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THE MOTHERHOOD WAGE PENALTY: A META-ANALYSIS

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Abstract

Mothers tend to receive lower wages than comparable childless women. This 'motherhood wage gap' has been reported in numerous studies. We summarize the existing empirical evidence on this topic using meta-analysis and test for several mechanisms which can be responsible for the persistence of the wage gap. Based on 208 wage effects of having exactly one child and 245 wage effects of the total number of children, we find an average motherhood wage gap of around 3.7 percent. While the gaps associated with the total number of children are mostly explained by the loss of mothers' human capital during child-related career breaks, the gaps associated with one child are predominantly driven by mothers' choice of jobs and occupations that pay less. The residual gap is smallest in Nordic countries, where public policies actively support gender equality and reconciliation of work and family, as well as Belgium and France, and largest in the post-socialist countries of Central and Eastern Europe and Anglo-Saxon countries.

Keywords

Motherhood penalty, family wage gap, motherhood, meta-analysis, meta-regression.

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The Motherhood Wage Penalty: A Meta-Analysis

Ewa Cukrowska-Torzewska and Anna Matysiak

1. Introduction

The fact that mothers earn less than childless women with similar characteristics is a well-known phenomenon widely documented in empirical research. Some studies reported this 'motherhood wage penalty' (also referred to as a 'family wage gap') to be relatively small and amount to around 0-1 percent (e.g. Datta Gupta and Smith 2002; Davies and Pierre 2005) while others found it to be as much as 10-13 percent (e.g. Waldfogel 1995; Davies and Pierre 2005; Nizalova, Sliusarenko, and Shpak 2016). Several mechanisms have been proposed to explain the persistence of the wage differences between mothers and non-mothers. It was hypothesized that mothers lose their skills during care-related career breaks (e.g. Budig and England 2001; Gangl and Ziefle 2009; Napari, 2010; Ejrnæs and Kunze 2013), select jobs which pay lower salaries but create better opportunities for combining economic activity with parenthood (e.g. Waldfogel 1997; Budig and England 2001; Amuedo-Dorantes and Kimmel 2008; Felfe 2012) or invest less effort into their work (e.g. Anderson et al. 2003, Kalist 2008; Simonsen and Skipper 2012). It was also posited that women may select into motherhood based on unobserved skills and earning potential (e.g. Korenman and Neumark 1992; Waldfogel 1997; Lundberg and Rose 2000) or that employers discriminate against mothers (Correll et al. 2007). Numerous studies have been conducted to test the relevance of the proposed mechanisms. Nonetheless, we still lack comprehensive knowledge of which factors are for the most part responsible for the persistence of motherhood wage penalty, because existing studies report mixed findings on their relative importance. Neither do we know why the reported family wage gap varies so strongly across studies. One of the reasons for this state of affairs is that existing studies use different data sources and analytical methods and refer to different samples, countries and periods, thus different institutional and cultural settings.

In this paper, we systematize the existing empirical studies on motherhood wage penalty and examine sources of the variation across the studies by employing a meta-analysis, also known as a quantitative literature review. The goal of the meta-analysis is to provide an estimate which reflects the true unknown parameter possibly best using the available empirical evidence (Borenstein et al. 2009). In addition, it allows for identifying reasons for the differences in the estimate of interest across studies. The advantages of meta-analysis over a single study lie in its greater statistical power and generality of its findings as it is based on numerous previous studies (Cohn and Becker 2003; Konstantopoulos 2006).

Meta-analysis has been employed successfully in research on gender, parenthood and labor market performance: examples include a meta-analysis on the gender wage gap (Stanley and Jarrell, 1998; Jarrell and Stanley, 2004; Weichselbaumer and Winter-Ebmer,

2005), the relationship between fertility and women's employment (Matysiak and Vignoli, 2008) or the male marriage premium (de Linde Leonard and Stanley, 2015). To the best of our knowledge, a throughout quantitative review of the research on the motherhood wage penalty is still missing, despite the fact that the literature on the topic is substantial and still growing. With this study, we aim to fill this gap and provide a systematic and consistent review of existing empirical work on mothers' pay disadvantage.

In our meta-analysis, we focus on the sources of heterogeneity in the motherhood wage gaps. We look at the role of control variables included in the originally estimated wage equations that relate to mechanisms aiming at explaining the wage gap. We also study the variation in the family wage gap across countries in order to understand how country-specific institutional and cultural factors (e.g. policies geared toward work and family reconciliation or attitudes towards mothers at work) shape the wage differences between mothers and childless women.

Our findings indicate that the motherhood wage gap is mostly explained by the loss of mothers' human capital during career-related breaks and, to a lower extent, mothers' choice of jobs and working conditions that correlate with lower pay. They also show that the gap is largest in CEE countries, followed by Anglo-Saxon countries. The gap is smallest in the Nordic and some of the Western European countries (Belgium and France) where mothers earn nearly as much as the childless. Small gaps are also observed in Southern Europe, which we relate to low female employment level (and thus strong selection of women into paid work).

The reminder of this paper is structured into six main sections. In the next section, we discuss theoretical background, focusing on the existing theories aiming at explaining mothers' lower relative wages and institutional determinants of the motherhood wage gap. In section three, we outline empirical approaches toward estimating the size of the motherhood wage gap and discuss how the reviewed theories were tested empirically. In section four, we present our meta-sample and in section five we present the analytical approach. In section six, we report the main findings, showing both descriptive evidence and meta-regression results. In section seven, we give concluding remarks.

2. The Motherhood Wage Penalty: Theoretical Framework

2.1. Theories and Concepts Behind the Motherhood Penalty

The observation that mothers are likely to receive lower wages compared to childless women is linked to several theories, which include the theory of human capital, the theory of compensating wage differentials, the theory of work-effort, and the selection of women into motherhood.

Following Becker's human capital theory (1985), mothers' lower wages relative to childless women are explained by differences in the standard human capital characteristics of mothers and non-mothers (such as differences in age and education) and the loss and non-accumulation of human capital during child-related employment breaks or reduced working hours (e.g. Hill, 1979, Wadfogel, 1997, Albrecht et al., 1999, Datta Gupta and Smith, 2002). Nonetheless, even if mothers are likely to have lower work experience and lower tenure, it is unclear to what extent these factors contribute to mothers'-non-mothers' wage gap. Budig and England (2001) write that "past studies are unclear about what part of the child penalty is explained by work experience because some authors report only penalties with or without controls for experience". They show that mothers'-non-mothers' differences in full-time and part-time experience and tenure, as well as employment breaks, explain part of the wage gap. However, the relative importance of these factors is different depending on the model that is used for the estimation: the raw difference in mothers'-non-mothers' wages of 8 percent is reduced by 75 percent when using OLS and by 40 percent when using a fixed-effects panel data model. Furthermore, the relative role of these factors seem to differ across countries. For example, Gangl and Ziefle (2009), who compare wage penalties in the UK, the US and Germany, report that while in the UK and the US, large parts of the wage gap can be attributed to human capital related factors, in Germany significant wage penalty is observed even when these factors are separated out.

Mothers are not only likely to work less and have lower work experience, but may also choose different kinds of jobs. In line with compensating wage differentials theory, mothers tend to receive lower wages because they choose jobs that on average pay less, but are better compatible with childcare. Part-time jobs, jobs with high share of females, public sector jobs, as well as jobs that offer flexible hours, do not require much travelling, weekend or evening work or are not highly stressful are perceived as mother-friendly. Once again, the empirical results on the importance of these factors are mixed. While Waldfogel (1997) and Budig and England (2001) shows that controlling for part-time status in wage models reduces the estimates of the wage gaps but does not eliminate them, Budig and England (2001) as well as Felfe (2012) conclude that mothers' work adjustments that take place following the childbirth explain little of the wage gap. Nielsen et al. (2004) as well as Simonsen and Skipper (2006), in turn, show that mothers tend to select into family-friendly public sector, where wages are on average lower. However, the exact job characteristics vary significantly across studies: some researchers tend to account for occupations, working time and sector, while others also consider industry or detailed work conditions (such as flexible hours, unionism, informal work at home) and work-adjustments following childbirth (e.g. changes in occupations or jobs). Even more importantly, many studies consider a set of characteristics jointly, rather than looking at them individually, which makes it unclear which are the specific characteristics that lead to the wage drop.

Lower wages of mothers that are found after controlling for the factors discussed above, might further stem from mothers' relative lower effort exerted at work, and thus relative lower productivity (Becker, 1985). Lower relative effort arises because, compared to childless women and men, mothers are more engaged in housework and childcare

activities and thus have less energy for work. In particular, mothers of younger children are expected to provide less effort at work because young children require more energy. Furthermore, it has been argued that highly-skilled jobs require higher work effort (Anderson et al., 2003). If the effort hypothesis holds, the size of the wage gap should be larger in the groups of better educated women and women with small children. Anderson et al, (2003) indeed find that the motherhood wage gap is highest for mothers with small children, but - contrary to work-effort hypothesis - not for highly-skilled mothers.

The wage gap seen between mothers and childless women may also arise due to selective allocation of women to motherhood. Women who decide to have children may differ from childless women already before having children in ways that relate to their productivity (Gough and Noonan, 2013). For instance, women who decide to have more children or have them earlier may be relatively more oriented towards family rather than towards professional career, and consequently may perform worse in their jobs – when compared to childless women (Anderson et al., 2000; Budig and England, 2001; Gough and Noonan, 2013; Korenman and Neumark, 1992; Lundberg and Rose, 2000, Waldfogel, 1997).

In general, the empirical literature on motherhood wage gaps concludes that the remaining gap that is left out after controlling for the mechanisms described above is likely "unexplained" and is often interpreted as discrimination. It is important to note, however, that the residual gap may not be equivalent to discrimination, because it may well come from other differences that are not directly measured in the data. Empirical tests of the discrimination hypothesis are scarce and mostly rely on experimental data. For example, Corell et al. (2007) test for discriminatory practices during the recruitment process and find that mothers are systematically assessed as less competent and are offered lower starting salaries than childless women.

Besides the theories listed above, researchers often discuss additional mechanisms that could be important for the size of the wage gap among mothers and childless women. Among these is women's selection into work, which may be especially relevant for mothers in countries with low participation of mothers in the labor market. In particular, when working mothers are a selected group of mothers that are highly motivated to work (i.e. mothers who return to work soon after having a child), mean wages of this subgroup are likely to be higher than when no selection takes place. In consequence, the motherhood wage penalty that would be observed in the event of no selection of mothers to work, would be even higher than the one that is reported based on the observed wages.

Similarly, marital status is considered as an important factor that may affect the size of the family wage gap. This is because marital status and motherhood are correlated, which means that the estimated motherhood wage gap that is derived without controlling for marital status also includes the wage effect of marriage. Another point related to marital status is that, the size of the motherhood penalty may differ by the marital status. On the one hand, married women may face a large wage gap due to increased specialization within the household (Becker, 1981). On the other hand, single motherhood may carry particularly

harsh wage penalty, because single mothers may receive less help with childcare from the fathers, which likely decreases their productivity at work.

2.2. Cross Country Variation in the Motherhood Wage Penalty

Apart from factors that affect mothers' wages at the individual level, comparative research points to the importance of the country social context in shaping mothers' wages and consequently motherhood related wage gaps, which is reflected in national family policies, social beliefs about women's and mothers' involvement in paid work, labor market flexibility and institutions (e.g. Harkness and Waldfogel, 2003; Davies and Pierre, 2005; Budig et al., 2012).

Among them, public childcare allows mothers to return earlier to work and spend more time in the labor market. Childcare should reduce the family wage gap, in particular if it is of high quality and opening hours of childcare facilities correspond well with parents' working hours (Hallden et al., 2016, Cukrowska-Torzewska, 2017, Pettit and Hook, 2005). Parental leave of moderate length can also improve women's labor market chances as it allows mothers to remain employed around birth (Baker and Milligan 2008, Thevenon and Solaz 2013). Parental leave can be especially beneficial for mothers' work careers if they encourage partners to share the leave, stimulating thereby egalitarian division of household labor. Nonetheless, long leave periods may have detrimental effects on women's labor market outcomes as they lead to human capital depreciation (Lapuerta, Baizán, and González, 2011; Cukrowska-Torzewska, 2017).

Social beliefs about women's and particularly mothers' roles are also relevant. Mothers may feel more reluctant to return to work soon after birth and make use of external childcare in societies where mothers' employment is less accepted and considered to be detrimental for children's well-being (Pfau-Effinger 2004). For instance, Budig et al. (2012) showed that reconciliation policies are associated with higher mothers' earnings in countries where mothers' employment is socially accepted but not where cultural attitudes support gender unequal division of labor.

Moreover, cross-country differences in the motherhood wage gaps can be shaped by such country level factors as women's and maternal employment rates, labor market structures and overall wage inequality (Budig et al. 2012, 2016, Cukrowska-Torzewska, 2017). Wage gaps can be smaller in countries with low employment rates, i.e. in countries where working mothers are a highly selected group of women who are either strongly motivated to work or who can easily combine paid work and care (e.g. receive care from their parents or other family members). This argument is in line with Olivetti and Petrongolo (2012), who proved that variability in women's employment rates explains a significant portion of the variation in the gender wage gaps across countries. Motherhood wage gaps may also be smaller in countries with high concentration of women in public employment as jobs in the public sector are usually more stable and require less overtime

(Duvivier and Narcy 2015). Labor market flexibility, measured by the flexibility of working hours and availability and quality of part-time jobs, can also affect the wage gap, although the direction of this influence is less clear. On the one hand, flexible working hours and well available part-time jobs facilitate reconciliation of paid work and care and thus may reduce the motherhood wage penalty. On the other hand, however, long-term participation of mothers in part-time employment may contribute to an increase in wage penalties, in particular if it implies working in low quality jobs, i.e. paying lower hourly wages or offering poor promotion or training opportunities (Goldin, 2014). Similarly, overall greater wage dispersion may translate to greater wage gaps associated with motherhood. Budig et al. (2016) show that the relative importance of these institutional factors is, however, rather limited and the variation in the size of the family wage gaps can be predominantly attributed to the social policies aimed at families and mothers as well as culture.

Thus, it can be expected that the size of the wage gap is lower in countries, in which welfare policies are oriented at allowing mothers a quick entry into work after birth and where employment of mothers with young children is socially more accepted. Nordic countries are the best example of such countries. The Nordic family policy model is explicitly oriented toward supporting gender equality in the labor market and care (Elingsaeter and Leira, 2006). This attitude is reflected in widespread public childcare provision with high quality standards (Karila, 2012) and highly individualized rights to parental leaves, which facilitate fathers' participation in childcare (Brandth and Kvande, 2009). Parental leaves available to women are relatively short, allowing career breaks for no longer than 1-1.5 years, and highly flexible. Nordic countries also score high in terms of social acceptance of women's work and fathers' participation in care (Matysiak and Weziak-Bialowolska, 2016). Mothers' employment is also well supported institutionally in France and Belgium, which display high provision of public childcare available largely on a full-time basis (Gauthier, 1996; Bettio and Platenga, 2004). In contrast to the Nordic family policy model, the Belgian and French family policies are, however, mainly targeted at supporting women's employment and less at increasing gender equality in care (Haas 2008).

The conditions for work and family reconciliation in other developed countries are generally worse (Gornick and Meyers, 2003; Matysiak and Weziak-Bialowolska, 2016) and thus it can be expected that the motherhood wage penalties may be higher there. For instance, Austria and Germany for a long time supported traditional division of labor between partners (Bettio and Platenga, 2004; Korpi et al., 2013). Even though the two countries have strongly reformed their family policies in the last years, they still display relatively poor provision of public childcare. Most importantly, childcare services in the German speaking countries have usually relatively short opening hours which may be one of the reasons for high prevalence of part-time employment in these countries (Berghammer, 2014; Baranowska-Rataj and Matysiak, 2016). Part-time employment is also widely spread among mothers in the Netherlands for whom it is a main way of combining work and care given the weak support from the state (Plantenga, 2002; Lewis et al., 2008). Beliefs about negative consequences of mothers' employment for their children are still

quite widespread in German speaking countries (Matysiak and Weziak-Bialowolska, 2016). Social attitudes toward mothers' employment are more positive in the Anglo-Saxon countries (US, UK, Canada or Australia), but the public support for working parents is very modest there (Esping-Andersen, 1999; McDonald and Moye, 2010). This poor public support is reflected in low public childcare provision and limited leaves. Most Anglo-Saxon countries have developed some leave policies, but they are rather poorly compensated. The US still lacks leave policies at federal level (OECD, 2107; Thévenon and Neyer, 2014). Childcare services in this group of countries usually need to be purchased in the market.

Very low public support for working parents is also provided in Southern Europe where public childcare provision for the youngest children is very limited and parental leaves are very short and low paid. In addition, the social perception of gender roles is still very traditional (Matysiak and Weziak-Bialowolska, 2016). Not surprisingly, female employment rates in this region are the lowest in Europe. Post-socialist countries of Central and Eastern Europe constitute yet another specific group of countries. Provision of public childcare in most of these countries is usually weak, in particular for the youngest children (Javornik, 2014). Instead, mothers are offered long parental leaves, which allows them to withdraw from employment for the first three years after birth. Studies show that women tend to return to full-time employment after these long leaves, however (Matysiak, 2011). This pattern partly results from conflicting social expectations toward women. On the one hand, women are perceived as main care providers and participation of men in care in this region is still low. On the other hand, women are strongly expected to earn income and contribute to the household budgets after children enter pre-school (Lueck and Hoffaecker, 2003).

3. Previous Research: Empirical Strategy

In empirical research the gap between mothers'-non-mothers' wages is identified by the estimation of the Mincerian wage equation for female samples, which includes a measure of motherhood status among the explanatory variables. In the majority of studies, the motherhood wage penalty is thus quantified by estimating the following equation:

$$\ln w_i = \beta_0 + \beta_1 MS_i + \sum_k \beta_k X_{ki} + \varepsilon_i \quad (1)$$

where MS_i is the motherhood status, and β_1 corresponds to the effect of interest, indicating the wage penalty associated with motherhood. Motherhood status is usually specified using various concepts, such as: 1) the total number of children measured as a continuous variable; 2) a dummy variable equal to one if children are present and zero otherwise; 3) the total number of children measured as a categorical variable (e.g. one child, two children, three or more children); 4) the number of children in a given age group. Similarly, studies use different definitions of the dependent variable, including hourly wage, yearly earnings or monthly salary.

Empirical research on the motherhood wage penalty commonly tests for the sources of the wage inequality associated with motherhood by adding to the basic model (i.e. the model that controls for the motherhood status only) control variables (represented by variables X_{ki}) that in line with theoretical predictions could explain the arising gap. The human capital hypothesis is tested by measures of age, education, work experience, tenure and work interruptions. Work experience is often measured either by exact experience or potential experience that is derived using age and years of education. Tests of compensating wage differential theory, in turn, usually involve accounting for such factors as occupation, work-schedule (part-time vs. full-time), sector (public vs. private) and working schedule or hours of work (e.g. Anderson et al. 2003; Gangl and Ziefle, 2009; Duvivier and Narcy, 2015). Some researchers also control for more detailed job characteristics, such as industry, working conditions or work adjustments after childbirth (e.g. occupation change, firm change). The role of selection into motherhood, which is based on unobservables, is addressed by using panel data models, such as fixed-effects or first differences, which allow for eliminating time invariant unobservable factors that correlate with motherhood status and wages. Some studies also rely on instrumental variable estimation (e.g. Korenman and Neumark, 1992; Angrist and Evans, 1998). Finally, to account for the problem of mothers' selection to work, researchers often apply Heckman's model for selection (Heckman, 1979).

Some researchers derive wage gaps for various sub-samples of women. For example, the motherhood penalty is often estimated by age groups, education level, marital status as well as sector of work. This approach also allows for identifying sources of the wage gaps, e.g. stratifying the sample by age or education may help to test work-effort theory, performing separate analyses for single and married women helps to verify the specialization hypothesis and sector of work is used to test for the compensating wage differential theory.

Research examining the reasons behind the motherhood penalty is abundant. Nonetheless, its findings are mixed and it is not clear which mechanism – lost human capital, sorting to mother-friendly jobs, lower work-effort, or selection to motherhood – is the most important explanation of the wage gap. Furthermore, based on the previous research it is still unclear what is the role of the country institutional and cultural context in shaping mother-non-mother wage inequalities. This is predominantly due to data constraints. Cross-country comparative studies often rely on small samples of countries and short time periods, which do not encompass the whole variety of family policies and labor market characteristics. Consequently, it is difficult to conclude to what extent the cross-country differences in findings are due to differences in institutional and cultural settings (e.g. Waldfogel, 1998; Gangl and Ziele, 2009; Gash, 2009). Moreover, cross-country research often focuses on the explanatory power of specific factors, such as family policies and social attitudes towards working mothers, rather than differences in the size of the estimated gaps across countries (e.g. Sigle-Rushton and Waldfogel, 2007; Dupuy and Fernandez-Kranz, 2011; Budig et al., 2016; Hallden et al., 2016, Dotti Sani, 2015; Misra et al., 2011, Cukrowska-Torzewska, 2017). What is even more important, studies define the gaps in various ways which implies that they examine different mechanisms through which institutional context

affects the gaps. For instance, some researchers look at 'raw' gaps (mean difference), others look at the gaps that arise when mothers'-non-mothers' age and education differences are separated out or the gaps that persist after controlling for all relevant differences between mothers and non-mothers.

Given different aims of various empirical works, which use different data sources, cover distinct time frames, and most importantly define the wage gaps using various specifications of the basic wage equation, it is difficult to compare the findings across studies and to draw conclusions regarding the size of the gap, the importance of the intervening mechanisms and the role of the country context. This is where the present analysis is especially useful: by collecting numerous estimates coming from various European countries and other developed countries outside of Europe, we are able to infer how the size of the motherhood wage gap varies across countries, while controlling for other sources of heterogeneity.

4. Construction of the Meta-sample

A necessary preliminary step in meta-analysis involves conducting a systematic literature search. The choice of the original papers should be driven by the principle of completeness. In our study we searched for the relevant papers using Web of Science, EconLit and RePEc databases. We used various combinations of keywords that included 'motherhood penalty', 'motherhood wage gap', 'family gap', 'mother', 'motherhood', 'wage', 'gap'. We stopped searching the databases in November 2016; supplementary search was conducted in July 2017 to update the database with the newest research. We limited our search only to peer-reviewed papers, leaving out working papers or reports. Additionally, we focused only on the papers published in English. The search resulted in the collection of over 230 studies.

We next reviewed the collected studies and retained only those, which included the estimation of women's wage equation and included any measure of motherhood status/childbirth; there were 86 such studies. Many studies that were initially collected had to be dropped as they focused on other topics such as theoretical issues, gender wage gap, women's labor market participation or motherhood issues that did not relate to earnings (i.e. qualitative studies).[1] Additionally, we reviewed references of the selected papers and included any missing studies, which resulted in the collection of nine additional journal articles. Table 1 summarizes how our selection criteria influence the number of studies accepted for the final analysis.

[1] This large decline in the number of studies predominantly stems from dropping of over 100 studies returned in the search of Web of Science database; these studies covered other topics related to motherhood and very often lacked any statistical analysis.

Table 1
Summary of studies' collection

Articles description	Number of articles
Articles found in the databases search:	232
Included in the meta-sample:	35
Dropped because:	
Unrelated topic	142
Thoeretical considerations only	4
Different motherhood measure	19
Different definition of the dependent variable (log monthly/yearly earnings, yearly earnings)	23
The lack of SE/p-value/t-test statistic/sample size	9
References search	9
Dropped because only white/black samples	5
Final number of articles	39

The studies we collected differed in various dimensions, such as the definition of the dependent variable or the measurement of the motherhood status, which further decreased the number of studies which could be analyzed in a consistent way. Most of the studies (63 out of 86) defined the dependent variable as a log of hourly wage rate and for consistency reasons we decided to keep only these studies[2]. In 44 out of 63 studies the motherhood status was measured by the number of children - either as a continuous or categorical variable, and 19 studies coded motherhood status as the dummy variable or in other way such as years after birth, or the number of children in a given age group. Given these inconsistencies, we kept only these articles, in which the gap was defined by the number of children. From our sample we further excluded 9 articles that failed to report standard errors/t-statistics/p-value/sample size. Out of papers, which used the categorical variable, we retained coefficients which describe the effect of having exactly one child[3]. Consequently, our indicators of the motherhood wage gap – or so-called *effect sizes* – include two effects: (1) the effect of the number of children measured as a continuous variable, and (2) the effect of having one child. We also dropped 5 articles with the effect sizes for the US that were estimated for the samples of white/blacks only. We did not include these observations because they are not comparable with the effect sizes for other countries, i.e. European countries, which are estimated for the whole population (including various ethnic groups living in the country).

[2] In few articles the dependent variable was defined as yearly income or monthly salary, either in logs or not.

[3] This was motivated by the fact that some studies distinguished between one child and two or more children, whereas others considered one child, two children and three or more children.

Our final collection of articles included 39 journal articles. They are listed in the Appendix. Out of 39 journal articles 23 articles reported effects of the total number of children, and 21 articles reported effects of having one child. The articles we analyze were published over the years 1979-2016 in economics and sociology journals. The estimates span 18 countries, including countries from Northern America, Europe as well as Australia.
The collected studies commonly report several model specifications, which control for a distinct mix of variables. This strategy is adopted by researchers in order to test for the specific mechanism behind the motherhood wage gap. Because of that, we coded all possible estimates of the motherhood wage gap reported in each article. As a consequence, we collected 245 effects of total number of children coming from 23 journal articles and 208 effects of having one child coming from 21 articles.

5. Analytical Approach

We start the analysis with testing for the presence of the publication bias, also known as funnel asymmetry (Egger et al. 1997, Stanley, and Doucauliagos, 2012), which arises when researchers tend to report only significant findings and underreport insignificant estimates. Such practice has been observed in previous meta-analyses, such as the meta-analysis of employment effects of minimum wages (Doucouliagos and Stanley, 2009; Giotis and Chletsos, 2015) or the male marriage premium (Megan de Linde and Stanley, 2015). Testing for the publication bias should precede any meta-regression analysis because the result of this test determines the basic form of the meta-regression model. We test for the presence of publication bias using the FAT-PET-MRA, which is an abbreviation for Funnel Asymmetry Test (FAT), Precision Effect Test (PET), and Meta-Regression Analysis (MRA). suggested by Stanley and Doucouliagos, 2012)[4]. The results reveal that for the two meta-samples we specified there is no evidence for the presence of the publication selection bias (see Appendix Table A.3 for detailed estimates).

In the next step, we summarize collected estimates of the motherhood wage gap. To this end, we first conduct a descriptive analysis of the collected effect sizes and second, run multiple meta-regressions given by:

$$\widehat{\beta_\iota} = \delta_0 + \sum_k \delta_k Z_{ki} + v_i \quad (2)$$

where $\hat{\beta}_i$ is the coefficient of interest (i.e. the effect size defined either as the coefficient reflecting the wage effect of total number of children or as the coefficient reflecting the wage effect of one child) and Z_{ki} stands for k characteristics associated with the effect size i. For the estimation of the meta-regression, we use weighted least squares (WLS) with the weights specified as the squared precision of the effect size ($1/SE_i^2$) rather than

[4] The test is based on the estimation of the $t_i = \gamma_0 + \gamma_1(1/SE_i) + v_i$, where t_i is the t-statistic for the effect size $\hat{\beta}_i$ and SE_i is its associated standard error. If γ_0 is significantly different from zero there is evidence of the publication selection.

conventional meta-regression models such as fixed and random effects models (Stanley and Doucouliagos 2014; Stanley, 2016). WLS estimation is commonly used for meta-analyses in economics (e.g. Megan de Linde, Stanley 2015, Iamsiraroj and Doucouliagos, 2015) and has proved not to perform worse, and in some circumstances, even outperform other models conventionally used in meta-analysis (Stanley and Doucouliagos 2014). Furthermore, it accounts for study-level dependence of the collected coefficients by specifying clustered standard errors (Stanley, 2016). This feature of WLS is particularly important for us since our data is hierarchically structured, the number of observations in relation to the number of articles is high, and there are significant study-level effects.

When estimating the WLS model we follow a general-to-specific approach, starting out with all the information that could explain the heterogeneity among collected coefficients and reducing the model to retain only those factors, which ensure the highest explanatory power of the final model[5]. We check the robustness of our results by running standard random-effects and fixed-effects panel data models that also account for the multilevel structure of our data. We also supplement the analysis with the WLS model with the weights specified as the inverse of the square root of the number of observations (Havranek, 2015; Iamsiraroj and Doucouliagos, 2015). The argument for using alternative weights to inverse variance weight is that the reported standard errors may be endogenous to the estimates, as certain estimation methods are likely to affect both the standard error and the point estimate. We also check the robustness of all four models by re-estimating the models based on a reduced sample derived by randomly dropping 5 percent of the observations.

The list of variables that are included in the meta-regressions and that serve as "candidate" variables for explaining heterogeneity in the motherhood wage penalty estimates, is presented in Table 2. Appendix Table A.1 additionally presents the mean values of the selected variables for the two samples. The variables are defined in line with the theoretical basis pointing at sources of mothers' lower wages relative to non-mothers.

More specifically, the significance of human capital theory is assessed by six dummy variables reflecting whether the wage equation omitted age, education, experience – either actual or potential – tenure, or work interruptions (either length or the number). The theory of compensating wage differentials is tested by specifying whether wage equation omitted controls for occupation, industry (NACE), sector of work (public or private), working time (part-time dummy indicator or exact working hours), and any indicators of mother-friendly work conditions or adjustments (e.g. flexible hours, unionism, work at home, change of the

[5] We use Stata *genspec* command. In this procedure each variable in the original (general) model is ranked by the size of its t-statistic and based on this ranking the algorithm uses a number of search paths for model reduction. The first path subsequently eliminates variables with the lowest t-statistics, the second path eliminates variables with the second lowest t-statistics, etc. For each search path, the reduced model is subject to a number of tests, among which is an F-test, that determines whether the reduced model is a valid restriction of a general model. If the reduced model passes the tests, the procedure starts again. This process is repeated until either all insignificant variables are removed or no more variables can be removed (Clarke, 2014).

employer after childbirth). In addition, we account for whether the sample was restricted to women working in a certain sector (private or public) or having a certain work schedule (part-time vs. full-time). Women may choose the public sector or part-time work in order to combine paid work and care but at the same time this choice may influence their wages.

Table 2
Independent variables used in meta-regression

Variable type	Variable name	Variable description
Human Capital Theory	Age	Equals to 1 if age is omitted
	Education	Equals to 1 if education is omitted
	Experience	Equals to 1 if actual experience is omitted
	Potential experience	Equals to 1 if potential experience is omitted
	Tenure	Equals to 1 if tenure is omitted
	Interruptions	Equals to 1 if detailed work interruptions are omitted
Compensating Wage Differentials	Occupations	Equals to 1 if occupation is omitted
	Industry	Equals to 1 if industry is omitted
	Hours	Equals to 1 if working schedule (part-time vs. full-time) or exact working hours are omitted
	Sector	Equals to 1 if sector is omitted
	Work conditions	Equals to 1 if mother friendly work conditions are omitted
	S_public	Equals to 1 if the sample is a restricted sample of women working in the public sector
	S_private	Equals to 1 if the sample is a restricted sample of women working in the private sector
	S_fulltime	Equals to 1 if the sample is a restricted sample of women working full-time
	S_parttime	Equals to 1 if the sample is a restricted sample of women working part-time
Work Effort	S_highly_ educated	Equals to 1 if the sample is a restricted sample of higher educated women
	S_lower_ educ	Equals to 1 if the sample is a restricted sample of lower educated women
	Mean_age	Mean age of the sample
Sex Specialization	S_married	Equals to 1 if the sample is a restricted sample of married women
	S_singles	Equals to 1 if the sample is a restricted sample of single women

Variable type	Variable name	Variable description
Selection to Motherhood	Motherhood_ sel	Equals to 1 if selection to motherhood is not controlled (either with the use of panel models or IV)
Selection to Work	Work_sel	Equals to 1 if labor market selection is not controlled (with the use of Heckman correction)
Marriage	Marriage	Equals to 1 if marital status is omitted
Data	Panel	Equals to 1 if panel data
Time Coverage	Seventies	Equals to 1 if data used in the estimation come from the period earlier than 1979
	Eighties	Equals to 1 if data used in the estimation come from the period 1980-1989
	Nineties	Equals to 1 if data used in the estimation come from the period 1990-1999
	Two_ thousand	Equals to 1 if data used in the estimation come from the period 2000-2010
	Two_ten	Equals to 1 if data used in the estimation come from the period 2010 and later
Geographical Coverage	Nordic Europe	Equals to 1 if the data come from Denmark, Finland or Sweden
	Western Europe 1	Germany or Netherlands
	Western Europe 2	France or Belgium
	Anglo-Saxon	Equals to 1 if the data come from the US, UK, Australia or Canada
	Central and Eastern Europe	Equals to 1 if the data come from Poland or Ukraine
	Southern Europe	Equals to 1 if the data come from Greece, Italy, Portugal or Spain

Furthermore, we verify the work effort hypothesis by including into our meta-model variables which specify whether the sample was restricted to women with certain education level. This is consistent with the argument by Anderson et al. (2003) that more educated workers tend to work in highly skilled jobs which typically require more effort than low skilled jobs, and that for this group of women the motherhood wage gap should be greater. To test work effort theory, we also account for the mean age of women for which the gap is estimated.[6] Since younger women tend to have younger children on average, mothers' mean age may partially capture the effect predicted by work-effort theory, as younger children require generally more attention and care (e.g. Anderson et al., 2003).

[6] The mean age of the sample is centered around its mean.

Unfortunately, work effort theory was tested very rarely in empirical research and thus the sample stratification by education and mean age were the only variables we could include in our meta-analysis to test this theory.

We also try to assess the relevance of sex specialization theory. To this end, we account for whether the sample in the original study was restricted only to married or single women. The role of women's selection into motherhood based on unobservable factors is identified by a variable reflecting whether the model was estimated with the use of fixed-effects or first-difference models or instrumental variable estimation.[7] Finally, we also include variables that capture whether the original study controlled for marriage and women's selection into work (with the Heckman selection model).

Related to the study design, we account for the nature of the data by specifying whether the data is longitudinal or cross-sectional and what is the time-span of the data used in the estimation. As we are interested in whether country-specific institutional and cultural context partly explains the size of the motherhood wage gap, we further look at geographical coverage by defining dummy variables for country clusters. Consistently with the arguments presented in Section 2 we distinguish between Nordic Europe, two groups of Western Europe, Anglo-Saxon countries, Central and Eastern Europe, and Southern European countries. The distribution of the effect sizes across the groups is shown in the Appendix Table A.2. The distribution turns out to be slightly different for the two effect sizes that we defined, and all six groups of countries are observed only for the sub-sample of the effect sizes defined as the wage gap associated with having one child.

6. Results

6.1. Descriptive Evidence

The unweighted distributions of the effect sizes of "total number of children" and "one child" are shown in Figure 1 and they are comparable. Using collected estimates, we infer that each child is associated with an average wage drop of 3.6 percent and one child leads to a wage decline of around 3.8 percent. The estimated wage effects range from about -20 percent to a +7 percent and most of the collected effect sizes report the wage gap of around -5 percent to 0 percent.

In Table 3, we additionally report the effect sizes weighted by their squared precision by six country clusters we defined. The results reveal that the greatest negative wage effects of having one child are seen in post-socialist countries of Europe (-10 percent), followed by Germany and the Netherlands (-8 percent), Anglo-Saxon countries as well as Belgium and

[7] Because the number of estimates that rely on instrumental variable estimation in our sample is rather low, we define only one indicator for both instrumental variable estimation and panel data models.

France, where the average effect is around -4.5 percent. In the case of the wage effects from total number of children, both the wage gaps and the differences between countries are smaller, as Germany and Netherlands report a wage gap of around -6 percent, Anglo-Saxon countries of -4.6 percent and CEE countries of -3.7 percent. In Belgium and France the effect is much lower, close to 0 percent. In both samples, the effects are smallest in Nordic Europe; the motherhood wage gap for this group of countries is close to zero.

Figure 1
Distribution of collected motherhood wage penalty estimates defined as the wage effect of the total number of children (Panel A) and wage effect having one child (Panel B)

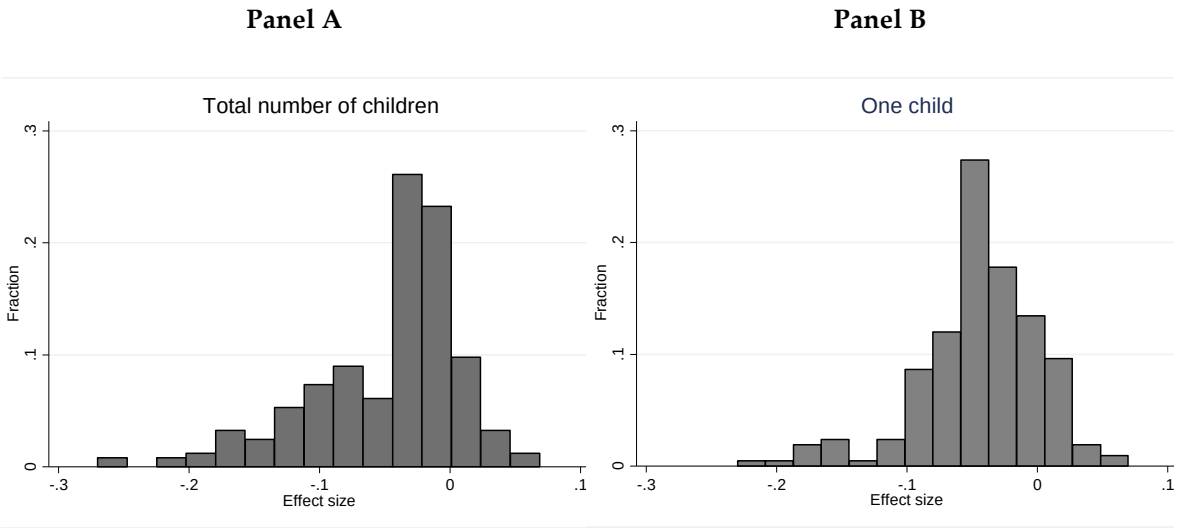


Table 3
Collected motherhood wage penalty by country cluster

	Total number of children		One child	
	Mean	N	Mean	N
Total	-0.036 (0.037)	245	-0.038 (0.026)	208
By Country cluster:				
Nordic Europe	0.000 (0.009)	28	-0.010 (0.009)	22
Western Europe 1 (DE & NL)	-0.063 (0.061)	47	-0.079 (0.086)	18
Western Europe 2 (BE & FR)	-0.003 (0.014)	8	-0.046 (0.009)	27
Anglo-Saxon	-0.046 (0.034)	152	-0.045 (0.025)	106
CEE	-0.037 (0.070)	10	-0.096 (0.068)	11
Southern Europe	N/A	0	-0.013 (0.035)	24

Note: Standard deviation in parenthesis

6.2. Meta-regression Results

Meta-regression is a useful tool to summarize empirical research and identify sources of variation in the collected estimates if among the collected estimates there is excess heterogeneity, i.e. heterogeneity that cannot be attributed to random sampling error alone. The preliminary step of performing any meta-regression thus includes testing for the excess variation using Cochran's Q test. As could be expected, the Cochran Q-test applied to our two meta-samples confirms that excess variation is present: the Q statistic for the effect of "total number of children" is equal to 7,262 (df=244; $p<0.001$) and for the effect of "one child" it is equal to 1,549 (df=207, $p<0.001$).

Our MRA results of general to specific modelling are presented in Tables 4 and 5. The tables present WLS results with weights defined as inverse of the squared standard errors and the three alternative specifications used for robustness checks: WLS with weights defined as inverse of the square root of the sample size, random-effects and fixed effects models. The results obtained based on a reduced sample that randomly excludes 5 percent of observations are presented in Appendix Tables A.4 and A.5. In the discussion that follows we focus on the consistent findings that we obtain from estimating different models.

Human capital measures are strong determinants of the motherhood wage gap in the sample of effect sizes associated with the total number of children. They are responsible for around 5-6 percentage point reduction in the size of the wage gap between mothers and childless women. Among them experience and work interruptions play the biggest role. Next, mothers' selection into paid work is also highly important for the evaluation of the wage gaps associated with children. Failing to account for selection leads to significantly smaller (by even 4.6 percentage points) negative wage gaps. The sign of the coefficient for work selection suggests that the sample of working mothers in original studies consists of highly motivated- highly paid women, for which the gap in wages in relation to childless women is rather small. Furthermore, mother-friendly work conditions explain another substantial part of the wage gap: once these are not controlled for in the estimation of the gap, the negative gaps are higher by approximately 2 percentage points. Interestingly, the choice of the industry sector does not explain the gap. In fact, it seems that mothers are more likely to work in industries where the average pay is relatively high. Furthermore, we also find higher motherhood wage gaps among lower educated women. This result contradicts work-effort theory because contrary to the argument by Anderson et al. (2003), wage gaps are not reduced but turn out to be even greater among women working in low skilled jobs that require lower effort. Finally, restricting the sample to single individuals significantly affects the motherhood wage gap. This result is, however, inconclusive because the sign of the coefficient on this variable changes among different models and the variable is entirely dropped in the final specification of the model in our robustness analysis (see Appendix Table A.4). It is thus difficult to draw conclusions regarding the specialization hypothesis on the basis of this finding.

Table 4:
Multiple meta-regression results: the wage effect associated with the total number of children

	WLS with Weights $1/SE_i^2$	WLS with Weights 1/sqrt(n)	REML	FEML
Constant (Motherhood Penalty)	-0.027***	-0.041***	-0.039**	-0.067***
	(-4.278)	(-4.728)	(-2.522)	(-3.957)
HUMAN CAPITAL THEORY				
Age	-0.008***	0.003	0.004	0.001
	(-5.120)	(0.543)	(0.666)	(0.204)
Tenure	-0.016***	-0.010	-0.007	0.003
	(-2.616)	(-1.415)	(-0.943)	(1.210)
Interruptions	-0.017***	-0.018**	-0.018**	-0.023***
	(-2.913)	(-2.402)	(-2.316)	(-7.388)
Experience	-0.022***	-0.041***	-0.036***	-0.034***
	(-3.153)	(-4.669)	(-4.419)	(-4.424)
COMPENSATING WAGE DIFFERENTIALS				
Industry	0.019**	0.040***	0.036***	0.032***
	(2.116)	(3.165)	(3.294)	(3.148)
Work Conditions	-0.024***	-0.020**	-0.019***	-0.022***
	(-3.914)	(-2.462)	(-2.801)	(-3.882)
SELECTION TO WORK				
Work_sel	0.046***	0.044***	0.029**	0.033**
	(8.826)	(8.903)	(2.482)	(2.248)
SEX SPECIALIZATION				
S_singles	-0.004**	0.012***	0.021**	0.021**
	(-2.358)	(2.978)	(2.381)	(2.338)
WORK EFFORT				
S_lower_educ	-0.020***	-0.029***	-0.016**	-0.007
	(-4.401)	(-2.845)	(-2.037)	(-0.663)
CALENDAR TIME				
Seventies	0.031***	0.029***	0.026***	0.030***
	(6.817)	(8.837)	(6.849)	(41.453)
Eighties	-0.039***	-0.052***	-0.041***	dropped
	(-9.117)	(-4.426)	(-2.604)	
Two_ten	0.039***	0.063***	0.113***	dropped
	(4.349)	(6.013)	(10.966)	
COUNTRY GROUPS				
Nordic Europe	0.019***	0.018	0.033***	0.035**
	(2.967)	(1.093)	(2.637)	(2.546)
Western Europe 2 (Belgium&France)	0.024***	0.024***	0.019***	0.015***
	(4.060)	(3.419)	(3.846)	(2.800)
CEE	-0.034	-0.083***	-0.103***	dropped
	(-1.640)	(-5.797)	(-10.483)	
Number of observations	245			

Notes: t-statistic in parentheses. Standard errors are clustered at the study level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5
Multiple meta-regression results: the wage effect associated with one child

	WLS with Weights $1/SE_i^2$	WLS with Weights 1/sqrt(n)	REML	FEML
Constant (motherhood penalty)	-0.032***	-0.044***	-0.045***	-0.038***
	(-7.981)	(-3.695)	(-3.567)	(-3.511)
HUMAN CAPITAL THEORY				
Age	0.009**	0.009	0.007	-0.003
	(2.063)	(1.303)	(0.854)	(-0.209)
Tenure	-0.008*	-0.007	-0.009	-0.005
	(-1.937)	(-1.439)	(-1.147)	(-0.520)
Interruptions	-0.012***	-0.006	-0.006	-0.015
	(-2.745)	(-0.650)	(-0.547)	(-1.013)
COMPENSATING WAGE DIFFERENTIALS				
Occupations	-0.007***	-0.009***	-0.013**	-0.014*
	(-3.649)	(-2.804)	(-2.017)	(-1.813)
Sector	-0.005***	-0.003	0.002	0.003
	(-3.985)	(-0.995)	(0.307)	(0.369)
S_private	-0.152***	-0.117***	-0.110***	dropped
	(-67.191)	(-19.248)	(-8.372)	
SEX SPECIALIZATION				
S_married	0.015***	0.025***	0.022***	0.018***
	(3.949)	(3.123)	(4.105)	(4.154)
S_singles	-0.014***	-0.006	-0.008	-0.013***
	(-4.248)	(-1.029)	(-1.461)	(-5.711)
CALENDAR TIME				
Seventies	0.017***	0.015**	0.020**	0.008
	(3.107)	(2.116)	(2.556)	(0.583)
Two_ten	0.094***	0.060***	0.059***	dropped
	(36.286)	(10.863)	(7.482)	
GEOGRAPHICAL COVERAGE				
Nordic Europe	0.051***	0.055***	0.049***	0.035***
	(8.506)	(6.788)	(4.557)	(3.501)
Western Europe 2 (Belgium&France)	0.064***	0.068***	0.066***	0.065***
	(11.352)	(10.855)	(17.637)	(33.155)
CEE	-0.067***	-0.065***	-0.062***	dropped
	(-11.319)	(-8.457)	(-7.434)	
Southern Europe	0.041***	0.053***	0.051***	0.053***
	(4.656)	(6.961)	(9.169)	(27.056)
Number of observations	208			

Notes: t-statistic in parentheses. Standard errors are clustered at the study level.
*** p<0.01, ** p<0.05, * p<0.1.

The role of the human capital measures is not as important in the sample of effect sizes associated with one child as it is in the sample of effects associated with the total number of children. Time absent from a job and work interruptions due to one childbirth are responsible for only 1-2 percentage point reduction in the size of the wage gap. These

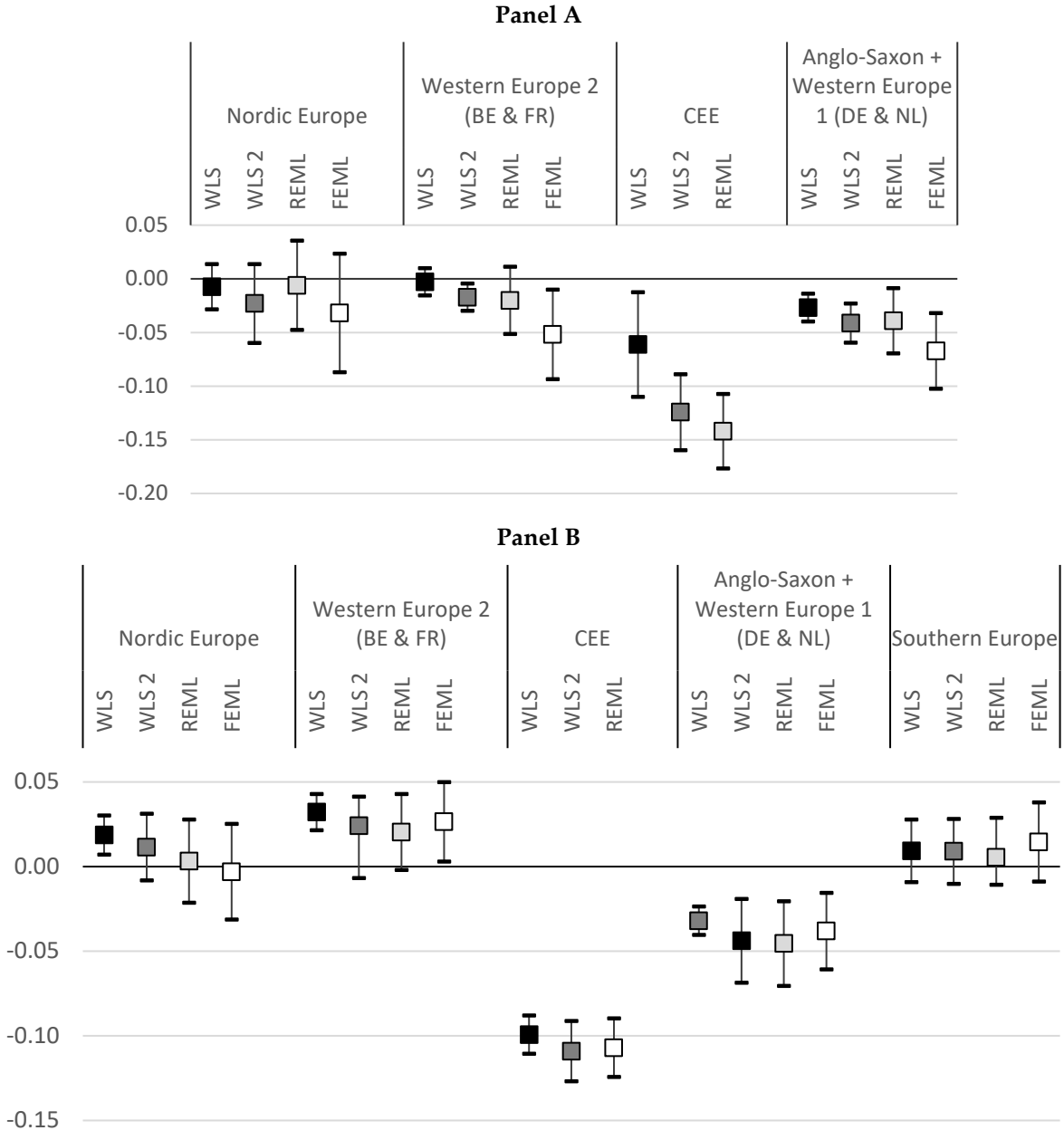
variables are, however, statistically significant only in the first model that is based on WLS with weights specified as $1/SE^2$ and turn out to be irrelevant in the other models. Factors that are in line with compensating wage theory seem to explain a higher proportion of the motherhood wage gap resulting from having one child than human capital characteristics. What matters here particularly strongly is the sector of work. Mothers of one child working in the private sector experience much higher wage penalties than mothers in the public sector – this difference amounts to as much as 11-15 percentage points. Choice of occupation further contributes to motherhood wage penalty - our results show that the gap of around 3-4.5 percent (depending on the model) increases by approximately 0.7-1.4 percentage points if occupation is omitted from the wage equation. Furthermore, we observe a significant difference in the size of the gap between married and single women. However, in contrary to the specialization argument, the gaps are larger among single women and smaller among married women.

For both models, we find lower gaps in the early seventies and even lower ones in years following 2010. We hypothesize that less negative gap estimates in the beginning of the empirical research on motherhood wage gap may reflect mothers' selective allocation into work, as women who had high opportunities and earnings prospects might have been more prone to come back to work after giving birth to a child. Lower wage gaps for recent years may reflect changing gender norms and attitudes towards mothers at work that are becoming more egalitarian and improving conditions for work and family reconciliation which allow mothers to continue working after a birth.

Finally, the following country clusters turned out to be significant in both models (for the total number of children and one child): the Nordic countries, group 2 of Western European countries (Belgium and France) and Central and Eastern European countries. We additionally obtained significant estimates for Southern European countries in the model for one child, which was the only model which covered this country group. Two groups – the Anglo-Saxon countries and conservative Western European countries (West Germany and the Netherlands) – were dropped from the model within the general to specific procedure. This means that the motherhood wage gaps are not significantly different in these two country groups and both country groups constitute a reference category.

Because of the way in which the explanatory variables are defined (i.e. dummy variables equal to one if some characteristic is not included and zero otherwise), the constants obtained in these models equal to the residual motherhood wage gaps for the reference country group. The residual motherhood wage gap is the wage gap which persists even if all the relevant factors that are behind the raw difference in wages between mothers and non-mothers are accounted for. The coefficients obtained for country clusters indicate by how much bigger the residual motherhood wage gap is in these clusters compared to the group of Anglo-Saxon and conservative Western European countries. Using the constant and these coefficients, we computed the residual motherhood wage gaps across the different country clusters (see Figures 2 A-B).

Figure 2
Predicted gaps with 95 % confidence intervals by country clusters: wage gaps associated with the total number of children (Panel A) and wage gaps associated with having one child (Panel B)



Consistent with our expectations, we find that mothers in Nordic countries and the country cluster composed by Belgium and France experience no wage disadvantage compared to childless women (after taking into account differences in human capital, selection to certain jobs and occupations, etc.). The residual wage gap from having one child is even slightly positive in these two groups of countries. Mothers are widely present in the labor market, often on a full-

time basis. They are offered good access to public childcare and their economic activity is highly socially accepted. In addition, Nordic countries strongly support fathers' involvement in childcare and thereby weaken gender inequalities in the labor market.

Interestingly, we also find no residual motherhood wage gap in Southern Europe (Figure 2B). This finding might be surprising since the conditions for work and family reconciliation in Southern Europe are far worse than in the Nordic countries, Belgium or France (Matysiak and Weziak-Bialowolska, 2016). We suspect thus that our findings are driven by strong selection of mothers to paid work as the employment of mothers in this region is low (OECD, 2017). Such selection was shown to be an important determinant of women's wages in the meta-regression for the effect of the total number of children on women's wages, but not in the meta-regression for the effect of one child, which was the only one that covered Southern Europe. We thus suspect that the residual wage gap for Southern Europe may reflect mothers' selective allocation into work.

The residual motherhood wage gap in the Anglo-Saxon and Western European cluster composed of Germany and the Netherlands is already negative. The point estimates for one child suggest the gap at the level of 3-4.5 percent, and for the total number of children of around 2.7-6.7 percent. Overall, the finding that the gap is negative was expected given the relatively poor conditions for work and family reconciliation in the two regions, where following a birth women massively opt for part-time employment and remain in this employment form even when the children are already at school.

The largest unexplained motherhood wage gaps are seen in Central and Eastern European countries. Specific estimates show that motherhood wage gap associated with having one child is the greatest here and amounts to around 9-10.9 percent, which is approximately 6 percentage points larger than in Anglo-Saxon countries, Germany and the Netherlands. The group of CEE countries, however, includes only Poland and Ukraine, and a closer inspection of the results suggests that this result is predominantly driven by Ukraine, in which the estimated gaps are high, with the averages of -14 percent for total number of children and -13 percent for one child. The respective averages for Poland are smaller and lie in the 0-2 percent range. This finding for Poland is consistent with research on the relationship between women's employment and childbearing (e.g. Matysiak and Vignoli 2013) and shows that Polish women tend to return to employment relatively quickly compared to, for instance, mothers in Italy, where combining paid work and care is equally hard.

7. Conclusion

This paper summarizes existing empirical research on motherhood wage penalty by performing a meta-analysis of the estimates of mothers'-non-mothers' gaps in wages. Previous research distinguished several mechanisms to explain the persistence of the wage gap between mothers and childless women. These mechanisms include: (1) depreciation of human capital and its lower accumulation during career breaks following childbirth, (2)

mothers' tendency to choose flexible jobs that give them better opportunities to combine childcare with paid work, (3) productivity differences between mothers and childless women, (4) women's selection into paid work and motherhood, and (5) employers' discrimination against mothers. Based on the previous empirical work it is, however, difficult to conclude how large the gap is and which factors drive it, because the studies differ in terms of the data sources, time coverage, and estimation methods used. For the same reasons, it is also not easy to judge how the size of the motherhood penalty is affected by country context, such as culture and family policies.

In this paper, we used meta-analysis to systematize existing empirical literature on the motherhood wage penalty in order to assess the relevance of the mechanisms that have been argued to explain the gap and the role of country-specific institutional and cultural context. By collecting information on the size of the wage gaps from previous studies, along with the information on data, methods, and study designs, we were able to infer which factors are the main contributors to the wage gap and how the size of the motherhood wage gap varies across countries, while controlling for other sources of its heterogeneity.

Based on 208 wage effects associated with having exactly one child and 245 wage effects associated with the total number of children collected from 39 journal articles, we find an average motherhood wage gap of around 3.7 percent. The meta-regression analysis reveals that the wage gap associated with total number of children is predominantly driven by mothers' lost experience and tenure as well as child-related work interruptions. Mother-friendly work conditions are also important but their relative role is not as high as the role of the human capital lost during the employment breaks. The theory of compensating wage differential is more relevant for explaining wage gaps associated with one child. The most important factors explaining these gaps are the choice of sector of work and occupation. Furthermore, we also find that selection into work substantially lowers the motherhood wage gap, which means that the sample of working mothers is a selected sample of highly motivated-highly paid women for which the negative wage effect of motherhood is small. Other mechanisms, i.e. related to work effort or specialization, do not receive much support in our analysis. In fact, we even find that single women experience higher wage gaps due to motherhood than married women, which speaks against the specialization hypothesis. We also find that lower educated women face stronger wage penalties, which is not consistent with the argument by Anderson et al. (2003) that low educated women work in jobs which require lower work effort and thus should experience lower wages penalties due to motherhood.

We also find that motherhood wage gaps depend on the country context. In Nordic countries, the cluster composed of Belgium and France, and Sothern Europe the motherhood wage gap is fully explained by human capital differences between mothers and non-mothers and arguments consistent with compensating wage differential theory. While in the case of Nordic Europe, Belgium and France this finding likely reflects institutional context that favors mothers' employment, in the case of Southern Europe low gaps are likely due to the low female employment level, and thus selective allocation to

work, that is seen in these countries. In the remaining country groups, i.e. Anglo-Saxon, Western Europe composed of Germany and the Netherlands and CEE, composed of Poland and Ukraine, we found clearly negative residual motherhood wage gaps. This means that other factors, apart from human capital differentials or selection of mothers into family-friendly jobs, are responsible for the fact that mothers earn less than childless women. This unexplained difference in wages amounts to 3-6 percent in Anglo-Saxon countries and Germany and the Netherlands and 6-14 percent in the CEE – depending on the model used in meta-analysis.

Our analysis suffers from several limitations. First, we were able to investigate the role of only some of the mechanisms behind the motherhood wage gap (e.g. deterioration of human capital, compensating wage differential or selection into work), but we could not, with the available data, study the role of discriminatory practices of employers. Furthermore, our test of work effort theory was limited to only two variables (sample restriction to highly educated women and mean age of the sample). Future research should thus pay more attention to these two competing hypotheses, to evaluate their role in shaping motherhood wage gaps. Second, the analysis is largely limited by low cross-country variation in the collected estimates of the motherhood wage gaps, especially the ones that relate to the total number of children. The limited number of estimates may drive some of our findings. In particular, for CEE countries we succeeded in collecting estimates only for Poland and Ukraine and having information for more countries in the cluster would allow a more accurate assessment of the situation in the region. Furthermore, given the limited number of estimates per country cluster we were not able to investigate whether the role of the mechanisms behind the motherhood wage penalty (e.g. human capital differences between mothers and non-mothers or selection of mothers into family-friendly jobs) is different across country groups. One can imagine, however, that women may be more likely to choose family-friendly jobs in countries where public support for work and family reconciliation is weaker and thus the selection into these types of jobs may explain a larger proportion of the motherhood wage penalty in these settings. Future research should thus investigate more closely whether the mechanisms behind the motherhood wage gap differ across various institutional and cultural contexts.

References

Albrecht, J. W., PA. Edin, M. Sundstrom and S.B. Vroman. 1999. Career Interruptions and Subsequent Earnings: A Reexamination Using Swedish Data. *Journal of Human Resources* 34(2), pp. 294-311.

Amuedo-Dorantes, C. and J. Kimmel. 2005. The Motherhood Wage Gap for Women in the United States: The Importance of College and Fertility Delay. *Review of Economics of the Household* 3, pp. 17-48.

Anderson, DJ. M. Binder And K. Krause. 2003. The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, And Work-Schedule Flexibility. *Industrial and Labor Relations Review* 56(2), pp. 273-294.

Angrist, JD. and WN. Evans. 1998. Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size. *The American Economic Review* 88(3), pp. 450-477.

Baker, M. and K. Milligan. 2008. How Does Job-Protected Maternity Leave Affect Mothers' Employment and Infant Health? *Journal of Labor Economics* 26(4), pp. 655-691.

Baranowska-Rataj, A., A. Matysiak. 2016. The Causal Effects of the Number of Children on Female Employment - Do European Institutional and Gender Conditions Matter? *Journal of Labor Research* 37(3), pp. 343-367.

Becker, Gary S. 1981. *A Treatise on the Family*. Cambridge, Mass.: Harvard University Press.

Becker, Gary S. 1985. Human Capital, Effort, and the Sexual Division of Labor. *Journal of Labor Economics* 3(1, part 2), pp. S33–58.

Berghammer, C. 2014. The return of the male breadwinner model? Educational effects on parents' work arrangements in Austria, 1980–2009. *Work, employment and society* 28(4), pp. 611-632.

Bettio, F., and J. Plantenga. 2004. Comparing care regimes in Europe. *Feminist Economics* 10(1), pp. 85-113.

Borenstein, M., LV. Hedges, JPT. Higgins and HR. Rothstein. 2009. *Introduction to Meta-Analysis*. Chichester: WILEY.

Budig, M. and P. England. 2001. The Wage Penalty for Motherhood. *American Sociological Review* 66(2), pp. 204-225.

Budig M., J. Misra and I. Boeckmann 2012. The motherhood penalty in cross-national perspective: The importance of work–family policies and cultural attitudes. *Social Politics: International Studies in Gender, State & Society* 19, pp. 163–193.

Budig M., J. Misra and I. Boeckman. 2016. Work–Family Policy Trade-Offs for Mothers? Unpacking the Cross-National Variation in Motherhood Earnings Penalties. *Work and Occupations* 43(2), pp. 119–177.

Clarke, D. 2014. General-to-specific modeling in Stata. *Stata Journal* 14(4), pp. 895-908.

Cohn, LC. And BJ. Becker. 2003. How Meta-Analysis Increases Statistical Power. *Psychological Methods* 8(3), pp. 243-253.

Correll, S., S. Benard and I. Paik. 2007. Getting a Job: Is There a Motherhood Penalty? *American Journal of Sociology* 112(5), pp. 1297-1338.

Cukrowska-Torzewska, E. 2017. Cross-Country Evidence on Motherhood Employment and Wage Gaps: The Role of Work–Family Policies and Their Interaction. *Social Politics: International Studies in Gender, State & Society* 24 (2), pp. 178-220.

Gupta, ND. and N. Smith. 2002. Children and Career Interruptions : The Family Gap in Denmark. *Economica* 69 (276), pp. 609–29.

Davies, R and G, Pierre. 2005. The family gap in pay in Europe: A cross-country study. *Labour Economics* 12, pp. 469–487.

De Linde Leonard M. and T. Stanley. 2015. Married with children: What remains when observable biases are removed from the reported male marriage wage premium. *Labor Economics 33*, pp. 72-80.

Dotti Sani, G. M. 2015. Within-Couple Inequality in Earnings and the Relative Motherhood Penalty. A Cross-National Study of European Countries. *European Sociological Review* 31(6), pp. 667-682.

Doucouliagos H. and TD. Stanley. 2009. Publication selection bias in minimum-wage research? A meta-regression analysis. *British Journal of Industrial Relations* 47, pp. 406–29.

Dupuy, A. and D. Fernandez-Kranz. 2011. International differences in the family gap in pay: the role of labour market institutions. *Applied Economics* 43, pp. 413–438.

Duvivier, Ch. and M. Narcy. 2015. The Motherhood Wage Penalty and Its Determinants: A Public–Private Comparison. *LABOUR* 29 (4), pp. 415–443.

Egger, M., GD. Smith, M. Schneider and ChE. Minder. 1997. Bias in Meta-Analysis Detected by a Simple, Graphical Test. *BMJ Clinical Research* 315(7109), pp. 629—634.

Ejrnæs, M. and A. Kunze. 2013. Work and Wage Dynamics around Childbirth. *Scandinavian Journal of Economics* 115(3), pp. 856–877.

Elingsaeter, A. and A. Leira. 2006. *Politicising Parenthood in Scandinavia: Gender Relations in Welfare States*. The Policy Press, University of Bristol

Esping-Andersen, G. 1999. *Social foundations of postindustrial economies*. New York, NY: Oxford University Press.

Felfe, Ch. 2012. The motherhood wage gap: What about job amenities? *Labour Economics* 19, pp. 59–67.

Gangl, M. and A. Ziefle. 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(2), pp. 341-369.

Gauthier, A. 1996. *The state and the family: a comparative analysis of family policies in industrialized countries*. Clarendon Press.

Giotis, G. and M. Chletsos. 2015. Is There Publication Selection Bias in Minimum Wage Research during the Five-year Period from 2010 to 2014? Economics e-journal Discussion Paper No. 2015-58.

Goldin, C. 2014. A Grand Gender Convergence: Its Last Chapter. *American Economic Review* 104(4), pp. 1091–1119.

Gornick, JC. and M. Meyers. 2003. *Families that work: Policies for reconciling parenthood and employment.* New York: Russell Sage Foundation.

Gough, M. and M. Noonan. 2013. A Review of the Motherhood Wage Penalty in the United States. *Sociology Compass* 7/4, pp. 328–342.

Haas, L. 2003. Parental Leave and Gender Equality: Lessons from the European Union. *Review of Policy Research* 20(1), pp. 89-114.

Halldén, K., A. Levanon and T. Kricheli-Katz. 2016. Does the motherhood wage penalty differ by individual skill and country family policy? A longitudinal study of ten European countries. *Social Politics: International Studies in Gender, State & Society* 23(3), pp. 363–88.

Harkness, S. and J. Waldfogel. 2003. The Family Gap In Pay: Evidence From Seven Industrialized Countries. *Research in Labor Economics* 22, pp. 369-414.

Havránek, T. 2015. Measuring Intertemporal Substitution: The Importance Of Method Choices And Selective Reporting. *Journal of the European Economic Association* 13(6), pp. 1180-1204.

Heckman, JJ. 1979. Sample Selection Bias as a Specification Error. *Econometrica* 47(1), pp. 153-161.

Hill, MS. 1979. The Wage Effects of Marital Status and Children. *Journal of Human Resources* 14(4), pp. 579-594.

Iamsiraroj S. and H. Doucouliagos. 2015. Does Growth Attract FDI? *Economics e-journal* 9(19), pp. 1-36.

Jarrell, SB. and TD. Stanley. 2004. Declining Bias and Gender Wage Discrimination? A Meta-Regression Analysis. *Journal of Human Resources* 39(3), pp. 828-838.

Javornik, J. 2014. Measuring state de-familialism: Contesting post-socialist exceptionalism. *Journal of European Social Policy* 24(3), pp. 240-257.

Kalist, D. 2008. Does Motherhood Affect Productivity, Relative Performance, and Earnings? *Journal of Labor Research* 29, pp. 219–235.

Karila, K. 2012. A Nordic Perspective on Early Childhood Education and Care Policy. *European Journal of Education* 47(4), pp. 584-595.

Konstantopoulos, S. 2006. Fixed and Mixed Effects Models in Meta-analysis. Bonn: The Institute for the Study of Labor. IZA Discussion Papers 2198.

Korenman S. and D. Neumark. 1992. Marriage, motherhood, and wages. *Journal of Human Resources* 27 (2), pp. 233–55.

Korpi, W., T. Ferrarini and S. Englund. 2013. Women's Opportunities under Different Family Policy Constellations: Gender, Class, and Inequality Tradeoffs in Western Countries Re-examined. *Social Politics: International Studies in Gender, State & Society* 20(1), pp. 1-40.

Lapuerta I., P. Baizán and M. González. 2011. Individual and institutional constraints: An analysis of parental leave use and duration in Spain. *Population Research and Policy Review* 30 (2), pp. 185–210.

Lewis, J., T. Knijn, C. Martin and I. Ostner, I. 2008. Patterns of Development in Work/Family Reconciliation Policies for Parents in France, Germany, the Netherlands, and the UK in the 2000s. *Social Politics: International Studies in Gender. State & Society* 15(3), pp. 261-286.

Lundberg, S. and E. Rose. 2000. Parenthood and the earnings of married men and women. *Labour Economics* 7(6), pp. 689-710.

Matysiak, A. 2011. *Interdependencies Between Fertility and Women's Labour Supply*. European Studies of Population 17, Springer Science+Business Media B.V.

Matysiak, A., and D. Węziak-Białowolska. 2016. Country-Specific Conditions for Work and Family Reconciliation: An Attempt at Quantification. *European Journal of Population*, pp. 1-36.

Matysiak, A. and D. Vignoli. 2008. Fertility and women's employment: A meta-analysis. *European Journal of Population* 24(4), pp. 363–384.

McDonald, P. and H. Moye. 2010. Why do English-speaking countries have relatively high fertility? *Journal of Population Research* 27, pp. 247-273.

de Linde Leonard M. and T. Stanley. 2015. Married with children: What remains when observable biases are removed from the reported male marriage wage premium. *Labour Economics* 33, pp. 72-80.

Misra J., M. Budig and I. Boeckmann. 2011. Work-family policies and the effects of children on women's employment hours and wages. *Community, Work & Family* 14 (2), pp. 139-157.

Napari S. 2010. Is There a Motherhood Wage Penalty in the Finnish Private Sector? *LABOUR* 24 (1), pp. 55–73.

Nielsen HS., M.Simonsen and M. Verner. 2004. Does the gap in family-friendly policies drive the family gap? *Scandinavian Journal of Economics* 106, pp. 721–744.

Nizalova, OY., T. Sliusarenko amd S. Shpak. 2016. The motherhood wage penalty in times of transition. *Journal of Comparative Economics* 44, pp. 56–88.

Olivetti, C. and B. Petrongolo. 2008. Unequal Pay or Unequal Employment? A Cross-Country Analysis of Gender Gaps. *Journal of Labor Economics* 26 (4), pp. 621–654.

Pettit B. and J. Hook. 2005. The structure of women's employment in comparative perspective. *Social Forces* 84 (2), pp. 779–801.

Pfau-Effinger B. 2004. Socio-historical paths of the male breadwinner model – an explanation of cross-national difference. *The British Journal of Sociology* 55(3), pp. 377-399.

Plantenga, J. (2002). Combining work and care in the polder model: an assessment of the Dutch part-time strategy. *Critical Social Policy* 22(1), pp. 53-71.

Sigle-Rushton, W. and J. Waldfogel. 2007. Motherhood and Women's Earnings in Anglo-American, Continental European, and Nordic Countries. *Feminist Economics* 13(2), pp. 55-92.

Simonsen, M. and L. Skipper 2006. The costs of motherhood: an analysis using matching estimators. *Journal of Applied Econometrics* 21(7), pp. 919-934.

Simonsen, M. and L. Skipper. 2012. The family gap in wages: What wombmates reveal. *Labour Economics* 19(1), pp. 102-112.

Stanley, TD. and H. Doucouliagos. 2016. Neither fixed nor random: weighted least squares meta-regression. *Research Syntesis Methods* 8(1), pp. 19-42.

Stanley, TD. and SB. Jarrell. 1998. Gender Wage Discrimination Bias? A Meta-Regression Analysis. *Journal of Human Resources* 33(4), pp. 947-973.

Stanley, TD. and H Doucouliagos. 2014. Meta-regression approximations to reduce publication selection bias. *Research Synthesis Methods* 5, pp. 60–78.

Stanley, TD. and H. Doucouliagos. 2016. *Meta-regression Analysis in Economics and Business.* Oxford: Routledge

Stanley, TD, Doucouliagos and Hristos 2012. *Meta-regression Analysis in Economics and Business*. Oxford: Routledge.

Thévenon O. and G. Neyer. 2014. Family policies and diversity in Europe: The state-of-the-art regarding fertility, work, care, leave, laws and self-sufficiency. Families and Societies Working Paper Series 7, pp. 2-13.

Thévenon, O. and A. Solaz. 2013. Labour Market Effects of Parental Leave Policies in OECD Countries. OECD Social, Employment and Migration Working Papers, No. 141, OECD Publishing, Paris.

Waldfogel, J. 1997. The Effect of Children on Women's Wages. *American Sociological Review* 62(2), pp. 209-217.

Waldfogel, J. 1995. The price of Motherhood: Family Status and Women's Pay in Young British Cohort. *Oxford Economic Papers* 47(4), pp. 584-610.

Weichselbaumer, D. and R. Winter-Ebmer. 2005. A Meta-Analysis of the International Gender Wage Gap. *Journal of Economic Surveys* 19(3), pp. 479–511.

Appendix

References to Articles Included in the Meta-analysis

Albrecht, J. W., PA. Edin, M. Sundstrom and S.B. Vroman. 1999. Career Interruptions and Subsequent Earnings: A Reexamination Using Swedish Data. *Journal of Human Resources* 34(2), pp. 294-311.

Amuedo-Dorantes, C. and J. Kimmel. 2005. The Motherhood Wage Gap for Women in the United States: The Importance of College and Fertility Delay. *Review of Economics of the Household* 3, pp. 17-48.

Anderson, DJ. M. Binder And K. Krause. 2003. The Motherhood Wage Penalty Revisited: Experience, Heterogeneity, Work Effort, And Work-Schedule Flexibility. *Industrial and Labor Relations Review* 56(2), pp. 273-294.

Avellar, S. and P. Smock. 2003. Has the Price of Motherhood Declined Over Time? A Cross-Cohort Comparison of the Motherhood Wage Penalty. *Journal of Marriage and Family* 68, pp. 597-607.

Bollen, K. and J. Brand. 2010. A General Panel Model with Random and Fixed Effects: A Structural Equations Approach. *Social Forces* 89(1), pp. 1-34.

Bryan, ML. and A. Sevilla-Sanzy. 2010. Does housework lower wages? Evidence for Britain. *Oxford Economic Papers* 63, pp. 187–210.

Buchmann, C. and A, McDaniel. 2016. Motherhood and the Wages of Women in Professional Occupations. *Journal of the Social Sciences* 2(4), pp. 128–150.

Budig, M. and P. England. 2001. The Wage Penalty for Motherhood. *American Sociological Review* 66(2), pp. 204-225.

Buligescu, D., D. de Crombrugghe, G. Mentesogluy and R. Montizaan. 2008. Panel estimates of the wage penalty for maternal leave. *Oxford Economic Papers* 61, pp. i35–i55.

Christina Felfe. 2012. The motherhood wage gap: What about job amenities?. *Labour Economics* 19 (2012) 59–67.

Cukrowska-Torzewska, E. 2015. She Cares and He Earns? The Family Gap in Poland. *Ekonomia* 42/2015, pp. 43-77.

Davies, R and G, Pierre. 2005. The family gap in pay in Europe: A cross-country study. *Labour Economics* 12, pp. 469–487.

Gangl, M. and A. Ziefle. 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(2), pp. 341-369.

Gash, V. 2009. Sacrificing Their Careers for Their Families? An Analysis of the Penalty to Motherhood in Europe. *Social Indicators Research* 93(3), pp. 569–598.

Glauber, R. 2012. Women's Work and Working Conditions: Are Mothers Compensated for Lost Wages?. *Work and Occupations* 39(2), pp. 115-139.

Green, CA. and MA. Ferber. 2008. The Long-Term Impact of Labor Market Interruptions: How Crucial is Timing? *Review of Social Economy* 66(3), pp. 351-379.

Gupta, ND. and N. Smith. 2002. Children and Career Interruptions: The Family Gap in Denmark. *Economica* 69(276), pp. 609–629.

Hardoy, I. and P. Schone. 2008. The family gap and family friendly policies: the case of Norway. *Applied Economics* 40, 2857–2871.

Harkness, S. and J. Waldfogel. 2003. The Family Gap In Pay: Evidence From Seven Industrialized Countries. *Research in Labor Economics* 22, pp. 369-414.

Hersch, J. 1991. Male-Female Differences In Hourly Wages: The Role Of Human Capital, Working Conditions, and Housework. *Industrial and Labor Relations Review* 44(6), pp. 746-759.

Killewald, A. and M. Gough. 2013. Does Specialization Explain Marriage Penalties and Premiums?. *American Sociological Review* 78(3), pp. 479-502.

Kühhirt, M. and V. LUDWIG. 2012. Domestic Work and the Wage Penalty for Motherhood in West Germany. *Journal of Marriage and Family* 74(1), pp. 186 – 200.

Livermore, T., J. Rodgers and P. Siminski. 2011. The Effect of Motherhood on Wages and Wage Growth: Evidence for Australia. *The Economic Record* 87, pp. 80–91.

Loughran, DS. and JM. Zissimopoulos. 2007. Why Wait? The Effect of Marriage and Childbearing on the Wages of Men and Women. *Journal of Human Resources* 44(2), pp. 326-349.

Lowen, A. and P. Sicilian. 2009. "Family-Friendly" Fringe Benefits and the Gender Wage Gap. *Journal of Labor Research* 30, pp. 101-119.

Meurs, D., A. Pailhé and S. Ponthieux. 2010. Child-related Career Interruptions and the Gender Wage Gap in France. *Annals of Economics and Statistics* 99/100, pp. 15-46.

Molina, JA. VM. Montuenga. 2009. The Motherhood Wage Penalty in Spain. *Journal of Family and Economic Issues* 30, pp. 237–255.

Moore, W. and M. Wilson. 1982. The Influence of Children on the Wage Rates of Married Women. Eastern Economic Journal 8(3), pp. 197-210.

Nizalova, OY., T. Sliusarenko amd S. Shpak. 2016. The motherhood wage penalty in times of transition. *Journal of Comparative Economics* 44, pp. 56–88.

Noonan, MC. 2001. The Impact of Domestic Work on Men's and Women's Wages. *Journal of Marriage and Family* 63(4), pp. 1134-1145.

Nsiah, Ch., R. DeBeaumont and A. Ryerson. 2013. Motherhood and Earnings: Wage Variability by Major Occupational Category and Earnings Level. *Journal of Family and Economic Issues* 34, pp. 224–234.

Staff, J. and JT. Mortimer. 2012. Explaining the Motherhood Wage Penalty During the Early Occupational Career. *Demography* 49, pp. 1–21.

Taniguchi, H. 1999. The Timing of Childbearing and Women's Wages. *Journal of Marriage and Family* 61(4), pp. 1008-1019.

Waldfogel, J. 1995. The price of Motherhood: Family Status and Women's Pay in Young British Cohort. *Oxford Economic Papers* 47(4), pp. 584-610.

Waldfogel, J. 1997. The Effect of Children on Women's Wages. *American Sociological Review* 62(2), pp. 209-217.

Waldfogel, J. 1998. The Family Gap for Young Women in the US and GB: Can Matenrity Leave Make a Difference. *Journal of Labor Economics* 16(3), pp. 505-545.

Waldfogel. J. 1998. Understanding the family gap in pay for women with children. *Journal of Economic Perspectives* 12(1), pp. 137-156.

Weeden, KA. 2005. Is there a flexiglass ceiling? Flexible work arrangements and wages in the United States. *Social Science Research* 34, pp. 454–486.

Wilner. L. 2016. Worker-firm matching and the parenthood pay gap: Evidence from linked employer-employee data. *Journal of Population Economics* 29(4), pp. 991–1036.

Table A. 1
Mean values of the independent variables used in meta-regression

Variable Type	Variable Name	Sample of Total Number of Children (n=245)	Sample of One Child (n=208)
Human capital theory	Age	0.298	0.192
	Education	0.412	0.207
	Experience	0.371	0.471
	Potential experience	0.967	0.793
	Tenure	0.763	0.538
	Interruptions	0.624	0.880
Compensating Wage Differentials	Occupations	0.759	0.793
	Industry	0.829	0.582
	Hours	0.698	0.688
	Sector	0.800	0.832
	Work conditions	0.776	0.933
Marriage	Marriage	0.473	0.255
Selection to Motherhood	Motherhood_sel	0.433	0.572
Selection to Work	Work_sel	0.645	0.798
Sample and Data	Mean_age	-0.183	-0.395
	Panel	0.784	0.899
Sample Restriction	S_married	0.151	0.043
	S_singles	0.155	0.082
	S_highly_educated	0.041	0.019
	S_lower_educ	0.029	0.019
	S_public	0.008	0.019
	S_private	0.008	0.091
	S_fulltime	0.143	0.101
	S_parttime	0.000	0.010
Time Coverage	Seventies	0.151	0.139
	Eighties	0.539	0.409
	Nineties	0.853	0.846
	Two_thousand	0.457	0.308
	Two_ten	0.041	0.111
Geographical Coverage	Nordic Europe	0.114	0.106
	Western Europe 1	0.033	0.130
	Western Europe 2	0.192	0.087
	Anglo-Saxon	0.620	0.510
	Central and Eastern Europe	0.041	0.053
	Southern Europe	0.000	0.115

Table A. 2
Definition of country clusters and the distribution of the effect sizes collected as of July 2017

Country/MS Measure	Total Number of Children	One child
Northern Europe (social-democratic)		
Denmark	4	10
Finland	8	3
Sweden	16	9
% of total	**11%**	**11%**
Western Europe 1		
Germany	43	14
Netherlands	4	4
% of total	**19%**	**9%**
Western Europe 2		
France	8	23
Belgium	.	4
% of total	**3%**	**13%**
Anglo-Saxon countries (liberal)		
US	119	68
UK	25	22
Australia	4	9
Canada	4	3
Ireland	.	4
% of total	**62%**	**51%**
Central and Eastern Europe		
Ukraine	6	7
Poland	4	4
% of total	**4%**	**5%**
Southern European		
Greece	.	4
Italy	.	4
Portugal	.	4
Spain	.	12
% of total	**0%**	**12%**

Table A. 3
The test for the publication bias: FAT-PAT Keta-regression

	Model 1 (Total Number of Children)	**Model 2 (One Child)**
Precision ($1/SE_i$)	-0.030***	-0.034***
	(0.011)	(0.010)
Constant (γ_0)	-1.305	-0.569
	(1.120)	(0.729)
Number of Observations	245	208
R2	0.189	0.419

Notes: Standard errors in parentheses. Standard errors are clustered at the study level.
*** p<0.01, ** p<0.05, * p<0.1

Table A. 4

Multiple meta-regression results obtained based on a reduced sample obtained by randomly dropping around 5 percent of the observations: the wage effect associated with total number of children

	WLS with Weights $1/SE_i^2$	WLS with Weights 1/sqrt(n)	REML	FEML
Constant (Motherhood Penalty)	-0.029***	-0.039***	-0.038***	-0.066***
	(-4.718)	(-4.407)	(-2.636)	(-3.774)
HUMAN CAPITAL THEORY				
Age	-0.008***	0.003	0.003	0.000
	(-4.552)	(0.547)	(0.451)	(0.017)
Tenure	-0.016**	-0.013*	-0.011	-0.000
	(-2.608)	(-1.733)	(-1.497)	(-0.006)
Interruptions	-0.017***	-0.018**	-0.017**	-0.020***
	(-2.882)	(-2.379)	(-2.104)	(-7.225)
Experience	-0.022***	-0.040***	-0.036***	-0.036***
	(-3.145)	(-4.373)	(-3.937)	(-4.482)
COMPENSATING WAGE DIFFERENTIALS				
Industry	0.019**	0.038***	0.036***	0.034***
	(2.109)	(3.049)	(3.298)	(3.554)
Work Conditions	-0.024***	-0.020**	-0.018**	-0.022***
	(-3.545)	(-2.171)	(-2.265)	(-2.828)
S_private	-0.007*	-0.031*	-0.014***	-0.005
	(-1.953)	(-1.735)	(-4.529)	(-1.119)
SELECTION TO WORK				
Work_sel	0.048***	0.044***	0.029***	0.033*
	(8.752)	(7.353)	(2.697)	(1.933)
WORK EFFORT				
S_lower_educ	-0.019***	-0.025**	-0.016*	0.005
	(-5.179)	(-2.617)	(-1.833)	(0.241)
CALENDAR TIME				
Seventies	0.032***	0.033***	0.029***	0.033***
	(6.420)	(8.320)	(7.011)	(73.066)
Eighties	-0.039***	-0.050***	-0.040**	dropped
	(-8.439)	(-4.118)	(-2.574)	
Two_ten	0.039***	0.062***	0.112***	dropped
	(4.272)	(5.767)	(11.499)	
COUNTRY GROUPS				
Nordic Europe	0.020***	0.021	0.035***	0.037**
	(3.109)	(1.275)	(2.577)	(2.432)
Western Europe 2 (Belgium&France)	0.025***	0.026***	0.021***	0.020***
	(4.186)	(3.669)	(4.792)	(2.900)
CEE	-0.033	-0.081***	-0.101***	dropped
	(-1.638)	(-5.391)	(-11.365)	
Number of Observations	234			

Notes: t-statistic in parentheses. Standard errors are clustered at the study level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A. 5
Multiple meta-regression results obtained based on a reduced sample obtained by randomly dropping around 5 percent of the observations: the wage effect associated with one child

	WLS with Weights $1/SE_i^2$	WLS with Weights 1/sqrt(n)	REML	FEML
Constant (Motherhood Penalty)	-0.027***	-0.033***	-0.027***	-0.029***
	(-5.361)	(-4.916)	(-2.580)	(-2.853)
HUMAN CAPITAL THEORY				
Age	0.013**	0.011	0.005	-0.004
	(2.397)	(1.332)	(0.449)	(-0.220)
Interruptions	-0.021***	-0.016*	-0.021***	-0.024**
	(-4.543)	(-1.828)	(-2.966)	(-2.764)
COMPENSATING WAGE DIFFERENTIALS				
Occupations	-0.009***	-0.010*	-0.013**	-0.015**
	(-3.187)	(-2.079)	(-2.164)	(-2.261)
Sector	-0.003**	-0.001	0.003	0.003
	(-2.141)	(-0.335)	(0.413)	(0.486)
S_private	-0.160***	-0.124***	-0.108***	dropped
	(-36.070)	(-10.083)	(-6.127)	
SEX SPECIALIZATION				
S_married	0.018***	0.029***	0.021***	0.019***
	(5.010)	(3.183)	(5.086)	(6.300)
S_singles	-0.016***	-0.008	-0.011*	-0.017***
	(-5.279)	(-1.119)	(-1.929)	(-17.394)
CALENDAR TIME				
Seventies	0.022***	0.020**	0.019*	0.007
	(4.304)	(2.701)	(1.707)	(0.478)
Eighties	-0.013*	-0.015	-0.008	dropped
	(-1.953)	(-1.437)	(-0.738)	
Nineties	0.008**	0.005	-0.005	dropped
	(2.363)	(0.684)	(-0.463)	
Two_ten	0.102***	0.067***	0.061***	dropped
	(22.806)	(6.264)	(5.219)	
GEOGRAPHICAL COVERAGE				
Nordic Europe	0.041***	0.047***	0.040***	0.030***
	(6.518)	(6.569)	(4.381)	(5.227)
Western Europe 2 (Belgium&France)	0.060***	0.063***	0.062***	0.061***
	(10.152)	(14.229)	(25.056)	(77.909)
CEE	-0.082***	-0.082***	-0.075***	dropped
	(-13.980)	(-18.109)	(-9.716)	
Southern Europe	0.037***	0.047***	0.047***	0.049***
	(3.626)	(6.918)	(10.181)	(62.627)
Number of Observations	195			

Notes: t-statistic in parentheses. Standard errors are clustered at the study level.
*** p<0.01, ** p<0.05, * p<0.1.

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