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Institutional Context and the Effect of Childcare on Maternal Labor Supply - a Cutoff-Based Cross-Country Analysis

INSTITUTIONAL CONTEXT AND THE EFFECT OF CHILDCARE ON MATERNAL LABOR SUPPLY
- A CUTOFF-BASED CROSS-COUNTRY ANALYSIS

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ABSTRACT

Previous evidence from single country studies suggest that estimates of the effect of subsidized childcare availability on maternal labor force participation vary greatly by the institutional context. We provide estimates of the childcare effect for 9 EU countries and assess their interactions with other institutional factors (such as leave policies, labor market flexibility and norms), based on harmonized data and the same quasi-experimental methodology. The identification of the childcare effect is based on birthdate-based kindergarten eligibility cutoffs specific to each country. We estimate the effect using instrumental variables for each country, then utilize the cross-country variation in institutional characteristics to analyze the causes of the variability in childcare effect estimates across contexts. To do so, we combine individual data from the EU-LFS, country and year level institutional variables collected from various sources, and information on eligibility cutoffs gathered from country experts and verified using EU-SILC data on childcare enrollment. The results suggest that the childcare effect is higher in countries where the leaves are longer and the availability of informal care is lower. The analysis is of use to policymakers from various countries in evaluating the potential impact of further childcare expansion.

Keywords: subsidized childcare, maternal labor force participation, maternal labor supply, institutional context

JEL Codes: H24, J13, J22

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1. INTRODUCTION

Previous evidence on the effect of subsidized childcare availability on maternal labor force participation (LFP) suggests that the effect varies greatly among countries due to differences in their institutional and cultural contexts (Cascio et al., 2015a; Vuri, 2016). Yet there is little evidence on the interdependencies of childcare availability and other factors, and policymaking is mostly limited to general targets for childcare coverage – for example, the EU’s Barcelona Targets¹ – that are not linked to reforms of other potential limiting factors. This paper provides quasi-experimental estimates of the childcare effect for 9 EU countries² (Austria, Czech Republic, Estonia, France, Greece, Hungary, Italy, Portugal and Slovakia) with varying institutional contexts, based on harmonized data and the same quasi-experimental methodology. The exogenous variation in childcare availability comes from country-specific kindergarten eligibility cutoffs around age 3 of children. Based on these cutoffs, we estimate the childcare effect by country, and utilize the cross-country variation in their institutional environments to assess the interdependencies of childcare and other contextual factors. The analysis combines two strands of literature: quasi-experimental single country estimates of the childcare effect, and policy analyses based on cross-country comparisons of country-level institutional indicators and maternal outcomes. We rely on evidence from these previous studies to determine which institutional factors play an important role in determining maternal labor force participation.

Methodologically, recent research on the childcare effect has increasingly turned towards quasi-experimental methods based on policy changes or birthdate-based eligibility cutoffs. While these allow for better identification of the childcare effect due to the exogenous source of variation, they are local in nature, and therefore highly dependent on the estimation context. The results of single country estimates vary accordingly, as they come from very different institutional settings and measure the impact at various child ages. One study highlights the relevant factors that most probably drive the differences (Cascio et al.,

¹ The European Union set specific targets for its countries in 2002 and renewed them in the Europe 2020 Strategy, prescribing a 33% coverage rate for children under 3, and a 90% coverage rate for those between 3 and the mandatory school age by 2010 (EC, 2013, 2008). While most previous estimates pertain to western countries with relatively supportive environments and already high maternal labor supply rates, little evidence is available from settings with very different institutional contexts, such as the Southern and Central-Eastern European (CEE) countries. Since most of these countries are significantly behind in fulfilling their obligations and expansion places a high financial burden on them, it is important to assess the expected labor market impact accurately given their particular context.

² The current version of the paper is based on 9 countries, but we are currently working on adding at least 3 further countries as the data becomes available. Latvia, Lithuania and Poland are potential candidates.

2015b), based on a review of a set of single country estimates. First, the actual labor supply of mothers affected by the treatment - i.e. its level prior to treatment - is key, since the scope for policy to increase labor supply would be limited by an already high rate. Second, interdependencies with other institutional elements - such as child-related leaves, labor market flexibility, and cultural norms - are also important. Quasi-experimental evidence from various countries is in line with these points. No effect or a very small effect was found in the US (Cascio, 2009; Fitzpatrick, 2010), and France (Givord and Marbot, 2015), where maternal employment rates of the treated were already high. A more significant impact was found in Spain (Nollenberger and Rodríguez-Planas, 2015), in 1996 Germany (Bauernschuster and Schlotter, 2015), and in Hungary (Lovasz and Szabo-Morvai, 2013) in settings where pre-treatment maternal employment rates were significantly lower. Some studies provide an analysis of the role of the leave system and cultural views in constraining the childcare effect (Givord and Marbot, 2015; Nollenberger and Rodríguez-Planas, 2015), and that of highly qualified mothers and the lack of childcare alternatives in magnifying it (Bauernschuster and Schlotter, 2015).

While quasi-experimental studies generally focus on the effect of a single policy, a strand of policy literature analyzes the roles of a set of family policies and cultural norms on maternal labor supply based on cross-country comparisons (Boca et al., 2009; Cipollone et al., 2014). These studies generally find that the availability of childcare - especially under age 3 -, the existence of job-protection and well-paid leave that are neither too short nor too long, flexible job opportunities, and cultural support for maternal employment lead to differences in the employment participation and working hours of mothers compared to childless women (Boeckmann et al., 2014). These articles provide our basis for considering which institutional elements to include in the cross-country analysis of the childcare effect.

So far, direct evidence on the interactions of childcare and other factors is scarce. One study shows that cultural attitudes moderate the impact of policies on women's earnings across countries (Budig et al., 2012). Another study estimates the effect of various policy measures on maternal employment and wages, based on individual level data from 28 European countries, allowing for the interaction of childcare availability and leave policies (Cukrowska-Torzewska, 2015). The findings indicate that the impact of leave is dependent on childcare availability: long maternity leaves combined with high childcare coverage lead to a higher gap in the employment of mothers and non-mothers compared to settings where the coverage is low. A study from Germany analyzes the combined effect of the expansion of subsidized childcare and a simultaneous reform of the leave system that increased the benefit amount but reduced the length available (Geyer et al., 2015). They do so using a structural model, as the exogenous variation in the two factors did not occur at the same time. They find that a combination of parental leave benefits and subsidized childcare can increase maternal labor supply significantly.

Our study focuses on the estimation of the causal effect of childcare availability for several countries, utilizing the exogenous variation due to eligibility cutoffs for more precise identification, and the cross-country analysis of the childcare effect in light of further institutional factors. The analysis combines representative harmonized European Labour Force Survey (EU LFS) data from 9 countries (covering 2005-2012), country-level information on kindergarten enrollment cutoffs provided by country experts and confirmed using further data sources on enrollment, and country and year-specific institutional characteristics based on various data sources, such as the the OECD Family Database, and the European Social Survey. As a first step, we document the country-level differences in the timing of maternal labor market return process after having a child, relative to major changes in family policy elements. Next, we estimate the country-specific effect of childcare availability on maternal labor supply, using an instrumental variables (IV) method based on the eligibility cutoffs, where birthdate serves as an instrument for childcare availability. We then compare these estimates in light of further characteristics of the institutional environment based on a two-step estimation similar to those used by Horn (2009) and Jusko and Shively (2005).

The analysis makes several contributions to the literature. No previous study provides quasi-experimental childcare effect estimates from a set of countries based on a harmonized dataset and methodology that makes a direct comparison of the estimates possible. Furthermore, the paper provides cutoff-based childcare effect estimates for some countries and regions from which no previous evidence was available, and which have very different institutional contexts from those analyzed before. The cross-country analysis of the cutoff-based estimates provides new insight on interdependencies, thus we can infer to the direction of the correlations between childcare effect and the elements of the overall institutional background, which is a new type of information in the literature. The results suggest that the childcare effect is higher in countries where the leaves are longer and the availability of informal care is lower. Policymakers should therefore aim to combine policy targets and steps aimed at shaping cultural views in order to achieve the potential benefits of investment in childcare.

2. INSTITUTIONAL CONTEXT

To determine what institutional measures are most relevant to the analysis of the childcare effect, and how these should be included in our cross-country analysis, we build on previous empirical findings in the literature on the determinants of maternal labor supply. We discuss evidence on the role of each factor in determining maternal labor supply, and consider their possible interaction with childcare availability. We also discuss the available harmonized country-level measures that have been collected and included in the institutional dataset used in our empirical analysis, and describe the differences in these measures among our sample of countries.

2.1. KEY INSTITUTIONAL CHARACTERISTICS

Previous evidence on the effects of family policies on maternal labor supply come from three main sources: quasi-experimental evidence, structural estimates, and cross-country analyses. Evidence on the effect of childcare availability from single countries is non-conclusive. Several studies focus on structural models and utilize regional and time variation for identification. Some support the existence of a childcare effect (Connelly, 1992; Del Boca, 2002; Haan and Wrohlich, 2011; Kimmel, 1992; Lokshin, 2004), while others find little or no significant impact (Chevalier and Viitanen, 2005; Chone et al., 2003; Ribar, 1995). Several recent studies use exogenous variation in childcare availability related to policy changes, or utilize eligibility cutoffs to identify the childcare effect. Some find a significant positive impact (Baker et al., 2008; Bauernschuster and Schlotter, 2015; Berlinski and Galiani, 2007; Bettendorf et al., 2015; Gelbach, 2002; Givord and Marbot, 2015; Haeck et al., 2015; Hardoy and Schøne, 2015; Lefebvre and Merrigan, 2008; Nollenberger and Rodríguez-Planas, 2015), while others find no effect (Cascio, 2009; Fitzpatrick, 2010; Havnes and Mogstad, 2011; Lundin et al., 2008). Cross-country comparisons also suggest that subsidized childcare availability under age 3 of children is strongly correlated with maternal labor supply (Boeckmann et al., 2014; Budig et al., 2012).

Regarding the leave system, evidence suggests that both the lengths and the benefit amounts of the leaves available to mothers are important factors in determining maternal labor supply. Previous studies suggest that moderately long, well-paid leaves increase maternal LFP (Boeckmann et al., 2014; Keck and

Saraceno, 2013; Olivetti and Petrongolo, 2017). Very short (or non-existent) leaves constrain the opportunities of women to reenter their jobs, and discourage women from higher income households to return to work. On the other hand, very long, low-paying leaves may lead to (especially low-skilled) mothers becoming detached from the labor market and the depreciation of their skills, as well as increased statistical discrimination against mothers and women (Boeckmann et al., 2014). In our cross-country analysis, we therefore focus on two aspects of leave policies: the length of paid leave (job protection) available to mothers, and the amount of the benefit that is available to mothers during the leave. The previous evidence available on the interaction of leaves and childcare availability suggest that non-optimal leaves may restrict effect of childcare expansion (Geyer et al., 2015), and that the lack of childcare may limit positive effect of leaves (Cukrowska-Torzewska, 2015). We explore this relationship in more detail, focusing on how the leave system may enhance or limit the effectiveness of childcare.

The flexibility of labor markets is also an important factor, though it lies outside the direct realm of family policies. Empirical evidence so far mainly focuses on the effect of part-time work opportunities on maternal LFP. The employment rate of mothers with young children is strongly correlated with the availability of part-time work opportunities: part-time work may provide mothers with a means to strengthen their attachment to the labor market and keep their skills up to date, while allowing for a more gradual separation from their child. The quality (related job protection, social benefits and earnings) of the available part-time jobs also matter (Del Boca, 2002), however, such information is not available for the countries in our sample. We include the ratio of part-time work within all jobs as the most basic measure of job flexibility in our analysis.

Cultural norms are also strongly correlated with maternal outcomes, and unfavorable attitudes towards maternal labor force participation may limit the effectiveness of family policies. Studies seek to identify the effect of culture on maternal labor market outcomes in several ways. One study compares migrants with different cultural values, who live in the same economic and institutional setting, finding a significant impact (Fernandez, 2007). Other studies use various available indices describing views on child development and female employment, to show that they affect maternal outcomes (Budig et al., 2012; Fortin, 2005). The interdependencies of policies and norms have been discussed extensively in social policy studies (Pfau-Effinger, 1998), however, the relationship is very difficult to identify empirically and remains unclear (Kremer, 2007). However, evidence suggests that norms may limit the effectiveness of family policies (Budig et al., 2012). A 2010 EC report on the evaluation of the fulfillment and effectiveness of the Barcelona childcare targets also notes the importance of norms related to parenthood, institutionalized childcare, and parental preferences at the country level, and the need for these norms to be shaped through raising public awareness (Mills et al., 2014). In our cross-country analysis, based on European Values Survey data, we use some rudimentary, country-specific measures of norms and attitudes to attempt to disentangle these effects.

Finally, the role of alternative childcare options, including private and informal care, is also important to consider. Private childcare plays an important role in some western European countries, but is very scarce and unaffordable to most people in the CEE countries. On the other hand, childcare by grandparents is common in several of the countries we study, particularly the CEE and southern European countries, due to the presence of a large, inactive older population. Informal childcare may be important in allowing mothers of younger children to work, especially when formal childcare is rationed (Ghysels, 2011; Posadas and Vidal-Fernández, 2012). This may be especially true in countries where views are generally unsupportive of institutionalized care at young child ages, such as the CEE countries (Saxonberg and Sirovátka, 2006). To assess the role of informal childcare, we include in our analysis the share of childcare time spent in informal care (by grandparents or other household members except parents, other relatives, friends and neighbors) relative to all childcare time in formal and informal care.

The sample of countries included in our analysis is determined by data availability and the existence of kindergarten eligibility cutoffs that are necessary for the identification strategy. However, the countries included differ significantly in terms of their institutional environments like family policies, and cultural norms. Table 1 summarizes the above described characteristics that play an important role in shaping maternal labor supply for the countries in our analysis. It reveals significant differences in institutional contexts among the countries included in our sample. Childcare enrollment rates, our main focus, themselves reveal significant cross-country variation, especially for children at age 2. France represents the western countries with rates well above the other countries at both age 2 and 3. The former socialist CEE have very low rates at age 2 of under or just above 10 percent, and Austria and Greece lie in the middle.

Table 1: Institutional characteristics of the countries

Country	Childcare enrollment at age 2 (%) ^a	Childcare enrollment at age 3 (%) ^a	Informal childcare (%) ^a	Total paid leave length (weeks) ^b	Total leave - average replacement rate (%) ^b	Cash benefits at age 3 (%) ^b	Share of female part-time in employment (%) ^c	Norms (Importance of family relative to work) (%) ^d
Austria		55	19	60	85	13	68	8
Czech Republic	7	42	24	110	51	16	13	12
Estonia	45	79	16	166	51	6	11	10
France	58	86	7	42	45	12	37	8
Greece	29	49	32	43	54	5	9	5
Hungary	17	60	20	160	44	23	9	11
Italy	38	81	18	47.7	53	5	38	11
Portugal	55	64	18	30.2	66	5	9	7
Slovakia	7	42	24	164	51	16	13	12

^a Own calculations using EU-SILC data for years 2005-2012 based on the methodology of OECD Family Database.

^b Source: OECD Family Database ^c Own calculations using EU-LFS ^d Own calculations using European Values Survey

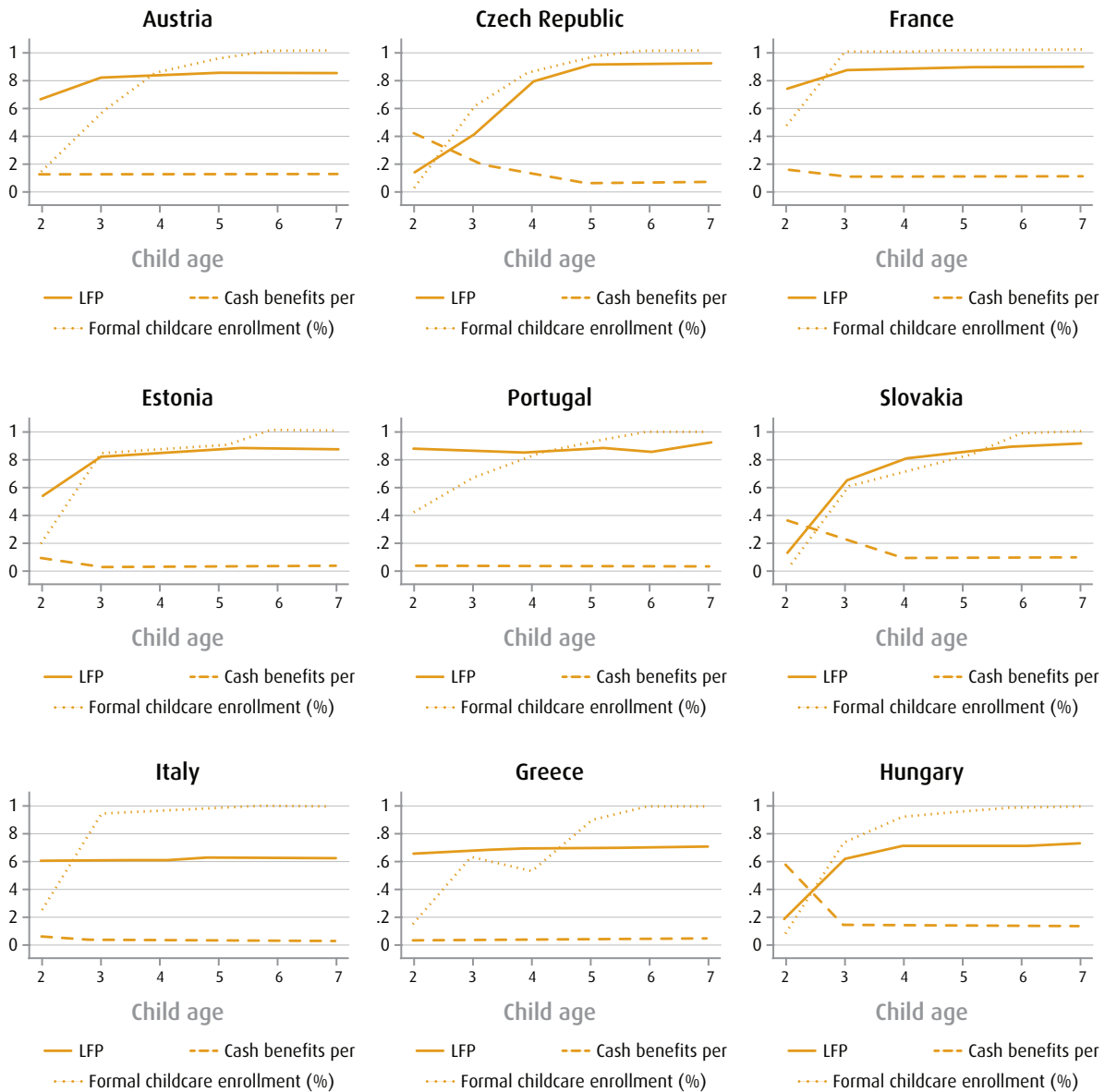
In terms of leaves, the CEE countries have very long, low paying leaves, while the other three countries have shorter, mostly better paid leaves. Part-time job opportunities are scarce in the CEE countries and Greece. In terms of norms regarding maternal employment with a small child, France shows the most favorable views, while Austria and Greece are the most traditional. Overall, we can say that the three CEE countries are similar in these characteristics likely due to their shared socialist heritage, with its legacy of institutions that do not support maternal employment, and views that are less supportive than the most liberal western countries, but more supportive than the traditional European countries. France represents the more liberalized western countries, with institutions and norms that favor maternal employment. Austria and Greece are more difficult to categorize, being similar to western countries in some characteristics, yet less supportive than CEE countries in others (norms).

2.2. MATERNAL PARTICIPATION PATTERNS BY COUNTRY

Figure 1 depicts maternal LFP by child age for each country. It shows that the dynamics of mothers' return to the labor market as a function of the age of the youngest child is rather dispersed between the countries. The likely reason for this is the fact that the countries differ in many relevant aspects, as seen in Table 1. The four post-socialist CEE countries (Czech Republic, Estonia, Hungary, Slovakia) show the lowest rates under age 3 of children – in line with institutions that do not support employment under age 3 – but high rates at older child ages. The evolution of maternal LFP appears to be closely correlated with the evolution of childcare enrollment, and negatively correlated with the amount of cash benefits received related to the child. Maternal LFP rates in the southern countries (Greece, Italy, Portugal), on the other hand, are relatively stable as children age, with no significant increase when childcare enrollment increases. Cash benefits also do not change as significantly with child age. The two western European countries in our sample (Austria, France) show higher maternal employment rates at all child ages, with a small increase around the time when childcare enrollment increases, and, in the case of France, when cash benefits decrease.

Overall, the patterns suggest that for CEE countries, childcare availability, leaves, and cash benefits around age 3 of children are all factors in determining maternal LFP. In southern countries, on the other hand, these play a less important role, and mothers of young children who work are likely to utilize informal as a substitute for formal childcare. Western European countries, with moderate, well-paid leaves and a more gradual increase in childcare enrollment over time, achieve higher maternal LFP at earlier child ages, and experience less of an increase around age 3 of children.

Figure 1: Maternal return to the labor market following childbirth by country (2005-2012)



Note: The LFP rates are calculated from EU-LFS data, and the child age reflects the age of the youngest child in the household. Formal childcare enrollment rates are based on EU-SILC information and the calculation method follows that of the OECD Family Database. The information about cash benefits come from the OECD Family Database and reflect the total family cash benefit spending of each country at a given child age as a proportion of the median working-age household income.

3. DATA AND METHODOLOGY

3.1. DATA

The analysis of the LFP of mothers is based on individual-level EU LFS data from 9 countries. The sample of countries is determined by (a) the existence of a kindergarten eligibility cutoff, (b) the availability of birth date and age information of the youngest child of each mother in the EU LFS dataset, and (c) the availability of the institutional measures used to describe the context.

To determine which countries have a birthdate-based eligibility cutoff in effect, we surveyed experts from each potential country, asking for detailed information regarding kindergarten enrollment rules and their changes over time. We then verified the cutoffs using EU-SILC childcare enrollment and birth quarter data, by comparing enrollment rate means by birthdate groups over various child ages. The cutoff of the birthdate varies by country, while the enrollment date is generally September 1st, so this is when treatment occurs. This means that in different countries, the age when treated children actually enroll varies. We summarize the details of each cutoff by country in Table 2.

Table 2: Country cutoff details and sources of information

Country	Birthdate cutoff	Enrollment date	Age at enrollment (treated)	Expert information on cutoff	EU-SILC information on cutoff
Austria	March 1	September 1	2.5	yes	yes
Czech Republic	January 1	September 1	2.7	Yes	yes
Estonia	January 1	September 1	2.7	N/A	Yes
France	January 1	September 1	2.7	Yes	N/A
Greece	March 1	September 1	2.5	Yes	Yes
Hungary	January 1	September 1	2.7	Yes	Yes
Italy	June 1	September 1	3.3	N/A	Yes
Portugal	June 1	September 1	3.3	N/A	Yes
Slovakia	January 1	September 1	3.0	yes	N/A

Note: According to the country experts there were no any change in the childcare enrollment rules in the included countries during the observation period (2005-2012) of this study.

In the EU LFS dataset, the exact day and month of birth of the youngest child is excluded for data security reasons, only the age (in years) of the youngest child in the household is available. However, when we have at least 4 quarters of observations in a row, we can infer the quarter of birth by observing when their age changes. For the countries included in the analysis, we are able to construct a stochastic panel of at least 4 quarters by linking household observations over quarters.³ We then derive the birth month of the youngest child by observing in which quarter (wave) their age changes, and assigning the interview month when the older age is first observed as the quasi birthdate.⁴ It is only possible to construct such panel data for countries where data was originally collected as a panel, which limits our sample significantly. Once birth dates are derived, we include the mothers of the youngest children in each household, identified using the parent codes of the youngest child, in our dataset. We observe their labor force participation, employment, child birthdate, as well as individual and household level characteristics. Table 3 depicts some descriptive statistics of the resulting dataset.

Table 3: Descriptive statistics of the sample by country (2005-2012)

Country	# of observations	LFP (Control)	LFP (Treatment)
Austria	798	76.8%	77.4%
Czech Republic	981	23.6%	37.7%
Estonia	72	63.6%	87.2%
France	2,588	77.3%	84.2%
Greece	1,277	63.6%	65.9%
Hungary	1,635	33.8%	53.2%
Italy	252	57.1%	60.1%
Portugal	70	83.3%	84.6%
Slovakia	640	36.6%	59.2%

Finally, we link the mother-level data to country-level institutional variables gathered from various sources. In our baseline specification, we include measures of the total length of paid leave available to mothers and the average leave replacement rate (OECD Family Database), the ratio of part-time jobs to all

³ We utilize a linking procedure to link household observations over time, for each country where the data was originally collected as a panel dataset. Linking is based on exact matches (or logical increases/decreases) of 56 variables describing the household level characteristics, household composition, and individual characteristics of certain members of the household.

⁴ Households differ in their month of observation within the quarter. When we observe a change in the youngest child's age between two quarters, we know that the birthdate of the child lies between the two interview months. We assign the month of the latter interview to the child as the month of birth, so the month of birth of each child is either in the month assigned, or in the two previous months. As a result, birth dates are known to a quarterly precision, and we have birth data with a monthly frequency. We take this into consideration when determining our treatment and control groups around the eligibility cutoff by excluding the 3-month birth date groups overlapping treatment and control birth periods.

jobs of females (EU-LFS), a rudimentary measure of the public attitude towards gender roles and maternal employment, specifically, the importance of family relative to work (European Values Study) , and a measure of informal childcare usage (EU-SILC), as detailed in Table 4.

Table 4: Description of the institutional variables

Variable	Description	Data source	Data structure	
			By country	By year
Leave replacement rate (%)	Monthly average sum of paid maternity leave / Previous average wage	OECD Family Database	x	
Part-time jobs (%)	Part-time employment of females (20-50)	EU-LFS	x	x
Leave length (year)	Length of paid leave (years after birth)	OECD Family Database	x	
Family > Work (%)	Importance of family relative to work (20-50 female answers) 100 = Family is very important, work is not at all important 50 = Both are equally important 0 = Family is not at all important, work is very important	European Values Study	x	
Informal care (%)	Share of child's time spent with informal caregiver (eg. granny) / All time spent with any type of childcare	EU-SILC	x	x

3.2 EMPIRICAL SPECIFICATION

In our empirical analysis, we first estimate the childcare effect for each country, based on an eligibility cut-off-based IV methodology similar to what was used previously in an analysis of Hungary (Lovasz and Szabo-Morvai, 2013). We then turn to the analysis of the interactions of childcare and other key institutional factors.

3.2.1. CUTOFF-BASED ESTIMATES OF THE CHILDCARE EFFECT BY COUNTRY

The basic idea of the cutoff-based methodology, inspired by Angrist and Krueger, is to use the birthdate of the child to sort mothers into treatment and control groups (Angrist and Krueger, 1991). We compare the labor supply of mothers on the two sides of the cutoff when their children are of the age at which

kindergarten generally begins for the treatment group. Since in most countries kindergarten availability is significantly higher than nursery availability (see Table 5), this means that treatment mothers have a significantly higher probability of being able to enroll their children in childcare compared to control mothers. The treatment variable is defined as follows:

$$T_i = \begin{cases} 1 & \text{if } \text{cutoff date} - 5 \text{ months} \leq b_i \leq \text{cutoff date} \\ 0 & \text{if } \text{cutoff date} \leq b_i \leq \text{cutoff date} + 5 \text{ months} \end{cases} \quad (1)$$

where b_i is the youngest child's date of the birth, and the cutoff date varies by country (see Table 2).

In order for the estimated treatment effect to be unbiased, we need sorting into treatment to be random so that the groups differ only in terms of treatment status. By the standard argument of the regression-discontinuity design, the selection of mothers into the groups can be regarded random if the window around the cutoff is narrow enough: mothers of children born on December 31 can be assumed to be very similar to mothers of children born on January 1. The wider windows of 5 months around the cutoff, which are needed to ensure a large enough number of observations, mean that we need to consider certain possible sources of bias more carefully. Other age-related changes can lead to significant differences between the groups, because the average age of children in the two groups differs significantly.⁵ To separate these other effects from the childcare effect, we define the estimation sample so that we include mothers in the treatment and control groups when their children are the same age. This sampling design ensures that child age, and therefore any further age-related characteristics - for example, child development or preferences regarding separation from the child - will be the same on average in the two groups.

To estimate the causal effect, we turn to IV estimation, where treatment (T) is an instrument for childcare availability. We estimate reduced form regressions separately for each country of the following form:

$$LFP_{yi} = \beta T_{yi} + \alpha_y + X'_{yi}\pi + \xi_{yi} \quad (2)$$

where subscripts indicate yearly (y), and individual (i) variation, and LFP_{yi} is the labor force participation (LFP) dummy for individual i . The equation adjusts for a set of individual (X_{yi}), α_y represents year fixed effects. The parameter β captures the effect of belonging to the treatment group on the LFP probability. It can be interpreted as representing how much more active mothers are if they are eligible for kindergarten rather than nursery school, which has significantly lower coverage. Since these rates differ by country, the magnitude of the childcare effect estimates need to be interpreted based on their mean differences.

⁵ With 5 month windows, child age differs by an average of 5 months between the two groups at any point in time, so the effects of these differences may be significant. Preferences regarding separation from the child are also likely to change significantly during these 5 months around age 3 (Blaskó, 2011).

As a following step, a rudimentary analysis of the magnitude of the effects is provided, using a Wald estimator of the following form:

$$\beta^W = \frac{E(LFP_{yi}|T_{yi} = 1) - E(LFP_{yi}|T_{yi} = 0)}{E(C_{yi}|T = 1) - E(C_{yi}|T = 0)} \quad (3)$$

We proxy the country-specific childcare availability of the treatment and the control groups with the childcare enrollment rates of 3 and 2-year-olds respectively (reflecting country averages of kindergarten and nursery school enrollment rates).

3.2.2. TWO-STEP ANALYSIS

In the second part of our analysis, we utilize a two-step method (see for instance Horn, 2009; Jusko and Shively, 2005). The Wald estimates from the single country estimates are used as dependent variables in country-level regressions of the following form:

$$\beta_c^W = \delta_0^n + \delta_1^n * i_c^n + \xi_c \quad (4)$$

where c denotes the countries and i_c^n is the n^{th} institution in country c . β_c^W stands for the country-specific Wald estimates, with $\beta_c^W \equiv 0$ in the case of insignificant coefficient estimates. From these regressions one can infer to the partial correlations of the childcare effect and certain institutional factors.

We also define the column vector of the country-specific institutions:

$$I_c = \begin{bmatrix} i_c^1 \\ \vdots \\ i_c^n \end{bmatrix} \quad (5)$$

The result of the following regression is also presented in order to sketch the overall interdependencies of the childcare effect with the institutional background on top of the partial effects.

$$\beta_c^W = \delta_0 + \delta_1' I_c + \xi_c \quad (6)$$

From the regression results we cannot infer to causal effects whatsoever, as the institutional characteristics are endogenous. Also as the number of observations equals the number of countries included, the standard errors are not informative. Note however, that we are able to extract indicative information about the direction of the correlations between childcare effect and the overall institutional background, and such information is not yet available in the previous literature at all. The interrelations between the estimated coefficients and the institutional factors are also graphically presented.

4. RESULTS

4.1. CHILDCARE EFFECT ESTIMATES BY COUNTRY

Results from the single country regressions (Eq. 2) are reported in Table 5. As indicated in the bottom row, the kindergarten eligibility cutoff points are either on the 1st of January, March, or June, depending on the country. The estimated treatment effect is positive and significant for the Czech Republic, Estonia, France, Hungary, and Slovakia. For Austria, Greece, Italy, and Portugal, the results show insignificant, though still positive effects. The magnitude of the treatment – change in childcare availability – differs by country. In order to interpret these results, the bottom of the table shows how much treatment increases childcare availability for the treatment group relative to the control group, based on childcare enrollment rates calculated for the specific age group of the two groups. The increase in enrollment varies highly among the countries, ranging from 9 percentage points in Portugal, to a high of 43 percentage points in Hungary. Wald estimators are presented at the bottom of the table, which adjust the estimated effects based on the treatment magnitude. These also show high variability. In the next section, we examine how further institutional elements may determine the size of these estimated effects.

Table 5: Reduced form estimates by country (Eq. 2)

		Austria	Czech Republic	Estonia	France	Greece	Hungary	Italy	Portugal	Slovakia
Regression results	T	-0.001	0.087	0.222	0.085	0.032	0.137	0.084	0.008	0.161
	P-value	0.984	0.001	0.046	0.002	0.235	0.000	0.521	0.887	0.000
	Individual and family controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	N	798	981	72	2,588	1,277	1,635	252	70	640
	R ²	0.204	0.372	0.470	0.199	0.197	0.307	0.423	0.384	0.212

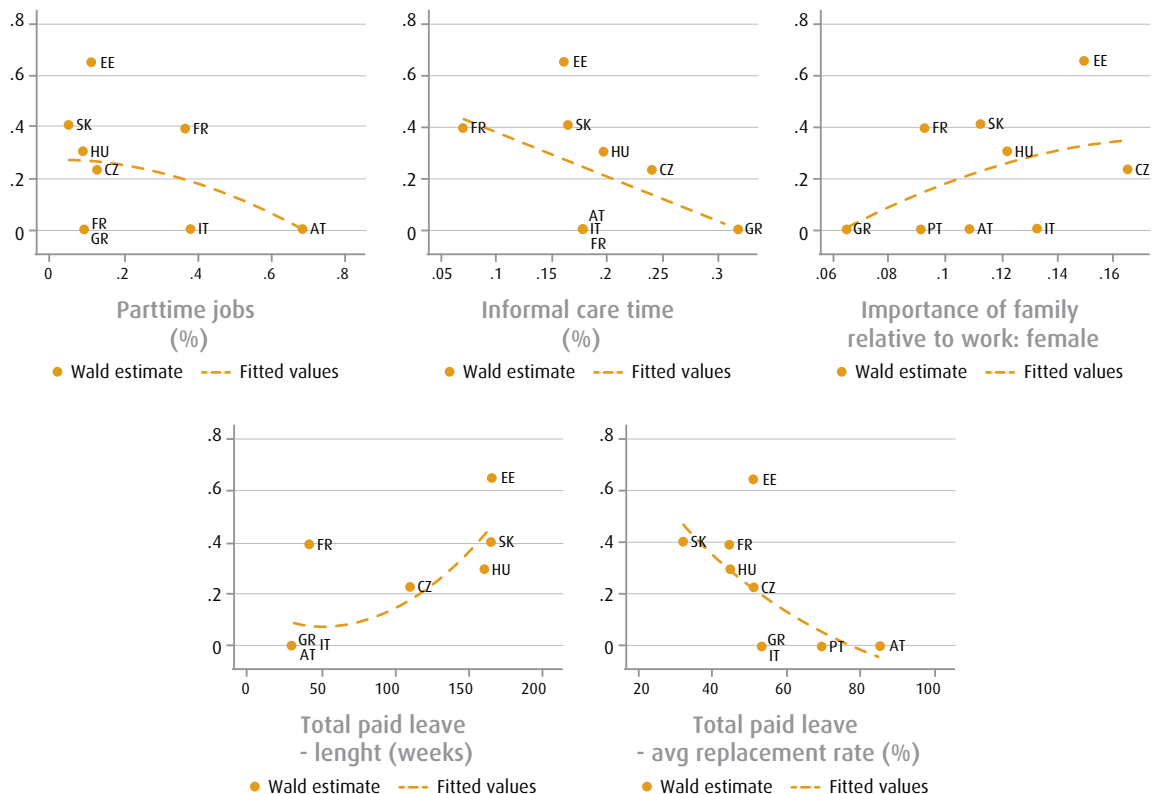
Childcare statistics	Nursery school enrollment rate at age 2 ¹	0.26	0.07	0.45	0.29	0.58	0.17	0.38	0.55	0.07
	Kindergarten enrollment rate at age 3 ²	0.55	0.42	0.79	0.49	0.86	0.60	0.81	0.64	0.46
	Difference in childcare availability	0.28	0.35	0.34	0.20	0.28	0.43	0.43	0.09	0.40
	Wald estimate	-0.002	0.250	0.654	0.415	0.113	0.315	0.195	0.094	0.406
	Birthdate cutoff ³	March 1	January 1	January 1	January 1	March 1	January 1	June 1	June 1	January 1

Notes:^{1,2} Own calculations on enrollment rates for 2 and 3 year olds in formal childcare and pre-school services. The data generally include children in center-based services, organized day care and pre-school (both public and private) and those who are cared for by a professional childminder, and exclude informal services provided by relatives, friends or neighbors. Exact definitions may however differ slightly across countries. ³ Cutoff dates based on country expert surveys.

4.2. TWO-STEP ESTIMATION RESULTS

In this section the results of the two-step estimates are discussed. First in the graphical analysis the Wald estimates are plotted against the five most important institutional factors. As is seen on Figure 2, the length and the replacement rate of the leaves and also the informal care availability seem to be fairly well correlated with the childcare effect.

Figure 2: Childcare effects and institutions



Second, the institutional variables are regressed one by one on the Wald estimates (Eq. 4). Although the number of observations (N=9) is low, still there are two policy variables with significant coefficient estimates. The longer the total paid leave, the higher childcare effect is to be expected in our set of countries. Naturally, as the length and the replacement rate are negatively correlated, the replacement rate shows a significant but negative relationship with the childcare effect. In specification (6) the results of Eq. 6 are shown. In this specification the correlation between the institutional elements are also accounted for. The signs of the estimated coefficients are not different from those in specifications 1-5. It turns out that the t-statistics of leave length and informal care are the lowest, thus we focus on these as the strongest results from the two-step analysis.

Table 6: Two-step regression estimates (Eq. 4 and 6)

Dependent variable: β_c^W	(1)	(2)	(3)	(4)	(5)	(6)
	Eq. 4	Eq. 4	Eq. 4	Eq. 4	Eq. 4	Eq. 6
Parttime jobs (%)	-0.404 (0.392)					-0.209 (0.490)
Informal care time		-1.706 (1.190)				-1.746 (1.165)
Importance of family over work			3.310 (2.629)			0.100 (2.569)
Total paid leave length				0.003** (0.001)		0.002 (0.002)
Total paid leave replacement rate					-0.009* (0.005)	-0.001 (0.007)
Constant	0.308** (0.117)	0.541* (0.236)	-0.163 (0.313)	-0.059 (0.108)	0.719** (0.265)	0.423 (0.404)
Adjusted R ²	0.008	0.117	0.068	0.502	0.258	0.448
F	1.066	2.056	1.585	9.075	3.785	2.298
AIC	1.256	0.213	0.694	-4.951	-1.359	-3.644
N	9	9	9	9	9	9

Note: specifications 1-5 are based on Eq. 4 and specification 6 is based on Eq. 6. The dependent variable is the country-specific Wald estimate indicated in Table 5, but in case of insignificant coefficients, zeros were imputed.

The results seen in Table 6 do not reflect causal relationship, as the elements of the institutional background are endogenous. For instance, the length of leave in each country has most probably been affected historically by the maternal employment possibilities of mothers. On the other hand, the length of leaves

may serve as a signal about the acceptable timing of maternal labor return, which could over years affect social norms and beliefs about how important is it for the mother to stay home with a young child. Also maternal employment possibilities, norms and leaves may be shaped by formal childcare availability under age 3 of the youngest child.

The estimation results suggest that the childcare has a larger impact on maternal LFP in countries where the leaves are longer. This may be due to the fact that in exactly these countries the maternal LFP rate is still quite low before the actual treatment, thus we can expect to observe a larger childcare effect. At the same time, the informal childcare availability shows a negative correlation with the effect of formal childcare and this is an intuitive result to think of formal and informal childcare possibilities as substitutes. The remaining institutional factors seem to be much less correlated with the formal childcare effect.

5. CONCLUSION

This study estimates the effect of childcare availability on maternal labor supply for 9 European countries with different institutional contexts, and utilizes this variation to learn about the interdependencies of childcare and other factors. We first provide comparable, quasi-experimental estimates – based on eligibility cut-offs – from several countries using harmonized data and a unified methodology. We then turn to a two-step estimation in order to show how the childcare effect estimates vary by the institutional factors. The results from the single country estimates as well as the pooled estimates are in line with previous results and theoretical expectations. Single country estimates indicate that a 10 percentage point increase in childcare enrolment rate raises the maternal LFP rate by 0-2.22 percentage points depending on country. These estimates are comparable to those of the existing literature. In response to a 10 percentage point increase in childcare availability, Nollenerger and Rodríguez-Planas (2015) found a 2 percentage point increase in maternal LFP rate in Spain, whereas Lovasz and Szabo-Morvai (2013) (Hungary) found an effect of 1.8 in Hungary, and Bauernschuster and Schlotter (2015) an effect of 3.5 in Germany. Estimates from the two-step model suggest that longer leaves, and more scarce informal care availability increase the childcare effect on maternal LFP.

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