She Cares and He Earns? The Family Gap 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 for.

Keywords: family gap, wage inequality, fatherhood premium, motherhood penalty, specialization
JEL Codes: J13, J22, J31
DOI: http://dx.doi.org/10.17451/eko/42/2015/130

Acknowledgements

The author would like to thank the participants of Warsaw International Economic Meeting 2015 and EAEPE 2015 Summer School for their valuable feedback. This research was supported by a grant from the National Science Centre, 2013/11/N/HS4/03136. All opinions expressed are those of the author and have not been endorsed by NSC.

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1. Introduction

Nowadays, most of the European countries are experiencing 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 and 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 the EU states. Based on Eurostat data for 2013 the lowest fertility rates were observed in Poland (1.29), Slovakia (1.34) and Hungary (1.35).[1]

The aim of this research is to document economic effects of fertility, which are understood as changes in male and female labour market outcomes that are due to child rearing. The analysis particularly focuses on the investigation of changes in men's and women's earnings as well as working hours adjustments caused by parenthood. The focus of this research is Poland, a country that over the last years has been struggling with a dramatic decline in women's fertility.

Existing literature concerning the impact of parenthood on earnings is already considerably well-developed, though concentrating mainly on Western European countries as well as the US. 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 report 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 labour market inequality due to parenthood is referred to as a 'family gap'. Existing research also reports that labour market outcomes of men and women, who do and do not have children, differ and fatherhood is associated with a premium in a form of wage increase. 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, often ignoring CEE countries. Second, most of the empirical research focuses either on women (more often) or men but not on both groups simultaneously. Given the differences in the data, samples and time coverage, the results cannot be compared. Third, existing research lacks a thorough analysis of both effects – i.e. working hours and wages − and very often limits the analysis to the investigation of one of them. In the case of wage effects such approach will, however, not fully describe 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. The aim of

[1] Comparably low fertility rates are reported for Portugal (1.21) and Cyprus (1.30).

this research is to address above limitations by providing a comprehensive analysis of parenthood impact on men's and women's working hours and wages for Poland.

This paper also adds to the existing state of knowledge in the analytical dimension. Previous literature on the family gap has proved that the estimation of the required effect is analytically a complex task as parenthood is likely to be endogenous with respect to wage and working time. 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, which limits the generalization of the results. To address the bias of the estimates that relates to children's endogeneity, I use a combination of propensity score matching with OLS estimation and fixed effects (FE) model. Moreover, to assess the role of sample selection for the estimated effects, I take advantage of the panel data structure to find out whether individuals that are working longer/shorter hours and receive greater/lower wages are also more likely to work following the childbirth. Such approach thus reveals whether the selection is of concern and – if so – what is the expected direction of the bias.

The data reveal that on average both mothers and fathers earn more in terms of monthly salary and hourly wage than childless female and male individuals. The analysis shows, however, that for women this positive gap stems from differences in their demographic characteristics, mostly age and related labour market experience. Once these individual characteristics are fixed, no motherhood wage gap is found. Mothers and childless women differ, however, not only in terms of these endowments, but also with respect to unobserved factors that determine wages. In consequence, when these factors are additionally accounted for, the analysis uncovers a negative motherhood gap in monthly earnings as well as hourly wages. Likewise, the results for men reveal that some of the positive 'raw' gap is driven by father's and non-father's differences in the work experience as well as demographic and job characteristics. Fathers and childless men are also found to substantially differ in unobserved fixed factors that also determine their wages. In consequence, if these characteristics are eliminated, no positive fatherhood wage premium can be found. The main findings related to working time further show that while women having children work slightly shorter hours than childless women, fathers tend to spend more of their time at work compared to childless men. When unobserved heterogeneity is eliminated, the negative relation among women becomes insignificant, but for men the findings partially confirm the positive impact.

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 transformations performed in order to obtain relevant variables. Next, the

estimation strategy is explained in detail. Section five describes the main findings, followed by the discussion presented in section six. Section seven gives concluding remarks.

2. Literature review

2.1. Children and men's and women's wages

There exist several theories that aim to explain why children may affect parent's wages. In the case of women, lower wages of mothers are mainly explained by three processes that are taking place following the childbirth, namely: 1) the loss in the human capital; 2) the loss in the efforts exerted at work; 3) the choice of mother-friendly jobs. The first explanation refers to natural consequences of childbearing, as following the childbirth women for some time become absent from the paid work, which leads to lowering of their labour market experience and skills depreciation. The second explanation in turn refers to the fact that even after returning to work, women's efforts exerted in the workplace may be lower than those of childless women. In line with Becker (1985) lower productivity of mothers may be thus attributed to their lower efforts caused by home-related responsibilities. Finally, according to the third explanation, 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' allowing for greater work flexibility and adjustments.

Lower wages of mothers may, however, also result from incorrect model specification, as women that are more likely to get higher pay may also be more likely to have children. This 'spurious relation' is usually accounted for by adequate estimation methods that eliminate the correlation between parenthood and other factors affecting wages such as ability, career and business orientation. Most commonly this research relies on fixed effects models 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 Høgsnes 2012). Other studies use instrumental variable estimation (e.g. Korenman and Neumark 1992; Angrist and Evans 1998). Recently, propensity score matching methods were also adopted (e.g. Simonsen and Skipper 2006). Most of the studies agree, 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 Becker's (1985) specialization theory stating that in the

household consisting of a wife, a husband and a child, woman tends to specialize in the production delivered at home, whereas man tends to specialize in the production delivered on the labour market (Lundberg and Rose 2000, 2002).[2] 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.[3] 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 assigned to their unobserved gains in the productivity induced by fatherhood or positive discrimination by the employers (Glauber 2008). Empirical evidence on fatherhood premium include Lundberg and Rose (2000, 2002), who using fixed effects estimation find that fatherhood in the US is associated with an increase in men's hourly wage. Similarly, Killewald and Gough (2013) using fixed effects models confirm the existence of this positive fatherhood premium. They also show that the premium is higher for married than not married men. At the European level Baranowska-Rataj and Matysiak (2014) analyse fatherhood premium from the international perspective linking it to a country specific context regarding welfare state and cultural norms.

While reviewing existing empirical research on family gaps, it is worth noting that most of the studies focus on the 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 CEE countries has been provided by Budig et al. (2012). Their research is, however, based on the linear regression model and Heckman correction, whose 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 analyse family gap for Poland and perform an analysis similar to that of Angrist and Evans (1998) using instrumental variable approach. Neverthless both papers focus on monthly earnings and ignore the number of hours worked, 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.

[2] For the rigorous mathematical framework of this model see Lundberg (2008).
[3] Consistently with the collective labour supply model.

2.2. Children and men's and women's working hours

Statistical data reveal that working hours of parents and childless individuals as well as male and female parents significantly differ, as is the time spend on caring activities (OECD 2015). Economists have proposed several theoretical models aiming at modelling men's and women's labour supply including unitary and family labour supply models. Recently they also recognized that when there is a child present in the household, male and female need to additionally decide on how many resources should be devoted to it (Blundell, Chiappori and Meghir 2005). The findings from the estimation of this so-called collective labour supply model with caring parents recently provided by Cherchye, De Rock and Vermeulen (2012) imply rejection of the unitary framework and reveal that children's utility is driven by both parents' time spent with them, with mother's greater relative importance.

Theoretical explanations of such interdependence of within-couple preferences regarding paid work refer mostly to Becker's theory of specialization. Women are thus expected to work fewer hours as they spend more of their time at home, taking care of children, whereas men are expected to work longer hours, as they specialize in the production delivered on the labour market to ensure financial stability of the family. On the other hand, there also arises a 'home-intensity effect' (Lundberg and Rose 1999), which 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.

There exist numerous empirical validations of the effects of fertility on women's labour supply (for a review see Browning 1992). Existing studies vary, however, by the casual interpretation of the estimated effect, since fertility is likely to be endogenous with respect to female labour supply. Researchers interested in estimating the casual relation between fertility and working hours therefore approach the problem by adapting adequate methodological tools. One of the methods to deal with the endogeneity and reverse causality is the instrumental variable estimation. Detailed review of such studies has been provided in Browning (1992).[4] In general these studies find that instrumenting women's fertility results

[4] This approach requires valid instrumental variable that has two main properties: 1) it is correlated with the fertility (number of children) and 2) does not have a direct effect on the outcome variable and is uncorrelated with unobservable factors related to fertility (Wooldridge 2003). Several instruments, such as religion, mother's number of siblings, mother's opinion on the ideal number of children, schooling of both parents have been proposed to instrument fertility, but though they are highly correlated with this measure, it is not clear whether they do not affect working hours as

in much lower effects than when the endogeneity is not accounted for. The findings of Angrist's and Evans's (1998) influential analysis confirm, however, that even then children lead to a decline in women's probability of working, number of hours worked and labour income.[5] They also document that for men there is no significant impact of children on their average hours worked and labour income.

Apart from instrumental variable estimation, some research also adopts panel data models – such as first difference and fixed effects models – which allow for controlling unobserved time invariant factors that are correlated with the family size (number of children) and number of hours worked. Similarly to unobserved factors that could be important for wages, these factors may include individual value of the family or a commitment to children. For example, Lundberg (1998) fits first differenced equations to model male and female labour supply; she finds evidence of interdependence in men's and women's labour supply in the households with young children. Lundberg and Rose (2002) also use fixed effects model to analyse the impact of children on men's and women's working hours. Their findings reveal that while in the case of women the presence of a child leads to fewer hours worked, in the case of men the effect is positive.[6]

3. Data and variables description

The review of the existing studies on the family gap provided in the previous section suggests that quantitative identification of the gap is not straightforward, as it encompasses a problem of children's endogeneity. Reliable quantification of the family gap thus requires a complex econometric analysis placing relatively high demands on the data.

Moreover, the relation between the labour supply and the family gap implies that the analysis of the labour income inequality should be based on hourly wages rather than on 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 women's and the positive effect on men's monthly earnings may be a pure indicator of gender differences in working time.

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well (Browning 1992). Other instruments that are more likely to fulfil the exogeneity requirement and correlation with fertility include experience (event) of multiple births (Rozenzweig and Wolpin 1980; Bronars and Grogger 1994; Gangahdharan and Rosenbloom 1996; Angrist and Evans 1998) or siblings sex composition (Angrist and Evans 1998) as well as women's experience of miscarriage (Li 2005).

[5] Their findings that relate to women's labour supply are also confirmed by Jacobsen *et al*. (1999).

[6] They also find that the effect is differentiated by the sex of a child. In particular, higher positive response in the average hours worked of men is found in case of a birth of a son than a daughter.

For these reasons, the empirical analysis carried out in this paper is based on the 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 an income. EU-SILC longitudinal component is a rotating panel, in which individuals are interviewed over 4 years and each year one quarter of the total sample is replaced by new respondents. The dataset covers a broad set of European countries, including Poland, for which the availability of panel data is largely limited. In the case of Poland the available time span covers years 2005−2012.

For the empirical analysis, I restrict the sample 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.[7] Moreover, I consider only individuals, who are working for a wage but are not self-employed and are not family workers, or are inactive. In addition – referring to within-household allocation and specialization model – I define a subsample of individuals that are living with a partner (either married or cohabiting with the partner). The analysis is thus carried out both for: 1) the sample of part-time and full-time employees aged 16−45, and 2) the sample of part-time and full-time employees aged 16−45 that are living in the same household as the partner.[8]

Primary variables involved in the analysis are parenthood related variables. The status of parenthood is, however, not directly identified in the dataset; it is instead 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.[9] To derive the parenthood identifier, I first define a new variable child, 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, I match parents' IDs with personal IDs and derive variables describing parenthood status and the number of children. To obtain the age of children, I use information on household composition and the age of its members.

Besides parenthood-related variables, the key variables involved in the analysis, are variables measuring labour market outcomes. In the longitudinal EU-SILC

[7] 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 also aims to reduce the bias stemming from the possible incorrect assignment of parenthood status.

[8] Existing literature mostly focuses on the sample that is not restricted to cohabitating individuals. However, given the theoretical framework presented in Section 2 and in particular specialization theory, the presence of a child should for the most part, affect time allocation of men and women within a given household.

[9] Parents of children with the oldest child aged 26 years or above are dropped from the analysis. The restriction does not affect the sample significantly since the number of parents aged below 45 that have children older than 25 is marginal.

there are two measures of labour income: gross and net employee cash or near cash income received during the *income reference period*, which for the Polish data is fixed to 12 month defined as the previous calendar year. There is also information on usual hours worked per week, which are reported for the *current* period. Since the yearly income refers to the previous year and average hours of work refer to the current situation, some assumptions and variable transformations are needed. First, to derive monthly salary for the year preceding the survey, I recalculate yearly salary to monthly measure. To do so, I use the information on the economic activity during each month of the previous year and assign each individual the number of months s/he spent full-time, part-time, self-employed or inactive in the year preceding the survey. Self-employed and individuals, who have switched from/to self-employment are not considered. Similarly, individuals, who have switched from full-time to part-time (or the other way around) are also dropped from the analysis as for them monthly salary cannot be derived in a straightforward way. For individuals, who during the preceding year have been working – either part-time or full-time – for at least 1 month, monthly salary is defined based on the yearly salary and the number of months spent in employment. Then, the obtained monthly salary is lagged one year, so that it refers to the same time frame as hours worked per week.[10] This means that observations for the last year an individual was interviewed would be dropped, as for them no 'lagged' monthly salary is provided. To increase the number of observations, for these individuals, I extrapolate previous year's monthly salary for the next year (i.e. the last year of observation). The extrapolation is however carried out only for those individuals, who did not change their economic activity (i.e. did not switched from full/part time to part/full time or self-employment). Finally, based on the monthly salary and the average number of hours worked per week, hourly wage is calculated by dividing the obtained monthly salary by the quadruple of the average working time.

The summary statistics on the selected measures used in the empirical analysis are shown in Table 1. The panel sample consists of 25,383 men and 20,731 women observed over the years 2005−2012. Around 59% of men and 66% of women have children. Parents have on average fewer than two children (approx. 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 only with one parent.[11] Gender specific summary statistics also show that women in Poland are generally better educated than men. Based on the data, when compared to men, women in Poland tend to receive by approx. 7 percent lower hourly

[10] This procedure has been described in detail in Engel and Schaffner (2012).

[11] 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.

wages. But they do work significantly fewer hours: 38.5 hours per week in the case of women against almost 43 hours per week for men. Parents – both male and female – are in general older and have greater labour market experience. The 'raw' family wage gap for women is positive around 9 percent, meaning that on average mothers earn by 9 percent more than childless women. The respective statistic for men is around 26%. Men that have children work, however, approximately 1 hour more than childless men.

Table 1. Descriptive statistics: individuals aged 16–45, who are not studying and are not self-employed and are family workers

Variable	Mean					
	Women	**Men**	**Mothers**	**Non-mothers**	**Fathers**	**Non-fathers**
Parent	0.663	0.587				
Number of children	1.195	1.069	1.802		1.822	
Married	0.717	0.651	0.949	0.258	0.977	0.186
Age	33.897	33.244	36.541	28.644	36.535	28.558
Primary and lower secondary education	0.035	0.071	0.04	0.024	0.058	0.089
Upper secondary education	0.525	0.702	0.555	0.464	0.726	0.668
Post-secondary non-tertiary education	0.069	0.032	0.069	0.069	0.029	0.035
Tertiary education	0.371	0.196	0.336	0.443	0.187	0.208
Hours	38.485	42.877	38.355	38.735	43.371	42.169
Monthly salary	2340.208	2849.469	2388.219	2246.431	3199.176	2342.549
Hourly wage	16.008	16.929	16.409	15.223	18.847	14.148
Log of hourly wage	2.578	2.65	2.609	2.517	2.758	2.493
Experience	10.74	11.625	13.081	6.104	15.152	6.588
Occupation: high skilled	0.0354	0.0393	0.035	0.036	0.049	0.0259
Occupation: professionals	0.262	0.104	0.267	0.253	0.097	0.114
Occupation: associate professionals	0.147	0.106	0.138	0.164	0.116	0.0919
Occupation: services	0.342	0.148	0.311	0.403	0.126	0.181
Occupation: elementary occupations	0.214	0.602	0.248	0.145	0.613	0.588

Part-time	0.092	0.032	0.085	0.105	0.019	0.051
Age of the partner	28.281	22.987	37.744	9.711	34.545	6.364
Parent in the HH	0.28	0.359	0.109	0.618	0.093	0.736
Income from financial sources)	55.356	57.592	53.555	59.173	46.843	72.92
Income from benefits and social assistance)	264.453	315.036	307.374	180.8	389.962	208.337
N	20731	25383	13741	6985	14899	10474

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

4. Methodology – estimation strategy

4.1. Estimating the family gap in men's and women's wages and working hours

To account for the children's endogeneity this research applies two estimation methods that were previously used in similar empirical works. These methods include: 2) propensity score matching (PSM) and 2) fixed effects (FE) model.[12]

Although widely used, each of these methods has certain drawbacks. Fixed effect panel data model accounts for the endogeneity by eliminating time invariant unobserved effects that are correlated with parenthood decision (children) and also affect labour market outcomes. The results may be, 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 the 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 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 model. This means that in the first step individuals are matched using propensity score and in the second step fixed effects model is estimated using the matched sample.

Formally, in the first step of the analysis childless individuals are matched with individuals that have children based on the propensity score estimated using

[12] The literature review presented in section 2.1. suggests that other methods that could be used include instrumental variable estimation. However, existing instruments that are available in the dataset and 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) report the effect conditional on having at least one or two children, which significantly reduces the interpretation of the results.

a probit model.[13] The propensity score thus represents the probability of having at least one child. Following Simonsen and Skipper (2006) independent variables in the probit model include age grouped into dummy variables, level of education, degree of urbanization and region, as well as age of the partner, the presence of a parent in the household and household's non-labour income.[14] The propensity score is estimated separately for men and women. Then, based on the estimated scores, individuals are matched into parent-non-parent pairs. Simple nearest neighbour with replacement is used in the matching procedure and the 'common support' is assured when matching is performed.[15] Since the dataset has a panel structure, to avoid time effects and matching the same individual with a different individual each year, I match individuals based on the characteristics from the first year in which they appear in the sample. Once matched, individuals remain in the sample for all subsequent years they are observed in the dataset. The final sample is constructed by merging the subsamples of parents and their matched childless counterparts.

Matched sample obtained from the propensity score matching is then used for the analysis of parenthood effects on labour income and working time. Since matching is performed for the individuals that appear in the sample for the first time, some individuals change their parenthood status. Similarly, for some individuals total number of children changes. This indicates that fixed effects model can be estimated; it takes the following form:

$$Outcome_{it,j} = \alpha_{1,j} + \alpha_{2,j} fertility\_measure_{it,j} + \boldsymbol{X_{it,j}\alpha_{k,j}} + u_{t,j} + v_{i,j} + \varepsilon_{it,j}. \quad (1)$$

As previously, the analysis is performed separately for men and women, that is j= *{female, 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 inclusion of year fixed effects. The parameter of interest, indicating the family gap is $\alpha_{2,j}$. The fertility measure is specified in four ways, that is by the inclusion of:

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

[14] 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.

[15] 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.

1) a dummy variable equal to 1 if one has children and 0 otherwise (regardless of the number of children);
2) a variable indicating total 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 labelled *Specification I to IV* respectively. The outcome variables include three main variables: a logarithm of monthly earnings, a logarithm of hourly wages and working hours per week. In line with the theoretical basis reviewed in section 2, in the models, in which the outcome variable is defined as hours worked per week, additional control for partner's working time is included. Since differences in working time may arise due to the nature of a job, controls also include occupations and part-time working schedule.[16] Similarly, in the models, in which the outcome is defined as wage/salary, additional controls for the theoretical explanations regarding the existence of family gap are included. These are: labour market experience measured by the polynomial in years spent in paid job, occupations and part-time working schedule.

I report both results obtained with the use of FE model and the estimates from OLS applied to the matched sample. OLS estimation is expected to lead to biased results as it does not account for unobservable factors that relate to parenthood and labour market outcomes. These results are thus treated with caution and are interpreted as baseline findings.

4.2. Assessing the consequences of labour market selection

In the analysis of the family wage gap one needs to deal not only with the endogeneity problem, but also with the possible consequences of labour market selection. This is especially important in the case of women, as their decision whether to work is highly related to motherhood status. In particular, if some non-random subsample of mothers drops from employment after having a baby, the obtained effects will uncover the impact of motherhood only for selected sample of working individuals, which cannot be representative for the population. In the existing research, when employment selection is accounted for, it is mainly corrected using

[16] The aggregation of occupations is consistent with the approach presented in Whelan *et al.* (2011) and they are grouped into four categories: highly skilled non-manual, lower skilled non-manual, skilled manual, elementary occupation. The group of elementary occupations is left as a reference group.

Heckman's model (Heckman 1976, 1979). In this case, the estimation of the family gap relies, however, on the linear regression model and ignores unobserved heterogeneity of parents and individuals that do not have children.[17]

To assess the consequences of labour market selection for the estimated cost of parenthood, instead of using Heckman's approach that requires valid exclusion restrictions, I show whether the problem of selection is a cause for concern and if so how it affects estimated effects. In particular, I analyse the relation between wages as well as working time and the decision regarding employment following the childbirth, to find out whether individuals that are observed working afterwards tend to receive higher or lower wages and work longer or shorter hours. The identification relies on the fact that individuals are observed both before and after the change in their parenthood status. Thus, it can be shown how the wage rate/working hours of individuals that are working before the childbirth relates to their decision regarding returning to work afterwards, leading to a selected sample of working individuals. Such an approach will thus reveal the nature of selection (positive/negative) and show the expected direction of the bias of the estimated gaps. To assess the role of employment selection, I therefore model the probability of working following the childbirth with the use of the probit model of the following form:

$$working_{ijt} = \beta_0 + \beta_1 outcome_{i,j,t-1} + \boldsymbol{Y_{it,j}\beta_{k,j}} + \xi_{ijt} \qquad (2)$$

where *outcome* denotes key labour market outcomes considered in the previous subsection, i.e. monthly salary, hourly wage and working hours. The coefficient of interest is β_1 showing the impact of the above measures on the probability of working following the childbirth. Other control variables denoted by a vector $\boldsymbol{Y}$ include standard demographic variables such as age, education, marital status as well as spatial and time effects. As in previous stages of the analysis, 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.

[17] One distinguishing study with respect to this is the recent analysis by Nizalova, Sliusarenko and Shpak (2015), who apply a combination of fixed effects and Heckman's selection correction.

5. Results

5.1. Validity of the propensity score matching

Propensity score matching is performed for all individuals that are not self-employed, are not family workers and are aged 16−45. Out of 32,461 women 17,676 individuals were matched (54% matched). In the case of men, the procedure has resulted in 17,822 matched cases out of 32,079 (56% matched). For the subsample of cohabitating individuals the shares of matched observations are somehow higher: around 69% for women and 88% for men.

The comparison of the subsample of male and female parents and childless individuals proceeding and following their matching with the use of propensity score is presented in Tables A.1 and A.2 in the Appendix. Tables contain group specific (parents/non-parents) means for the variables, based on which individuals were matched, as well as t-test statistics for their comparison between the groups.

Before applying propensity score matching male and female parents and non-parents significantly differ, in particular in terms of marital status, age, age of the partner and the presence of own parent in the household. By definition smaller differences are observed in the subsample of cohabitating individuals. Nevertheless for both the samples, t-test statistics for the above variables are very high, showing that the differences in means for parents and non-parents are statistically significant. For the matched sample, the differences in means of the above mentioned variables are significantly reduced, suggesting that the matching procedure has balanced the sample. Despite this reduction, for most variables t-test statistics still do not allow us to reject the null hypothesis of equal means in the groups. The comparison of the mean characteristics before and after the propensity score matching suggests, however, that matching has led to a significant reduction of observable heterogeneity between mothers/fathers and childless females/males.

5.2. Family gap in men's and women's earnings

Following matching the groups of parents and childless individuals with the use of propensity score, I proceed with OLS and FE model estimations. Table 2 reports estimates for monthly earnings; respective estimates for hourly wage are presented in Table 3. Both tables present results using four specifications of fertility measure that apart from the mere fact of having children take into account their total number and age.

When monthly earnings are considered, the estimates from propensity score matching combined with OLS reveal small but mostly insignificant negative impact of children on mother's earnings. The only significant gap of around 3.8 percent is present for mothers of one child. For cohabitating women the effects are slightly

lower so that no motherhood penalty may be found. This means that women living with a partner do not experience a salary drop when they have children. In the case of men, OLS provides significant and positive estimates for all models' specifications. The first specification provides an estimate of around 0.06, indicating that fathers earn on average 6 percent higher salary than comparable childless men; similar gap is also present among cohabitating men (6.7 percent). The results also indicate that each child is associated with 1.5 percent (full sample) to 2.4 percent (cohabitating only) increase in men's monthly salary and the premium is received mostly by men, whose children are aged 0−14; for older children no significant relation is found. The premium is however likely to be non-linear in the number of children, as the first child leads to 4−5 percent increase in monthly salary, two or more children to around 7−9 percent.

When fixed effects model is fit to data the findings change substantially. F-test for a joint significance of individual fixed effects implies rejection of the null hypothesis stating that unobserved fixed effects equal to zero. The findings from FE model should be thus viewed as corrected for the omitted fixed effects through the within transformations and should be preferred to OLS estimates that do not correct for them and carry heterogeneity bias. Detailed results for women demonstrate that mothers are paid significantly less than women with no children. The estimated drop in mother's monthly earnings accounts for 12 percent.[18] For cohabitating women the effect is lower and equals to negative 8 percent. Specific results furthermore reveal that the first child reduces mother's salary by approx. 12 percent and two children by approx. 18 percent (specification III). Respective values for cohabitating women are lower and equal to negative 8 and 12 percent respectively. The findings also imply that mostly mothers of very small children – aged 0−3 – are experiencing a salary drop. High negative effects that are found with fixed effects model are consistent with the idea that mothers are endowed with unobserved individual fixed traits that are positively correlated with their earnings, driving their average earnings up. On the other hand, the results for men show that the fatherhood premium in the form of greater remuneration partially results from unobserved differences between fathers and childless men as well as differences in their labour market characteristics (work experience, occupation and working scheme). In particular, when fixed effects model that accounts for job characteristics is used, inequality in earnings due to fatherhood is entirely reduced. For some model's specifications the estimates turn out to be even negative and statistically valid, meaning that compared to other equal childless men fathers are disadvantaged and receive lower monthly income from the paid work.

[18] The finding is similar to the one presented by Cukrowska-Torzewska (2015).

Table 2. OLS and FE estimates of fertility effects on the logarithm of monthly earnings for the sample of working individuals aged 16−45 (Panel A) and working individuals aged 16−45 that are living with a partner (Panel B)

Sample		Panel A: Full sample				Panel B: Cohabitating only			
Gender		Women		Men		Women		Men	
Model specification		OLS	FE	OLS	FE	OLS	FE	OLS	FE
I	*Parent*	-0.032	-0.124**	0.058***	-0.023	-0.001	-0.081*	0.067***	-0.023
		(0.020)	(0.048)	(0.021)	(0.019)	(0.022)	(0.044)	(0.021)	(0.021)
R^2		0.404	0.038	0.281	0.036	0.398	0.037	0.284	0.035
II	*# children*	0.004	-0.047*	0.015**	-0.018*	0.011	-0.029	0.024***	-0.021*
		(0.008)	(0.026)	(0.007)	(0.011)	(0.008)	(0.023)	(0.008)	(0.011)
R^2		0.404	0.037	0.281	0.037	0.399	0.037	0.284	0.036
III	*1 child*	-0.038*	-0.121**	0.044**	-0.024	-0.008	-0.078*	0.052**	-0.023
		(0.021)	(0.048)	(0.021)	(0.019)	(0.022)	(0.044)	(0.021)	(0.021)
	2 children	-0.032	-0.181***	0.073***	-0.048*	0.001	-0.123**	0.081***	-0.052*
		(0.022)	(0.067)	(0.023)	(0.025)	(0.023)	(0.056)	(0.023)	(0.027)
	3 or more	0.014	-0.101	0.068**	-0.066*	0.039	-0.048	0.090***	-0.078**
		(0.030)	(0.091)	(0.028)	(0.036)	(0.030)	(0.086)	(0.028)	(0.038)
R^2		0.405	0.04	0.282	0.037	0.399	0.039	0.284	0.036
IV	*# aged 0-3*	-0.025	-0.059*	0.016	-0.021*	-0.002	-0.039	0.025**	-0.024*
		(0.017)	(0.031)	(0.012)	(0.012)	(0.017)	(0.027)	(0.013)	(0.012)
	# aged 3-6	0.013	-0.018	0.033***	-0.007	0.029**	-0.004	0.039***	-0.008
		(0.014)	(0.031)	(0.012)	(0.015)	(0.015)	(0.029)	(0.013)	(0.015)
	# aged 6-14	0.012	-0.024	0.012	-0.004	0.018*	-0.013	0.020**	-0.004
		(0.010)	(0.027)	(0.009)	(0.016)	(0.010)	(0.026)	(0.009)	(0.017)
	# aged 14-18	0.004	-0.008	-0.001	-0.025	0.004	-0.001	0.010	-0.025
		(0.013)	(0.024)	(0.012)	(0.018)	(0.013)	(0.023)	(0.013)	(0.019)
	# aged 18-25	-0.009	-0.020	0.000	-0.021	-0.008	-0.011	0.018	-0.016
		(0.014)	(0.021)	(0.016)	(0.018)	(0.014)	(0.021)	(0.017)	(0.019)
R^2		0.405	0.039	0.276	0.037	0.4	0.038	0.279	0.036
No. Observations		10 886	10 886	13 754	13 754	10 366	10 366	13 008	13 008

Notes: 1) OLS stands for ordinary least squares, FE stands for fixed effects panel model.

2) Control variables include: for OLS – age, marital status, education, polynomial in labour market experience, four occupation groups, part-time work, time and spatial (degree of urbanization and region) effects; for FE models – marital status, polynomial in labour market experience, fours occupation groups, part-time work and time fixed effects.

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

4) Detailed estimation outputs are available from the author upon request.

When hourly wage instead of monthly earnings is analysed, both men and women are found to experience lower wage inequality caused by parenthood. The estimates are however subject to relatively high standard errors, limiting the reliability and interpretation. For women, OLS combined with PSM reveal marginal wage drop associated with motherhood, which is statistically not different from

zero. On the other hand for men significant fatherhood wage premiums of around 4−5 present are still found.

As previously, when FE combined with PSM is used, the estimated size of the wage gap considerably changes. For women, FE model reveals a wage penalty for motherhood of around 10 percent when job characteristics are controlled for. When compared with monthly earnings, the estimated penalty is around 2 percentage points lower. Relatively high gap in monthly earnings may be thus partially attributed to differences in working time of mothers and childless women. Similarly to previous findings, the greatest gap is found for mothers of two children and very small kids. Estimates for the subsample of cohabitating women are less statistically significant; though as in the case of monthly earnings they reflect lower effects. On the other hand, the results for men reveal that when fixed unobserved factors are controlled for, there is no fatherhood premium in a form of higher wages. Similarly to previous findings, fathers are found to receive even lower hourly wages than childless men (compare Specification III). Among cohabitating men, these unfavourable effects are even stronger.

Table 3. OLS and FE estimates of fertility effects on the logarithm of hourly wages for the sample of working individuals aged 16−45 (Panel A) and working individuals aged 16−45 that are living with a partner (Panel B)

Sample		**Panel A: Full sample**				**Panel B: Cohabitating only**			
Gender		**Women**		**Men**		**Women**		**Men**	
Model specification		**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
I	*Parent*	-0.021	-0.102*	0.042*	-0.037	0.010	-0.073	0.056***	-0.037
		(0.021)	(0.054)	(0.021)	(0.023)	(0.023)	(0.051)	(0.021)	(0.025)
R^2		0.435	0.046	0.292	0.042	0.431	0.048	0.296	0.042
II	*# children*	0.002	-0.042	0.009	-0.024**	0.008	-0.027	0.018**	-0.028**
		(0.009)	(0.029)	(0.007)	(0.012)	(0.009)	(0.027)	(0.008)	(0.012)
R^2		0.435	0.046	0.292	0.042	0.431	0.048	0.269	0.043
III	*1 child*	-0.024	-0.100*	0.031	-0.038*	0.008	-0.070	0.044**	-0.038
		(0.022)	(0.054)	(0.022)	(0.023)	(0.024)	(0.051)	(0.022)	(0.025)
	2 children	-0.025	-0.157**	0.055**	-0.065**	0.008	-0.111*	0.068***	-0.071**
		(0.023)	(0.074)	(0.023)	(0.029)	(0.025)	(0.066)	(0.024)	(0.030)
	3 or more	0.016	-0.088	0.044	-0.088**	0.039	-0.047	0.068**	-0.105**
		(0.031)	(0.104)	(0.028)	(0.039)	(0.031)	(0.101)	(0.029)	(0.041)
R^2		0.435	0.048	0.292	0.042	0.431	0.049	0.297	0.043

IV	*# aged 0-3*	-0.009	-0.051	0.006	-0.025*	0.015	-0.035	0.015	-0.030**
		(0.018)	(0.034)	(0.013)	(0.013)	(0.018)	(0.031)	(0.013)	(0.013)
	# aged 3-6	0.008	-0.026	0.029**	-0.015	0.022	-0.018	0.035**	-0.020
		(0.015)	(0.035)	(0.013)	(0.016)	(0.015)	(0.033)	(0.013)	(0.016)
	# aged 6-14	0.015	-0.025	0.009	-0.014	0.018*	-0.017	0.017*	-0.017
		(0.010)	(0.031)	(0.009)	(0.017)	(0.010)	(0.030)	(0.010)	(0.018)
	# aged	-0.005	-0.011	-0.001	-0.030	-0.005	-0.005	0.009	-0.030
	14-18	(0.013)	(0.027)	(0.012)	(0.019)	(0.013)	(0.027)	(0.013)	(0.020)
	# aged	-0.021	-0.023	-0.003	-0.031	-0.022	-0.013	0.015	-0.025
	18-25	(0.014)	(0.023)	(0.016)	(0.019)	(0.014)	(0.023)	(0.017)	(0.020)
R^2		0.436	0.046	0.293	0.043	0.432	0.048	0.297	0.043
No. Observations		10 886	10 886	13 750	13 750	10 366	10 366	13 004	13 004

Notes: As in Table 2. Robust clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

5.3. Family gap in men's and women's working hours

The estimation outputs for the outcome variable defined as the usual hours worked per week are provided in Table 4. As in the previous subsections, the results are reported both for OLS and FE as well as for four specifications of the fertility measure.

OLS estimation results report a decline in women's weekly time spent at work of around 0.5 hour that may be attributed to motherhood. The results obtained from III model's specification moreover show that there is little difference in the size of the effects for mothers of one or more children. It is also mostly mothers of very small children – aged 0−3 – who spent fewer hours at work (estimate of 0.6 hour per week). On the contrary, in the case of men OLS estimation outputs reveal positive significant effects. In particular, controlling for partner's working time and job characteristics fatherhood as such leads to 0.7 hour longer working time per week (specification I). Second model specification also shows that the more children the father has, the longer hours he is working. This finding is confirmed by the coefficients from the specification III, which shows that fathers of one child work on average by 0.6 hour longer, fathers of two children by 0.8 hour, and fathers of three and more children longer by more than 1 hour per week longer than childless men. At the same time, the children's age is not found to differentiate the way children affect men's working time. Similar estimates – though carrying greater standard errors – are also found for the subsample of cohabitating individuals.

Table 4. OLS and FE estimates of fertility effects on the hours worked per week for the sample of working individuals aged 16−45 (Panel A) and working individuals aged 16−45 that are living with a partner (Panel B)

Sample		Panel A: Full sample				Panel B: Cohabitating only			
Gender		Women		Men		Women		Men	
Model specification		OLS	FE	OLS	FE	OLS	FE	OLS	FE
I	*Parent*	-0.493*	-0.667	0.754**	0.777	-0.537*	-0.266	0.580*	0.847
		(0.281)	(0.543)	(0.294)	(0.554)	(0.304)	(0.456)	(0.298)	(0.543)
R^2		0.343	0.177	0.117	0.054	0.342	0.177	0.113	0.051
II	*# children*	-0.020	-0.215	0.233**	0.375	0.026	-0.115	0.266**	0.442*
		(0.109)	(0.247)	(0.094)	(0.248)	(0.110)	(0.243)	(0.105)	(0.252)
R^2		0.343	0.177	0.117	0.054	0.342	0.177	0.113	0.051
III	*1 child*	-0.565*	-0.494	0.632**	0.774	-0.643**	-0.253	0.441	0.841
		(0.295)	(0.646)	(0.305)	(0.553)	(0.320)	(0.516)	(0.309)	(0.542)
	2 children	-0.423	-0.517	0.826***	1.020	-0.468	-0.255	0.642**	1.156*
		(0.306)	(0.739)	(0.316)	(0.647)	(0.326)	(0.649)	(0.320)	(0.639)
	3 or more	-0.319	-0.453	1.092***	1.410*	-0.252	-0.151	1.072***	1.682**
		(0.395)	(0.923)	(0.391)	(0.810)	(0.407)	(0.852)	(0.409)	(0.809)
R^2		0.343	0.156	0.117	0.054	0.342	0.163	0.114	0.051
IV	*# aged 0-3*	-0.645***	-0.388	0.332*	0.318	-0.648***	-0.267	0.357*	0.402
		(0.227)	(0.274)	(0.191)	(0.256)	(0.237)	(0.271)	(0.201)	(0.258)
	# aged 3-6	0.063	0.074	0.135	0.488*	0.122	0.258	0.188	0.610**
		(0.198)	(0.304)	(0.175)	(0.288)	(0.206)	(0.299)	(0.184)	(0.296)
	# aged 6-14	-0.147	-0.157	0.309**	0.468	-0.091	-0.068	0.360***	0.549*
		(0.129)	(0.299)	(0.125)	(0.314)	(0.130)	(0.294)	(0.136)	(0.327)
	# aged 14-18	0.271	0.031	0.385**	0.305	0.291	0.081	0.473**	0.272
		(0.185)	(0.295)	(0.189)	(0.369)	(0.185)	(0.290)	(0.206)	(0.396)
	# aged 18-25	0.310*	0.130	0.404*	0.547	0.378**	0.117	0.407	0.474
		(0.187)	(0.273)	(0.225)	(0.404)	(0.188)	(0.267)	(0.249)	(0.440)
R^2		0.344	0.177	0.115	0.053	0.343	0.178	0.112	0.051
No. Observations		10 914	10 914	13 803	13 803	10 392	10 392	13 060	13 060

Notes: 1) OLS stands for ordinary least squares, FE stands for fixed effects panel model.

2) Control variables include: for OLS – age, marital status, dummies for education, partner's working hours, polynomial in labour market experience, four occupation groups, part-time work, time and spatial (degree of urbanization and region) effects; for FE models - marital status, polynomial in labour market experience, four occupation groups, part-time work and time fixed effects.

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

4) Detailed estimation outputs are presented in Tables A.3. and A.4 in the Appendix.

Once fixed effects model is used, the size of the estimated effects is only marginally affected. Similarly to previous findings, the results from F-test for a joint significance of individual fixed effect lead to the rejection of the null hypothesis, suggesting that FE models should be preferred to OLS estimates that do not account for unobserved heterogeneity. For most model's specifications the signifi-

cance level of the estimates is however substantially reduced, limiting the interpretation of the results. Importantly, the positive and significant impact of children on men's working time is still present for the sample of men living with a partner in the same household.

Tables A.3 and A.4 in the Appendix moreover present detailed estimation outputs, which also report estimated coefficients on partner's working time. Based on the reviewed theory we would expect to see a negative relation, meaning that there is an interdependence in men's and women's working time. Such relation is, however, only found for OLS estimation in the male sample. When FE model is used, man's working hours are not found to be significantly affected by the amount of time his partner spends working. By contrast, in the case of women, the estimated coefficients on the variable measuring partner's working time demonstrate a positive relation. This finding suggest that women are more likely to work longer once their partner is also staying at work for a longer time.

5.4. The role of labour market selection

Table 5 reports the estimated coefficients on the key labour market outcomes obtained from the probit model of the probability of remaining working following the appearance of a child. The reported coefficients reflect the way labour income and working time relate to the decision regarding employment after having a baby.

The estimates for women demonstrate that women, who earn higher wages/get higher salary are more likely to stay at the labour market following the pregnancy. This finding thus shows that sample of working mothers is selected and the estimated motherhood effects are likely to be upward-biased. As a result, the 'population' effect of motherhood on wages/salary is likely to be lower than the effects estimated based on the sample of working women. On the other hand, the estimated coefficient related to usual hours of work is insignificant, meaning that mothers do not choose to return to work in reference to the amount of time they spent working.

For men the probit coefficients on key labour market outcomes are subject to high errors showing that there is no significant relation and men who become fathers do not select to employment in connection to earnings and working time. Among the subsample of men living with partner, the coefficient on earnings remains however positive and significant. This result suggests that among cohabitating men the probability of being working after the appearance of a child is greater if they get paid more.

Table 5. Estimated coefficients on lagged key labour market outcomes from the employment probits; sample of matched individuals, who are changing their parenthood status

Independent variable	Panel A: Full sample		Panel B: Cohabitating only	
	Women	Men	Women	Men
Wage before the child	0.572***	-0.021	0.763***	0.400
	(0.185)	(0.209)	(0.179)	(0.274)
	0.215	0.123	0.220	0.180
Earnings before the child	0.486**	0.344	0.559***	0.672**
	(0.168)	(0.300)	(0.174)	(0.324)
	0.214	0.121	0.197	0.208
Hours before the child	-0.002	0.024	0.005	0.017
	(0.012)	(0.024)	(0.014)	(0.022)
	0.188	0.121	0.161	0.150
No. Observations	304	338	256	356

Notes: Probit models control for age, marital status, dummies for education, time and spatial (degree of urbanization and region) effects. Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

6. Discussion

Simple comparison of mean earnings of mothers and childless women led to the conclusion that on average mothers in Poland earn more than childless women. The estimation results however reveal that this positive motherhood gap stems from differences in mother's and childless women's characteristics, particularly age and labour market experience, as mothers are, on average, older and more experienced than women without children. Once these factors are accounted for in a linear regression, there is no statistically significant difference in mother's and childless women's monthly salary and hourly wages. However, significant and negative relation is present once we compare childless women and mothers that are 'equal' in terms of the above characteristics and eliminate unobserved individual fixed traits, which is done by FE model. The analysis thus shows that women in Poland are indeed penalized for motherhood and receive lower earnings and lower hourly wages. These adverse effects of motherhood are present both among all women as well as among women that are living with a man in the same household; for the latter sample the impact is only marginally less severe.

The results that relate to women's employment selection moreover reveal that the more the woman earns, the more likely it is that she returns to work after an event of a childbirth. The observed sample of working mothers may be thus subject to a positive selection, so that the true 'population' effect is likely to be even

stronger. Women in Poland therefore face high cost of motherhood, which may not be explained by their lower labour market experience, occupational allocation or shorter working hours. At the same time, mothers and non-mothers are not found to work significantly different number of hours, which would explain some of the positive gap in their mean remuneration. However, once again this 'raw' difference stems from demographic and job characteristics' differences. Once these are controlled for, mothers are found to work by approximately 0.5 hour per week less than childless women.

Similarly, fathers in Poland get paid more than childless men. This positive and high 'fatherhood premium' is however only partially attributed to father's and non-father's differences in key determinants of earnings, such as age, education and labour market experience. When these determinants are controlled for, we still observe a positive gap in men's earnings and wages that arises due to fatherhood. Similarly to women, childless men and men that have children and are also found to differ substantially in terms of unobserved factors, which are important for wages. In consequence, when this heterogeneity is eliminated with the use of FE model, there is no significant wage premium associated with fatherhood. Instead, some of the model's specifications result in negative estimates of the fatherhood gap, especially among cohabitating men. Surprisingly, the results obtained from probit models aiming at capturing the role of labour market selection, suggest that cohabitating men with children may be subject to positive employment selection, with a consequence of positive bias of the estimated effects. Finally, contrary to women, men that have children work more than childless men, even when they have comparable labour market attributes, such as experience and occupations. Given these and opposed to the evidence reported by the existing literature/empirical research, men in Poland do not 'benefit' from fatherhood and do not significantly differ from childless men in terms of wages, though they work slightly longer time.

The results presented in this paper bring some new insights on the dramatically low fertility level in Poland. In particular, the results show that parenthood in Poland is costly, as it leads to a substantial decline in women's remuneration and working time and does not significantly (and positively) affect men's earnings. Compared to estimates reported in existing studies the estimated motherhood wage gap is indeed high and much higher than the one found for the US or Western European countries (for a review see Nizalova, Sliusarenko, Shpak 2105, comparative analysis is included in Davies and Pierre 2005).

The analysis provides also some evidence regarding specialization of men and women in the 'labour' and 'home' productions. First, the results confirm that gender specialization attributed to childrearing is partially arising when it comes to working time, as mothers work less and fathers more than childless individuals. The estimates, however, show that despite father's longer working time, they do not receive a monetary premium in a form of greater monthly remuneration. On the

other hand, mothers are paid less than childless women even when hourly wages are considered.

7. Concluding remarks

This paper provides estimates of the cost of parenthood for men and women in Poland. To account for children's endogeneity, it uses propensity score matching along with OLS and FE model. The results confirm that similarly to other countries, the motherhood penalty in monthly earnings as well as hourly wages is also observed in Poland. They do not, however, prove the existence of a positive fatherhood wage premium for men, which has been found for the US or other European countries. Given these results and dramatically low fertility statistics occurring in Poland, it may be thus hypothesized that working women in Poland postpone motherhood as they bear relatively high labour costs associated with having children, which are not compensated by men's higher earnings. Further research would be needed to assess the relation between economic cost of parenthood and changes in fertility level. Future directions of such research could particularly concentrate on the investigation of the family gap from the cohort perspective.

When interpreting the results provided in this paper, it is necessary to point at their limitations. Most importantly, it has to be noted that the models used in this paper – although widely applied in similar empirical research – do not account for the potential problem of reverse causality. Possible solution would include instrumental variable estimation. The use of the instruments proposed by other authors is however largely constrained either by the data availability or limited generalization of the final results.

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Appendix

Table A.1. Comparison of full sample of fathers and childless men and groups of fathers and childless men matched with the use of propensity score matching

Variable	Full sample							
	Unmatched				Matched			
	Parent (1)	Child-less (2)	(1)-(2)	T-test	Parent (1)	Child-less (2)	(1)-(2)	T-test
Married	0.975	0.145	0.831	277.98	0.960	0.835	0.125	21.29
Age	36.631	28.638	7.993	119.74	37.263	34.147	3.116	19.41
Primary and lower secondary education	0.066	0.153	-0.086	-25.18	0.058	0.067	-0.009	-1.31
Upper secondary education	0.735	0.658	0.077	15.05	0.740	0.619	0.121	9.88
Post-secondary non-tertiary education	0.028	0.030	-0.003	-1.38	0.029	0.031	-0.002	-0.42
Tertiary education	0.171	0.159	0.012	2.88	0.173	0.284	-0.111	-10.38
Urbanization: densely populated	0.355	0.328	0.027	5.07	0.363	0.466	-0.103	-7.82
Urbanization: intermediate area	0.156	0.155	0.001	0.21	0.156	0.138	0.019	1.9
Urbanization: thinly populated	0.489	0.517	-0.028	-4.96	0.481	0.397	0.084	6.18
Central Poland	0.197	0.209	-0.012	-2.75	0.197	0.214	-0.017	-1.55
Southern Poland	0.194	0.180	0.014	3.15	0.198	0.212	-0.015	-1.34
Eastern Poland	0.201	0.194	0.007	1.65	0.201	0.191	0.009	0.87
Northern-Western Poland	0.155	0.155	0	-0.10	0.150	0.148	0.001	0.13
Southern-Western Poland	0.097	0.100	-0.002	-0.73	0.097	0.085	0.012	1.47
Northern Poland	0.157	0.163	-0.006	-1.45	0.158	0.149	0.009	0.89
Age of the partner	34.607	4.931	29.676	295.30	35.105	30.691	4.414	24.05
Parent in the HH	0.094	0.779	-0.685	-172.39	0.087	0.121	-0.034	-4.36
Log(income from financial sources)	0.216	0.192	0.024	1.89	0.226	0.261	-0.035	-1.07
log(income from benefits and social assistance)	3.172	1.680	1.491	43.75	2.976	1.363	1.613	18.78
N (not weighted)	16810	15269			16353	1469		

Variable	Cohabitating only							
	Unmatched				Matched			
	Parent (1)	Child-less (2)	(1)-(2)	T-test	Parent	Child-less	(1)-(2)	T-test
Married	0.977	0.798	0.178	40.82	0.961	0.862	0.099	17.03
Age	36.664	31.537	5.127	42.14	36.982	34.041	2.941	18.15
Primary and lower secondary education	0.066	0.044	0.022	4.11	0.053	0.063	-0.010	-1.59
Upper secondary education	0.735	0.593	0.142	14.60	0.735	0.624	0.111	8.88
Post-secondary non-tertiary education	0.028	0.035	-0.007	-1.80	0.029	0.025	0.004	0.77
Tertiary education	0.171	0.328	-0.157	-18.56	0.184	0.288	-0.104	-9.46
Urbanization: densely populated	0.355	0.504	-0.149	-14.22	0.380	0.489	-0.109	-8.15
Urbanization: intermediate area	0.156	0.128	0.028	3.57	0.152	0.128	0.024	2.39
Urbanization: thinly populated	0.489	0.368	0.121	11.18	0.468	0.383	0.086	6.25
Central Poland	0.197	0.236	-0.039	-4.49	0.198	0.232	-0.034	-3.11
Southern Poland	0.194	0.187	0.006	0.72	0.202	0.200	0.001	0.13
Eastern Poland	0.201	0.195	0.006	0.69	0.202	0.198	0.003	0.30
Northern-Western Poland	0.155	0.144	0.011	1.41	0.146	0.146	0.000	0.02
Southern-Western Poland	0.097	0.088	0.009	1.37	0.097	0.072	0.024	3.03
Northern Poland	0.157	0.150	0.007	0.90	0.156	0.151	0.005	0.48
Age of the partner	34.666	29.712	4.954	37.91	34.969	31.487	3.482	19.42
Parent in the HH	0.093	0.142	-0.048	-7.47	0.086	0.092	-0.006	-0.83
Log(income from financial sources)	0.217	0.328	-0.111	-4.24	0.236	0.276	-0.040	-1.17
Log(income from benefits and social assistance)	3.177	1.015	2.162	31.80	2.776	1.263	1.513	17.69
N (not weighted)	16694	2434			15301	1442		

Table A.2. Comparison of full sample of mothers and childless women and groups of mothers and childless women matched with the use of propensity score matching

Variable	Full sample							
	Unmatched				Matched			
	Parent (1)	Childless (2)	(1)-(2)	T-test	Parent (1)	Childless (2)	(1)-(2)	T-test
Married	0.932	0.241	0.691	180.98	0.911	0.698	0.213	28.90
Age	35.389	28.331	7.058	93.73	35.589	33.149	2.440	15.63
Primary and lower secondary education	0.079	0.068	0.010	3.19	0.044	0.049	-0.005	-0.90
Upper secondary education	0.616	0.501	0.115	19.22	0.566	0.512	0.055	4.56
Post-secondary non-tertiary education	0.062	0.064	-0.002	-0.55	0.068	0.049	0.019	3.10
Tertiary education	0.243	0.366	-0.123	-22.78	0.322	0.391	-0.069	-6.06
Urbanization: densely populated	0.357	0.388	-0.031	-5.24	0.389	0.432	-0.043	-3.65
Urbanization: intermediate area	0.155	0.156	-0.001	-0.2	0.167	0.138	0.029	3.29
Urbanization: thinly populated	0.488	0.456	0.032	5.2	0.443	0.430	0.013	1.14
Central Poland	0.189	0.229	-0.04	-8.18	0.204	0.203	0.001	0.09
Southern Poland	0.200	0.189	0.011	2.28	0.206	0.188	0.018	1.83
Eastern Poland	0.188	0.189	0	-0.05	0.201	0.188	0.013	1.38
Northern-Western Poland	0.165	0.150	0.015	3.38	0.153	0.159	-0.006	-0.69
Southern-Western Poland	0.099	0.097	0.002	0.67	0.091	0.110	-0.019	-2.72
Northern Poland	0.158	0.147	0.012	2.63	0.146	0.152	-0.007	-0.80
Age of the partner	36.562	9.084	27.478	184.97	36.128	28.442	7.686	27.02
Parent in the HH	0.128	0.658	-0.529	-114.20	0.126	0.229	-0.104	-12.68
Log(income from financial sources)	0.206	0.224	-0.019	-1.32	0.260	0.320	-0.060	-1.92
Log(income from benefits and social assistance)	3.247	1.448	1.798	47.52	2.312	1.295	1.017	13.85
N (not weighted)	22834	9627			15694	1982		

Variable	Cohabitating only							
	Unmatched				Matched			
	Parent (1)	Child-less (2)	(1)-(2)	T-test	Parent	Child-less	(1)-(2)	T-test
Married	0.977	0.829	0.148	37.87	0.959	0.890	0.069	12.02
Age	35.667	30.407	5.26	41.26	35.861	33.701	2.160	12.34
Primary and lower secondary education	0.073	0.034	0.038	7.24	0.037	0.036	0.000	0.07
Upper secondary education	0.617	0.456	0.161	15.77	0.572	0.507	0.065	4.82
Post-secondary non-tertiary education	0.062	0.042	0.020	4.06	0.065	0.041	0.024	3.62
Tertiary education	0.248	0.468	-0.22	-23.85	0.326	0.415	-0.089	-6.96
Urbanization: densely populated	0.354	0.481	-0.127	-12.6	0.392	0.422	-0.030	-2.24
Urbanization: intermediate area	0.159	0.136	0.023	3.05	0.166	0.147	0.019	1.92
Urbanization: thinly populated	0.487	0.383	0.104	9.93	0.441	0.431	0.010	0.77
Central Poland	0.191	0.224	-0.033	-3.97	0.205	0.209	-0.004	-0.40
Southern Poland	0.205	0.196	0.008	1	0.209	0.194	0.014	1.32
Eastern Poland	0.191	0.201	-0.010	-1.20	0.202	0.197	0.006	0.51
Northern-Western Poland	0.160	0.14	0.020	2.64	0.150	0.158	-0.009	-0.92
Southern-Western Poland	0.096	0.095	0.001	0.19	0.091	0.095	-0.004	-0.55
Northern Poland	0.157	0.144	0.013	1.71	0.143	0.146	-0.002	-0.26
Age of the partner	38.408	33.068	5.340	37.08	38.097	35.995	2.102	9.78
Parent in the HH	0.094	0.144	-0.049	-7.84	0.095	0.103	-0.008	-0.99
Log(income from financial sources)	0.215	0.341	-0.127	-4.98	0.265	0.317	-0.052	-1.47
Log(income from benefits and social assistance)	3.102	0.782	2.319	35.25	2.164	0.830	1.334	16.59
N (not weighted)	21312	2540			14954	1508		

Table A.3. Full estimation output for OLS estimates on the hours worked per week for the sample of working individuals aged 16−45 (Panel A) and working individuals aged 16−45 that are living with a partner (Panel B)

Panel A: Full sample								
Gender	**Women**				**Men**			
Specification	**(I)**	**(II)**	**(III)**	**(IV)**	**(I)**	**(II)**	**(III)**	**(IV)**
Married	-0.643*	-0.746**	-0.675*	-0.702**	-0.193	-0.148	-0.217	-0.340
	(0.349)	(0.349)	(0.350)	(0.348)	(0.491)	(0.492)	(0.491)	(0.541)
Age	-0.099***	-0.102***	-0.102***	-0.139***	-0.089***	-0.097***	-0.097***	-0.118***
	(0.015)	(0.016)	(0.016)	(0.019)	(0.015)	(0.016)	(0.016)	(0.021)
Education 1	0.235	0.281	0.242	0.304	-0.463	-0.388	-0.411	-0.343
	(0.439)	(0.438)	(0.439)	(0.437)	(0.403)	(0.406)	(0.405)	(0.432)
Education 2	-0.059	-0.026	-0.043	0.042	-0.938	-0.840	-0.864	-0.886
	(0.510)	(0.509)	(0.509)	(0.507)	(0.613)	(0.614)	(0.615)	(0.634)
Education 3	-4.208***	-4.155***	-4.196***	-4.043***	-1.895***	-1.838***	-1.842***	-1.856***
	(0.483)	(0.482)	(0.482)	(0.483)	(0.480)	(0.483)	(0.482)	(0.512)
Part time	-15.631***	-15.641***	-15.639***	-15.618***	-15.708***	-15.720***	-15.722***	-15.224***
	(0.349)	(0.348)	(0.349)	(0.347)	(0.819)	(0.820)	(0.820)	(0.869)
Occupation 1	-0.652**	-0.645**	-0.641**	-0.587**	-1.916***	-1.884***	-1.901***	-1.804***
	(0.258)	(0.258)	(0.258)	(0.256)	(0.401)	(0.400)	(0.401)	(0.417)
Occupation 2	1.254***	1.257***	1.267***	1.265***	-1.497***	-1.488***	-1.492***	-1.499***
	(0.251)	(0.251)	(0.251)	(0.249)	(0.407)	(0.407)	(0.407)	(0.425)
Occupation 3	1.661***	1.656***	1.669***	1.633***	-0.161	-0.153	-0.163	-0.054
	(0.283)	(0.282)	(0.283)	(0.279)	(0.368)	(0.368)	(0.369)	(0.385)
Working time - spouse	0.012**	0.012**	0.012***	0.012***	-0.010**	-0.009**	-0.009**	-0.010**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
Constant	45.444***	45.220***	45.574***	46.405***	49.690***	50.143***	49.923***	50.512***
	(0.764)	(0.751)	(0.773)	(0.817)	(0.843)	(0.843)	(0.856)	(0.996)
N	10 914	10 914	10 914	10 972	13 803	13 803	13 803	12 443
R^2	0.343	0.343	0.343	0.344	0.117	0.117	0.117	0.115

Panel B: Cohabitating only								
Gender	**Women**				**Men**			
Specification	**(I)**	**(II)**	**(III)**	**(IV)**	**(I)**	**(II)**	**(III)**	**(IV)**
Married	-1.403***	-1.501***	-1.427***	-1.441***	-0.656	-0.653	-0.673	-0.766
	(0.533)	(0.533)	(0.534)	(0.530)	(0.505)	(0.503)	(0.504)	(0.528)
Age	-0.100***	-0.106***	-0.105***	-0.145***	-0.086***	-0.096***	-0.096***	-0.120***
	(0.016)	(0.016)	(0.016)	(0.020)	(0.016)	(0.017)	(0.017)	(0.022)
Education 1	0.315	0.349	0.331	0.396	-0.524	-0.438	-0.459	-0.401
	(0.452)	(0.451)	(0.451)	(0.450)	(0.436)	(0.439)	(0.438)	(0.466)
Education 2	0.110	0.128	0.140	0.219	-0.928	-0.812	-0.835	-0.859
	(0.533)	(0.532)	(0.532)	(0.531)	(0.655)	(0.655)	(0.656)	(0.677)
Education 3	-4.198***	-4.153***	-4.177***	-4.012***	-2.053***	-1.971***	-1.986***	-1.980***
	(0.493)	(0.492)	(0.492)	(0.494)	(0.508)	(0.511)	(0.510)	(0.540)
Part time	-15.434***	-15.450***	-15.446***	-15.424***	-15.633***	-15.641***	-15.643***	-15.099***
	(0.371)	(0.371)	(0.372)	(0.370)	(0.831)	(0.830)	(0.832)	(0.874)
Occupation 1	-0.751***	-0.733***	-0.732***	-0.665**	-1.978***	-1.964***	-1.964***	-1.908***
	(0.264)	(0.265)	(0.265)	(0.263)	(0.433)	(0.433)	(0.433)	(0.447)
Occupation 2	1.322***	1.338***	1.341***	1.369***	-1.456***	-1.455***	-1.451***	-1.510***
	(0.258)	(0.258)	(0.259)	(0.258)	(0.439)	(0.439)	(0.439)	(0.455)
Occupation 3	1.512***	1.514***	1.520***	1.494***	-0.305	-0.311	-0.312	-0.245
	(0.288)	(0.287)	(0.288)	(0.283)	(0.401)	(0.401)	(0.402)	(0.416)
Working time - spouse	0.010**	0.010**	0.010**	0.010**	-0.010**	-0.009*	-0.009*	-0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	46.416***	46.155***	46.593***	47.362***	50.313***	50.663***	50.576***	51.042***
	(0.938)	(0.913)	(0.944)	(0.984)	(0.879)	(0.882)	(0.890)	(1.022)
N	10 392	10 392	10 392	10 451	13 060	13 060	13 060	11 796
R^2	0.342	0.342	0.342	0.343	0.113	0.113	0.114	0.112

Notes: 1) Models' specifications in terms of fertility measures as in Table 4: (I) parenthood dummy; (II) total number of children; (III) three dummy variables indicating the exact number of children (one child, two children, three or more children); (IV) five variables indicating number of children in the certain age group: 0-3 years old, 4-6 years old, 7-12 years old, 12-18 years old and 18 or more. 2) Controls for the level of education include: Education 1 − upper secondary education, Education 2 − post-secondary non-tertiary education, Education 3 − tertiary education (first and second stage); Controls for the occupation include: Occupation 1 − highly skilled non-manual, Occupation 2 − lower skilled non-manual, Occupation 3 − skilled manual, elementary occupation. 3) Urbanization, region and year fixed effects included in the regressions. 4) Robust clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Table A.4. Full estimation output for FE estimates on the hours worked per week for the sample of working individuals aged 16−45 (Panel A) and working individuals aged 16−45 that are living with a partner (Panel B)

Panel A: Full sample								
Gender	**Women**				**Men**			
Specification	**(I)**	**(II)**	**(III)**	**(IV)**	**(I)**	**(II)**	**(III)**	**(IV)**
Married	-1.110*	-1.113*	-1.402	-1.096*	-0.408	-0.407	-0.447	-0.408
	(0.596)	(0.597)	(1.151)	(0.595)	(0.896)	(0.903)	(0.897)	(0.903)
Part time	-11.893***	-11.889***	-11.084***	-11.875***	-12.204***	-12.192***	-12.197***	-12.127***
	(0.659)	(0.658)	(0.779)	(0.657)	(1.400)	(1.401)	(1.401)	(1.410)
Occupation 1	0.512	0.504	-0.547	0.480	-1.454	-1.451	-1.456	-1.452
	(0.692)	(0.692)	(0.816)	(0.691)	(0.930)	(0.931)	(0.930)	(0.933)
Occupation 2	1.112*	1.106*	0.252	1.096*	-0.253	-0.258	-0.256	-0.272
	(0.658)	(0.658)	(0.762)	(0.656)	(0.840)	(0.841)	(0.839)	(0.843)
Occupation 3	0.984	0.995	0.463	0.997	0.057	0.069	0.061	0.063
	(0.714)	(0.717)	(0.804)	(0.718)	(0.695)	(0.697)	(0.695)	(0.701)
Working time - spouse	0.015***	0.015***	0.026***	0.014***	0.003	0.004	0.004	0.004
	(0.006)	(0.006)	(0.008)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	39.184***	38.936***	39.485***	38.778***	44.369***	44.447***	44.224***	44.399***
	(0.961)	(0.903)	(1.505)	(0.902)	(1.240)	(1.169)	(1.251)	(1.166)
N	10 914	10 914	8 288	10 972	13 803	13 803	13 803	13 818
R^2	0.177	0.177	0.156	0.177	0.054	0.054	0.054	0.053
Panel B: Cohabitating only								
Gender	**Women**				**Men**			

Specification	**(I)**	**(II)**	**(III)**	**(IV)**	**(I)**	**(II)**	**(III)**	**(IV)**
Married	-1.714**	-1.713**	-1.498	-1.710**	-0.509	-0.525	-0.562	-0.535
	(0.690)	(0.690)	(1.429)	(0.687)	(0.925)	(0.930)	(0.926)	(0.930)
Part time	-11.836***	-11.834***	-11.235***	-11.822***	-12.023***	-12.009***	-12.013***	-12.016***
	(0.676)	(0.676)	(0.747)	(0.675)	(1.492)	(1.493)	(1.494)	(1.490)
Occupation 1	-0.637	-0.640	-0.569	-0.652	-1.063	-1.059	-1.065	-1.065
	(0.703)	(0.704)	(0.756)	(0.703)	(0.982)	(0.983)	(0.982)	(0.985)
Occupation 2	0.211	0.209	0.380	0.210	0.106	0.100	0.100	0.088
	(0.637)	(0.637)	(0.708)	(0.637)	(0.908)	(0.910)	(0.908)	(0.911)
Occupation 3	0.175	0.179	0.353	0.190	0.366	0.380	0.371	0.369
	(0.671)	(0.672)	(0.736)	(0.676)	(0.741)	(0.743)	(0.741)	(0.746)
Working time - spouse	0.016***	0.016***	0.027***	0.015***	0.007	0.008	0.008	0.007
	(0.005)	(0.005)	(0.008)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Constant	40.292***	40.233***	39.448***	40.070***	44.016***	44.085***	43.845***	44.052***
	(1.050)	(1.026)	(1.692)	(1.023)	(1.287)	(1.216)	(1.297)	(1.214)
N	10 392	10 392	8 340	10 451	13 060	13 060	13 060	13 074
R^2	0.177	0.177	0.163	0.178	0.051	0.051	0.051	0.051

Notes: 1) Models' specifications in terms of fertility measures as in Table A.3. 2) Occupations defined as in Table A.3. 3) Year fixed effects included in the regressions. 4. Robust clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.