^{o+5} \alpha_{o,j} \text{non labor income}_{i,j} + \\ & \alpha_{o+6,j} \text{age partner}_{i,j} + \alpha_{o+7,j} \text{parent in the HH}_{i,j} + \xi_{i,j} \end{aligned} \quad (1)$$

The propensity score is estimated separately for men and women, that is $j=\{\text{female}, \text{male}\}$. Independent variables include age dummies, level of education, degree of urbanization, region of the country, non-labour income available to the household, as well as the age of the partner and a dummy indicator for the presence of a parent in the household (i.e. parent of an individual i). Controls for the level of education consist of four dummy variables indicating: *primary and lower secondary education*, *upper secondary education*, *post-secondary non-tertiary education*, *tertiary education* (first and second stage); the omitted category is no education or incomplete primary education. Urbanization controls stand for dummy variables indicating the degree of urbanization: *densely populated area*, *intermediate area*; the omitted category is *thinly populated area*. Regions are dummy variable indicating the region of the country that corresponds to NUTS1 units; 5 variable are included: *Eastern Poland*, *Southern Poland*, *Northern-Western Poland*, *Southern-Western Poland* and *Northern Poland*; *Central Poland* is the omitted group.

Matched sample obtained from the propensity score matching is then used for the final analysis of the parenthood effect on working hours and hourly wages. Since matching is performed for the individuals that appear in the sample for the first time, some individuals change their parenthood status. This indicates that fixed effects model can be estimated; it takes the following form:

$$\text{Outcome}_{it,j} = \beta_{1,j} + \beta_{2,j} \text{fertility_measure}_{it,j} + \mathbf{X}_{it,j} \boldsymbol{\beta}_{k,j} + u_{t,j} + v_{i,j} + \varepsilon_{it,j}. \quad (2)$$

As previously, the analysis is performed separately for men and women, that is $j=\{\text{female}, \text{male}\}$. Individual fixed effects are represented by $v_{i,j}$ and $\varepsilon_{it,j}$ is an error term; $u_{t,j}$ stands for time effects that are accounted for by the inclusion of year fixed effects. The parameter of

¹³ The matching is performed with the use of *psmatch2* command in Stata software, (Leuven and Sianesi, 2003).

¹⁴ The common support ensures that there is a childless individual that is comparable to individuals with children. Technically this means that treated observations, whose propensity score is higher than the maximum or less than the minimum propensity score of the controls, are dropped from the sample.

interest, indicating the family gap is $\alpha_{2,j}$. The fertility measure is specified in four ways, that is by the inclusion of:

- 1) a dummy variable equal to 1 if one has children and 0 otherwise (regardless the number of children);
- 2) a variable indicating the number of children;
- 3) dummy variables indicating the exact number of children;
- 4) five variables indicating number of children in certain age groups: 0-3 year old (*aged_0_3*), 4-6 (*aged_4_6*), 7-12 (*aged_7_12*), 12-18 (*aged_12_18*) and 18 or more (*aged_18_plus*).

For the sake of clarity this four different models are named as *Specification I to IV* respectively. The outcome variables include two main variables: hours of work and wages. Hours of work are measured by the number of hours usually worked per week, whereas wages are defined as the natural logarithm of an hourly wage. Additionally, to test the hypothesis that differences in earnings of childless and childrearing individuals stem from working hours adjustments, monthly earnings are also considered. No controls for demographic variables such as age and education are included. This is caused by the fact that education is constant over time and age is in turn perfectly collinear with individual and time fixed effects (the change in age is the same for all the individuals in the sample); (Wooldridge, 2003). The models however control for these characteristics as they are accounted for via the individual fixed effects. In the models, in which the outcome variable is defined as hours worked per week additional controls for occupations and part-time working schedule are included. Occupations are grouped into four categories: *highly skilled non-manual*, *lower skilled non-manual*, *skilled manual*, *elementary occupation*.¹⁵ Similarly, in the models, in which the outcome is defined as wage/salary, additional controls for the theoretical explanations regarding the existence of the family gaps are included; these are labour market experience measured by the years spent in paid job, occupations and part-time working schedule.

Results obtained with the use of FE estimation are supplemented with the OLS estimation on the matched sample. The OLS estimation will result in biased results as it does not account for unobservable factors that relate to parenthood and labour market outcome variables. However, their comparison with the FE estimates enables to assess the direction of the bias as well as the role of unobserved individual characteristics in shaping parenthood related labour market inequalities.

4.2. Accounting for selection to employment in family wage gap analysis

In the analysis of parenthood wage effects one needs to deal not only with the endogeneity of fertility but also with the consequences of selection to employment. This is especially important in the case of women, as their decision whether to work is highly related to parenthood status. To assess the consequences of the selection into employment for the estimates of the cost of parenthood, this research identifies individuals that tend to drop the labour market following the childbirth. In particular, it reveals whether the individuals that drop the labour tend to receive higher or lower wages. The identification relies on the fact that individuals are observed both before and after the change in their parenthood status. It is

¹⁵ The aggregation of occupations is consistent with the approach presented in Whelan et al. (2011). The group of elementary occupations is left as a reference group.

therefore possible to identify whether the wage rate of individuals that are working before the childbirth is related to their decision regarding returning to work after the childbirth. This is done by estimating the probability of working following the presence of a child with the probit model of the following form:

$$\begin{aligned} \text{working after}_{ijt} = & \gamma_0 + \gamma_1 \text{wage before}_{i,j,t} + \sum_k^{k+4} \gamma_k \text{education}_{i,j,t} + \sum_l^{l+2} \gamma_l \text{urbanisation}_{i,j,t} + \\ & \sum_m^{m+5} \gamma_m \text{region}_{i,j,t} + \zeta_{ijt} \end{aligned} \quad (3)$$

5. Results

5.1. Fixed effect estimation results on a sample matched using propensity score matching

5.1.1. Family gaps in working hours

Fixed effect estimates of equation (2) for men and women with the outcome variable defined as the usual hours worked per week in the main job using four different specification of fertility measures are shown in Table 2. The effects are estimated using both individuals fixed effects as well as OLS estimations on the sample obtained from the propensity score matching. In addition to full sample a subsample of individuals that are living with a partner in the same household is also considered. The results for this subsample are presented in Table 3.

In the case of the full sample there are 9,385 females and 12,540 males. The estimates obtained with the use of OLS estimation show that parenthood leads to significantly longer working hours of men: father are found to work by 0.8 hour longer per week than childless men. The respective impact for women is negative and equals to negative half an hour per week. Once the number of children is considered, each children increases working time of fathers by app. 0.3 hour. For women no significant effect is found. The next model specification (specification III) indicates that the effect of children on men's working hours is non-linear, as the first child leads to longer working hours of app. 0.7 hour, second child of app. 0.8 hour, and third and subsequent child by more 1.4 hour per week. The more children the father has, the longer his working hours. For women, the effects show rather minor difference in the number of children. Finally, when the age of children is additionally taken into account, the results indicate that fathers and mothers of the smallest children (aged 0-3) tend to work the longest and shortest hours respectively.

When fixed effects estimation instead of OLS is used, the estimates provide slightly different findings. In the case of men the coefficients obtained from FE estimation are lower and less precise than those obtained from the OLS estimation. This indicates that there is an unobserved heterogeneity, so that those men, who have children at the same time have characteristics that make them work longer hours. Longer working hours of men are therefore not a result of their adjustment after the childbirth but rather of the fact that those men, who work more decide to have children. In the case of women, in most models the effects of children on working hours obtained with the use of fixed effects estimation remain negative but are no longer statistically significant. These results are also slightly less negative than the ones provided when linear regression is used, suggesting that some of the negative effect may be due to unobserved differences between childrearing and childless women.

Table 2. OLS and FE estimates of the fertility effects on the hours usually worked per week for men and women; sample of not studying individuals aged 16-45.

Full sample					
Parenthood specification		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	0.569 (0.454)	0.827*** (0.220)	-0.104 (0.418)	-0.478** (0.206)
	R ²	0.059	0.150	0.178	0.320
(II)	Number of children	0.255 (0.282)	0.325*** (0.083)	0.141 (0.261)	-0.081 (0.090)
	R ²	0.059	0.150	0.178	0.319
(III)	Exactly one child	0.565 (0.453)	0.709*** (0.233)	-0.117 (0.413)	-0.572*** (0.218)
	Exactly two children	0.656 (0.640)	0.828*** (0.242)	0.045 (0.585)	-0.298 (0.236)
	Three or more children	0.872 (0.954)	1.453*** (0.320)	0.508 (0.907)	-0.556* (0.319)
	R ²	0.059	0.150	0.178	0.320
(IV)	Number of children aged 0-3	0.226 (0.291)	0.545*** (0.166)	0.107 (0.288)	-0.588*** (0.202)
	Number of children aged 3-6	0.294 (0.367)	0.290* (0.165)	0.822** (0.350)	0.223 (0.178)
	Number of children aged 6-14	0.369 (0.427)	0.379*** (0.108)	0.237 (0.353)	-0.098 (0.115)
	Number of children aged 14-18	-0.006 (0.505)	0.100 (0.152)	0.180 (0.359)	-0.114 (0.167)
	Number of children aged 18-25	0.172 (0.583)	0.219 (0.205)	0.299 (0.326)	0.106 (0.167)
	R ²	0.058	0.150	0.182	0.320
N		12 540		9 385	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.001.

In the case of the sample restricted to individuals that are living with a partner, there are 8,569 men and 6,726 women. Both for men and women, the OLS estimation results for the subsamples of cohabitating individuals indicate that the effects are slightly weaker than for the full sample. This is however not true for FE estimation, as individuals living with the partner are subject to greater premiums associated with parenthood. The estimates suffer however from large standard errors. The comparison of the results thus suggests that living in the same household with a partner does not mitigate the effects of children on the average hours worked per week but rather strengthens the specialization of men and women.

The results are interesting in the framework of the reviewed theories. In line with the theoretical explanations parenthood of Polish men is associated with a slight increase in their working hours. However, this increase is caused by men's selection to parenthood as men with unobserved characteristics that are important for working hours (e.g. devotion to work) tend to be fathers. Mothers in turn tend to work slightly fewer hours than childless women. When individual factors that are important for the decision on parenthood are accounted for the effects are slightly lower, suggesting that some of the effect is driven by these unobserved heterogeneity. The comparison of the results for the full sample and the subsample of individuals living with a partner moreover suggests that after accounting for unobserved factors the specialization is greater among cohabitating individuals. The results thus indicate

that indeed there is an independence in men's and women's working hours, which is even stronger for individuals that are living in the same household and are jointly rising children.

Table 3. OLS and FE estimates of the fertility effects on the hours usually worked per week for men and women; sample of not studying individuals aged 16-45, who are living with a partner.

Only living with a partner					
Parenthood specification		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	0.756 (0.543)	0.714*** (0.236)	-0.372 (0.442)	-0.247 (0.239)
	R ²	0.042	0.109	0.178	0.326
(II)	Number of children	0.350 (0.313)	0.392*** (0.092)	-0.059 (0.265)	-0.016 (0.094)
	R ²	0.042	0.109	0.178	0.324
(III)	Exactly one child	0.754 (0.542)	0.569** (0.247)	-0.372 (0.439)	-0.344 (0.254)
	Exactly two children	0.910 (0.722)	0.744*** (0.259)	-0.425 (0.610)	-0.093 (0.261)
	Three or more children	1.205 (1.030)	1.528*** (0.341)	0.012 (0.940)	-0.334 (0.335)
	R ²	0.042	0.109	0.178	0.326
(IV)	Number of children aged 0-3	0.347 (0.316)	0.650*** (0.180)	-0.070 (0.301)	-0.649*** (0.218)
	Number of children aged 3-6	0.370 (0.387)	0.292* (0.167)	0.585 (0.364)	0.225 (0.187)
	Number of children aged 6-14	0.469 (0.449)	0.456*** (0.117)	-0.081 (0.363)	-0.027 (0.119)
	Number of children aged 14-18	0.080 (0.527)	0.139 (0.164)	-0.088 (0.348)	0.039 (0.169)
	Number of children aged 18-25	0.143 (0.603)	0.135 (0.217)	0.145 (0.311)	0.252 (0.169)
	R ²	0.042	0.109	0.183	0.326
N		8 569		6 726	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

5.1.2. Family gaps in wages

The fixed effect estimates of the effect of children on men's and women's pay are shown in Tables 4 and 6 for the full sample and 5 and 7 for the subsample of cohabitating individuals. Tables 4 and 5 present the effects of parenthood on gross monthly earnings. Results shown in Tables 6 and 7 refer to hourly wages, calculated based on the information on usual hours worked per week and gross monthly earnings.

When monthly earnings are considered, the estimates from the OLS and FE estimations differ substantially. In the case of men, a positive and significant premium from parenthood is found when linear regression is used. When individual unobserved factors relevant for the choice of parenthood status as well as earnings are eliminated with the use of FE estimation, the estimates are however rather negligible and less statistically significant. This comparison once again indicates that men tend to positively self-select into parenthood, so that those men, who have higher valued unobserved skills, tend to have children. In the case of women, small and negative premiums associated with parenthood are found when linear regression model is adapted. However, when unobserved heterogeneity between mother and childless women is

controlled for, the estimated effects are more negative and statistically significant. This comparison reveals positive correlation between individual fixed effects and earnings, meaning that women with skills that are more valued at the labour market tend to have children. The results show that parenthood in general leads to approximately 13% lower monthly earnings. This finding is similar to the one presented in Cukrowka-Torzewska (2015). Specific results furthermore show that each child reduces mother's salary by app. 9% (specification II). The findings also show that mostly mothers of very small children – aged 0-3 – and children aged 6-14 are experiencing a salary drop of 9%. Mothers of children aged 3 to 6 still experience a penalty of around 7%.

Table 4. OLS and FE estimates of the fertility effects on the logarithm of monthly earnings for men and women; sample of not studying individuals aged 16-45.

Full sample					
Parenthood <i>specification</i>		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	-0.014 (0.023)	0.079*** (0.014)	-0.131** (0.052)	-0.019 (0.014)
	R ²	0.065	0.313	0.079	0.422
(II)	Number of children	-0.012 (0.017)	0.032*** (0.006)	-0.094*** (0.036)	0.004 (0.006)
	R ²	0.065	0.321	0.079	0.421
(III)	Exactly one child	-0.013 (0.023)	0.055*** (0.015)	-0.128** (0.051)	-0.028* (0.015)
	Exactly two children	-0.044 (0.037)	0.102*** (0.016)	-0.220*** (0.083)	-0.011 (0.016)
	Three or more children	-0.058 (0.056)	0.109*** (0.021)	-0.244* (0.132)	0.014 (0.023)
	R ²	0.065	0.313	0.079	0.422
(IV)	Number of children aged 0-3	-0.015 (0.018)	0.038*** (0.011)	-0.094** (0.041)	-0.008 (0.017)
	Number of children aged 3-6	0.016 (0.025)	0.039*** (0.012)	-0.075* (0.042)	0.030** (0.013)
	Number of children aged 6-14	0.014 (0.028)	0.026*** (0.007)	-0.094** (0.040)	0.009 (0.008)
	Number of children aged 14-18	-0.009 (0.034)	0.029*** (0.011)	-0.056 (0.034)	0.002 (0.010)
	Number of children aged 18-25	0.011 (0.035)	0.015 (0.015)	-0.052* (0.028)	-0.018 (0.011)
	R ²	0.063	0.313	0.080	0.422
	N	12 476		9 359	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

When the results for the full sample are compared with the subsample of cohabitating individuals, slightly lower earning premiums are observed among cohabitating men and women. For the sample of married women the effect of parenthood is lower and equal to 11%. The results also show that each child reduces the earnings by 8.7%. Very likely, the effect is however nonlinear: having one child leads to lower monthly salary of women by around 11%, whereas having exactly two children as well as three or more children reduces the earnings by 22%. Among the full sample and the subsample of women living with a partner the penalty for mothers of the smallest children is comparable.

Table 5. OLS and FE estimates of the fertility effects on the logarithm of monthly earnings for men and women; sample of not studying individuals aged 16-45, who are married or living with a partner.

Only living with a partner					
Parenthood specification		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	-0.017 (0.025)	0.067*** (0.015)	-0.115* (0.063)	-0.011 (0.016)
	R ²	0.061	0.280	0.070	0.405
(II)	Number of children	-0.026 (0.018)	0.036*** (0.006)	-0.087** (0.040)	0.010 (0.007)
	R ²	0.061	0.286	0.070	0.403
(III)	Exactly one child	-0.018 (0.025)	0.046*** (0.016)	-0.115* (0.062)	-0.023 (0.017)
	Exactly two children	-0.065 (0.039)	0.090*** (0.017)	-0.221** (0.096)	0.002 (0.018)
	Three or more children	-0.102* (0.057)	0.108*** (0.022)	-0.223 (0.139)	0.019 (0.025)
	R ²	0.061	0.280	0.070	0.405
(IV)	Number of children aged 0-3	-0.024 (0.019)	0.043*** (0.012)	-0.093** (0.047)	-0.011 (0.018)
	Number of children aged 3-6	0.001 (0.027)	0.040*** (0.012)	-0.073 (0.046)	0.027** (0.013)
	Number of children aged 6-14	0.007 (0.031)	0.030*** (0.008)	-0.084** (0.042)	0.021** (0.009)
	Number of children aged 14-18	0.004 (0.035)	0.034*** (0.011)	-0.043 (0.036)	0.009 (0.011)
	Number of children aged 18-25	0.021 (0.036)	0.023 (0.015)	-0.043 (0.030)	-0.014 (0.012)
	R ²	0.057	0.280	0.075	0.405
N		8 529		6 704	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

The results obtained from the estimation of the effects of parenthood on the log of hourly wages are presented in Tables 6 and 7. The findings are slightly different and show that once hourly wage is considered the premium from fatherhood is lower than when monthly earnings are analyzed. For women, the opposite applies, as the effects of motherhood are slightly larger when hourly wage is analyzed. This is true both for the full sample (Table 6) and subsample of individuals living with the partner in the same household (Table 7). The results thus show that for men no fatherhood premium in a form of higher wages is present if individual fixed effects and working hours are taken into account. On the other hand, the results for women indicate that women with children receive on average 10-13% lower wages than childless women (for the full sample and for the subsample of living with a partner respectively)– even after controlling for women’s selection to parenthood and working hours adjustments. The wage penalty also varies in the number of children: one child leads to 10-13% lower wages, two children to 22-23% lower wages and three and more children to almost 30% lower wages of mothers. The wage penalty is moreover comparable for mothers of children aged 0-3, 3-6 and 6-14.

Table 6. OLS and FE estimates of the fertility effects on the logarithm of an hourly wage for men and women; sample of not studying individuals aged 16-45.

Full sample					
Parenthood <i>specification</i>		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	-0.020 (0.024)	0.064*** (0.015)	-0.133** (0.055)	-0.008 (0.015)
	R ²	0.071	0.322	0.075	0.442
(II)	Number of children	-0.015 (0.018)	0.026*** (0.006)	-0.104*** (0.039)	0.005 (0.007)
	R ²	0.071	0.322	0.075	0.441
(III)	Exactly one child	-0.019 (0.024)	0.044*** (0.016)	-0.130** (0.054)	-0.013 (0.016)
	Exactly two children	-0.053 (0.038)	0.088*** (0.017)	-0.231*** (0.088)	-0.006 (0.017)
	Three of more children	-0.067 (0.060)	0.082*** (0.021)	-0.281* (0.146)	0.024 (0.024)
	R ²	0.071	0.322	0.075	0.442
(IV)	Number of children aged 0-3	-0.016 (0.019)	0.025** (0.012)	-0.103** (0.044)	0.007 (0.018)
	Number of children aged 3-6	0.012 (0.026)	0.038*** (0.012)	-0.110** (0.047)	0.020 (0.013)
	Number of children aged 6-14	0.007 (0.030)	0.025*** (0.008)	-0.111** (0.045)	0.011 (0.009)
	Number of children aged 14-18	-0.011 (0.036)	0.031*** (0.011)	-0.068* (0.039)	0.005 (0.011)
	Number of children aged 18-25	0.002 (0.037)	0.007 (0.015)	-0.065** (0.031)	-0.024** (0.012)
	R ²	0.068	0.322	0.076	0.442
N		12 476		9 359	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

To conclude, contrary to the expectations formulated based on the reviewed theory, men are not found to receive a substantial and significant wage premium associated with the parenthood, when individual characteristics – observed and unobserved ones – that are relevant for wages are controlled. Mothers do however experience lower wages than childless women. The wage effect of parenthood for cohabitating women are only marginally lower than in the case of the full sample, suggesting that living with the partner might not mitigate the negative impact of children on their wages as men and women do specialize in the home and market production.

Table 7. OLS and FE estimates of the fertility effects on the logarithm of an hourly wage for men and women; sample of not studying individuals aged 16-45, who are married or living with a partner.

Only living with a partner					
Parenthood specification		Men		Women	
		FE	OLS	FE	OLS
(I)	Parent (dummy)	-0.026 (0.027)	0.055*** (0.016)	-0.108 (0.067)	-0.007 (0.018)
	R ²	0.067	0.300	0.062	0.441
(II)	Number of children	-0.029 (0.019)	0.028*** (0.006)	-0.091** (0.044)	0.008 (0.007)
	R ²	0.067	0.300	0.062	0.440
(III)	Exactly one child	-0.026 (0.027)	0.037** (0.017)	-0.109* (0.066)	-0.015 (0.018)
	Exactly two children	-0.073* (0.041)	0.078*** (0.018)	-0.219** (0.103)	-0.000 (0.020)
	Three of more children	-0.112* (0.060)	0.079*** (0.023)	-0.244 (0.157)	0.021 (0.026)
	R ²	0.067	0.300	0.062	0.441
(IV)	Number of children aged 0-3	-0.025 (0.020)	0.027** (0.012)	-0.097* (0.051)	0.004 (0.019)
	Number of children aged 3-6	-0.001 (0.028)	0.037*** (0.012)	-0.100* (0.052)	0.015 (0.014)
	Number of children aged 6-14	0.003 (0.033)	0.026*** (0.008)	-0.091* (0.048)	0.020** (0.009)
	Number of children aged 14-18	0.003 (0.038)	0.035*** (0.012)	-0.047 (0.041)	0.007 (0.011)
	Number of children aged 18-25	0.015 (0.039)	0.020 (0.016)	-0.051 (0.033)	-0.023* (0.013)
	R ²	0.063	0.300	0.067	0.441
	N	8 529		6 704	

Notes: In OLS estimation additional controls for age, education, urbanization and region are included.

Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

5.2. Assessing the role of women's selection to work following the childbirth

Table 8 reports the estimates of employment probits for those individuals, who were matched in the propensity score matching and change their parenthood status. The employment probits represent the probability of being working after having children. The estimated coefficients related to wage rate in the period preceding the childbirth show whether the wage rate is correlated with the decision to stay at the labour market. Both men and women are considered, though employment selection is expected to be of concern especially for women, as it is mostly women that stay at home to take care of a child following its birth.

Columns 1 and 2 in Table 8 represent the estimated coefficients for men and refer to hourly wage and monthly salary respectively. The estimated coefficients on these variables are subject to high errors showing that men, who become parents do not select to employment in connection to their wages. Among the subsample of men living with the partner, the estimated coefficient remain however positive and significant, suggesting that men who earn higher wages/get higher salary are more likely to work for a wage after the occurrence of a child. The true population effect of fatherhood that take into account their labour market selection are therefore likely to be lower than the effects estimated based on the sample of working men.

Table 8. The estimates of the employment probits for individuals, who are changing their parenthood status; sample of not studying individuals aged 16-45.

Full sample				
Independent variables	ln(wage)	ln(earnings)	ln(wage)	ln(earnings)
	Men	Men	Women	Women
wage/earnings before the child	0.160 (0.208)	0.286 (0.234)	0.577*** (0.139)	0.577*** (0.131)
Married	0.063 (0.303)	0.042 (0.309)	0.015 (0.165)	-0.014 (0.170)
age 21 to 25	-3.333*** (0.572)	-3.307*** (0.572)	4.132*** (0.353)	4.245*** (0.357)
age 26 to 30	-2.795*** (0.632)	-2.789*** (0.631)	4.306*** (0.357)	4.428*** (0.360)
age 31 to 35	-2.860*** (0.604)	-2.873*** (0.597)	4.531*** (0.364)	4.631*** (0.364)
age 36 to 40	-2.825*** (0.635)	-2.832*** (0.633)	4.572*** (0.434)	4.662*** (0.436)
age 41 to 45			4.976*** (0.484)	5.205*** (0.492)
Education: upper secondary	0.330 (0.262)	0.290 (0.271)	1.452** (0.597)	1.029* (0.607)
Education: post-secondary non-tertiary			1.879*** (0.634)	1.453** (0.646)
Education: tertiary	0.320 (0.370)	0.245 (0.392)	1.973*** (0.597)	1.607*** (0.617)
No. Observations	655	655	582	582
R2	0.119	0.126	0.17	0.168
Only living with a partner				
Independent variables	ln(wage)	ln(earnings)	ln(wage)	ln(earnings)
	Men	Men	Women	Women
wage/earnings before the child	0.479** (0.217)	0.580** (0.261)	0.614*** (0.165)	0.724*** (0.166)
Married	-0.814* (0.481)	-0.948* (0.563)	-0.198 (0.324)	-0.213 (0.327)
age 21 to 25	0.417 (0.487)	0.450 (0.497)	-0.442 (0.569)	-0.378 (0.580)
age 26 to 30	1.155*** (0.443)	1.190*** (0.456)	-0.306 (0.559)	-0.258 (0.573)
age 31 to 35	1.357*** (0.445)	1.384*** (0.455)	-0.184 (0.565)	-0.180 (0.576)
age 36 to 40	1.247** (0.532)	1.292** (0.546)	-0.018 (0.651)	-0.060 (0.659)
Education: upper secondary	0.171 (0.341)	0.091 (0.357)	1.534** (0.702)	0.981 (0.673)
Education: post-secondary non-tertiary			1.889** (0.759)	1.344* (0.737)
Education: tertiary	-0.022 (0.420)	-0.088 (0.454)	2.098*** (0.701)	1.563*** (0.690)
No. Observations	530	530	412	412
R2	0.223	0.229	0.1728	0.1791

Notes: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

The respective values for women are shown in columns 3 and 4 in Table 8. In both models the estimated coefficients related to income from work are positive and statistically significant. This indicates that women who earn higher wages/get higher salary are more likely to stay at the labour market following the pregnancy, whereas low- earners are more likely to leave the

labour market. This finding thus shows that the estimated effects of motherhood on wages are subject to the selection bias, which stems from mother's self-selection to employment, as only mother that earn sufficiently high wages are observed working. As a results, the true effect of motherhood on wages of all women is likely to be lower than the effects estimated based on the sample of working women.

6. Conclusion

This paper provides estimates of the cost of parenthood for men and women in Poland. It also tests possible sources of wage inequality related to parenthood and looks at working hours adjustments and parent's selection into parenthood.

To account for individuals' self-selection to parenthood – both on observable and unobservable characteristics – propensity score matching and fixed effects estimation are used. While propensity score matching minimizes differences in observable characteristics of individuals with and without children, fixed effects estimation allows for eliminating time invariant unobserved factors that relate to parenthood and labour market outcomes. Additionally, the importance of possible individual self-selection into employment following the childbirth is tested by showing which individuals – low/high earners - are more likely to stay at the labour market following the childbirth.

In general the results of the paper reveal that:

- men that have children are working slightly longer hours than childless men, whereas women with children are working shorter hours than childless women;
- in the case of men, children's effects on working hours are lower once individual unobserved heterogeneity is controlled for, suggesting that those men, who work longer hours are also more likely to have children;
- in the case of women children's effects on working hours are slightly lower once individual unobserved heterogeneity is controlled for, suggesting that part of the gap in working hours may be due to the unobserved differences between mothers and childless women;
- the impact of children on working hours of men and women is greater among individuals that are married or living with a partner, suggesting that among couples the specialization in home and market production is more intense;
- fathers are found to receive greater earnings than childless men but the premium stems from unobserved heterogeneity of fathers (father's selection to parenthood) and working hours adjustments;
- mothers are found to receive lower earnings than childless women, even after controlling for mothers unobserved factors and working hours adjustments;
- motherhood penalty is only slightly lower for the subsample of married and cohabitating women, indicating that living with a partner may not mitigate negative wage effects of motherhood;
- the sample of working mothers is not random and women that earn higher wages before the childbirth are more likely to stay at the labour market afterwards; as a results, if the fact that some mothers drop the labour market could be corrected in the estimated effects, the effects would be more negative.
- There is some evidence on the positive selection to work among fathers that are living with a partner in the same household, suggesting that true premium from fatherhood may be lower.

Based on the above specific findings, the paper concludes that parenthood does influence the labour market outcomes of men and women in Poland in the opposite way. Mothers work fewer hours and get lower wages, whereas fathers work longer hours and receive greater pay. However, men and women do similarly decide to have children as both men and women, who are endowed with characteristics that make them work longer and get greater pay are more likely to have children. This means, that the positive effects of parenthood for fathers to some extent are a result of this positive self-selection to parenthood. But for women, the opposite applies, as when similar women with this respect are compared, mothers are found to work shorter hours and also receive lower pay for their work.

References

- Anderson D. J., Binder M., Krause K., 2003. „The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, and Work Schedule Flexibility”, *Industrial and Labor Relations Review*, 56, pp. 273-294.
- Angrist, J. D. and Evans W. N., 1998. „Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size”, *American Economic Review* 88(3): 450-477
- Apps, P.F and Rees R., 1997. „Collective Labor Supply and Household Production”, *Journal of Political Economy* 105(1): 178-90.
- Becker G. S., 1985. „Human Capital, Effort, and the Sexual Division of Labor”, *Journal of Labor Economics* 3, pp. S33-S58.
- Blundell, R., Chiappori P.A, and Meghir C., 2005. „Collective Labor Supply with Children”, *Journal of Political Economy* 113(6): 1277-1306.
- Browning, M., 1992. „Children and Household Economic Behavior”, *Journal of Economic Literature*, vol. 30, no. 3, pp. 1434-1475.
- Budig M. J., England P., 2001. „The Wage Penalty for Motherhood”, *American Sociological Review*, 66, pp. 204-225.
- Budig M. J., Hodges M. J., 2010. „Differences in Disadvantage: Variation in the Motherhood Penalty Across White Women's Earnings Distribution”, *American Sociological Review* , 75 (5), pp. 705-728.
- Cherchye L., De Rock B., Vermeulen F., 2010. „Married with Children: A Collective Labor Supply Model with Detailed Time Use and Intrahousehold Expenditure Information”, IZA DP No. 5190
- Chiappori, P.A., 1988. „Rational household labor supply”, *Econometrica*, 56, 63-89.
- Chiappori, P.A., 1992. „Collective labor supply and welfare”, *Journal of Political Economy*, 100, 437-467.
- Chiappori, P.A., 1997. „Introducing household production in collective models of labor supply”, *Journal of Political Economy*, 105, 191-209.
- Cukrowska-Torzewska, E., 2015. „How much does it cost to rear children in Poland”, *European Journal of Women's Studies*, forthcoming.
- Dalmia, S. and Sicilian P., 2008. “Kids Cause Specialization: Evidence for Becker's Household Division of Labor Hypothesis”, *International Advances in Economic Research*, 14 (4), pp 448-459.
- Datta Gupta, N., Smith, N., 2002. „Children and career interruptions”, *Economica*, 69, pp. 609–629.

- Davies R., Pierre G., 2005. „The Family Gap in Pay in Europe: A Cross-Country Study”, *Labour Economics*, 12, pp. 469-486.
- Engel M. and Schaffner S., 2012. „How to Use the EU-SILC Panel to Analyse Monthly and Hourly Wages”, *Ruhr Economic Papers* #390.
- Felfe, Ch., 2012. The motherhood wage gap: What about job amenities?, *Labour Economics* 9 (1): 59–67.
- Fodor, É., Glass, Ch., Kawachi J., and Popescu L., 2002. „Family Policies and Gender in Hungary, Poland, and Romania”, *Communist and Post-Communist Studies* 35: 475-490.
- Fortin B. and Lacroix G., 1997. „A Test of the Unitary and Collective Models of Household Labour Supply”, *Economic Journal* 107(443): 933-55.
- Gangl M., Ziefle A., 2009. „Motherhood, Labor Force Behavior, and Women’s Careers: An Empirical Assessment of the Wage Penalty for Motherhood in Britain, Germany and the United States”, *Demography*, 46, pp. 341-94.
- Glauber, R., 2008. „Gender and Race in Families and at Work: The Fatherhood Wage Premium”, *Gender & Society* 22(1): 8-30.
- Heckman J., 1976. „The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models”, *Annals of Economic and Social Measurement*, 5, pp. 475–492.
- Heckman J., 1979. „Sample selection bias as a specification error”, *Econometrica*, 47 (1), pp. 153 - 161.
- Karbownik, K. and Myck, M., 2012. „For Some Mothers More Than Others: How Children Matter for Labour Market Outcomes When Both Fertility and Female Employment Are Low”, *IZA Discussion Papers* 6933, Institute for the Study of Labor (IZA).
- Killewald, A., 2013. „A Reconsideration of the Fatherhood Premium: Marriage, Residence, Biology, and the Wages of Fathers”, *American Sociological Review* 78:96-116.
- Killewald, A. and Gough M., 2013. „Does Specialization Explain Marriage and Parenthood Penalties and Premiums?”, *American Sociological Review* 78:477-502.
- Kim, J. and Aassve, A., 2006. „Fertility and its Consequence on Family Labour Supply”, *IZA Discussion Papers* 2162, Institute for the Study of Labor (IZA).
- Korenman S., Neumark D., 1992. „Marriage, motherhood and wages”, *Journal of Human Resources*, 27, pp. 233-255.
- Koslowski, S. A., 2011. „Working Fathers in Europe: Earning and Caring”, *European Sociological Review*, 27 (2): 230-245.
- Leuven E., Sianesi B., 2003. „PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing”, *Statistical Software Components*

- Li, X., 2005. „Impact of childrearing on women’s labor market outcomes: Using new data and methods”. Unpublished, PhD draft, Yale University, New Haven, CT.
- Lundberg S., 2008. „Gender and Household Decisionmaking”, in *Frontiers in Gender Economics*, ed. Francesca Bettio, New York: Routledge.
- Lundberg, S and Rose E., 2000. „Parenthood and the earnings of married men and women”, *Labour Economics* 7(6): 689-710.
- Lundberg, S and Rose E., 2002. „The Effects Of Sons And Daughters On Men’S Labor Supply And Wages”, *The Review of Economics and Statistics* 84(2): 251-268.
- Lundberg, S. and Rose E., 1998. „The Determinants of Specialization Within Marriage”, Working Papers 0048, University of Washington, Department of Economics.
- Nielsen H. S., Simonsen M, Verner M., 2004. „Does the gap in family-friendly policies drive the family gap?”, *Scandinavian Journal of Economics*, 106, pp. 721–744.
- Pascall, G., Kwak, A., 2005. *Gender Regime in Transition in Central and Eastern Europe*, Bristol, Policy Press.
- Petersen, T., Penner, A. Hogsnes, G., 2007. „From Motherhood Penalties to Fatherhood Premia: The New Challenge for Family Policy”, Institute for Research on Labor and Employment UC Berkeley Working Paper Series
- Rosenzweig, M. R. and Wolpin, K. I., 1980. „Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural Experiment”, *Econometrica*. *Econometric Society* 48(1): 227-40, January.
- Schultz, T.P., 1981. *Economics of Population*, Reading, MA: Addison-Wesley.
- Simonsen M., Skipper L., 2006. „The costs of motherhood: an analysis using matching estimators”, *Journal of Applied Econometrics*, 21(7), pp 919-934.
- Trappe, H. and Rosenfeld R.A., 2000. „How do Children Matter? A Comparison of Gender Earnings Inequality for Young Adults in the Former East Germany and the Former West Germany”, *Journal of Marriage and the Family* 62(2), pp. 489-507.
- Waldfogel J., 1998. „The Family Gap for Young Women in the United States and Britain: Can Maternity Leave Make a Difference?”, *Journal of Labor Economics*, 16 (3), pp. 505-545.
- Waldfogel, J., 1997. „The Effect of Children on Women’s Wages”, *American Sociological Review* 62(2):209-17.
- Wooldridge, J., 2003. *Introductory Econometrics: A Modern Approach*, South-Western College Pub.

Theoretical model of specialization and its implications for the labour supply and wages of men and women

In the original Becker's argument, the specialization of men and women in the 'home production' and 'market production' occurs in the household consisting of a married couple with an implicit assumption that children are also present. In line with Lundberg and Rose (2002), in this work it is argued that the specialization of men and women takes place following the childbirth, not the marriage itself.¹⁶

The simple theoretical model of specialization presented in this subsection is based on Lundberg (2002, 2008). The model is simplified as the goal of this work is to test the specialization hypothesis and the model serves only as an illustration of the theory. The presentation of the model is followed by the discussion of its implications for the analysis. First, the model is presented for the household consisting of three agents: wife, husbands and a child. The outcomes of men and women in this household are then compared to the outcomes of men and women in the event of the lack of a child.

The model assumes that the household consists of a father (f), a mother (m) and a child (K). Parents make decisions about their consumption and time allocation over two time periods, $t=1, 2$. Their individual utility depends on consumption of a private good (c_i) and the consumption of a public good (K), i.e. a child. The model assumes no altruism, so that the utility of individual i does not depend on consumption of individual j . There is also no borrowing, savings and discounting.

In period 1, man and woman divide their time between market work at fixed wage rates, w_f and w_m , and an investment in a child (K). It is assumed that in period 1 there is no wage inequality, so that $w_f=w_m=w$. In period 2, spouses divide their time between market work and leisure. The wage rate depends positively upon the amount of the market work performed in period 1. In line with the collective labour supply models (Chiappori, 1988) the couple maximizes an objective function, which is defined as a weighted average of identical utilities, with the wife's utility weighted by λ :

$$W = U_1(c_{f,1}, K) + U_2(c_{f,2}) + \lambda[U_1(c_{m,1}, K) + U_2(c_{m,2})] \quad (1)$$

The objective function is maximized over the private consumption in period 1 and 2, and public consumption (child). It is assumed that the utility function in period 1 is strongly separable in the private good and child, so that:

$$U_1(c_{i,1}, K) = U_1(c_{i,1}) + \gamma(K) \quad (2)$$

The public good is produced with the time inputs of a husband and wife, so that:

$$K = h_m k_m + h_f k_f \quad (3)$$

where h_i is the productivity level of an individual i . Women are assumed to be more productive at home (this may stem for example from their attachment to the child during the

¹⁶ Dalmia and Sicilian (2008) using Becker's model of marriage market find that children induce within household spacialization, which is not true for the couples without children.

pregnancy), so that $h_m > h_f$.¹⁷ The individual time endowment is normalized to 1. In the period 1, all time not allocated to child is spent in the market work, so that:

$$c_{m,1} = w(1 - k_m) \quad (4)$$

$$c_{f,1} = w(1 - k_f) \quad (5)$$

And family budget constraint in period 1 is given by:

$$c_{m,1} + c_{f,1} = w(2 - k_f - k_m) \quad (6)$$

In period 2, wages are positively related to human capital accumulated in period 1 and the productivity rate β . It is assumed that both the spouses work. The wage in period 2 is thus:

$$w_{i2} = \beta w(1 - k_{i,1}). \quad (7)$$

And the family budget constraint in period 2 is:

$$c_{m,2} + c_{f,2} = \beta w(1 - k_{m,1}) + \beta w(1 - k_{f,1}). \quad (8)$$

Following Lundberg (2008) it is allowed that some cash transfer between the household members takes place and it is assumed that the couple can commit in period 1 and negotiate an intertemporal contract, which may be expressed as:

$$c_{f,2} = \beta w(1 - k_{m,1}) + t \quad (9)$$

$$c_{m,2} = \beta w(1 - k_{f,1}) - t \quad (8)$$

This means that both the wife and husband commit towards their collective utility.¹⁸ Given that, the couple maximizes the following utility function:

$$W = U_1(w(2 - k_m - k_f) - c_{m,1}) + \gamma(h_m k_m + h_f k_f) + U_2(\beta w(1 - k_{m,1}) + t) + \lambda[U_1(c_{m,1}) + \gamma(h_m k_m + h_f k_f) + U_2(\beta w(1 - k_{f,1}) - t)] \quad (10)$$

The first order conditions with respect to child investment k_m, k_f yield:

$$(1 + \lambda)h_f \gamma'(K) - w[U'_1(c_{f,1}) + U'_2(c_{f,2})] \leq 0 \quad (11)$$

$$(1 + \lambda)h_m \gamma'(K) - w[U'_1(c_{f,1}) + U'_2(c_{m,2})] \leq 0 \quad (12)$$

Given the child investment function $K = h_m k_m + h_f k_f$ and $h_m > h_f$, it is apparent that the interior solutions $0 < k_m, k_f < 1$ will not be optimal, and the husband will fully specialize in the market production and wife will fully specialize in the home production. In period 2, when both parents work, the wage rate of mothers is $\beta w(1 - k_{m,1})$, which is lower than $\beta w(1 - k_{f,1})$. Mothers wage rate in period 2 is also lower than in the event of the lack of the specialization, i.e. when women do not take care of children and home, due to the lower human capital accumulation. Note however, that mother's wage rate may also be lower due to

¹⁷ By the end of this subsection it will be apparent that this is the crucial assumption, which leads to the specialization of mothers in the home production and the specialization of fathers in the market production.

¹⁸ Event that could affect this assumption is for example an event of the divorce, which may impact the negotiated contract.

the lower β that may be interpreted as a productivity level or employer's discriminatory taste (if β for mothers is less than β for non-mothers or fathers).

The model may also predict time allocation and wages under different family models. For example in the event of egalitarian family, where father and mother equally share their parental responsibilities, i.e. $k_m = k_f$, the husbands and wives wages would grow at the same rate. If the β parameters for childless individuals is the same, then we can expect the lack of specialization results in no motherhood penalty and fatherhood premium. If however, the productivity or employer's taste for parents and childless individuals differ, then their wages does not have to be comparable.

If the specialization takes place in the moderate form, so that wives spend more time in home production, whereas fathers work longer hours at the market, then the model predicts that mothers wages in period 2 will be lower than in the event of the lack of the specialization and child investment. This also means that mothers will experience lower wages than non-mothers. Similarly, father's wages in period 2 will be greater, so that they will experience a fatherhood premium.



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