# EARLY EDUCATION AND CARE QUALITY: DOES IT MATTER FOR MATERNAL WORKING HOURS?

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## Abstract

This study investigates whether mothers whose children enter early childhood education and care (ECEC) centers of higher quality are more likely to work longer hours. The empirical analysis links the Socio-Economic Panel (SOEP) Study with the $K^2$iD-SOEP extension study, which collected ECEC quality information from childcare centers across Germany. Based on a sample of 556 mothers of 628 children with a mean age of 2.6 years at center entry, the authors applied change score models with entropy balancing to account for differences in a rich set of observable characteristics. The findings show that higher levels of quality with respect to child-teacher-ratio and partly also activities promoting child learning and offered services for parents are associated with greater increases in working hours for mothers since the year before using the ECEC center. No significant relationships emerged for group size and equipment.


Keywords: Child care arrangement; early childhood; maternal employment; family policy; motherhood; entropy balancing

## Introduction

Many parents must rely on non-parental care for their young children while they are at work. This care may take various forms ranging from early childhood education and care (ECEC) centers or family day-care to paid or unpaid care by relatives, friends, or nannies. Over the past decade, the provision of state-subsidized ECEC services has expanded in many Western countries with the aim to facilitate parental employment and work-life balance. In recent years, potential positive effects of ECEC attendance on child development, especially in the domain of cognitive competencies, have also received increasing attention (for reviews, see Barnett, 2011; Burger, 2010; Waldfogel, 2015). However, an increasing body of research indicates that the effects of ECEC attendance depend on the quality of the interactions and the learning environment in these institutions (Anders et al., 2012; Dearing, McCartney, & Taylor, 2009; Keys et al., 2013).

Despite this growing body of evidence, consequences of the quality of ECEC for mothers' employment have received much less attention in the international economic and sociological literature, which has focused on ECEC availability and costs. Results of these studies generally suggest positive, albeit sometimes small, associations of greater state-subsidized day-care provision (e.g., Del Boca & Vuri, 2007; Havnes & Mogstad, 2011; Pettit & Hook, 2005; Steiber & Haas, 2009) and lower childcare costs (e.g., Anderson & Levine, 2002; Blau & Currie, 2006; Fitzpatrick, 2012) with maternal employment.

A few previous studies with a focus on ECEC quality have investigated the relevance of "convenience factors" of ECEC institutions and point to modest positive relationships with proximity to home and with stability of care (Hofferth & Collins, 2000; Meyers, 1993; Miller, 2006). Several small-scale studies, mostly from the United States, have provided evidence that higher levels of satisfaction or perceived childcare quality correlate with lower rates of absenteeism at work, greater perceived productivity, and lower work-family conflict.

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Most of these studies, however, are cross-sectional and rely on parent-reported measures of ECEC quality or satisfaction, which may correlate with maternal employment or work-family conflict reports for various reasons including potential reverse causality or unobserved third variables. So far, we know very little about the relationship between pedagogic quality aspects of ECEC institutions and maternal labor market outcomes. By drawing on longitudinal data on mothers on the one hand, and matched information from ECEC center directors and educators on the other hand, we expand the existing literature and investigate whether mothers whose children enter ECEC centers of higher quality are more likely to work longer hours.

## Conceptualization of ECEC Quality Characteristics

The early childhood education literature frequently differentiates between four dimensions of pedagogic quality in ECEC institutions: structural quality, networking with families, pedagogic processes, and orientation quality (Kluczniok & Roßbach, 2014; Tietze et al., 2013). Structural quality comprises quantifiable and regulable features of the ECEC context. Whereas several studies find that improved child–staff-ratios and teacher qualifications are positively associated with more stimulating or sensitive pedagogic processes and child development, findings for other structural characteristics such as group size, space per child, availability of materials, and further training or accreditation procedures are more mixed (Kuger, Kluczniok, Kaplan, & Rossbach, 2016). Networking with families mainly refers to the cooperation between educators and parents (Anders & Rossbach, 2015; Kluczniok, Anders, & Ebert, 2011). Several studies have found positive associations of parent involvement in ECEC institutions with children's development (Fantuzzo, McWayne, Perry, & Childs, 2004; Zygmunt-Fillwalk, 2011). Process quality, in turn, includes the entirety of pedagogical interactions with the child, and the child's experience with the social and material environment. High process quality positively affects children's development,

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although the effect sizes vary (Anders et al., 2012; Dearing et al., 2009; Keys et al., 2013). Orientation quality comprises the education- and care-related expectations, attitudes, norms and values of teachers in ECEC settings. Teacher enthusiasm, joy and interest in specific activities have been found to correlate with higher instructional quality (Anders & Rossbach, 2015; Kluczniok et al., 2011).

Following the structure-process model of quality, the four quality components may impact children and families as a whole (Kluczniok & Roßbach, 2014). We argue that process and orientation quality are particularly difficult to assess for parents, as measuring them usually requires observations by experts and detailed enquiries from pedagogic staff, respectively. Structural quality measures, such as child-teacher-ratios or group sizes, equipment, learning activities for children and specific offers of support for parents are easier to observe or enquire for parents when dropping off or picking up their children, during parent meetings or by talking to their children. Therefore, this study will focus on characteristics of structural quality and networking with families.

## Previous Studies

Most of the small existing literature on the question how pedagogic quality characteristics of ECEC institutions may impact maternal employment choices has been conducted in the United States. The majority of previous studies considered quality measures based on parent reports rather than information provided by educators or experts, which may portray a more objective image of ECEC institutions' characteristics. Two studies (Buffardi & Erdwins, 1997; Feldman, Sussman, & Zigler, 2004) based on relatively small samples found that mothers who were more satisfied with aspects of childcare quality, such as the attentiveness of pedagogic staff, expressed greater employer attachment, job satisfaction and self-reported work productivity, respectively. Meyers (1993) evaluated the impact of the quality of childcare used by single mothers who participated in a welfare-to-work program in

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the US on their continuation of education and job search activities. Two significant factors predicting program continuation were mothers' safety assessments of the childcare arrangements and whether the child-staff-ratio met staffing recommendations by experts.

Several cross-sectional studies have explored the relationships of maternal satisfaction with childcare quality and their perceived work-family balance and wellbeing, which is of great relevance to effects on employment and may represent an important mechanism of subsequent increases in maternal work hours and wages. Most of them were, however, based on relatively small and non-representative samples. These studies have provided evidence that mothers who were more satisfied with the overall childcare arrangements (Erdwins, Casper, & Buffardi, 1998; Greenberger & O'Neil, 1990; Press, Fagan, & Bernd, 2006) or with specific quality aspects (Erdwins, Buffardi, Casper, & O'Brien, 2001; Payne, Cook, & Diaz, 2012; Press et al., 2006) reported better work-family balance and psychological well-being. In particular, mothers who rated the attentiveness and communication of pedagogic staff higher reported lower levels of work-family conflict and separation anxiety, greater employer commitment and job satisfaction (Buffardi & Erdwins, 1997; Payne et al., 2012; Poms, Botsford, Kaplan, Buffardi, & O'Brien, 2009). Based on a large sample of mothers from the National Longitudinal Study of the High School Year '72, Johansen et al. (1996) also found that US mothers who worked longer hours attached greater importance to educational and developmental attributes of their childcare choice. However, their cross-sectional analysis only showed a correlation, leaving the direction of the relationship unclear.

A few studies have drawn attention to and attempted to reduce unobserved heterogeneity issues in analyzing the relationship between childcare quality and maternal employment (Gordon, Usdansky, Wang, & Gluzman, 2011). Two early studies exploited regional variations in teacher-child ratios in the US and found inconsistent or not significant associations with maternal employment (Hofferth & Collins, 2000; Hofferth & Wissoker,

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1992). A methodologically similar study from Germany (Schober & Spiess, 2015) found that mothers with children under three years in East Germany were more likely to be employed and to work longer hours in counties with smaller ECEC groups. This study found no statistically significant relationships with structural quality indicators for mothers with older children and for West Germany. The authors propose that mothers are more likely to pay attention to ECEC quality when their institution choice is not strongly restricted by excess demand of places and for younger children, for which the use of formal care is less taken for granted. Two intervention studies, which offered a randomly selected group of parents access to high-quality childcare, found evidence of faster labor market return of mothers and longer work hours in the short and long-term in comparison to a control group (Brooks-Gunn, McCormick, Shapiro, Benasich, & Black, 1994; Ramey et al., 2000). As these interventions involved both improved access to childcare and higher quality institutions and were partly combined with other services like home visits, these effects cannot be clearly attributed to the quality of the ECEC institutions.

Based on NICHD SECCYD data and using alternative regression models with lagged dependent variables and fixed effects, Gordon et al. (2011) documented that mothers' reports of choosing the ECEC institution primarily due to reasons of pedagogic quality were more predictive of lower levels of depression than expert ratings of the quality of the ECEC setting. The direction of the relationship still remains unclear in this study, as depressive mothers may assess ECEC settings less positively or may prioritize factors other than quality. Overall, more studies with longitudinal data and more detailed exogenous measures of ECEC quality are needed to address these issues.

We extend these previous studies by investigating how several quality aspects of the specific ECEC center, which the children attend, may matter for maternal employment. By combining longitudinal individual level data of mothers with ECEC quality reports of

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pedagogic staff of the ECEC centers and controlling for previous levels of labor market participation of mothers, we reduce the risk of unobserved factors, such as maternal mental health, career or childcare preferences influencing the quality measures and the relationship with maternal employment.

## Institutional Context of Early Childhood Education and Care in Germany

Since 1996, all children aged three years to school age have been entitled to a slot in an ECEC center in Germany (Spiess, 2008). The legal entitlement for children from age 1 onwards has only been in effect since August 2013. In 2015, 33 percent of children under three and 95 percent of children aged three to five years of age attended formal ECEC services in Germany (Statistisches Bundesamt, 2015). A large majority of mothers in Germany wish to return to the labor market within three years after childbirth, with just over half of mothers planning to return after one year. Yet, two thirds of mothers report that they would have preferred to return earlier with a lack of suitable childcare being the most frequently mentioned reason for not returning earlier (BMFSFJ, 2014). Informal care, e.g. by grandparents, constitutes a frequent source of support but is not eligible to subsidies in Germany. About one third of children under age three are regularly cared for by informal caregivers, partly in addition to attending formal childcare. The growing availability of ECEC services has gone hand in hand with a reduction of informal care (Stahl & Schober, 2018).

A recent study on ECEC quality in Germany has shown that out of 146 evaluated day-care centers for children from the age of three, the majority offered a pedagogic quality that is sufficient but no more. Depending on the measure used, the quality of three to seven percent of the centers was good, whereas at least 10 percent offered insufficient levels of quality (Tietze et al., 2013). This suggests that quality levels may well be of concern to mothers and may affect their decisions as to when to return to work and for how many hours.

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Parents can generally not obtain higher quality by paying higher fees. The German ECEC system is highly subsidized and for-profit providers, who receive no or limited subsidies in some German states, play a very limited role (Spiess, 2008). Parents' fees are mostly income-dependent with households with lower incomes paying less. In 2012, they amounted on average to €144 per month and family (Schröder, Spiess, & Storck, 2015). This may be one reason why children from poor families do not seem to experience systematically lower ECEC quality (Stahl, Schober, & Spiess, 2018). As there are no designated catchment areas, parents may choose freely between ECEC centers and in our $K^2$ID survey 91% of parents reported that they had a choice between at least two centers (own calculations). On average, families in our sample lived in counties with about 1.3 ECEC centers per 100 children (SD: 0.25), while centers served varying numbers of children (mean: 82.5, SD: 45). A recent analysis found that three fourth of parents choose centers within 2.1 kilometers of their home (Stahl, 2017). Given parents' strong preference for centers close to their home, families in densely populated areas tend to enjoy greater choice than families in rural areas (Franke, Pieper, Kürten, & Schweikart, 2015). A recent study, however, indicates no significant differences in structural quality between rural and urban areas and rather points to the important role that state regulations play (Stahl, 2017).

Minimum standards for structural quality vary considerably across federal states and often fall short of evidence-based recommendations (European Commission Childcare Network, 1996; NAEYC, 2014). The minimum requirements for most aspects, such as maximum group size, training, and space, range from precise to very general to none at all. Quality variation between institutions may furthermore arise, for instance, because some providers, such as church-related or other non-profit providers, may allocate more funding to ECEC centers than public providers (i.e., municipalities). Also, municipalities vary in how

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much they spend on ECEC provision due to political reasons or to budget constraints (Andronescu & Carnes, 2015).

## Conceptual Model

We combine a rational choice model with considerations of constrained choices and accommodations (Chaudry, Henly, & Meyers, 2010; Meyers & Jordan, 2006) and identity-related perspectives (Stets & Burke, 2005; Stryker & Burke, 2000) to understand how the quality of ECEC institutions may influence maternal employment decisions. Following a rational choice framework, a parent's decision to pursue or increase employment over family care activities depends upon the relative value attached to his or her time in the market compared to time at home and on income from other sources, such as a partner with higher earnings (Becker, 1981; Blau, 2001). In theory this assumption is formulated in a gender neutral way; yet, in practice in Germany, mothers regularly interrupt or reduce their employment, whereas fathers rarely decrease their work hours substantially (Bünning, 2015; Bünning & Pollmann-Schult, 2016). The value of market time depends upon the potential wage of the mother and the cost of substitutes for her care time. With fathers and other informal caregivers frequently not being available for the required hours, the expanding formal childcare services have become more important (Stahl & Schober, 2018). In Germany, the relatively low and mostly income-dependent costs of ECEC centers have been found to have only small effects on the take-up of ECEC places (Wrohlich, 2004). The psychological costs (e.g., bad conscience, separation anxiety) may be more important than monetary costs.

The economic perspective has been frequently criticized for assuming that i) parents are perfectly informed about the quality of all ECEC institutions, and ii) parents have homogeneous and relatively fixed ex-ante preferences for ECEC characteristics (Chaudry et al., 2010; Meyers & Jordan, 2006). The accommodation model seeks to combine a rational action perspective of parents with insights on varying information on the childcare system

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and on parental preferences that may adapt to context-specific care availability and easily accessible information. According to sociological identity theory (Stets & Burke, 2005; Stryker & Burke, 2000), parents (re-)construct their parenting identities through the chosen work-care arrangements. Mothers' identity constructions vary between educational groups and between West and East Germany, for instance, due to stratified social norms and networks and regionally distinct work-care cultures. Profound differences in family policies between East and West Germany before reunification in 1990 have shaped cultural ideals regarding maternal employment and use of formal childcare (Rosenfeld, Trappe, & Gornick, 2004). Furthermore, in recent years family policy reforms have set varying incentives for different socio-economic groups of parents leading to divergent labor market return patterns {Geyer, 2015 #1611;Stahl, 2018 #1825}. As a result of greater acceptance of formal childcare as well as stronger work orientations and financial pressures, mothers in East Germany on average return to work and enroll their children in ECEC services earlier and for longer hours than in West Germany (Lietzmann & Wenzig, 2017; Zoch & Hondralis, 2017). Highly educated mothers return to work and take up childcare earlier than those with low levels of qualifications (Stahl & Schober, 2018).

Mothers are likely to consider higher-quality ECEC institutions more suitable substitutes for their own care time. Recent studies on maternal childcare preferences indeed suggest that mothers base their choices between different childcare arrangements and institutions on criteria of pedagogic quality as well as convenience, such as opening hours and proximity (Chaudry, Henly, & Meyers, 2010; Johansen et al., 1996; Vandenbroeck, Visscher, & Nuffel, 2008). We argue that mothers base their trust in and satisfaction with the care arrangements in particular on easily observable indicators, such as child-teacher-ratio and group size as well as on children's or educators' reports of offered activities. Cooperation between

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educators and parents is likely to be another important component of a high-quality care, as it allows both parties to adapt the care to children's needs and fosters trust.

When children enter a new ECEC institution, the settling-in phase may be easier in a center of high quality, as the latter may provide more structured or individualized care and better communication with the parent. This facilitates a faster labor market re-entry of mothers and an extension of working hours. Lower levels of quality may lead to extended settling-in periods during which mothers may postpone their labor market re-entry or work shorter hours for extended periods. Care of lower quality may increase the chance of the child showing behavioral difficulties, which may keep mothers from extending their working hours or even lead them to temporarily reduce their working hours to spend more time with the child. Due to different work-care cultures (Stahl & Schober, 2018) and varying career opportunities and childcare resources (Damaske, 2011), especially mothers in East Germany and those with college degrees are most likely to gradually increase their working hours to longer part-time or full-time if high-quality childcare is available. By contrast, mothers in West Germany and those with low levels of education might postpone their labor market returns or reduce their hours again if childcare quality is insufficient. Due to sample size limitations, the subsequent analysis is unable to differentiate between different employment status changes and to examine subgroups separately. We therefore examine the hypothesis that mothers whose children attend an ECEC center of higher quality with respect to structural quality and parental support are more likely to enter the labor market or increase their employment hours than mothers whose children attend lower-quality institutions.

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## DATA AND METHOD

### *Data and Sample*

The analyses draw on longitudinal information from the Socio-Economic Panel (SOEP, waves 2009 to 2014, http://www.diw.de/en/soep), the largest and the longest running multidisciplinary panel study in Germany (Wagner, Frick, & Schupp, 2007). In 2014, 28,042 individuals living in 16,037 households participated in the study (Gerstorf & Schupp, 2015). Of these, 6,011 individuals originated from the supplementary study 'Families in Germany' (FiD), which oversampled specific families (e.g., families with young children, low-income families) and was integrated into the SOEP in 2014 (Schröder, Siegers, & Spiess, 2013). Starting in October 2013, nearly 74 percent of all SOEP families with a child born after 1 September 2007 (1,870 of 2,538 households) agreed to participate in the K²ID-SOEP extension study (Wave 1) on external childcare (Schober, Spiess, Stahl, Zoch, & Camehl, 2017). About 93 percent of parents who used an ECEC center for their child revealed the center address, allowing to survey these centers in 2014. About 55 percent of contacted centers (N=680) across Germany answered all or part of two detailed questionnaires on ECEC quality intended for the director and the main educator of a child's group, or at least a highly compressed questionnaire version for the director.

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The new ECEC quality data was matched with 869 children and their families. However, given our focus on *transitions*, we could only keep the children of 593 mothers for whom we had panel data in the sample, i.e., those with employment data from the *last wave before* ($T_0$) and at least from one of the *first three waves following* the child's entry to the surveyed ECEC center (T1-Tk), respectively. Also, we only kept observations before the child entered school to isolate transitions to ECEC from transitions to school. After deleting cases with missing values or outliers on one or several control variables, this left a total of 556 mothers of 628 children (72 percent of children with ECEC data) who attended 576 different groups nested in 523 ECEC centers. Although we analyzed maternal employment outcomes, the units of analysis were children. Standard errors were clustered at mother level in order to

account for this data structure. However, for the great majority of families (N=486) we only observed one child. The analyses included mothers with children of a broad age range, the great majority of whom entered the observed center between age one and three (mean = 2.6 years).

*Analytical Strategy*

The present paper pursues the question as to whether mothers are more likely to enter the labor market or extend their work hours if their children attend high-quality (treatment group) as compared to low-quality (control group) ECEC settings. However, using high- or low-quality ECEC services is not random but may be correlated with family characteristics such as parental education and migration background (Augustine, Cavanagh, & Crosnoe, 2009; Dowsett, 2008; Stahl et al., 2018). Although conventional linear regression models can take into account a rich set of control variables, they may even "increase bias in the estimated treatment effect when the true relationship is even moderately non-linear, especially when there are large differences in the means and variances of the covariates in the treated and control groups" (Stuart, 2010, p. 3). Matching techniques can help counteract covariate imbalance to decrease the error and model dependency when calculating the treatment effect (Hainmueller, 2012). These approaches usually establish covariate balance *indirectly*, e.g., via model-based propensity scores (Rosenbaum & Rubin, 1983), and sometimes fail to reach satisfactory balancing levels (Hainmueller, 2012; Hainmueller & Xu, 2013). As an appealing non-parametric alternative, entropy balancing (EB) calculates balancing weights *directly*, i.e., through exact matching of all pre-specified moments (e.g., mean, variance) regarding the covariate distributions of the treatment and control group, prior to estimating any causal effects (Hainmueller, 2012; Zhao & Percival, 2016). If successful, EB makes the treatment variable orthogonal to the observed characteristics (Hainmueller, 2012). Our analytical strategy combined two steps: 1) entropy balancing, and 2) Ordinary Least Squares (OLS)

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regressions of change scores of maternal work hours. We estimated separate models for each quality indicator and each outcome. To correct for selective non-response to the K²ID-SOEP study, we used sampling weights as provided in the dataset (Schober et al., 2017).

*Step 1* (EB): The observations in the control group (low quality) were reweighted based on a set of covariates which had been measured *prior to* treatment, i.e., in the last wave before a child entered the surveyed ECEC center ($T_0$). Cases cannot only be matched or discarded, but their weights can vary smoothly, meaning that control observations that are more similar to the treatment observations receive higher weights (Hainmueller, 2012). As a result of reweighting, the means of all categorical covariates and - in case of continuous variables - also their variances became exactly the same as in the treatment group. In addition, the pre-treatment employment outcome, i.e., maternal working hours in $T_0$, had to be identical with regard to the third-order moment (skewness). Taking the example of child-teacher-ratio and actual working hours of mothers, Figure 1 indicates substantial covariate imbalance before EB. For instance, in $T_0$ mothers in the treatment group worked more hours and were less likely to live in a medium-sized municipality. After EB, the means of all covariates were exactly the same in both groups (see Table A-1 in the online appendix for all results on this example; the remaining results from EB are available from the authors upon request). The analyses were conducted using the Stata package 'ebalance' (Hainmueller & Xu, 2013).

*Step 2*: Using the weights generated in step 1, we regressed the change in mothers' working hours from the last wave before the child's ECEC entry to the period after the child's entry ($T_1$-$T_k$) on the treatment indicator (high vs. low quality). Assuming that employment trends are not independent of the response at the first time point, it is essential to take into account mothers' pre-treatment working hours. We also expect the latter to capture part of the unobserved heterogeneity. Next, we included all conditioning variables used for

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entropy balancing in the OLS regression model. This can reduce unexplained variance, thereby attenuating the standard error of the estimated treatment effect. Finally, we added controls for relevant changes between $T_0$ and $T_1$-$T_k$ that could have caused changes in the relevant outcomes. Below, we only present results from this 'main model', which we compare to a standard, unbalanced OLS regression model ('baseline model'). Please note that the estimated treatment effect would have been the same if we had used absolute levels of working hours instead of changes as outcome.

Basically, we estimated whether the transition to using a (new) ECEC center was associated with a stronger increase in working hours if the center offered high rather than low quality. A positive coefficient of the respective quality indicator can be interpreted in the way that mothers who used high-quality ECEC for their children increased their working hours more strongly since $T_0$ than mothers who used a low-quality ECEC center. In $T_0$, 74 percent of the children did not yet attend any ECEC institutions, whereas only 26 percent of children attended another ECEC institution before entering the center for which we have data on quality. Whenever we observed maternal working hours two or three times after ECEC entry, we calculated the average across time points in order to detect any medium- rather than just short-term effects. Given that the sample children entered the ECEC institutions between 2009 and 2014, the outcomes were mostly measured before 2014 and hence before these institutions were surveyed about their quality. To account for this, the survey year at $T_0$ entered the balancing part as a covariate because quality changes become more likely the further the measurement points are apart. Moreover, structural characteristics which are frequently regulated by law have been found to be comparatively stable across multiple years (Kuger et al., 2016). A core assumption the approach rests upon is that if families in the treatment group had chosen a low-quality instead of a high-quality ECEC setting, the employment *trends* would have been identical in both groups. However, this is not testable,

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and it is possible that the control variables insufficiently capture unobserved characteristics that correlate with both ECEC quality and/or changes in working hours. Possible unobserved confounders include, for instance, individual differences in preferences for employment or ECEC quality, or the quality of the previous ECEC setting.

*Definition of treatment and measuring ECEC quality*

Entropy balancing required splitting the sample into two groups characterized by low (control) and high (treatment) ECEC quality. This procedure is robust against outliers and conservative, as we just assumed that the surveyed center remained in the same category over time. We selected several indicators of ECEC quality and set a threshold to form two groups of sufficient size. All quality indicators are based on questionnaire answers by the ECEC teachers. Previous studies found that educators tend to overestimate quality compared to expert raters but less so than parents. Educator reports of quality have been shown to generate valid measures of ECEC quality, especially with respect to more easily observable and relatively fixed characteristics, such as group size, child-teacher-ratio and available materials (Barros & Leal, 2015; Hachfeld & Anders, 2016; Kuger et al., 2016). Quality was measured using four indicators of structural ECEC quality and one indicator of networking quality, which should be of particular importance as well as accessible to parents: a) the group's unstandardized child-teacher-ratio, that is the number of children in the group divided by the number of educators usually present at the same time; b) the number of enrolled children per group (group size); c) the equipment with five types of playing materials (picture books; drawing/writing material; bricks; socially stimulating material; dolls/puppets) captured by a factor derived from polychoric factor analysis; d) the average score of the frequencies with which the group offered to children four kinds of activities (music education; arts education; German language education; mathematics and natural sciences education), which were selected based on polychoric factor analysis; and e) the average score of the frequencies with which the center

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offered three types of services to parents (counselling and activities for parents only; parents' evenings; conversations about the child's development) as an indicator of parental involvement. A fourth type of service ('conversations when dropping off or picking up children') was omitted due to lack of variation. Concerning a) and b), children in groups whose ratio or group size was in line with the NAEYC Early Childhood Program Standards and Accreditation Criteria (NAEYC 2014) considering the respective child's age formed the treatment group. With regard to c), d) and e), the threshold was set at the median, i.e., being in the treatment group meant that the equipment, the frequency of offered activities and services for parents was at or above the median. Educators indicated whether 'no children', 'some', 'about half', or 'almost all children' could play with the respective toys at the same time on a scale from 0 to 3. ECEC staff rated the frequency of activities offered to children by choosing between six categories ranging from 1 to 6 ('activity not offered', 'at least once a year', 'several times a year', 'at least once a month', 'once a week', 'several times a week') and the frequency of services for parents by choosing between six categories from 1 to 6 ('activity not offered', 'yearly', 'biannually', 'several times a year' / 'month' / 'week'). The indicator for group size correlated substantially with those for ratio (r=.57) and materials (r=.29). Otherwise, the correlations between the treatment indicators were weak. Less than 10 percent of children attended ECEC settings which provided either good or bad quality on all five quality indicators.

Table 1 displays descriptive statistics of all treatment variables and their underlying continuous quality indicators. While treatment and control groups differed substantially with respect to the quality they received, mostly by more than a standard deviation, the group-specific standard deviations also indicate that the treatment groups experienced much more homogenous conditions than the respective control groups.

*Dependent variables*

We used two different outcome variables to assess the effect of ECEC quality on maternal employment: mothers' changes in a) actual weekly working hours, hence including possible overtime, and in b) contractual weekly working hours. Whereas positive links between ECEC quality and the former may signify that mothers enjoy temporal flexibility and can work overtime if demanded, links with contractual working hours may suggest that mothers can raise their labor market attachment on a permanent basis, which in turn leads to higher income from paid work. Mothers on full-time parental leave received the value of zero on both measures of working hours. To analyze change scores, we subtracted the values in the pre-treatment wave ($T_0$) from the average values in the post-treatment period ($T_1$-$T_k$). Thus, positive values signify an increase and negative values a decrease in working hours, whereas zero indicates no change over time. On average, actual working hours increased by 7.1 (SD=14.2) and contractual working hours rose by 5.9 (SD=12.8). The correlation of both change scores was 0.90. Table A-2 in the online appendix gives an overview of the frequency of changes in actual and contractual working hours across the sample by mothers' employment status in $T_0$. 20 percent of the sample children have mothers who raised their actual working hours within employment over time, whereas the continuously employed mothers of 16 percent and 5 percent of the children, respectively, reduced their hours or did not change them. Among 35 percent of the sample, the mothers were not employed in $T_0$ but entered employment after the child's ECEC entry. The mothers of 24 percent of children remained continuously non-employed over the observation period. Changes in contractual working hours were distributed similarly but slightly less frequently observed compared to those in actual working hours.

*Control variables*

Next to the pre-treatment level of the respective employment outcome and the survey year, the covariate list for the balancing part contained a range of other characteristics of the

mother, child and household. The first group captured mothers' educational attainment based on the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification, which combines the length of the educational experience as well as a differentiation between general and vocationally-oriented education (for details, see Braun & Müller, 1997). We differentiated between a low level of elementary education up to basic vocational qualification (0-1c), a medium level capturing intermediate to full vocational or general secondary qualifications (2a-2c), and the highest level including any tertiary (3a-3b) education. We also included mothers' cumulated work experience in years (both full- and part-time) at $T_0$ before the child entered the ECEC center and their employment status in the year before the child was born (collected retrospectively), distinguishing full-time, part-time, not employed and a residual category if the employment status was unknown. To capture maternal work orientations, another categorical variable indicated whether the mother desired an increase of her working hours within the next five years. Two further variables indicated if she was very worried, somewhat worried or not worried at all about the personal economic situation and if she was pregnant or had given birth recently, respectively.

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As child characteristics, three binary variables indicated if the child was female, if it had a migration background and if it was the youngest child in the household. A categorical variable distinguished between children who were zero, one, two, or at least three years of age. In terms of childcare arrangements, we controlled for the use of informal childcare and for the hours the child spent in another ECEC center in the pre-treatment phase.

As part of the household characteristics, we controlled for the inflation-adjusted, equivalized net household income using the revised OECD scale (OECD, 2013). Further covariates included an indicator of single-parent families, the number of children in the household, mother's age in years at the time of the survey, residence in East or West Germany and in a small (<20,000 inhabitants), medium-sized (20,000 to 500,000

inhabitants), or large (>500,000 inhabitants) municipality. Finally, two continuous variables captured the county-level unemployment rate and the number of months between the $T_0$ interview and the child's ECEC entry (on average five months). More negative values signify a longer period between the two events, which increases the risk of a change in the outcomes of interest before ECEC entry. All continuous control variables were mean-centered.

In addition to these pre-treatment variables measured at $T_0$, we also controlled for relevant changes that might have affected maternal employment outcomes independently of ECEC quality during or after the transition of interest. Specifically, we included dummy variables to indicate if the family moved, if the mother became pregnant or if she experienced a change in partnership status between $T_1$ and $T_k$.

## RESULTS

As a first step, Table 2 shows the results from the OLS regressions of change scores without balancing the observations. Even though the majority of treatment indicators point towards positive associations between high ECEC quality and increases in both actual and contractual working hours among mothers, only a favorable child-teacher-ratio revealed a statistically significant link with actual and contractual working hours. This association was sizable, with the treatment group's increases exceeding those of the control group by over three hours per week for both actual and contractual hours. None of the other four quality indicators reached statistical significance in the OLS models.

Considering the control variables, mothers who worked longer hours in the wave before their child entered a center experienced smaller increases in subsequent waves (Table A-3 in the online appendix). Tertiary education, more work experience and living in East Germany were predictors of stronger increases in actual work hours. Other characteristics such as having another younger child or being single correlated with smaller increases or even reductions in working hours. Child age was *negatively* correlated with both measures of

working hours, possibly because women who decide to use ECEC earlier after childbirth are more inclined to pursue their professional careers.

Table 2 furthermore displays the results from the final models applying entropy balancing. Although the positive associations between higher quality in terms of child-teacher-ratio and increases in actual and contractual working hours were attenuated compared to the unbalanced results, the differences were still 2.9 and 2.7 hours, respectively, and statistically significant at the 5%-level. Mothers in the control group revealed an average increase in actual working hours of 4.4 hours, whereas mothers whose children were exposed to high quality showed increases of 7.3 hours (Figure 2). The change in contractual working hours was slightly smaller in both groups but equally statistically significant. The findings also reveal a positive relationship between activities offered in ECEC settings and changes in actual working hours which is only statistically significant in a one-tailed test. Using an ECEC center that frequently offered diverse learning activities to children was associated with greater growth in actual working hours by about two hours a week among mothers. Furthermore, an above-average frequency of services for parents related to greater increases in mothers' contractual working hours by about 3 hours per week. However, the relationship between services for parents and actual work hours did not reach statistical significance. Once again, group size and equipment were not significantly associated with actual or contractual working hours (Table 2).

*Sensitivity analyses*

We re-estimated the models for child-teacher-ratio, learning activities and services for parents constraining the sample to West Germany. The results were robust, which means that the observed relationships were not solely driven by the relatively few East German mothers. We also investigated the observed significant relationships between quality and outcomes

again by only including the outcomes at $T_1$, i.e., the first wave after ECEC entry. The estimates increased, which might suggest that part of the effect may be short-term. Our results were moreover consistent when estimating logistic regression of binary outcomes instead of linear regressions after entropy balancing.

In sum, the presented findings provide partial evidence that ECEC quality may contribute to mothers' labor market involvement. The most consistent findings are that using an ECEC setting which offers adequate ratios between children and staff was associated with greater increases in maternal working hours, both actual and contractual. None of the associations with group size and equipment were significant. Evidence for the remaining relationships was more mixed but in the expected direction. Our results therefore partly supported our hypothesis, which expected mothers who used higher-quality ECEC centers for their child to increase their labor market involvement more than mothers whose children attended lower-quality institutions.

## DISCUSSION

This study investigated how five different quality aspects of ECEC centers attended by children relate to changes in their mothers' work hours after labor market return. By focusing on pedagogical ECEC quality, we extend the literature most of which focused on the importance of childcare availability, costs, or convenience factors of care. Our results suggest that some aspects of ECEC quality may influence mothers' employment hours. Mothers who used an ECEC setting which offered adequate ratios between children and staff extended their actual and contractual working hours more than mothers whose children attended lower-quality ECEC centers. Furthermore, a high frequency of learning activities for children in ECEC institutions correlated with extensions of actual working hours of mothers (significant only in a one-tailed test). The frequency of interactions between pedagogic staff and parents was associated with larger increases in mothers' contractual working hours. By contrast,

smaller group sizes and better equipment were not significantly associated with maternal employment outcomes.

The different findings across quality aspects may seem surprising at first. However, theoretically it makes sense that parents attach more weight to child-teacher-ratio than raw group size. The former is certainly a better indicator as to whether the provided care is adequate with regard to safety considerations as well as attention each child receives, and mothers seem to be willing to leave their children in a setting with age-appropriate ratios for longer hours. Likewise, from the perspective of parents mere availability of materials may be less critical than the amount of offered learning activities. If mothers believe that their children encounter various opportunities for learning during the day, they may be more inclined to work overtime if need be. Services for parents capture the overall intensity of interactions between centers and parents. Even though more frequent services were positively associated with contractual working hours, other aspects of parent-educator cooperation (e.g., quality of communication) might show more consistent results. The non-significant association with increases in actual work hours is somewhat surprising but should not be over-interpreted. After all, both coefficients were sizeable and in the expected direction.

The results on the relevance of child-teacher-ratios for maternal employment hours are partially in line with previous studies. Meyers (1993) found that using a day care center whose child–teacher-ratios met accreditation requirements was positively associated with the probability of single mothers continuing a welfare-to-work program in the United States. By contrast, Schober and Spiess (2015) and Hofferth and Collins (2000) did not find that local child–teacher-ratios correlated with the probability of employment among mothers with children under school age in Germany and the USA, respectively. One possible explanation for the discrepancy in results may be that the characteristics of the ECEC institutions that mothers actually use are more important than local area averages.

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Our study extended previous cross-sectional studies (Buffardi & Erdwins, 1997; Erdwins et al., 2001; Erdwins et al., 1998; Payne et al., 2012; Poms et al., 2009; Press et al., 2006), which considered only parental satisfaction with quality or parent-reported measures of quality, by linking longitudinal parental data with measures of quality reported by pedagogic staff of ECEC centers. Our results contrast slightly with Gordon et al. (2011) who found that mothers' perceptions of higher childcare quality significantly predicted reduced depression, whereas expert quality ratings did not. Our results suggest that quality characteristics reported by pedagogic staff may also matter for mothers' labor market involvement. Parents may be unable to assess ECEC quality in the same way experts and ECEC staff would do, but mothers may integrate some of the more observable quality aspects of their children's ECEC settings into their employment-related decisions. Quality improvements may hence be beneficial to families as a whole, and practitioners should make sure to communicate such improvements to parents.

The rich longitudinal indicators of mothers' employment histories, orientations and childcare arrangements allowed us to consider many relevant control variables in our models and to apply an innovative method of statistical matching, entropy balancing, to reduce bias beyond what would be possible within an OLS regression framework. Yet, a potential limitation of this analysis is the assumption of relatively stable structural and networking quality in the ECEC institutions over several years (Kuger et al., 2016). Due to data limitations, we were also unable to consider childcare support by mothers' partners and quality characteristics of previous childcare arrangements for those children who had already been in non-parental care previously. Finally, even though we account for a substantial set of covariates including planned work hours extensions, a risk of bias remains due to unobserved career orientations of mothers, which may lead more ambitious mothers to search for higher-quality ECEC centers in anticipation of their increasing working hours.

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From a broader policy perspective, our results provide evidence that investments in ECEC quality may not only benefit child development but may also facilitate the postnatal labor market participation among mothers with young children. Future studies should ideally follow larger samples of mothers from childbirth and consider in more detail the mechanisms how ECEC quality aspects may influence maternal employment choices and also subsequent wage trajectories. Possible mechanisms relate, for example, to the timing of return, job continuity and productivity at work, which may in turn be mediated by psychological factors such as work-family conflict and feelings of doubt versus reassurance that the child receives high-quality care and education. The role that today's fathers play in childcare choices also deserves more attention, as some actively involved fathers may take parental leave or temporarily reduce their working hours when high-quality formal childcare is not available. Variations across work-care cultures represent another promising avenue for future research.

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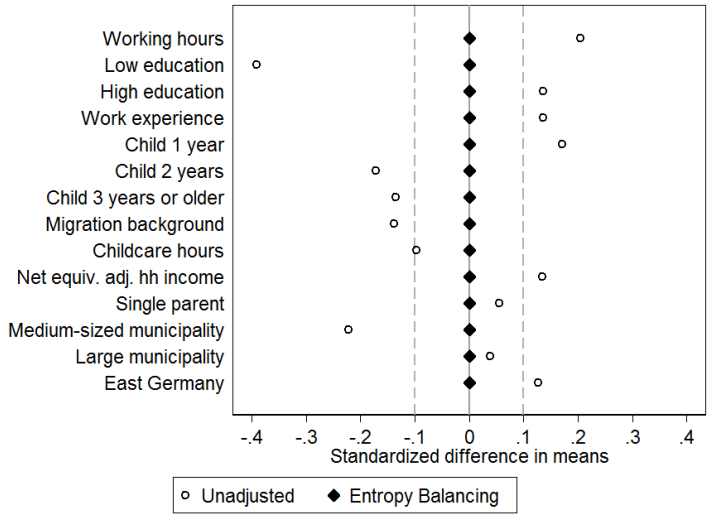
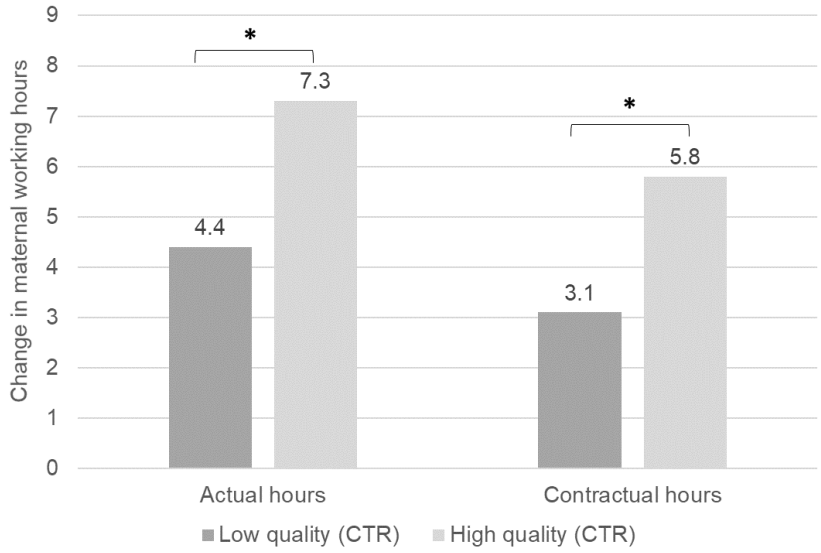
## FIGURES

*Figure 1. Balance of Selected Covariates Before (white dots) and After (black diamonds) Entropy Balancing using the example of Child-Teacher-Ratio and Maternal Actual Working Hours.*




Note: X-axis displays difference in means divided by the standard deviation in the full treated group (Stuart 2010). Negative (positive) values indicate that the covariate mean in the treatment group is lower (higher) than in the control group. After entropy balancing, the means of all covariates are identical in both groups.
Source: SOEP v31 (2009-2014) and 2014 K²ID-SOEP extension study (own calculations).

*Figure 2. Predicted Average Changes in Actual and Contractual Working Hours as a function of ECEC Quality in terms of Child-Teacher-Ratio (CTR).*




Note: * p < 0.05. Source: SOEP v31 (2009-2014) and 2014 K²ID-SOEP extension study (own calculations).

TABLES

Table 1. *Summary Statistics of all Treatment Variables and their underlying Continuous Quality Indicators*

| *Binary treatment indicator* | | | *Underlying continuous quality aspect* | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *By subgroup* | | | *Overall* | | |
| **Quality aspect** | **Quality level** | **%** | **Mean** | **Diff** | **SD** | **Median** | **Mean** | **SD** |
| Child-teacher-ratio (N=554) | *Low* | 40.0 | 13.1 | -6.3 *** | 7.5 | 8.5 | 9.3 | 5.8 |
| | *High* | 60.0 | 6.8 | | 2.0 | | | |
| Group size (N=568) | *Low* | 51.7 | 26.6 | -11.0 *** | 14.4 | 20.0 | 21.9 | 12.4 |
| | *High* | 48.3 | 15.6 | | 3.7 | | | |
| Equipment (N=404) | *Low* | 51.1 | 2.0 | 1.0 *** | 0.5 | 2.5 | 2.5 | 0.6 |
| | *High* | 48.9 | 3.0 | | 0.2 | | | |
| Activities (N=569) | *Low* | 43.2 | 4.0 | 1.7 *** | 1.1 | 5.3 | 4.9 | 1.1 |
| | *High* | 56.8 | 5.7 | | 0.2 | | | |
| Services for parents (N=477) | *Low* | 43.4 | 2.6 | 1.0 *** | 0.4 | 3.3 | 3.2 | 0.6 |
| | *High* | 56.6 | 3.6 | | 0.3 | | | |

Note: Results are weighted.

Source: SOEP v31 (2009-2014) and 2014 K²ID-SOEP extension study (own calculations).

Table 2. *Results from OLS and Entropy Balancing (EB) on Associations between ECEC Quality and Changes in Working Hours*

| | OLS (baseline models) | | EB (main models) | |
|---|---|---|---|---|
| | **Δ actual hours** | **Δcontractual hours** | **Δ actual hours** | **Δcontractual hours** |
| **Child-teacher-ratio** | 3.64** | 3.02** | 2.91* | 2.69* |
| (N=554) | (1.20) | (1.11) | (1.30) | (1.29) |
| *adjusted* $R^2$ | 0.548 | 0.518 | 0.575 | 0.543 |
| **Group size** | 1.58 | 0.57 | 0.30 | -0.61 |
| (N=569) | (1.34) | (1.24) | (1.36) | (1.39) |
| *adjusted* $R^2$ | 0.539 | 0.506 | 0.640 | 0.609 |
| **Equipment** | 1.15 | 1.13 | 1.62 | 1.47 |
| (N=404) | (1.47) | (1.42) | (1.36) | (1.43) |
| *adjusted* $R^2$ | 0.549 | 0.489 | 0.699 | 0.677 |
| **Activities for children** | 0.67 | 0.55 | 2.25 | 1.74 |
| (N=568) | (1.09) | (1.04) | (1.15) | (1.10) |
| *adjusted* $R^2$ | 0.540 | 0.506 | 0.575 | 0.493 |
| **Services for parents** | 1.15 | 1.49 | 2.30 | 3.08* |
| (N=477) | (1.50) | (1.33) | (1.44) | (1.20) |
| *adjusted* $R^2$ | 0.502 | 0.458 | 0.625 | 0.662 |

Note: Results are weighted; SE clustered (mother) in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Each cell presents estimates from a separate model. All models include the following variables: Outcome $T_0$, maternal age and education, work experience, pre-birth employment status, increase in working hours desired, worries about the personal economic situation, (recently) pregnant, child age, youngest child, child female, migration background, childcare hours, informal care use, household income, single parent, number of children in household, municipality size, county unemployment rate, East Germany, months between $T_0$ and ECEC entry, survey year, household moved, changes in partnership status, mother pregnant (the latter three were measured post-treatment).
Source: SOEP v31 (2009-2014) and 2014 K²ID-SOEP extension study (own calculations).