

Müller, Kai-Uwe; Wrohlich, Katharina; Sengül, Denise

Conference Paper

Does subsidized care for toddlers increase maternal labor supply? Evidence from a large-scale expansion of early childcare

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2016: Demographischer Wandel -
Session: Evaluation of Labor Market Policies, No. A20-V1

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Müller, Kai-Uwe; Wrohlich, Katharina; Sengül, Denise (2016) : Does subsidized care for toddlers increase maternal labor supply? Evidence from a large-scale expansion of early childcare, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2016: Demographischer Wandel - Session: Evaluation of Labor Market Policies, No. A20-V1, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/145654>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Does subsidized care for toddlers increase maternal labor supply?

Evidence from a large-scale expansion of early childcare

Kai-Uwe Müller*, Denise Sengül, Katharina Wrohlich

This version: February 25, 2016

Preliminary and incomplete! Please do not quote!

This paper assesses whether there is a causal link between the provision of publicly subsidized childcare and the labor supply of mothers. We contribute to the related quasi-experimental literature by focusing on mothers with children aged 1 to 3. The effects of full-time and part-time care are disentangled. We exploit spatial and temporal variation in the expansion of publicly subsidized childcare triggered by comprehensive policy reforms. The utilization of various data sets and a systematic comparison of estimation frameworks sheds light on this relationship under different identifying assumptions. The crucial point is whether identification is restricted to quasi-experimental variation within regions. We confirm previous findings by showing the sensitivity of results to the choice of the research design, in particular the source of variation. Relying on credible exogenous variation we do not find a significant impact of childcare expansion on mothers' extensive labor supply margin. We find, however, a significant effect at the intensive margin. Our results cast doubt on previous empirical findings in terms of identification and effect size.

Keywords: childcare provision; mother's labor supply; generalized difference-in-difference

JEL classification: J22; J13; H43

* Corresponding author: German Institute for Economic Research Berlin (DIW Berlin), Mohrenstr. 58, D-10117 Berlin, Tel.: +49 30 89789 154, Fax: +49 30 89789 114, E-mail: kmueller@diw.de

1 Introduction

In light of low fertility and female employment rates the provision of public childcare has been on the agenda of many countries (Immervoll and Barber, 2006). The expansion of public childcare is supposed to increase fertility, mothers' labor market attachment, and promote childrens' development in early life. A positive effect of public childcare on maternal employment can be rationalized within an economic model of the family (Blau, 2003). The implied decrease in costs of childcare changes the relative utilities of consumption and leisure. Yet, income effects, preferences for the quality of care, or the availability of alternative modes of private care loosen this relationship. Subsidized childcare may crowd-out other forms of (private or informal) care conditional on maternal employment.

Given the theoretical ambiguity, an empirical literature on the effects of subsidized childcare has emerged. Evidence from early reduced-form studies and structural models unequivocally points to a significant impact of costs and availability of childcare on mothers' labor supply (Anderson and Levine, 2000; Blau and Currie, 2006). A different type of approach exploits quasi-experimental variation induced by policy reforms. Results from those studies are mixed. Although a majority of findings confirms the significant effect of childcare,¹ several analyses report negligible or insignificant estimates.² Moreover, effects are often found to be heterogeneous: the impact is larger for singles (compared to married mothers), women without additional young children (compared to mothers with multiple young children), for less educated mothers (compared to high-skilled women with lower elasticities), and it increases with the age of the youngest child.

In this study, we follow the quasi-experimental approach to identify potential effects of childcare availability on mothers' labor supply. We make use of two comprehensive policy reforms in Germany from 2005 and 2008 that created a suitable quasi-experimental setting. Starting from very low levels, childcare coverage for children aged 0 to 3 in West Germany more than doubled from about 8% in 2005

¹See Gelbach (2002), Blau and Tekin (2007), Berlinski et al. (2011), and Felfe et al. (2014) for examples using an instrumental variables (IV) approach and Berger and Black (1992), Berlinski and Galiani (2007), Baker et al. (2008), Lefebvre and Merrigan (2008), Lefebvre et al. (2009), Simonsen (2010), Havnes and Mogstad (2011), Nollenberger and Rodríguez-Planas (2011), and Schlosser (2011) for estimates from a difference-in-difference (DD) framework.

²See Fitzpatrick (2010) for an exemplary IV study and Lundin et al. (2008) and Havnes and Mogstad (2011) for the DD approach.

to more than 20% in 2011. We are thus able to work with a substantial increase in the provision of childcare and not only marginal changes in childcare costs. At the same time the level of public care for children aged 4 to 6 remained largely constant (Figure A1 in the Appendix). Peculiarities of the administrative process and frictions in the market for childcare led to regional variation over time. We argue that – conditional on covariates – (part of) this variation can be considered exogenous and used for identification. In this paper we assess whether there is a causal link between the provision of publicly subsidized childcare and the labor supply of mothers with children aged 1 to 3 in West Germany.

Quasi-experimental approaches sidestep some identification issues arising in structural or reduced-form estimations: decisions on a childcare arrangement and mother’s labor supply are, for instance, not made independently. Costs (sometimes the availability) of informal care are not observed. Instead, variation in the costs or provision of childcare is used that is generated by processes exogenous to mothers’ employment and childcare choices. Our study contributes to the branch of this literature which is based on regional variation in the supply of childcare (see, e.g., Havnes and Mogstad, 2011). The main problem here is whether (or which portion of) it is truly exogenous. Depending on the assumptions made different estimation strategies can be applied.

Several papers on Germany have exploited the cross-sectional part of this variation. It serves as exclusion restriction for the determination of childcare costs in structural models (Wrohlich, 2011; Haan and Wrohlich, 2011; Müller and Wrohlich, 2014), as excluded instrument in instrumental variable (IV) frameworks (Bauernschuster and Schlotter, 2013; Felfe and Lalive, 2013) or is used directly in reduced-form employment equations (Kreyenfeld and Hank, 2000; Büchel and Spieß, 2002; Schober and Spieß, 2014). Cross-sectional differences in the supply of childcare may be endogenous, however: Parents with given preferences could demand a certain amount of childcare. Childcare providers (parents) could select into a municipality with a specific demand for (supply of) childcare. Municipalities could use the provision of childcare to attract high quality labor (Felfe et al., 2014). Relying only on within-region variation may be less restrictive when the expansion of childcare as a result of policy reforms is subject to implementation frictions.

In this paper we exploit the variation across regions and over time in the supply

of childcare in order to identify the causal effect of childcare availability on mothers' labor supply. For the empirical analysis we use several waves of the German Microcensus. This data set does not contain information on the individual choice of a childcare arrangement, however, we can estimate intention-to-treat effects (ITT) of the provision of public childcare on maternal labor supply. The identifying assumptions in terms of county fixed effects, i.e. reliance on within-county vs. overall variation, turn out to be crucial for the estimated effects.

While most previous work is focused on labor force participation, we distinguish various indicators of maternal labor supply, including the intensive margin. We are furthermore able to differentiate between the provision of full-time and part-time care. Our preferred specifications include control variables at the individual and regional level that might affect mothers' labor supply and childcare decision. The estimates are further conditioned on regional determinants potentially driving the local supply of childcare.

We find significantly positive effects of subsidized childcare on maternal labor supply based on the overall variation in childcare provision. This holds for all measures of labor supply at the extensive and intensive margin. The picture, however, changes dramatically when identification is restricted to quasi-experimental within-county variation. Under these identifying assumptions, we do not find significant effects at the extensive margin but small significant effects at the intensive margin.

In line with previous assessments (Blau, 2003; Blau and Currie, 2006) we conclude that estimates based on quasi-experimental variation are very sensitive with respect to identifying assumptions and related model specifications. This has far-reaching consequences for the substantive implications of the findings. It casts doubt on previous estimates of significant participation effects – most of them did neither rely exclusively on quasi-experimental variation, nor provide robustness checks with county fixed effects.

Taking the findings based on the arguably more credible exogenous quasi-experimental variation at face value there is no identifiable extensive margin effect of the expansion of childcare for children aged 1 to 3 on their mothers' labor supply. Already employed mothers may increase their working hours, though. Comparable studies for Sweden (Lundin et al., 2008) and Norway (Havnes and Mogstad, 2011) found similar patterns. It furthermore confirms small extensive margin elasticities

of structural approaches for Germany (Wrohlich, 2011; Müller and Wrohlich, 2014). Showing that there might be a systematic difference between the extensive and intensive margin adds to the international literature, as does the flexible specification in terms of full- and part-time childcare provision.

The rest of the paper is organized as follows. Section 2 provides some theoretical considerations about the relationship between the provision of publicly subsidized childcare and maternal employment, reviews the related empirical literature, and discusses developments on the German childcare market. Section 3 describes the data for the empirical analysis. The estimation strategy is discussed in section 4 including identification issues, variable and sample definitions. Empirical results are presented in section 5 including a number of robustness checks. Section 6 summarizes the main findings and concludes.

2 Provision of childcare and maternal labor supply

2.1 Theoretical considerations

We interpret the causal impact of public childcare on the employment decision of mothers within an economic framework of the family (Becker, 1981; Blau, 2001). Mothers in single or couple households (co-)decide simultaneously on their labor supply and a care arrangement for their children by maximizing a utility function in the arguments of consumption, leisure, and quality of care subject to budget and time constraints. In terms of childcare modes a complete choice set includes maternal care, (unpaid) informal care by relatives or friends, private formal care (by nannies or for-profit providers), and formal care in publicly subsidized/financed care centers. Households might be constrained with respect to informal as well as public childcare whereas private care can always be obtained at market prices.

The provision (subsidization) of public childcare affects the budget constraint by reducing costs for this form of care. The number of alternatives in the choice set of households constrained in certain care dimensions increases. As a consequence absolute and relative prices for different modes of care are altered which affects utility in the corresponding alternatives. The substitution effect leads *ceteris paribus* to a higher utilization of public childcare and increased maternal labor supply. This is the main channel for the supposed positive relationship between subsidized childcare and mothers' employment. As Blau (2003) points out the associated income effect goes in the opposite direction. It depends on her preferences which effect dominates and whether a given woman will increase or reduce labor supply. This is one of the sources of ambiguity or heterogeneity in empirical estimates (Gelbach, 2002; Cascio, 2009).³

Including (unpaid) informal care in the analysis provides another margin of adjustment. Blau (2003) notes that the provision of subsidized childcare changes relative costs of formal and informal care conditional on employment. Likewise households might substitute between different modes of care with the labor supply of mothers remaining constant. This is one of the mechanisms cited regularly in the empirical literature for explaining small or insignificant estimates for the effect of childcare on

³This ambiguity is particularly relevant for the intensive labor supply margin and larger at in case of non-linear subsidies (Blau, 2003).

maternal labor supply (Havnes and Mogstad, 2011). Felfe and Lalive (2013) provide some evidence for this channel.

Childcare quality and parental preferences for different modes of care related to children’s well-being also influence behavioral reactions. Public childcare will only be utilized when its perceived quality is sufficiently high compared to the alternatives of maternal (or informal) care. It is conceivable – particularly for very young children – that monetary incentives do not outweigh quality considerations. This constitutes another mechanism that impedes an effect of public childcare on maternal employment.⁴

Fitzpatrick (2010) refers to another point not related to childcare. Rationed labor demand or working hours constraints can also be reasons why improved labor supply incentives do not translate into higher employment. Moreover, the strength of the relationship between childcare and mothers’ employment will depend on the context. Preferences and care cultures vary considerably across, sometimes even within countries. Germany is one example with traditionally stark contrasts between the West and the East in utilization of early care and mothers’ employment rates.

The different reasons for a loose link between childcare and employment can be qualified in terms of effect heterogeneity related to incentives or preferences. The aforementioned factors might be only binding for different sub-groups. Monetary incentives often vary between single and married or cohabiting mothers. Mothers’ decisions related to a given child will be influenced by (younger) siblings. The latter point is related to preference heterogeneity with respect to the age of a child. Mothers are in general less willing to send their children to public childcare at very young ages (Pungello and Kurtz-Costes, 1999). Womens’ level of qualification relates to heterogeneity in incentives and preferences. Empirical evidence supports these different aspects (Anderson and Levine, 2000; Blau and Currie, 2006).

To sum up, there are several reasons why the impact of publicly subsidized childcare on maternal employment might be ambiguous. Whether or not there is a significant effect depends on the empirical application. In addition to economic incentives and preferences, to the market for childcare and ‘care culture’, it depends on the population of mothers and children considered.

⁴Another (rather extreme) case is that mothers only work to finance high quality childcare. When the price for this type of care is reduced by public subsidies, these mothers might reduce their employment.

2.2 Empirical literature

Empirical studies of the relationship between public(ly subsidized) childcare and mothers' labor supply exploit different sources of variation. Childcare costs may vary at the household level, across regions, or as a result of childcare policy (reform). Using individual or regional variation of childcare costs reduced-form and structural studies estimate employment elasticities for mothers. Structural models are also used to simulate the outcomes of existing or proposed policies. Evaluation studies exploit quasi-experiments that generate exogenous variation in the costs or provision of public childcare.⁵

Early empirical studies are based on *reduced-form* employment *regressions* with the utilization of public childcare as main explanatory variable. The main methodological challenges are the endogeneity of childcare in this estimation as well as selection problems related to employment and public childcare. The literature is dominated by studies on the U.S. (Blau and Robins, 1991; Connelly, 1992; Ribar, 1992; Kimmel, 1995; Powell, 1997; Kimmel, 1998; Anderson and Levine, 2000; Han and Waldfogel, 2001; Baum II, 2002; Meyers et al., 2002). Virtually all studies find a significantly relationship between costs of childcare and maternal employment with a considerable range of estimates ranging between elasticities close to zero and below -3. Blau and Currie (2006) argue that this can be explained by methodological discrepancies (specification, exclusion restrictions, controls) and much less by different data sources and samples.

Structural approaches directly model the decisions on a childcare arrangement and maternal labor supply. Simultaneity of the care and employment choices, selectivity issues, different modes of care, and rationing on the childcare market are addressed within this framework. The first and most of the studies again refer to the U.S. (Heckman, 1974; Blau and Robins, 1988; Michalopoulos et al., 1992; Ribar, 1995; Averett et al., 1997; Blau and Hagy, 1998; Michalopoulos and Robins, 2002; Connelly and Kimmel, 2003; Tekin, 2007). More recently structural evidence is also available for Sweden (Gustafsson and Stafford, 1992), the UK (Duncan and Giles, 1996; Blundell et al., 2000a,b; Duncan et al., 2001; Parera-Nicolau and Mumford,

⁵See Blau (2003) and Blau and Currie (2006) for an overview of comparable methodological approaches on other outcomes like utilization of childcare or childrens' development. Outcomes for women include fertility (see Haan and Wrohlich (2011) for an exemplary study on Germany) or welfare receipt (see, e.g., Connelly and Kimmel, 2003).

2005), Canada (Michalopoulos and Robins, 2000; Powell, 2002; Michalopoulos and Robins, 2002), Italy (Del Boca, 2002; Del Boca and Vuri, 2007; Del Boca and Sauer, 2009), France (Choné et al., 2003), and Germany (Müller and Wrohlich, 2014). Although smaller in magnitude compared to reduced-form work, the vast majority of those studies finds significant employment elasticities. Main challenges in this framework include the endogenous access to different types of care with respect to mothers' employment and the unobserved costs or availability of informal care.

Quasi-experimental settings generated by policy reforms have been used increasingly in more recent years to circumvent some of the identification issues.⁶ When individual information on the utilization of subsidized childcare is available, the exogenous variation is used to instrument the childcare choice within an IV framework. This variation, for example, is generated by birth thresholds for the enrollment into childcare or preschool programs (Gelbach, 2002; Fitzpatrick, 2010; Goux and Maurin, 2010; Berlinski et al., 2011; Fitzpatrick, 2012). The staggered introduction or expansion of subsidies (provision of public care) across regions serves as alternative instrument (Blau and Tekin, 2007; Felfe et al., 2014).

Without household information on the choice of childcare, quasi-experimental variation is used in a DD or panel framework to identify intention-to-treat effects. Some studies exploit exogenous variation within a single state (Berger and Black, 1992) or the difference between a single treated region vs. the rest of the country (Baker et al., 2008; Lefebvre and Merrigan, 2008; Lefebvre et al., 2009). In the most common setting, childcare or preschool policies induce exogenous variation between and within several regions of a country. The effect can then be estimated in a (generalized) DD design with a region-time-specific treatment indicator, region and time fixed effects and control variables at the individual and regional level. Evidence is available for a number of different institutional contexts; see Cascio (2009) for the U.S., Berlinski and Galiani (2007) for Argentina, Lundin et al. (2008) for Sweden, Simonsen (2010) for Denmark, Havnes and Mogstad (2011) for Norway, and Schlosser (2011) for Israel. The empirical work of this paper is conducted within this framework.

Quasi-experimental studies have put the unequivocal findings from the earlier

⁶Yet another branch of the literature is based on social experiments and demonstration projects; see Gennetian et al. (2001), Blau (2003), Blau and Currie (2006), and Blau and Tekin (2007) for further references.

literature into perspective. A sizeable portion of papers fails to identify statistically or economically insignificant effects (Fitzpatrick, 2010; Lundin et al., 2008; Havnes and Mogstad, 2011). Results are often heterogeneous: employment effects turn out to be more often significant for single than married or cohabiting mothers (Goux and Maurin, 2010; Cascio, 2009). The impact on maternal employment is also repeatedly found to be absent with younger siblings in the family (Gelbach, 2002; Berlinski et al., 2011; Cascio, 2009). Related to that effects tend to be higher for mothers with older children (Goux and Maurin, 2010). Finally, less-educated mothers tend to be more responsive to subsidized childcare as they have higher elasticities than high-skilled women with a higher overall labor market attachment ().

The *evidence for Germany* is based on all three approaches. In two early studies cross-sectional variation in childcare coverage is included in reduced-form employment equations. Using the SOEP for 1996 Kreyenfeld and Hank (2000) do not get a significant effect for mothers with children below the age of 12 in West Germany. Büchel and Spieß (2002) use SOEP data for 1998, restrict the sample to preschool children and include the share of full-time slots as additional regressor. They find more significant effects for part-time employment and larger estimates for older children. Schober and Spieß (2014) use data from the SOEP and ‘Families in Germany’ (‘Familien in Deutschland’, FiD) for 2010/11. In addition to quantitative childcare indicators they include quality measures at the county level (available for one year) in an identical research design. They get insignificant quantity effects and partially significant coefficients for quality. Signs of those coefficients partially change between West and East Germany and are not always consistent with theoretical expectations.⁷

There are several structural models estimated on German data. Wrohlich (2011) develops a framework for the joint decisions on childcare and mothers’ labor supply. The most important feature of this model estimated with SOEP data from 2001 to 2003 is that it deals with rationing in the childcare market by exploiting regional variation on childcare coverage. Wrohlich finds relatively low childcare cost elasticities of labor supply (-0.13). Müller and Wrohlich (2014) extend this framework by considering childcare choices of all children in the household below the age of

⁷We consider the specification of aggregate ‘quality indicators’ problematic. The effect of care quality is not identified at this level of aggregation by including these measures as separate regressors. This applies also to the share of full-time slots in Büchel and Spieß (2002).

13 based on data from SOEP and FiD for 2010. They use individual information on access restrictions to childcare from FiD and include regional dummies in the rationing equation. Their analysis yields even smaller overall childcare cost elasticities (-0.08). These findings are plausible given the significant rationing in the West German market for childcare (Wrohlich, 2008). Both studies simulate significantly positive labor supply effects of an expansion of public childcare. This finding is also supported by two dynamic structural models based on SOEP data. Haan and Wrohlich (2011) estimate a model that jointly determines a women's labor supply and fertility decision and includes feedback effects. Bick (2011) calibrates a life-cycle framework with a detailed depiction of childcare decisions. Both studies simulate substantial employment effects as a consequence of an extended provision of care.

Most closely related to this paper are studies that exploit quasi-experimental variation at the regional (county) level.⁸ Felfe and Lalive (2013) use regional variation in the provision of publicly subsidized care for children aged 0 to 3 as an instrument for the endogenous choice of childcare in the first stage of a marginal treatment effects framework. In their estimation based on SOEP data for the years 2002 to 2008 they include fixed effects at the state, not at the county level. Although being primarily interested in child outcomes, they also look at labor supply and find substantial positive effects at the extensive margin. Bauernschuster and Schlotter (2013) analyze the effect of publicly subsidized childcare for 3 to 4 year olds on their mothers' employment based on SOEP data from 1991-2005. They exploit regionally varying cut-off rules for the access to a kindergarten place during the implementation of a reform-induced expansion of care. Although they do not observe the actual distribution of rules, they take the eligibility criterion as an instrument in the first stage of an IV model. Similar to Felfe and Lalive (2013) they control for state, but not for county fixed effects. According to their results a 10 percentage point increase in public childcare increases maternal employment 3.5 percentage points.

The work by Bauernschuster et al. (2013) is the only study for Germany that closely resembles the DD/panel design of our study (section 4). They are interested on the impact the expansion of childcare for children in the age of 0 to 3 years had on fertility. A DD specification similar to Havnes and Mogstad (2011) is used

⁸See Coneus et al. (2008) and Bauernschuster and Schlotter (2013) for alternative instruments and Bauernschuster and Schlotter (2013) for an alternative control group.

where regions with an above-median increase in childcare coverage during the period of analysis are considered as treated. Alternatively a standard fixed effects linear panel model is estimated. They use administrative data aggregated at the county level and find a significantly positive effect – a 10 percentage point increase in care lead to 1.4 more births per 1000 women (3.2%).

How does our study line up with the literature? It is based on commonly used quasi-experimental variation at the regional level. In terms of treatment intensity the policy reform is midtable, comparable to Havnes and Mogstad (2011), above Lundin et al. (2008), and below Nollenberger and Rodríguez-Planas (2011). Although being standard in the international literature, accounting for regional fixed effects in a DD or fixed effects panel framework has not been done so far in empirical studies for Germany. We analyze the effects in the West-German context with low pre-reform levels of fertility, public childcare coverage and maternal employment. This might mostly resemble Nollenberger and Rodríguez-Planas (2011) and Havnes and Mogstad (2011). Moreover, we focus on children aged 1 to 3, which has not been so much in the focus of international studies that mostly look at children above the age of 3, and we distinguish between the availability of part-time and full-time childcare.

2.3 The childcare market and policy reforms

Germany has traditionally been characterized by low fertility and labor force participation; the latter holds in particular for mothers with young children (Fig. A2 in the Appendix). Besides incentives of the tax and transfer system, social norms or attitudes towards motherhood and women’s employment, the low supply of formal childcare is often quoted as an important cause. Peculiar for Germany is a stark regional contrast: Women and mothers in the East have been much better integrated into the labor market than their peers in the West. Due to the division of the country family policies have diverged historically. Childcare coverage has therefore been much lower in West Germany, in particular for children under the age of three (Fig. A1 in the Appendix).

Except for the legal claim to a kindergarten place in the child and adolescent support law (*“Kinder- und Jugendhilfegesetz”*) of 1996, policy reforms have only been initiated since the middle of the 2000s (Spieß, 2011). The day care expansion

law (*Tagesbetreuungsbaugesetz*, TaG) adopted in 2005 explicitly addresses the demand-oriented expansion of care for children under the age of three. The law particularly aims at enhancing the quality of care by childminders (*Tagespflege*). It formulates explicit quality standards to render these equivalent to alternative childcare facilities. In December 2008 the law on support for children (*Kinderförderungsgesetz*, KiFöG) was adopted that commits states to a gradual expansion of childcare supply for children under the age of three. A binding deadline was defined when local supply has to meet demand for childcare. As of 1 August 2013 each child under the age of three is legally entitled to a subsidized childcare slot.⁹

West Germany has experienced a large expansion of publicly subsidized early childcare. The increase started from an average level of about 2% in 2002 reaching roughly 22% in 2011 (Fig. A1 in the Appendix). East Germany, in comparison, has been characterized by a high supply of formal childcare since German re-unification. Coverage for children aged 3 to 6 was already very high at the end of the 1990s.¹⁰ The German care market for children under the age of three has been characterized by excess demand (Wrohlich, 2008). Although its degree has declined, rationing still persists as demand increased parallel to supply. According to newly available FiD data it amounts to 16% in West and 14% in East Germany (Müller and Wrohlich, 2014). We thus assume a full take-up of newly created childcare slots for children under the age of three for the subsequent empirical analysis.

Public childcare in Germany is provided by communities. Private providers include religious non-profit, non-religious non-profit, or commercial institutions. Public together with non-religious and religious non-profit providers cover almost the entire market; in 2009 roughly 2% of slots were owned by commercial providers (Mühler, 2010). Market composition varies across regions (Mühler, 2010; Hüskens, 2010, 2011). For children under the age of three, religious and commercial centers provide the majority of slots, especially for full-time care. The government also subsidizes certified child minders that take care of children outside of their homes. This comes at considerably higher cost. The share of public funding in the German

⁹Children under the age of one only have this legal right, if their parents are working, currently searching for work or in education.

¹⁰The reduction of childcare provision for this age group in Fig. A1 is due to a change in data collection. Before 2006 availability was measured in slots per 100 children (by age group). It is defined as the percentage of children in childcare since then. This did not affect figures for under three year olds because of rationing.

childcare system is quite low compared to other European countries. Parents pay income-dependent fees with rules varying across municipalities.

The expansion of subsidized childcare following the aforementioned reforms is financed in part by the federal government and partly by the states. The amount and composition of funds vary by state-specific contracts. The general objective, strategy and funding are determined at the federal and state level. Youth welfare offices (*Jugendämter*) and/or municipal governments do most of the operational planning; arrangements vary between states (Hüsken, 2010, 2011). Local authorities estimate the number of additional slots (and amount of daily care) needed and develop an appropriate expansion strategy. They refer to residents' registration statistics (*Einwohnermeldestatistiken*), use childcare facilities' waiting lists and information on past years. Almost half of the youth offices declared to interview parents with respect to their care preferences (BMFSFJ, 2011, 2012, 2013). This process is not codified by federal or state laws and subject to projection error. The vast majority of municipalities report financial, personell and spatial shortages when trying to meet local demand (BMFSFJ, 2011, 2012, 2013). There are thus substantial frictions in the implementation of those reforms. We exploit this type of variation arising from the reform-induced expansion of publicly subsidized childcare for identification (sub-section 4.2).

Two policy reforms which potentially influenced maternal labor supply coincided with the expansion of childcare during this period. The reform of unemployment insurance and assistance in 2005 by the so-called 'Hartz laws' comprised a large decrease in unemployment benefits. The implied higher labor supply incentives affected everyone receiving unemployment benefits (Jacobi and Kluve, 2007). The parental allowance reform (*Elterngeld*) reform from 2007 reduced the maximum duration of maternal (parental) benefits to 12 (14) months while relating the benefits to previous labor earnings. It only affected employment incentives of mothers in the first and second year after childbirth. The new parental leave scheme provides negative work incentives for women in the first year after childbirth and positive work incentives afterwards compared to the pre-reform period (Geyer et al., 2014). Both reforms applied at the federal level and were not systematically related to the expansion of subsidized childcare (sub-section 4.2).

3 Data

For our empirical analysis, we need to match regional information on availability of childcare to a large micro data set. The German Microcensus (MC) is a 1 percent sample of the German population and contains detailed information on family and employment status of women (sub-section 3.2). Information on childcare is available at the level of German counties. These data are provided by the German Statistical Office and the German Youth Institute (Deutsches Jugendinstitut e.V., DJI). Additional indicators driving the local demand for childcare and affecting maternal labor supply are also available at this level of aggregation (sub-section 3.1).

3.1 Regional data

Information on the supply of childcare are only available at the level of counties (*Kreise*) which add up to a total number of 440 in Germany. For the years 1994, 1998, and 2002 these data were gathered by German Youth Institute based on material by the Statistical Offices of federal states. Provision of childcare was measured as slots available per 100 children in the respective age groups without information on the actual take-up of these places. From 2006-2012 data has been provided by the German Statistical Office. The indicator is defined as the percentage of children using subsidized formal childcare in this period. For the age group under the age of three the difference between both concepts is not too severe because there has been substantial rationing in the market and take-up was therefore high.

From 2007 onwards we also can distinguish between full-time and total coverage of subsidized childcare. We consider 2007 to 2011 as our baseline period of analysis. More recent MC waves are not yet available. Robustness checks include data from earlier years. We have not exploited data for East Germany. There exists no consistent county panel due to reorganizations of local governments. We plan to include East Germany in the next version version of this paper on he basis of a harmonized county panel.

In addition, we use several control variables that are collected and edited jointly by the German Statistical Office with the Federal Institute for Research on Building, Urban Affairs and Spatial Development within the Federal Office for Building and Regional Planning. The dataset “Indicators and Maps on the Spatial Devel-

opment” (“Indikatoren und Karten zur Raumentwicklung”, INKAR, see Helmcke, 2008) allows longitudinal comparisons at different regional levels for Germany. The information used here is aggregated at the county level. Childcare data and INKAR are merged with SOEP and MC using those county identifiers.

3.2 German Microcensus

The German Microcensus (MC) is the largest household survey of all European countries (Lengerer et al., 2005; Lotze and Breiholz, 2002a,a). It is a representative one percent sample of the German population and has a particular focus on demographic and labor market related topics. Comparable studies for Germany also use the MC for these reasons (Bauernschuster and Schlotter, 2013; Gathmann and Sass, 2012). The MC is collected annually and has a panel dimension for a sub-population over a limited period of time that is not exploited here. Since households are sampled as a whole, mothers are linked to their children.

The MC does not contain information on the individual choice of a childcare arrangement. Yet, it provides comparable indicators for the extensive and intensive labor supply margin of individuals as well as the current contract status of those in employment. In addition, most of the individual-level control variables are available. In 2005 the survey design changed from the consideration of a fixed reference week per year to the collection of information during a year (Afentakis and Bihler, 2010). This affected particularly variables related to the employment status. Our baseline estimates therefore refer to the period after this conceptual break.

4 Empirical methodology

Depending on the data used and the variation available, different approaches to estimate the relationship between subsidized childcare and maternal labor supply become available. Should the mother’s labor market status and her choice of a care arrangement be observed, instrumental variables (IV) estimation is the natural choice.¹¹ The Microcensus, however, does not contain information on the individual choice of a childcare arrangement. Under these circumstances we use the quasi-experimental regional variation in subsidized childcare to estimate an intention-to-treat effect (ITT) on maternal employment.

4.1 Specification

Mothers i ’s employment outcome y_{ijt} in region j at time t is explained by exogenous variables at the individual X_{ijt} and the regional X_{jt} level as well as time fixed effects γ_t . The variable of interest throughout this paper is the regional childcare coverage cc_{jt} which varies at the county level and over time. In this setting the identification of the effect on mothers’ labor supply is based on quasi-experimental variation in the provision of childcare. The main difference is whether specifications include regional fixed effects μ_j which rule out time-invariant unobserved confounders affecting childcare and mothers’ employment:

$$y_{ijt} = \alpha + \delta cc_{jt} + X'_{ijt}\beta_1 + X'_{jt}\beta_2 + \gamma_t + \varepsilon_{ijt} \quad (1a)$$

$$y_{ijt} = \alpha + \delta cc_{jt} + X'_{ijt}\beta_1 + X'_{jt}\beta_2 + \mu_j + \gamma_t + \varepsilon_{ijt} \quad (1b)$$

These equations are estimated by OLS; Angrist (2001) discusses the adequacy of the linear probability model for binary outcomes which applies in our case to all extensive margin variables (sub-section 4.3).

The underlying assumption of specification (1a) is that variation in childcare coverage cc_{jt} is exogenous conditional on observables X and a general time trend γ_t . Several (unobserved) mechanisms lead to a correlation between cc_{jt} and ε_{ijt} , though. The selection of childcare providers into certain counties with higher de-

¹¹We have also done this in a previous version of this paper (Müller et al., 2015) based on data from the German Socio-Economic Panel (SOEP). The limited sample size of the SOEP leaves only a small amount of within-county information. We were confronted with weak instruments in the first stage of the IV estimation when county fixed effects were included.

mand for childcare (or vice versa) is an example for such a relation. The observed cross-sectional variation in childcare coverage may thus be (in part) a result of the spatial matching between childcare providers and mothers with high labor market attachment. The effect of childcare on maternal employment would be biased when this part of variation is used for estimation.

In contrast, the two-way fixed effects specification (1b) can be interpreted as a generalized difference-in-differences approach. The inclusion of county fixed effects controls for time-invariant unobserved factors that might be correlated with regional childcare provision. Identification is only based on within-county differences over time and therefore related to the quasi-experimental variation induced by policy reforms.¹²

We investigate sub-sample heterogeneity of the estimated effect by running separate estimations for XX UPDATE single and married mothers, highly and poorly educated mothers and for mothers interviewed before and after the introduction of the *Elterngeld* in robustness analyses. In order to correct for possible serial correlation of the error terms, we cluster standard errors at the county-year level and additionally use nonparametric block bootstrapping (Betrand et al., 2004) as a robustness check for the clustered standard errors.

4.2 Identification

This approach, that bases identification on spatial and temporal variation in the publicly subsidized provision of childcare at the level of (West) German counties, has several threats to identification (Felfe et al., 2014; Havnes and Mogstad, 2011):

- (i) Macro-shocks might affect the treatment and control groups differently.
- (ii) Childcare providers (parents) locating (migrating) to areas with high female labor force participation and a sufficient demand for (supply of) childcare may lead to a two-sided selection process.
- (iii) Municipalities are interested in attracting qualified labor by offering or subsidizing childcare slots of sufficient magnitude and quality.

¹²This specification is similar to Bauernschuster et al. (2013) who estimate this model with aggregate data at the county level.

- (iv) Parents are equipped with certain beliefs towards child-rearing and employment. They demand a certain amount of care and lobby or vote for local childcare policies according to their preferences.
- (v) The new childcare laws explicitly call for a demand-oriented expansion of childcare. Regions that are doing better economically might face less shortages initially. Counties where excess demand is particularly high may thus initiate the largest expansion of childcare.¹³
- (vi) The gradual increase in childcare availability opens the door for differential long-term trends in treatment and control counties.

Processes (i) through (iv) are more of general nature whereas (v) and (vi) relate to childcare policy reforms. This does not preclude the former to affect childcare expansion induced by reforms. All are related to two common problems in treatment/control setups: differential time trends unrelated to the treatment and compositional changes between those groups. Moreover, reverse causality plays an important role as childcare supply might adjust to demand. The crucial difference between specifications in all estimation strategies of this paper is whether or not fixed regional effects are controlled for. According to this distinction different parts of the variation in childcare coverage are exploited for identification. All of the listed problems apply unconditionally to cross-sectional analyses. Assumptions with respect to the temporal within-county part are less demanding.

Childcare expansion is assumed to be exogenous conditional on a number of intervening variables. Covariates in the estimations (sub-section 4.4) are supposed to control for several of the mechanisms depicted above. Mother- and household-specific characteristics (e.g. marital status, the number and age of children, other household income as well as age, qualification and labor market experience of the mother) reflect heterogeneity in preferences, financial incentives and capabilities in terms of mothers' labor market participation and utilization of childcare. These variables control primarily for compositional changes across the treatment and control units which might lead to shifts in maternal labor supply and demand for public childcare. Regional variables (population density, gross domestic product,

¹³This is a problem in many of the studies based on regional variation in childcare expansion (see, e.g., Havnes and Mogstad, 2011 or Nollenberger and Rodríguez-Planas, 2011).

female employment rate, fertility) approximate structural differences between counties. These might account for systematic differences in the demand for and supply of childcare which could lead to differential trends between treatment and control groups.

We argue that conditional on these covariates, the variation emanating from childcare reforms can be considered exogenous. This is a result of the implementation process in Germany (sub-section 2.3). Implementation involves a lengthy process at different administrative levels that consists of planning and projection of demand, applications for state-funding filed by local providers, and approval of proposal by state authorities (Felfe and Lalive, 2013):

- (1) There is substantial error in local projections of childcare demand which has been documented (Hüsken, 2010, 2011). Planning is organized at the local level and those errors are not evenly distributed.
- (2) Municipalities are capacity-constrained in terms of financial scope, qualified personnel, or suitable construction grounds (BMFSFJ, 2011, 2012, 2013). Targets are therefore rarely met in the projected time frame.
- (3) There are often considerable delays in the approval within the state administration.

As a result of severe shortages in supply, childcare providers operate with waiting lists. Families who sign up their children early are given preferred access. Children with single or working parents and with siblings may jump waiting lists. These different reasons generate exogenous variation between the municipalities which we observe at the county level and exploit for identification. These arguments only hold for the reform-induced expansion of childcare. The DD approach as well as IV and panel specifications with county fixed effects explicitly rely on this part of the variation.

Descriptive evidence illustrates the substantial increase in childcare coverage for children aged under 3. The average coverage rate has increased monotonically between 2006 (2007)¹⁴ and 2011 in West Germany (Tab. A1 in the Appendix). Overall (full-time) coverage has almost tripled from 7% (2.5%) to almost 20% (6.5%). This

¹⁴We only have data for full-time slots from 2007 onwards.

poses a marked supply shock, i.e. a treatment of significant magnitude across West Germany. An expansion of publicly subsidized childcare for children under the age of 3 started already at the beginning of the 2000s (Fig. A1 in the Appendix), but the tempo increased considerably in the middle of the 2000s. The monotonic increase holds for each single state which demonstrates that compliance has been comprehensive.

Regional heterogeneity has been reduced in relative terms as measured by the Theil index during this period of expansion (bottom of Tab. A1).¹⁵ Not only have childcare slots become more equally distributed across all of West Germany, but also between and within federal states. Inequality in childcare provision has decreased more within than between states. This holds for overall and full-time coverage. As of 2011 there is still considerable regional variation between and within West German states in the provision of childcare, considerably more so for full-time slots.

It is hard to pin down empirical evidence that the implementation of reforms generated idiosyncratic variation in the provision of childcare. A detailed visualization of how the spatial distribution of childcare coverage has evolved over the post-reform period provides some guidance in that regard (Fig. A3 in the Appendix). The considerable within- and between-state variation in the cross-section, but also over time is confirmed. In 2006 certain counties start from a much higher level than others. In 2006 there are several regional clusters with high coverage, e.g. the north of Bavaria or the south of Rhineland Palatinate, but also large cities as Hamburg or Munich. More importantly the expansion does not proceed with uniform tempo. Certain counties move faster than others that catch up the following year or later. Although many of the aforementioned focal points keep their edge, it is also visible that many counties catch up to a certain degree over time.

Comparing the development of overall and full-time coverage also reveals some important insights. Some of the counties/regions with above-average overall coverage also provide a high number of full-time slots (some large cities as Hamburg or Munich), some do not. The Bavarian north-south divide does not exist for full-time care. Some counties/regions that proceeded more quickly in expanding overall child-

¹⁵Bauernschuster et al. (2013) argue that heterogeneity increased as measured by standard deviations. Yet, this is rather a mechanical effect depending on the level of childcare coverage. This is a question of relative and absolute heterogeneity; it is not a priori clear what is more relevant for identification.

care coverage also have invested more in full-time slots. On the other hand, certain counties, in some instances regions or whole states (e.g. North-Rhine Westphalia), which have long lagged behind in overall coverage, moved to the top in terms of full-time care. These findings underline the erratic spatial pattern during the expansion and provide evidence for exogenous variation in childcare supply.

4.3 Dependent variables

The effect of subsidized childcare for the group of mothers with young children will likely be heterogeneous for different margins of labor supply (sub-section 2.1). We therefore estimate the relationship for various outcome variables y_{ijt} capturing the extensive or intensive margin:

- (1) *Participation*: $y_{ijt}^{(1)}$ is a dummy variable where $y_{ijt}^{(1)} = 1$, if the mothers hours of work are positive, i.e. $h_{ijt} > 0$, and $y_{ijt}^{(1)} = 0$ otherwise. This is an overall indicator for mothers' labor supply at the extensive margin.
- (2) *Full-time participation*: $y_{ijt}^{(3)}$ is a dummy variable where $y_{ijt}^{(3)} = 1$, if $h_{ijt} > 0$ and the self-assessed employment status is full-time; $y_{ijt}^{(3)} = 0$ otherwise. This outcome measures the influence of public childcare on increasing the full-time share among employed women.
- (3) *Marginal employment*: $y_{ijt}^{(4)}$ is a dummy variable where $y_{ijt}^{(4)} = 1$, if the mother works in a mini-job; the state $y_{ijt}^{(4)} = 0$ includes quality participation ($h_{ijt} > 0$) and non-employment ($h_{ijt} = 0$). When marginal employment does not necessarily depend on public childcare, one would expect a different effect compared to other participation measures.
- (4) *Hours of work*: $y_{ijt}^{(5)}$ is a cardinal variable whereas $y_{ijt}^{(5)} = h_{ijt}$, if $h_{ijt} > 0$. It measures the intensive margin of labor supply and is only observed, if $y_{ijt}^{(1)}$. Since we can only analyze the intensive labor supply margin for women participating in the labor market, we adjust for all hours estimates for a potential selection bias.

Descriptive statistics for different dependent variables and sample periods can be found in Table A2 in the Appendix. In order to account for selection into employment we follow standard practice and apply a Heckit two-step model for the hours

of work estimation (Heckman (1979)). Under the assumption that the error terms in the respective structural and selection equations are distributed jointly normal, we add the inverse Mills ratio λ_{ijt} in each of our structural equations as a selection correction. The selection equation is estimated for the respective pooled samples and includes the dummies for being a lone mother and married as well as other household income as exclusion restrictions.

4.4 Explanatory variables

The explanatory variable of interest measures the provision of childcare for children aged under 3 at the county level. In the majority of specifications for the period 2006 to 2011 the childcare coverage rate cc_{jt} is available defined as the percentage of children of this age group using subsidized formal childcare county j in year t . Between 2007 and 2011 we have information on the split of full-time cc_{jt}^{FT} and part-time coverage rates cc_{jt}^{PT} with $cc_{jt} = cc_{jt}^{FT} + cc_{jt}^{PT}$. The theoretical considerations have shown that the mother's employment decision will depend on the quantity and quality of different childcare options available to her. It is conceivable that she prefers a certain number of working hours that can only be reached when the child is in full-time childcare.

We therefore use the following flexible specification::

$$\kappa cc_{jt} = \kappa_1 cc_{jt}^{FT} + \kappa_2 cc_{jt}^{PT} \quad (2)$$

We use overall childcare coverage cc_{jt} and full-time coverage cc_{jt}^{FT} for robustness analyses. We define the treatment and control groups in the standard DD model based on overall coverage cc_{jt} and use a distinction on the basis of only full-time coverage cc_{jt}^{FT} as a robustness check. Descriptive statistics on childcare coverage are documented in Tab. A1 in the Appendix.

The general set of individual control variables for the mother includes her age (included in linear and quadratic form in all specifications), the level of qualification, her marital status and nationality. For the estimations based on the SOEP we also exploit information on the mother's labor market experience as well as additional household information. We distinguish single and cohabiting mothers, the gender of the (youngest) child, and other household income. These variables account for het-

erogeneity in mother’s preferences, variation in financial incentives and capabilities determining her labor market participation and utilization of childcare.

Hüsken (2010) runs various regressions to detect determinants of regional differences in childcare coverage for under three year olds based on data from 2010. She finds that the degree of urbanicity, gdp per capita, the female employment rate, the proportion of employed women working part time and the proportion of highly skilled workers in the area are positively correlated with childcare coverage for children under the age of three in West Germany, while the latter is negatively correlated with the regional fertility and unemployment rate. Therefore we control for the endogeneity of childcare supply by including these variables measured at the county level as control variables. We will conduct a similar test regression for our sample.

4.5 Sample

We analyze the effect of subsidized childcare for children aged under 3 on their mothers’ labor supply. We focus on West Germany where the childcare expansion was largest. Due to administrative reforms that changed the alignment of counties, we do not have consistent panel data on childcare coverage for East Germany. There are further restrictions concerning the childcare data (sub-section 3.1). Information on full-time coverage is only available between 2007 and 2011. We therefore restrict our main analysis to this period.

Robustness analyses are conducted for a number of sub-groups for this time period. The validity of robustness analyses with longer time periods is limited, though. Before 2006 regional childcare data are only available for the years 1998 and 2002. For those years childcare statistics are based on available slots and not the actual utilization (sub-section 3.2). Changes in the survey design of the MC that affected the labor supply measures further diminishes comparability. We present some robustness checks for 2006 to 2011 and 2002 to 2011 bearing those limitations in mind.

5 Results

5.1 Main specification

We find positive associations between childcare coverage and all outcome variables except for marginal employment in specifications (1) through (3) without regional fixed effects (Table 1).¹⁶

Table 1: Regression estimates, effects of childcare provision on labor supply

	(1)	(2)	(3)	(4)
Extensive margin				
<i>Participation</i>				
Full-time childcare	0.192** (0.071)	0.328*** (0.086)	0.276** (0.093)	0.057 (0.299)
Part-time childcare	0.308*** (0.078)	0.266** (0.090)	0.232* (0.095)	0.214 (0.229)
<i>Full-time employment</i>				
Full-time childcare	0.305*** (0.080)	0.118 (0.076)	0.156 (0.084)	0.190 (0.306)
Part-time childcare	0.075 (0.063)	0.032 (0.070)	0.065 (0.076)	0.016 (0.203)
<i>Marginal employment</i>				
Full-time childcare	-0.313*** (0.055)	-0.255*** (0.058)	0.036 (0.048)	0.247 (0.231)
Part-time childcare	-0.385*** (0.047)	-0.288*** (0.048)	-0.071 (0.042)	-0.352* (0.166)
N	32893	32893	32893	32893
Intensive margin				
<i>Hours worked</i>				
Full-time childcare	0.142** (0.043)	0.060 (0.036)	0.126** (0.044)	0.221* (0.105)
Part-time childcare	-0.032 (0.025)	-0.026 (0.029)	0.020 (0.032)	0.080 (0.089)
N	26547	26547	26547	26547
Controls				
Covariates		✓	✓	✓
Time fixed effects			✓	✓
County fixed effects				✓

Notes: Standard errors in parentheses; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Source: Microcensus, own calculations.

The negative sign for marginal employment reflects a lower (higher) share of marginal (regular) employment in counties with better childcare coverage. Although not all of those coefficients are statistically significant. In particular adding time

¹⁶Full regression results for the main specification and all dependent variables can be found in Table A3 in the Appendix.

fixed effects in (3) reduces their magnitude and statistical significance. Both variables follow a similar time trend.

As argued above, a causal interpretation of these associations is problematic for a number of reasons. Credible exogenous variation is generated, however, through implementation frictions over time across different counties which corresponds to specification (4). The main finding here is that coefficients for the extensive margin outcomes become insignificant when county fixed effects are included. In spite of the relatively large sample size of the MC within-county variation does apparently not suffice to get significant coefficients for childcare coverage. The coefficient for participation is also markedly smaller in magnitude. We interpret this as evidence that the impact of an expansion of subsidized childcare on the participation of mothers with very young children is smaller than previously thought, potentially even absent.

Yet, we do get a marginally statistically significant effect of full-time childcare coverage for the working hours of employed mothers: One more full-time slot per 100 children increases the average working hours of already employed mothers by more than 0.2 hours per week (Table 1). A cautious interpretation would be that already employed mothers with small children extend their working hours as childcare coverage, more precisely the supply of full-time places, improves. This explanation is consistent with the positive, although not statistically significant coefficient of full-time coverage in specification (4) for full-time employment of women.

5.2 Heterogeneity & robustness

The insignificant effects at the extensive margin might reflect heterogeneity across different groups. We therefore re-ran our preferred specification (4) with county fixed effects on different sub-samples which are known to react differently to the provision of public childcare: married vs. unmarried mothers, mothers with or without additional children in this age group, different qualification levels and different age groups. The first result is that we do not get any statistically significant participation effects for any of these sub-groups (Table 2). However, the point estimates are markedly larger in magnitude for unmarried, medium-skilled, and younger mothers which is consistent with the existing literature that usually ascribes higher labor supply elasticities to those groups.

Table 2: Regression estimates, effects of childcare provision on labor supply, heterogeneity

	Main effect	Marital status		Siblings below 3		Mother's qualification			Mother's age	
		unmarried	married	no	one or more	low	medium	high	≤ 35	> 35
Extensive margin										
Participation										
Full-time childcare	0.057 (0.299)	2.092 (1.100)	-0.200 (0.306)	0.050 (0.455)	0.017 (0.402)	-0.709 (0.478)	0.534 (0.378)	-0.775 (1.137)	0.467 (0.503)	-0.217 (0.372)
Part-time childcare	0.214 (0.229)	0.133 (0.854)	0.175 (0.232)	0.262 (0.323)	0.163 (0.283)	-0.130 (0.358)	0.314 (0.282)	-0.275 (0.837)	0.480 (0.381)	-0.085 (0.266)
Full-time employment										
Full-time childcare	0.190 (0.306)	1.751 (1.099)	0.014 (0.320)	-0.060 (0.472)	0.376 (0.408)	-0.645 (0.740)	0.678* (0.325)	-0.994 (0.728)	0.380 (0.336)	0.084 (0.448)
Part-time childcare	0.016 (0.203)	0.269 (0.814)	-0.044 (0.214)	-0.012 (0.292)	0.093 (0.263)	0.353 (0.422)	-0.202 (0.236)	-0.354 (0.410)	0.353 (0.272)	-0.311 (0.283)
Marginal employment										
Full-time childcare	0.247 (0.231)	0.276 (0.402)	0.239 (0.253)	0.543 (0.332)	0.022 (0.241)	0.455 (0.346)	0.261 (0.301)	-0.532 (0.560)	0.268 (0.244)	0.248 (0.314)
Part-time childcare	-0.352* (0.166)	-0.572 (0.319)	-0.318 (0.178)	-0.251 (0.238)	-0.430* (0.191)	0.193 (0.250)	-0.515* (0.215)	-0.296 (0.384)	-0.133 (0.199)	-0.474* (0.217)
N	32893	3019	29874	14694	18199	8475	21309	3109	12863	20030
Intensive margin										
Hours worked										
Full-time childcare	0.221* (0.105)	-0.047 (0.389)	0.228* (0.114)	0.057 (0.144)	0.328* (0.154)	0.000 (0.214)	0.327** (0.125)	-0.363 (0.470)	0.352* (0.178)	0.174 (0.125)
Part-time childcare	0.080 (0.089)	-0.273 (0.291)	0.097 (0.094)	0.024 (0.117)	0.124 (0.115)	0.000 (0.145)	0.097 (0.101)	0.170 (0.354)	0.235 (0.151)	-0.006 (0.098)
N	26547	2253	24294	12048	14499	7515	17219	1813	9044	17503
Controls										
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
County fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: Standard errors in parentheses; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Source: Microcensus, own calculations.

Second, we find some interesting patterns at intensive margin: the coefficient of full-time care is only significant for married women (Table 2). Moreover, the impact of full-time care is substantially larger for mothers with additional small children. At first sight these findings seem to contradict previous results that single mothers and those with only children are more responsive. Yet, the expansion of full-time childcare in Germany might have enabled already employed mothers to increase their working hours. We also get larger and significant intensive margin effects for mothers with medium skills and below the age of 36. This is consistent with expectations generated by previous research and larger extensive margin coefficients.

We also conducted a number of robustness checks with respect to the childcare indicator and the sample period. Again we stick to our preferred specification (4) from Table 1 which includes county fixed effects. Replacing the full- and part-time childcare coverage indicators with a measure of overall childcare renders all extensive and intensive margin measures for the labor supply of mothers statistically insignificant (Table A4 in the Appendix, left column). This picture does not change when we increase the sample window to 2006-2011, or 2002-2011 as overall the overall childcare is also available for the earlier MC waves.¹⁷ Increasing the within-county variation apparently does not outweigh the advantage of a more nuanced specification of the childcare coverage for the later years. This further underlines the importance of full-time care.

A final robustness check concerns the empirical specification in a more basic sense. We alternatively estimated a Havnes and Mogstad (2011) type difference-in-difference model. This approach utilizes reform-induced temporal and spatial variation in the provision of childcare. Treatment and control groups are defined on the basis of the change in childcare coverage between post- and pre-reform levels ($\Delta_t cc_j = cc_{jt_1} - cc_{jt_0}$). The analysis is only based on those two points in time. Counties in the treatment (control) group have an above- (below-) median expansion of childcare. Due to restrictions on the childcare data (sub-section 3.1), the closest pre-reform period is $t_0 = 2002$. We use the latest available wave of the MC as post-reform period $t_1 = 2011$.¹⁸ The coefficients representing the treatment effect

¹⁷Keep in mind, however, that there is a conceptual break in the MC as well as the childcare data before 2006 (sub-section 3.2).

¹⁸The main robustness analysis uses the years 2006 and 2011; this specification uses a base period after the introduction of the first reform.

turn out to be highly insignificant for all outcomes, throughout all specifications and for both sample periods (Table A5 in the Appendix). The loss in efficiency seems to be too large when only two waves of data are exploited.

6 Discussion and conclusion

We have estimated the effect of the expansion of subsidized childcare on the labor supply of mothers with children aged 1 to 3 in Germany. We have found significantly positive effects of subsidized childcare on maternal labor supply based on the overall variation in childcare provision. This holds for all measures of labor supply at the extensive and intensive margin. Results change dramatically when identification is restricted to quasi-experimental within-county variation as effects for all extensive margin measure become statistically insignificant. We find, however, marginally significant effects at the extensive margin.

In line with previous assessments (Blau, 2003; Blau and Currie, 2006) we conclude that estimates based on quasi-experimental variation are very sensitive with respect to identifying assumptions and related model specifications. This has far-reaching consequences for the substantive implications of the findings. It casts doubt on previous estimates of significant participation effects – most of them did neither rely exclusively on quasi-experimental variation, nor provide robustness checks with county fixed effects.

Taking the findings based on the arguably more credible exogenous quasi-experimental variation at face value there is no identifiable extensive margin effect of childcare on labor supply of mothers. However, already employed mothers may increase their working hours. A marginal increase of childcare availability (one additional full-time childcare slot per hundred children) increases average working time of already employed mothers by about 0.2 hours per week. Our results are in line with comparable studies for Sweden and Norway that found similar patterns. They also confirm the small extensive margin elasticities found in structural approaches.

Thus, our paper contributes to the existing empirical literature in several ways. First, we provide evidence for the impact of a large childcare expansion in Germany – a country with very low initial childcare coverage and very low maternal employment. Second, in contrast to most of the international literature that focuses on children aged three years and older, we consider children in the age group of 1 to 3 years. Second, we distinguish between the extensive and the intensive margin, which appears to be crucial since we find heterogeneous effects for the two margins. Moreover, we distinguish between the availability of part-time and full-time

childcare which has very different implications for the employment opportunities of mothers.

References

- Afentakis, Anja and Wolf Bihler**, “Das Hochrechnungsverfahren beim unterjährigen Mikrozensus ab 2005,” *Wirtschaft und Statistik*, 2010, 10/2010, 1039–1048.
- Anderson, Patricia M. and Phillip B. Levine**, “Child Care and Mothers’ Employment Decisions,” in David E. Card and Rebecca M. Blank, eds., *Finding Jobs: Work and Welfare Reform*, Russel Sage Foundation, 2000, pp. 420–462.
- Angrist, Joshua D.**, “Estimation of Limited Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice,” *Journal of Business & Economic Statistics*, 2001, 19 (1), 2–16.
- Averett, Susan L., H. Elizabeth Peters, and Donald M. Waldman**, “Tax Credits, Labor Supply, And Child Care,” *The Review of Economics and Statistics*, February 1997, 79 (1), 125–135.
- Baker, Michael, Jonathan Gruber, and Kevin Milligan**, “Universal childcare, maternal labor supply and family well-being,” *Journal of Political Economy*, 2008, 116 (4), 709–745.
- Bauernschuster, Stefan and Martin Schlotter**, “Public Child Care and Mothers’ Labor Supply – Evidence from Two Quasi-Experiments,” Technical Report, CESifo Working Paper No. 4191, Ifo Institute – Leibniz Institute for Economic Research at the University of Munich, Munich 2013.
- , **Timo Hener, and Helmut Rainer**, “Does the Expansion of Public Child Care Increase Birth Rates? Evidence from a Low-Fertility Country,” Technical Report, ifo Working Paper No. 158, Ifo Institute – Leibniz Institute for Economic Research at the University of Munich, Munich 2013.
- Becker, Gary S.**, *A Treatise on the Family* number beck81-1. In ‘NBER Books.’, National Bureau of Economic Research, Inc, 1981.
- Berger, Mark C. and Dan A. Black**, “Child Care Subsidies, Quality of Care, and the Labor Supply of Low-Income, Single Mothers,” *The Review of Economics and Statistics*, 1992, 74 (4), 635–642.

- Berlinski, Samuel and Sebastian Galiani**, “The effect of a large expansion of pre-primary school facilities on preschool attendance and maternal employment,” *Labour Economics*, 2007, *14*, 665–680.
- , —, and **Patrick J. McEwan**, “Preschool and Maternal Labor Market Outcomes: Evidence from a Regression Discontinuity Design,” *Economic Development and Cultural Change*, 2011, *59* (2), 313–344.
- Betrand, Marianne, Esther Duflo, and Sendhil Mullainathan**, “How much should we trust difference-in-difference estimates,” *The Quarterly Journal of Economics*, 2004, *119* (1), 249–275.
- Bick, Alexander**, “The quantitative role of child care for female labor force participation and fertility,” Technical Report, MPRA PaperNo. 25474, University Library of Munich, Germany August 2011.
- Blau, David**, *The Child Care Problem*, New York: Russel Sage Foundation, 2001.
- , “Child Care Subsidy Programs,” in “Means-Tested Transfer Programs in the United States” NBER Chapters, National Bureau of Economic Research, Inc, Jan-Jun 2003, pp. 443–516.
- and **Erdal Tekin**, “The determinants and consequences of child care subsidies for single mothers in the USA,” *Journal of Population Economics*, 2007, *20* (4), 719–741.
- and **Janet Currie**, “Pre-School, Day Care, and After-School Care: Who’s Minding the Kids?,” in Erik Hanushek and F. Welch, eds., *Erik Hanushek and F. Welch, eds.*, Vol. 2 of *Handbook of the Economics of Education*, Elsevier, June 2006, chapter 20, pp. 1163–1278.
- Blau, David M. and Alison P. Hagy**, “The Demand for Quality in Child Care,” *Journal of Political Economy*, February 1998, *106* (1), 104–146.
- Blau, David M and Philip K Robins**, “Child-Care Costs and Family Labor Supply,” *The Review of Economics and Statistics*, August 1988, *70* (3), 374–81.
- Blau, David M. and Philip K. Robins**, “Child Care Demand and Labor Supply of Young Mothers over Time,” *Demography*, 1991, *28* (3), 333–351.

- Blundell, Richard, Allen Duncan, Julian MacCrae, and Costas Meghir**, “Household Labour Supply, Childcare Costs and Tax Credits,” Technical Report 2000.
- , – , **Julian McCrae, and Costas Meghir**, “The Labour Market Impact of the Working Families’ Tax Credit,” *Fiscal Studies*, 2000, *21* (1), 75–104.
- BMFSFJ**, “Zweiter Zwischenbericht zur Evaluation des Kinderförderungsgesetzes,” Technical Report, Bundesministerium für Familie, Senioren, Frauen und Jugend (BMFSFJ), Bericht der Bundesregierung für das Berichtsjahr 2010 2011.
- , “Dritter Zwischenbericht zur Evaluation des Kinderförderungsgesetzes,” Technical Report, Bundesministerium für Familie, Senioren, Frauen und Jugend (BMFSFJ), Bericht der Bundesregierung für das Berichtsjahr 2011 2012.
- , “Vierter Zwischenbericht zur Evaluation des Kinderförderungsgesetzes,” Technical Report, Bundesministerium für Familie, Senioren, Frauen und Jugend (BMFSFJ), Bericht der Bundesregierung für das Berichtsjahr 2012 2013.
- Boca, D. Del and D. Vuri**, “The mismatch between employment and child care in Italy: The impact of rationing,” *Journal of Population Economics*, 2007, *20* (4), 805–832.
- Boca, Daniela Del**, “The Effect of Child Care and Part Time Opportunities on Participation and Fertility Decisions in Italy,” *Journal of Population Economics*, 2002, *15* (3), 549–573.
- **and Robert M. Sauer**, “Life cycle employment and fertility across institutional environments,” *European Economic Review*, 2009, *53*, 274–292.
- Büchel, Felix and C. Katharina Spieß**, “Kindertageseinrichtungen und Müttererwerbstätigkeit: neue Erkenntnisse zu einem bekannten Zusammenhang,” *Vierteljahrshefte zur Wirtschaftsforschung*, 2002, *71* (1), 95–113.
- Cascio, Elizabeth U.**, “Maternal Labor Supply and the Introduction of Kindergartens into American Public Schools,” *The Journal of Human Resources*, 2009, *44* (1), 140–170.

- Choné, Philippe, David le Blanc, and Isabelle Robert-Bobée**, “Female Labor Supply and Child Care in France,” Technical Report, CESifo Working Paper No. 1059, Center for Economic Studies & Ifo Institute for Economic Research 2003.
- Coneus, Katja, Kathrin Goeggely, and Grit Muehler**, “Maternal employment and child care decision,” *Oxford Economic Papers*, 2008, *61*, i172–i188.
- Connelly, Rachel**, “The Effect of Child Care Costs on Married Women’s Labor Force Participation,” *The Review of Economics and Statistics*, February 1992, *74* (1), 83–90.
- **and Jean Kimmel**, “The Effect of Child Care Costs on the Employment and Welfare Reciprocity of Single Mothers,” *Southern Economic Journal*, January 2003, *69* (3), 498–519.
- Cowell, Frank A.**, *Measuring Inequality*, Oxford, UK: Oxford University Press, 2000.
- Duncan, Alan and Christopher Giles**, “Labour Supply Incentives and Recent Family Credit Reforms,” *Economic Journal*, January 1996, *106* (434), 142–55.
- **, Gillian Paull, and Jayne Taylor**, “Mothers’ employment and the use of child-care in the UK,” Technical Report, IFS Working Papers No. W01/23, Institute for Fiscal Studies (IFS) October 2001.
- Felfe, Christina and Rafael Lalive**, “Early Child Care and Child Development: For Whom It Works and Why,” Technical Report, SOEPpapers on Multidisciplinary Panel Data Research No. 536, German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung, DIW) 2013.
- **, Michael Lechner, and Petra Thiemann**, “After-school care and parents’ labor supply,” Technical Report, Swiss Institute for International Economics and Applied Economics Research (SIAW), University of St. Gallen 2014.
- Fitzpatrick, Maria Donovan**, “Preschoolers Enrolled and Mothers at Work? The Effects of Universal Prekindergarten,” *Journal of Labor Economics*, 01 2010, *28* (1), 51–85.

- , “Revising Our Thinking About the Relationship Between Maternal Labor Supply and Preschool,” *Journal of Human Resources*, 2012, 47 (3), 583–612.
- Gathmann, Christina and Bjoern Sass**, “Taxing Childcare and its Effects on Children and their Families in Germany,” Technical Report, SOEPpapers on Multidisciplinary Panel Data Research No. 438, German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung, DIW) 2012.
- Gelbach, Jonah B.**, “Public Schooling for Young Children and Maternal Labor Supply,” *American Economic Review*, 2002, 92 (1), 307–322.
- Gennetian, Lisa A., Anna Gassman-Pines, Aletha C. Huston, Danielle A. Crosby, Young Eun Chang, and Edward D. Lowe**, “A Review of Child Care Policies in Experimental Welfare and Employment Programs,” Technical Report, MDRC Working Paper Series No. 1, Manpower Demonstration Research Corporation (MDRC), New York 2001.
- Geyer, Johannes, Peter Haan, and Katharina Wrohlich**, “The Effects of Family Policy on Mothers’ Labor Supply. Combining Evidence from a Structural Model and a Natural Experiment,” Technical Report, SOEPpapers on Multidisciplinary Panel Data Research No. 645, German Institute for Economic Research (DIW Berlin), Berlin 2014.
- Goux, Dominique and Eric Maurin**, “Public school availability for two-year olds and mothers’ labour supply,” *Labour Economics*, December 2010, 17 (6), 951–962.
- Gustafsson, Siv and Frank Stafford**, “Child Care Subsidies and Labor Supply in Sweden,” *Journal of Human Resources*, 1992, 27 (1), 204–230.
- Haan, Peter and Katharina Wrohlich**, “Can child care policy encourage employment and fertility? Evidence from a structural model,” *Labour Economics*, 2011, 18, 498–512.
- Han, Wenjui and Jane Waldfogel**, “Child Care Costs and Women’s Employment: A Comparison of Single and Married Mothers With Pre-School-Aged Children,” *Social Science Quarterly*, 2001, 82 (3), 552–568.

- Havnes, Tarjei and Magne Mogstad**, “Money for nothing? Universal child care and maternal employment,” *Journal of Public Economics*, 2011, 95 (11), 1455–1465.
- Heckman, James J.**, “Effects of Child-Care Programs on Women’s Work Effort,” *Journal of Political Economy*, 1974, 82 (2), pp. S136–S163.
- , “Sample Selection Bias as a Specification Error,” *Econometrica*, 1979, 47 (1), 153–162.
- Helmcke, Thomas**, “Regionalstatistik auf europäischer und nationaler Ebene,” *Wirtschaft und Statistik*, 2008, 3, 207–216.
- Hüsken, Katrin**, *Kita vor Ort. Betreuungsatlas auf Ebene der Jugendamtsbezirke 2008* 2010.
- , *Kita vor Ort. Betreuungsatlas auf Ebene der Jugendamtsbezirke 2010* 2011.
- II, Charles L. Baum**, “A Dynamic Analysis of the Effect of Child Care Costs on the Work Decisions of Low-Income Mothers with Infants,” *Demography*, 2002, 39 (1), 139–164.
- Immervoll, Herwig and David Barber**, “Can Parents Afford to Work? Child-care Costs, Tax-Benefit Policies and Work Incentives,” Technical Report, IZA Discussion Paper No. 1932, Institute for the Study of Labor (Forschungsinstitut zur Zukunft der Arbeit, IZA) January 2006.
- Jacobi, Lena and Jochen Kluve**, “Before and After the Hartz Reforms: The Performance of Active Labour Market Policy in Germany,” *Zeitschrift für ArbeitsmarktForschung*, 2007, 40 (1), 45–64.
- Kimmel, Jean**, “The Effectiveness of Child-Care Subsidies in Encouraging the Welfare-to-Work Transition of Low-Income Single Mothers,” *American Economic Review*, May 1995, 85 (2), 271–75.
- , “Child Care Costs As A Barrier To Employment For Single And Married Mothers,” *The Review of Economics and Statistics*, May 1998, 80 (2), 287–299.

- Kreyenfeld, Michaela and Karsten Hank**, “Does the availability of child care influence the employment of mothers? Findings from western Germany,” *Population Research and Policy Review*, 2000, 19 (4), 317–337.
- Lefebvre, Pierre and Philip Merrigan**, “Child-Care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada,” *Journal of Labor Economics*, 2008, 26 (3), pp. 519–548.
- , —, and **Matthieu Verstraete**, “Dynamic labour supply effects of childcare subsidies: Evidence from a Canadian natural experiment on low-fee universal child care,” *Labour Economics*, 2009, 16 (5), 490–502.
- Lengerer, Andrea, Jeanette Bohr, and Andrea Jan”sen**, “Haushalte, Familie und Lebensformen im Mikrozensus – Konzepte und Typisierungen,” Technical Report, ZUMA-Arbeitsbericht No. 5/2005, Leibniz Institute for the Social Sciences (gesis), Mannheim 2005.
- Lotze, Sabine and Holger Breiholz**, “Zum neuen Erhebungsdesign des Mikrozensus. Teil 1.,” *Wirtschaft und Statistik*, 2002a, 5/2002, 359–366.
- Lundin, Daniela, Eva Mörk, and Björn Öckert**, “How far can reduced child-care prices push female labour supply?,” *Labour Economics*, August 2008, 15 (4), 647–659.
- Meyers, Marcia K., Theresa Heintze, and DouglasA. Wolf**, “Child care subsidies and the employment of welfare recipients,” *Demography*, 2002, 39 (1), 165–179.
- Michalopoulos, Charles and Philip K. Robins**, “Employment and child-care choices in Canada and the United States,” *Canadian Journal of Economics*, May 2000, 33 (2), 435–470.
- and —, “Employment and child-care choices of single-parent families in Canada and the United States,” *Journal of Population Economics*, 2002, 15 (3), 465–493.
- , —, and **Irwin Garfinkel**, “A Structural Model of Labor Supply and Child Care Demand,” *Journal of Human Resources*, 1992, 27 (1), 166–203.

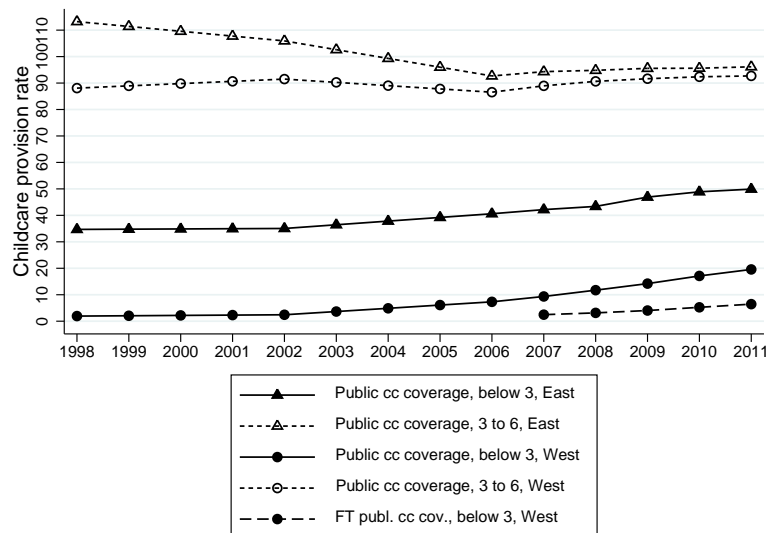
- Mühler, Grit**, “Consequences of the Mixed Provision of Childcare – an Overview on the German Market,” Technical Report, ZEW Discussion Paper No. 08-077, Centre for European Economic Research (ZEW) 2010.
- Müller, Kai-Uwe and Katharina Wrohlich**, “Two Steps Forward – One Step Back? Evaluating Contradicting Child Care Policies in Germany,” Technical Report, SOEPpapers on Multidisciplinary Panel Data Research No. 684, German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung, DIW), Berlin 2014.
- , **Denise Sengül, and Katharina Wrohlich**, “Child care expansion and mothers’ labor supply: is there a causal link?,” mimeo, German Institute for Economic Research (DIW Berlin), Berlin 2015.
- Nollenberger, Natalia and Núria Rodríguez-Planas**, “Child Care, Maternal Employment and Persistence: A Natural Experiment from Spain,” Technical Report, IZA Discussion Paper No. 5888, Institute for the Study of Labor (Forschungsinstitut zur Zukunft der Arbeit, IZA), Bonn 2011.
- Parera-Nicolau, Antonia and Karen A. Mumford**, “Labour Supply and Child-care for British Mothers in Two-Parent Families: A Structural Approach,” IZA Discussion Papers 1908, Institute for the Study of Labor (IZA) December 2005.
- Powell, Lisa M.**, “The Impact of Child Care Costs on the Labour Supply of Married Mothers: Evidence from Canada,” *Canadian Journal of Economics*, 1997, 30 (3), 577–594.
- , “Joint Labor Supply and Childcare Choice Decisions of Married Mothers,” *Journal of Human Resources*, 2002, 37 (1), 106–128.
- Pungello, Elizabeth Puhn and Beth Kurtz-Costes**, “Why and How Working Women Choose Child Care: A Review with a Focus on Infancy,” *Developmental Review*, 1999, 19 (1), 31–96.
- Ribar, David C.**, “Child Care and the Labor Supply of Married Women: Reduced Form Evidence,” *Journal of Human Resources*, 1992, 27 (1), 134–165.

- Ribar, David C**, “A Structural Model of Child Care and the Labor Supply of Married Women,” *Journal of Labor Economics*, July 1995, 13 (3), 558–97.
- Schlosser, Amalia**, “Public Preschool and the Labor Supply of Arab Mothers: Evidence from a Natural Experiment,” Technical Report, The Eitan Berglas School of Economics, Tel Aviv University 2011.
- Schober, Pia S. and C. Katharina Spieß**, “Local Day-Care Quality and Maternal Employment: Evidence from East and West Germany,” *Journal of Marriage and Family*, 2014, *forthcoming*.
- Simonsen, Marianne**, “Price of High-quality Daycare and Female Employment,” *Scandinavian Journal of Economics*, 09 2010, 112 (3), 570–594.
- Spieß, C. Katharina**, “Vereinbarkeit von Familie und Beruf – wie wirksam sind deutsche “care policies”?,” *Perspektiven der Wirtschaftspolitik*, 2011, 12, 4–27.
- Tekin, Erdal**, “Childcare Subsidies, Wages, and Employment of Single Mothers,” *The Journal of Human Resources*, 2007, 42 (2), pp. 453–487.
- Wrohlich, Katharina**, “The excess demand for subsidized child care in Germany,” *Applied Economics*, 2008, 40 (10), 1217–1228.
- , “Labor Supply and Child Care Choices in a Rationed Child Care Market,” Technical Report, DIW Discussion Papers No. 1169, German Institute for Economic Research (DIW Berlin), Berlin 2011.

Appendix

Additional figures

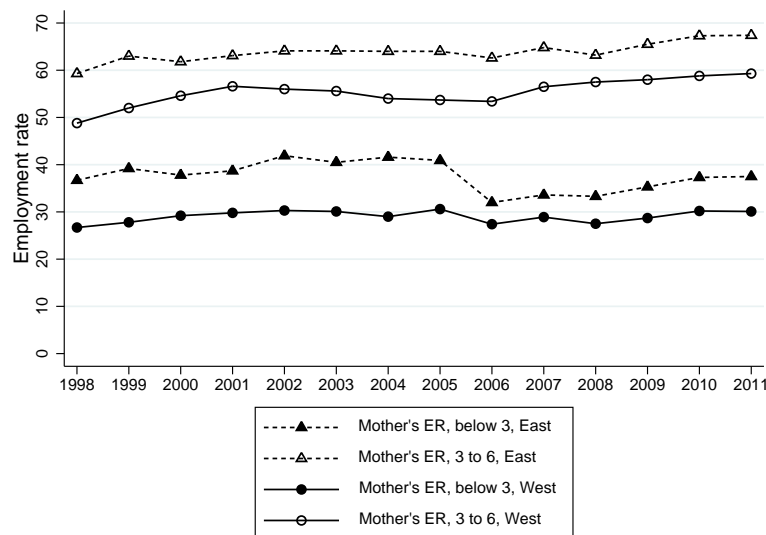
Figure A1: Provision of public childcare in West and East Germany



Notes: cc=childcare, below 3=children aged below 3, 3 to 6=children aged 3 to 6, FT=full-time, publ.=public, cov.=coverage, data for full-time care only available from 2002 onwards.

Source: German Statistical Office.

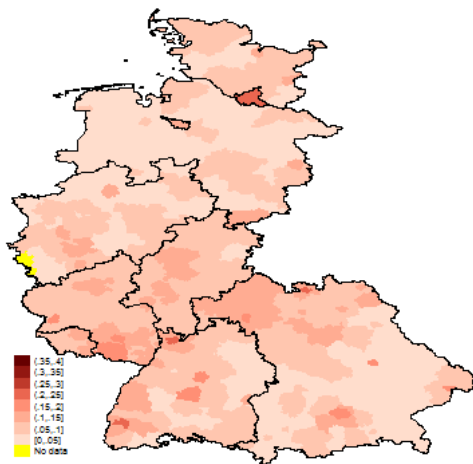
Figure A2: Mothers' employment rates in West and East Germany



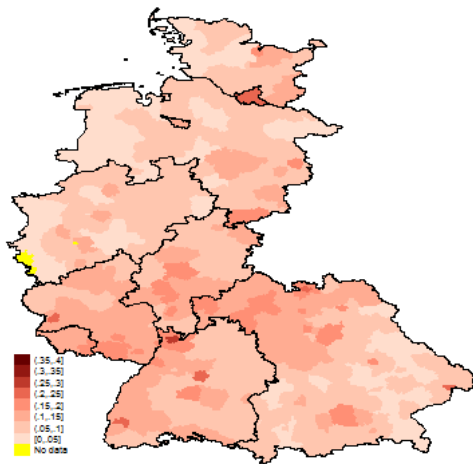
Notes: ER=employment rate, below 3=mothers with children aged 0 to 3, 3 to 6=mothers with children aged 3 to 6.

Source: German Statistical Office, SOEP, MC, own calculations.

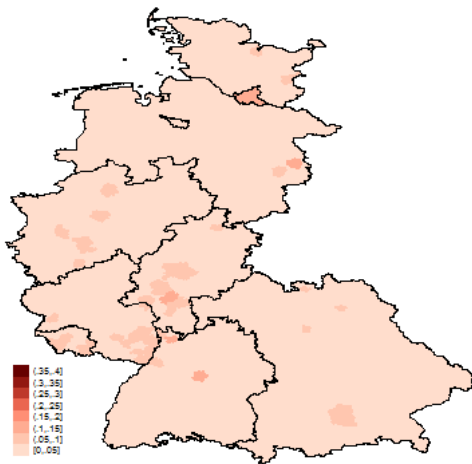
Figure A3: Childcare coverage (in %) at the county level, 2006-2011, West Germany



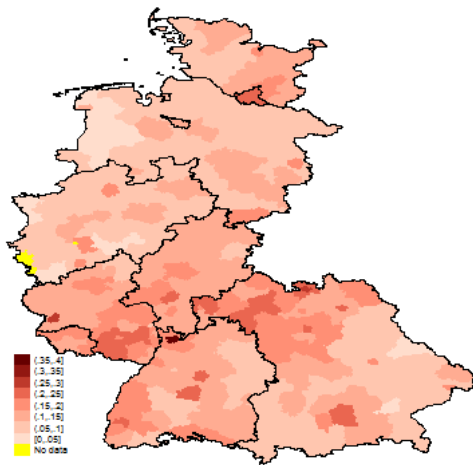
(a) Overall, 2006



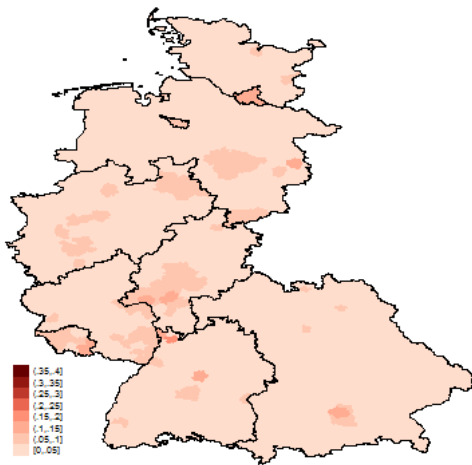
(b) Overall, 2007



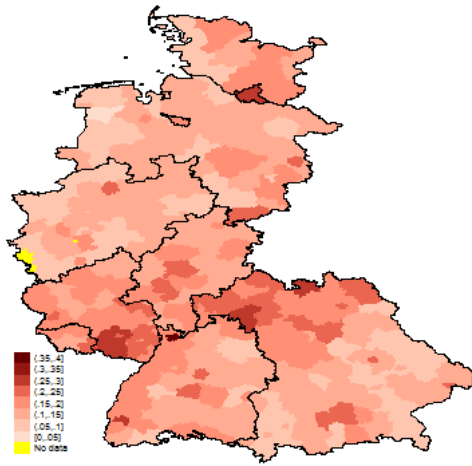
(c) Full-time slots, 2007



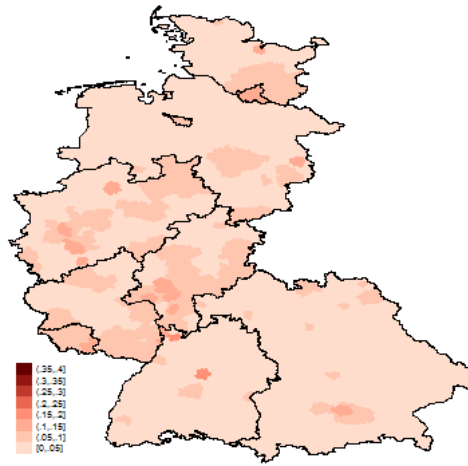
(d) Overall, 2008



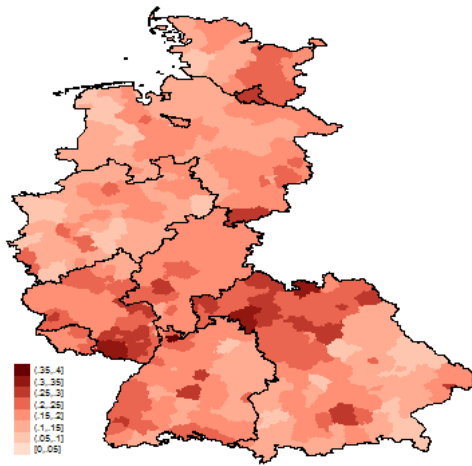
(e) Full-time slots, 2008



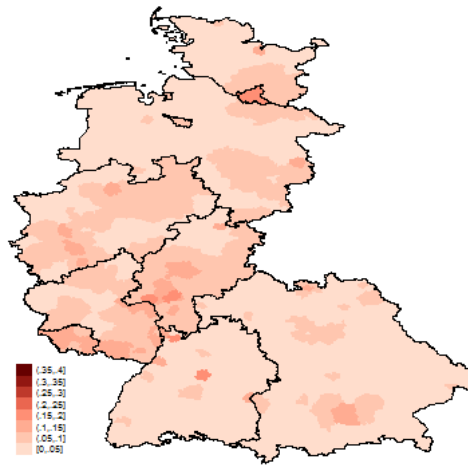
(f) Overall, 2009



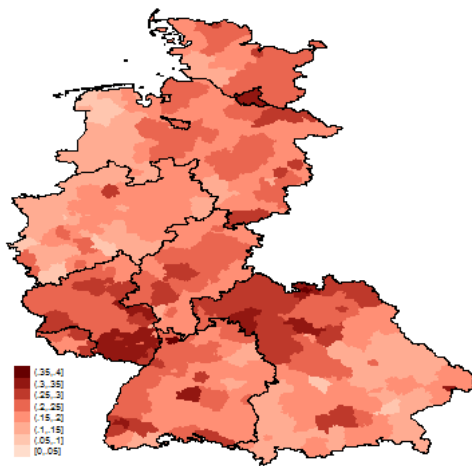
(g) Full-time slots, 2009



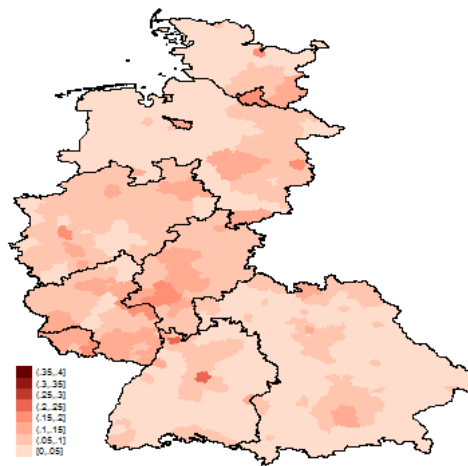
(h) Overall, 2010



(i) Full-time slots, 2010



(j) Overall, 2011



(k) Full-time slots, 2011

Notes: Childcare coverage measured at the county level. Thick lines mark state borders.
Source: German Youth institute, Federal Statistical Office, own calculations.

Additional tables

Table A1: Descriptive statistics, provision of subsidized childcare, 2006-2011

	Overall provision of childcare						Provision of full-time childcare				
	2006	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
West Germany											
Mean	0.073	0.094	0.117	0.142	0.171	0.196	0.025	0.032	0.040	0.053	0.064
Minimum	0.010	0.022	0.033	0.037	0.071	0.092	0.000	0.001	0.002	0.004	0.005
Maximum	0.233	0.289	0.352	0.359	0.365	0.376	0.136	0.155	0.166	0.192	0.205
Schleswig-Holst.											
Mean	0.074	0.083	0.114	0.141	0.176	0.212	0.023	0.030	0.040	0.053	0.070
Minimum	0.032	0.038	0.059	0.080	0.084	0.113	0.004	0.005	0.008	0.011	0.019
Maximum	0.141	0.151	0.167	0.192	0.232	0.273	0.071	0.083	0.101	0.134	0.185
Hamburg											
Mean	0.210	0.222	0.229	0.257	0.287	0.324	0.107	0.115	0.136	0.159	0.182
Minimum	0.210	0.222	0.229	0.257	0.287	0.324	0.107	0.115	0.136	0.159	0.182
Maximum	0.210	0.222	0.229	0.257	0.287	0.324	0.107	0.115	0.136	0.159	0.182
Lower Saxony											
Mean	0.048	0.064	0.086	0.114	0.151	0.178	0.014	0.019	0.027	0.037	0.048
Minimum	0.010	0.022	0.035	0.037	0.071	0.092	0.001	0.001	0.003	0.004	0.006
Maximum	0.144	0.160	0.180	0.210	0.264	0.284	0.101	0.113	0.132	0.147	0.184
Bremen											
Mean	0.070	0.083	0.106	0.114	0.138	0.171	0.034	0.044	0.053	0.063	0.092
Minimum	0.036	0.049	0.071	0.079	0.100	0.133	0.022	0.031	0.044	0.050	0.082
Maximum	0.104	0.118	0.141	0.150	0.175	0.209	0.046	0.057	0.061	0.076	0.103
North Rhine-W.											
Mean	0.062	0.064	0.086	0.108	0.133	0.152	0.030	0.040	0.051	0.062	0.072
Minimum	0.028	0.032	0.033	0.062	0.078	0.093	0.006	0.007	0.013	0.025	0.029
Maximum	0.141	0.144	0.184	0.226	0.244	0.250	0.066	0.089	0.116	0.131	0.155
Hesse											
Mean	0.083	0.115	0.135	0.157	0.189	0.209	0.038	0.050	0.064	0.088	0.104
Minimum	0.036	0.074	0.094	0.110	0.137	0.144	0.010	0.012	0.021	0.037	0.051
Maximum	0.141	0.188	0.203	0.216	0.255	0.286	0.108	0.123	0.134	0.178	0.198
Rhineland-Pal.											
Mean	0.096	0.122	0.153	0.178	0.204	0.244	0.034	0.042	0.055	0.072	0.093
Minimum	0.052	0.072	0.090	0.115	0.136	0.147	0.006	0.009	0.016	0.019	0.032
Maximum	0.162	0.202	0.256	0.274	0.330	0.343	0.086	0.093	0.107	0.143	0.179
Baden-Wuertt.											
Mean	0.082	0.110	0.132	0.154	0.179	0.203	0.023	0.029	0.034	0.045	0.054
Minimum	0.023	0.058	0.071	0.087	0.100	0.131	0.001	0.003	0.006	0.009	0.013
Maximum	0.233	0.289	0.352	0.359	0.365	0.376	0.136	0.155	0.166	0.192	0.205
Bavaria											
Mean	0.074	0.098	0.122	0.149	0.179	0.199	0.018	0.022	0.028	0.037	0.045
Minimum	0.018	0.028	0.044	0.061	0.074	0.093	0.000	0.001	0.002	0.004	0.005
Maximum	0.202	0.243	0.272	0.292	0.323	0.357	0.091	0.102	0.109	0.123	0.141
Saarland											
Mean	0.104	0.125	0.149	0.160	0.185	0.210	0.046	0.062	0.083	0.102	0.126
Minimum	0.081	0.103	0.119	0.124	0.150	0.170	0.024	0.036	0.063	0.072	0.097
Maximum	0.139	0.170	0.196	0.204	0.231	0.257	0.085	0.103	0.112	0.144	0.171
Degree of variation – Theil index											
Overall	0.130	0.106	0.079	0.060	0.048	0.042	0.327	0.285	0.247	0.214	0.194
Between states	0.023	0.029	0.020	0.014	0.009	0.009	0.062	0.062	0.062	0.059	0.055
Within states	0.106	0.077	0.059	0.047	0.039	0.032	0.264	0.223	0.185	0.155	0.139

Notes: The Theil index is decomposable into a weighted sum of between- and within-subgroup inequality. For a definition and the relation to other inequality measures, see Cowell (2000).

Source: German Youth institute, Federal Statistical Office, own calculations.

Table A2: Descriptive statistics of dependent and independent variables for different samples

	2002 – 2011			2006 – 2011			2007 – 2011		
	mean	sd	N	mean	sd	N	mean	sd	N
Employed	0.652	0.476	46936	0.676	0.468	38928	0.681	0.466	33317
Full-time employed	0.235	0.424	46936	0.236	0.425	38928	0.237	0.425	33317
Marginally employed	0.092	0.289	46936	0.084	0.277	38928	0.076	0.265	33317
Hours of work	31.485	13.476	35441	32.257	13.179	31097	32.372	13.163	26887
Childcare coverage (< 3 years)	12.059	7.378	46323	13.854	6.601	38775	14.841	6.395	33164
Full-time coverage (< 3 years)	5.349	4.175	33041	5.349	4.175	33041	5.349	4.175	33041
Part-time coverage (< 3 years)	9.513	4.410	32994	9.513	4.410	32994	9.513	4.410	32994
Child's age	1.511	0.500	46936	1.509	0.500	38928	1.508	0.500	33317
Child's sex	1.489	0.500	46936	1.490	0.500	38928	1.489	0.500	33317
Sibling aged < 3 years	0.621	0.857	46935	0.732	0.893	38928	0.729	0.890	33317
Sibling aged 3 – 6 years	0.335	0.508	46935	0.329	0.505	38928	0.328	0.505	33317
Sibling aged 7 – 18 years	0.435	0.792	46935	0.428	0.787	38928	0.432	0.792	33317
Mother's age	37.408	7.087	46936	38.287	7.227	38928	38.352	7.232	33317
Mother low-skilled	0.262	0.440	46663	0.283	0.451	38879	0.286	0.452	33270
Mother medium-skilled	0.749	0.434	46663	0.763	0.425	38879	0.765	0.424	33270
Mother high-skilled	0.234	0.424	46411	0.251	0.434	38831	0.258	0.438	33232
Mother married	0.912	0.283	46936	0.908	0.289	38928	0.908	0.289	33317
Mother German	0.889	0.314	46936	0.896	0.306	38928	0.897	0.303	33317
Population density	830.085	975.299	46541	846.939	989.654	38604	855.093	997.027	33041
Women's employment rate	45.547	3.861	46533	45.760	3.874	38596	46.087	3.824	33033
Fertility rate	1.388	0.104	46533	1.386	0.099	38596	1.390	0.097	33033
Women's unemployment rate	7.018	2.779	46533	6.930	2.847	38596	6.620	2.693	33033
GDP per capita	30.780	11.983	46525	31.493	12.052	38588	31.683	12.032	33025

Notes: sd – standard deviation.

Source: Microcensus, own calculations.

Table A3: Full regression estimates, main specification

	Participation	FT empl.	Marg. empl.	Hours worked	Selection
FT childcare	0.057 (0.299)	0.190 (0.306)	0.247 (0.231)	22.103* (10.513)	2.128*** (0.307)
PT childcare	0.214 (0.229)	0.016 (0.203)	-0.352* (0.166)	8.038 (8.873)	0.528* (0.259)
Child's age	-0.009 (0.005)	-0.007 (0.005)	-0.008* (0.003)	-0.138 (0.174)	-0.011 (0.018)
Child's sex	0.008 (0.005)	0.001 (0.004)	0.002 (0.003)	0.072 (0.149)	0.018 (0.017)
Sibling < 3 y.	-0.035*** (0.003)	0.008** (0.003)	-0.006*** (0.002)	0.436*** (0.098)	-0.065*** (0.010)
Sibling 4 – 6 y.	-0.071*** (0.005)	-0.043*** (0.005)	-0.004 (0.003)	-0.794*** (0.194)	-0.175*** (0.017)
Sibling 7 – 18 y.	-0.058*** (0.003)	-0.032*** (0.003)	-0.002 (0.002)	-0.490*** (0.125)	-0.113*** (0.011)
Mother's age	0.037*** (0.004)	-0.007* (0.003)	0.004* (0.002)	-0.207 (0.119)	-0.031* (0.014)
	-0.000*** (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.007*** (0.001)	0.001*** (0.000)
Mother med.-skill	0.160*** (0.008)	0.084*** (0.006)	0.035*** (0.004)	0.958** (0.369)	0.428*** (0.024)
Mother high-skill	0.178*** (0.006)	0.128*** (0.007)	-0.009 (0.005)	2.112*** (0.317)	0.512*** (0.026)
Mother married	0.019* (0.009)	-0.020** (0.007)	0.029*** (0.004)		0.073** (0.028)
Mother German	0.214*** (0.009)	0.053*** (0.007)	0.016*** (0.004)		0.311*** (0.026)
Pop. density	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.001 (0.004)	-0.000 (0.000)
Fem. empl. rate	-0.003 (0.002)	-0.001 (0.002)	-0.001 (0.001)	0.033 (0.063)	0.004 (0.003)
Fertility rate	0.049 (0.041)	0.003 (0.043)	0.020 (0.026)	0.674 (1.503)	0.340** (0.105)
Unempl. rate	-0.002 (0.002)	-0.002 (0.003)	-0.001 (0.001)	-0.025 (0.100)	0.010* (0.005)
GDP/capita	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.010 (0.014)	0.000 (0.001)
Year 2008	0.002 (0.010)	-0.020* (0.009)	-0.066*** (0.007)	-0.359 (0.331)	-0.046 (0.028)
Year 2009	0.023 (0.012)	-0.017 (0.012)	-0.065*** (0.010)	-0.560 (0.464)	0.048 (0.028)
Year 2010	0.019 (0.018)	-0.015 (0.017)	-0.076*** (0.015)	-1.802** (0.676)	-0.118*** (0.029)
Year 2011	0.032 (0.023)	-0.005 (0.023)	-0.078*** (0.019)	-1.550 (0.883)	-0.103** (0.032)
Inv. Mills r.				3.438* (1.445)	
N	32893	32893	32893	26547	32893
Adjusted r^2	0.191	0.078	0.037	0.044	
Ξ^2					3734.640

Notes: Standard errors in parentheses; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Source: Microcensus, own calculations.

Table A4: Regression estimates, effects of childcare provision on labor supply, Robustness: childcare indicator & sample

	2007–2011	2006–2011	2002–2011
Extensive margin			
<i>Participation</i>			
Childcare	0.173 (0.205)	0.130 (0.168)	-0.060 (0.142)
<i>Full-time employment</i>			
Childcare	0.059 (0.191)	0.084 (0.155)	0.010 (0.130)
<i>Marginal employment</i>			
Childcare	-0.204 (0.159)	-0.160 (0.135)	-0.173 (0.095)
N	32893	38444	45510
Intensive margin			
<i>Hours worked</i>			
Childcare	0.125 (0.081)	0.106 (0.066)	0.049 (0.050)
N	26547	30721	34594
Controls			
Covariates	✓	✓	✓
Time fixed effects	✓	✓	✓
County fixed effects	✓	✓	✓

Notes: Standard errors in parentheses; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Source: Microcensus, own calculations.

Table A5: DD estimates, effects of childcare provision on labor supply

	2006, 2011			2002, 2011		
	(1)	(2)	(3)	(1)	(2)	(3)
Extensive margin						
<i>Participation</i>						
Treatment	0.013 (0.018)	0.012 (0.016)	0.010 (0.023)	-0.009 (0.020)	0.003 (0.019)	0.027 (0.038)
<i>Full-time employment</i>						
Treatment	0.014 (0.015)	0.017 (0.014)	0.031 (0.024)	0.006 (0.018)	0.016 (0.018)	0.014 (0.031)
<i>Marginal employment</i>						
Treatment	-0.005 (0.012)	-0.006 (0.011)	-0.014 (0.017)	-0.001 (0.012)	-0.001 (0.012)	-0.005 (0.021)
N	12199	12199	12199	13349	13349	13349
Intensive margin						
<i>Hours worked</i>						
Treatment	-0.272 (0.521)	0.065 (0.527)	0.118 (0.548)	0.196 (0.699)	0.330 (0.693)	-0.407 (0.734)
N	9514	9514	9514	8933	8933	8933
Controls						
Covariates		✓	✓		✓	✓
Time fixed effects		✓	✓		✓	✓
County fixed effects			✓			✓

Notes: Standard errors in parentheses; *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Source: Microcensus, own calculations.