

The Effects of Early Childhood Education and Care Quality on Children's Non-cognitive Skills[☆]

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Georg Camehl, DIW Berlin and Free University Berlin¹

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Abstract

One of the main benefits of early childhood education and care (ECEC) lies in fostering children's social and emotional development. However, much of the evidence for this finding comes from small scale and intensive US early intervention studies. The literature on universal programs is less conclusive. Studies focusing on Europe observe beneficial or neutral effects of ECEC-attendance on child non-cognitive skills while studies from North America detect detrimental effects. A possible reason for these diverse findings is the quality of ECEC-services. Using a new dataset, this paper investigates the causal effects of ECEC quality on children's non-cognitive skills in Germany. The analyses are based on the National Educational Panel Study (NEPS). Children's outcomes (social skills and personality traits) are assessed when the child is around five years old. The analyses use within center variation in quality of ECEC-groups to identify the causal effect of quality on child non-cognitive skills. While selectivity may be a threat to identification, in the German context differences in quality between groups can be considered exogenous to the parents. This study provides evidence of a beneficial effect of high ECEC-quality on children's non-cognitive skills. In particular, structural quality indicators of the institution have a positive effect on social skills as measured by the strengths and difficulties questionnaire (SDQ) and emotional stability (from the Big Five personality traits inventory). This result is of considerable interest to policy makers in light of the discussion about education quality as structural features are relatively easy to improve compared to other aspects of quality.

Keywords: Early childhood education and care, non-cognitive skills, quality

JEL: I21, I26, J13, J24, C31

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Email address: gcamehl@diw.de (Georg Camehl, DIW Berlin and Free University Berlin)

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1. Introduction

One of the main benefits of early childhood education and care (ECEC) attendance lies in fostering of children’s non-cognitive skills (see e.g. Barnett (2011)). Non-cognitive skills are competencies not related to cognitive capability (i.e. intelligence or language skills) and include personality traits as well as social and emotional skills. These social and emotional skills are particularly relevant with regards to child development (Almlund et al. (2011)). The literature provides evidence for improvements of cognitive skills through ECEC attendance, but these are often short-term. In contrast, effects on non-cognitive skills are usually more persistent and can lead to long-term benefits in many life areas such as health, education, and the labor market (see e. g. Heckman et al. (2013)).

However, much of the research establishing these findings is based on small-scale intensive early intervention studies in the US. Prominent examples are the Perry Preschool Program (Schweinhart et al. (2005)) and the Abecedarian Project (Campbell et al. (2002)). The literature on the effects of large- scale programs is less conclusive (for an overview see Camehl (2016)). On the one hand, studies using data from Europe often detect positive or at least neutral effects. Notable examples are the studies by Felfe and Lalive (2012) and Felfe and Lalive (2014) who provide evidence that in Germany, ECEC attendance before the age of three leads to improvements of socio-emotional behavior and school readiness. On the other hand, studies from North America demonstrate that ECEC attendance can have negative effects on children’s non-cognitive outcomes. Most notably the study by Baker et al. (2008), which looks at the introduction of a right to a place in child care in the Canadian province of Quebec, finds generally negative effects on child behavior.

Given these differential findings, one possible explanation may be the relatively large variation in entrance age and hours per day amongst these studies. However, another crucial factor explaining these differences may be the quality of the ECEC services, which so far has not been analyzed in depth in this strand of the economic literature. Thus, this paper aims to contribute to the literature by addressing this gap. Using a new and especially well-suited dataset for Germany, I examine the potential causal effect of ECEC quality on children’s non-cognitive skills.

This paper is based on data from the German National Educational Panel Study (NEPS, for an overview see Blossfeld et al. (2011)). The NEPS is a unique dataset on educational trajectories of overall more than 60,000 individuals from Germany. The study employs a multi-cohort design covering six different age groups which range from newborn children to adults. The analyses in this paper are based on the so-called starting cohort 2

which comprises around 2900 children attending child care centers which are on average 5 years old at the time of the first interview. While the primary unit of observation in this part of the NEPS is the child, sampling is based on institutions, meaning that data on several groups and children for each sampled institution is available. The dataset contains data on 197 institutions with 575 groups, so that on average 12 children in 3 groups per institution are included. The dataset also includes data on various measures of non-cognitive skills and quality ratings of the ECEC institutions. The set of skills included in this paper are the Strengths and Difficulties Questionnaire (SDQ, Goodman (1997), used here to measure social skills) and the Five Factor Model of personality traits (Big 5, McCrae and Costa (1999)). Children's skills are assessed at different points in time during the child's attendance of the institution by their parents. Quality indicators are given by the teacher of the group the child attends within the ECEC institution. The provided information includes indicators for structural quality (for example the child to teacher ratio), orientation quality (the motivation of teachers to foster skills), as well as process quality (indicators for day-to-day interaction between teachers and children). Additionally, the dataset contains an extensive set of parental background characteristics including measures of the home environment and further information on the area surrounding the institution.

Selection into institutions with different quality levels depending on unobserved parental characteristics could lead to spurious correlations between ECEC quality and children's non-cognitive skills. To address this selection issue, I use within center variation in quality and thus estimate fixed effects models. While parents could in principle observe the quality of an ECEC institution¹, it is unlikely that they also observe differences in quality between different groups within the same institution. Furthermore, in many institutions waiting lists for places exist and assignment to groups is carried out in most institutions based on availability. That is, a child is assigned to the group which has available space. As demand for child care spaces is still exceeds supply in Germany, it seems unlikely that parents will reject an offered space in a child care group in order to have their child enrolled in a higher quality group in an institution they already deemed acceptable. Institutions could also change group quality, for example to assign better qualified teachers to groups with children with low-non-cognitive skills to help them

¹However, there is literature that shows that observing quality is not easy for parents, see e.g. Mocan (2007) and Camehl et al. (2016).

improve their skills. In this case, positive effects can be interpreted as a lower bound². Thus, analyzing the effects of ECEC quality on non-cognitive skills using the described fixed effects approach should yield reliable but conservative estimates of the underlying potential causal effects.

This paper provides evidence that there is a beneficial effect of structural quality indicators on social skills as measured by the SDQ and emotional stability from the Big Five personality traits inventory. The effects are relatively small at around 6% of a standard deviation for a one-standard deviation change in quality. But, the effects are precisely estimated and withstand robustness checks.

The remainder of the paper is structured as follows: Section two presents an overview of the previous literature and further illustrates the contribution of this paper. Section three provides theoretical background on the influence of early educational investments on non-cognitive skills, the measurement of ECEC quality, and the German ECEC context. Section four describes the dataset and section five the empirical strategy. Section six presents descriptive statistics, the main results and some robustness checks. Section seven concludes.

2. Previous research

Much of the research on the effects of child care on child non-cognitive skills is based on small scale intensive early intervention studies. One important example is the Perry Preschool Project (see e.g. Heckman et al. (2010)). The literature on the effects of ECEC provision on a larger scale, specifically with respect to non-cognitive skills, is growing but less conclusive (for an overview see Camehl (2016)). With data from the German Socio-Economic Panel Study (SOEP), Felfe and Lalive (2012) use regional variation in child care attendance rates as an instrument in a marginal treatment framework to estimate the causal effect of attending child care between age two and three. They argue that the regional variation can be interpreted as a proxy for supply of child care which is exogenous to the parents. They find positive effects of child care attendance, especially for children with a low socioeconomic background. In another study (Felfe and Lalive (2014)) the same authors analyze data from the school entrance examination in the German state of Schleswig Holstein. They use the same identification strategy and again find positive effects, this time on the general ability to attend school and on the socio-emotional

²There is no reason to believe that highly qualified teachers would be specifically assigned to groups with high overall non-cognitive skill level in the context of the German ECEC-system which is highly subsidized and dominated by non-profit organizations

development.

Peter et al. (2016) analyze data from the Millenium Cohort Study (England) and use propensity score matching to analyze the effect of entering child care after the age of two and a half. They find negative effects of entering later on the socio-emotional development, especially for boys of low-income mothers. Two additional studies from the UK using matching do not find conclusive evidence of the effects of child care on child non-cognitive skills. Goodman and Sianesi (2005) use data from the National Child Development Study. They can differentiate between teachers and parental assessments of non-cognitive skills. Indeed, they find a positive effect of child care on teacher evaluations of social behavior and a negative effect on parental assessments when the child attends primary school. One possible explanation is that both groups refer to different contexts during which they observe the child and thus both view may be valid³. Apps et al. (2013), Datta Gupta and Simonsen (2010), and Datta Gupta and Simonsen (2012) find neither clear positive nor negative effects of ECEC attendance on child non-cognitive skills. So overall, for European countries, previous research generally finds positive to neutral effects of ECEC attendance.

On the other hand, a body of research based on data from the United States and Canada show negative effects on non-cognitive skills: An important subject for research is the reform in the Canadian province of Quebec that gave guarantees to a full-day place in child care to parents of incrementally younger children. First, this guarantee was given to the parents of four year olds, then three and so on, to finally all children. There is a relatively large body of research estimating intention-to-treat effects of this reform on child outcomes and specifically also on child non-cognitive skills finding mostly harmful effects on children's aggressive behavior and other non-cognitive skills. Other studies on the effects of ECEC-attendance on children's non-cognitive skills for North-American countries are those by Loeb et al. (2007), Magnuson et al. (2007) and Herbst and Tekin (2010). Overall, these studies find detrimental effects of ECEC attendance for children between ages 5 and 6.

There is overall very little direct evidence concerning the effects of ECEC quality on child non-cognitive skills in the economic literature. Baker et al. (2015) and other studies finding detrimental effects argue that low quality of the services is a main factor for these. However, they cannot explicitly evaluate the effects of quality. At the other end of the scale, Jensen et al. (2016) find a positive effect of experimentally improving the

³This is a reason why will I also look at teacher and parental ratings separately in future research, more details on this are given in the data section.

skills of pedagogical staff on socio-emotional development of children. They implement a field experiment in Denmark in which professional development activities are randomly assigned to preschool teachers. Using the strengths and difficulties questionnaire, they find overall positive effects of this part of structural quality. With this paper, I contribute to the literature on the effects of ECEC attendance on non-cognitive skills by providing further evidence on the effects of ECEC quality.

3. Theoretical background

The following section provides theoretical background on the potential effects on ECEC quality on children's non-cognitive skills, before giving more general background on ECEC quality and the German ECEC context. Concerning the relationship between ECEC quality and children's non-cognitive skills, there are two relevant issues. The first issue is to determine how early investments in education related to development of non-cognitive skills in an economic theory setting. The second issue concerns the way in which quality of educational investments could be related to development of non-cognitive skills. From an economic theory perspective, early investments in education are essential for skill development. In general, early development of skills facilitates later development of other skills. This is the "skills-beget-skills"-argument derived from the life cycle model of skills formation due to Cunha and Heckman (2007). So if a child enters school with a well-developed set of (non-cognitive) skills, it will be easier for her to follow the teaching and thus develop further skills. The other way around, if a child lacks basic skills, she has to pick up these before or at the same time with other things she is supposed to learn at school. In addition, it can be argued, that the "skills-begets-skills" argument is particularly relevant for non-cognitive skills. There is a large body of psychological literature showing that e.g. personality traits are especially malleable early in life McCrae and Costa (1994). Once certain traits are set, it may be very difficult to change them in a beneficial way.

The quality of early educational investments can easily be incorporated into these models. It is especially likely that non-cognitive skills are affected by quality of early educational investments as they are relatively broad skills that are used and shaped in many contexts of everyday life. For instance, social skills could be affected by day to day activities of children with each other. These activities are included in measures for process quality. Similarly, a better staff to child ratio could enable teachers to have more meaningful interactions with children which in turn could also improve their social skills. Thus the overall hypothesis of this paper is that higher quality of

the ECEC institution should have beneficial effects on development of non-cognitive skills.

Having laid out the connection between a relatively abstract notion of ECEC-quality and development of non-cognitive skills in the previous section, the following will go into more detail on the measurement of ECEC-quality. I will present three different subsets of quality that are frequently used in the educational literature and that I will also use in the analyses in this paper.

Structural quality indicators are the most tangible kind of measures, namely aspects related to the physical environment in the institution and also the objective characteristics of teachers. Often used indicators include the child teacher ratio, the education of teachers and, as mentioned, aspects of the physical environment such as available space or materials for playing and learning.

Orientation quality indicators are related to the attitudes of the teachers towards their and the institutions role concerning the education aspect of ECEC. On the one extreme, teachers could regard solely regard themselves as providers of child care to the benefit of parents. This may lead to the opinion, that teachers should not be involved in the education and skill development of the children. On the other hand, teachers might regard themselves as active educators for young children who, apart from fostering their general development also prepare them for the transition to primary school.

Process quality indicators describe the day-to-day interactions and activities in the ECEC context. An important scale for rating this is the ECERS (early childhood environment rating, see e.g. Sylva et al. (2003)), but other measures such as the amount and diversity of activities in the group are used as well. In the educational literature, process quality is often regarded as the most important subset of overall quality with the other subsets rather being necessary conditions for beneficial effects of ECEC-services Tietze et al. (2012).

A last aspect concerning the theoretical background of this paper is the relevant characteristics of the German ECEC-system. These are both important to judge the results of this paper in international comparison, but also for the empirical part which follows afterwards. Children enter primary school at age six in Germany. At age three, almost all children attend formal ECEC outside of the family. The high share of children attending an ECEC institution is also politically wanted: A reform from 2013 yield the right to a place in ECEC from the age 1 onwards to the families. Before that, a right to a place from the age of 3 onwards had been in place since the 1990s (see e.g. Spiess

(2008)). Thus, ECEC institutions are the main place of learning outside of the family in Germany. In line with this, almost all institutions are not-for profit (the share of for profit centers is at 1% (Bundesamt (2016))) and highly subsidized. A large share is also publicly run (around 40%), almost all other institutions are run by the six *Träger der Kinder- und Jugendhilfe* which include churches and other charitable organizations.

In the federal system of Germany, policy concerning ECEC is generally carried out by the individual states (the right to a place described above being the exception rather than the rule). Regulations concerning fees vary by state and often even by county. Due to the high degree of subsidization, fees are generally low by international standards. On average, a place in an ECEC institution costs 21.5% of an average wage in Germany. The OECD average for this figure, on the other hand is 27.2% (OECD (2015)).

The same holds for quality regulations. While quality is described as mediocre by professional standards (Tietze et al. (2012)), quality regulations and thus quality varies widely between states and municipalities. At the same time, information about quality is hard to acquire ex ante for parents as there exist no objective rating systems as they exist for the US (Herbst (2016)). Furthermore, communication between parents and centers is low and parents have trouble observing quality even when their child already attends the institution. This also has the result that only a small share of children changes the child care center after they have entered it. By far the most important reason for the choice of child care is the proximity to the home of the parents (Camehl et al. (2016)).

ECEC institutions are usually organized in groups. Children enter groups with up to 20 children and several teachers according to group size (note that some centers do not use this type of organization and use what is called "open groups"; this is relatively rare). These groups are also often organized by age such that certain groups only take in children in a certain age range. Assignment into groups is usually organized by the center. As there exists excess demand for places in child care, it seems unlikely that parents, once they are given a place at a center which they deem acceptable, then change their mind because the child may not enter their preferred group.

4. Data

The National Educational Panel Study (NEPS; Blossfeld et al. (2011)) is the largest panel study focusing on education in Germany. Its first wave was collected in 2010 with an overall number of participants of over 60,000 individuals. These include persons among all age groups and specific questionnaires and tests have been developed for 8

so-called starting cohorts. In this paper, I focus on the participants of one particular starting cohort, namely children in child care (starting cohort 2). Sampling is based on child care institutions, so no children who do not attend such an institution are in the dataset. Children's non-cognitive skills are rated both by their parents and their teachers, but the results presented in this paper are based on the parents' assessments only. Future research will also take in to account the teachers' ratings.

Outcomes:

Social skills. The dataset includes one subscale of the strengths and difficulties questionnaire (SDQ, Goodman (1997)). In general, the scale covers different aspects of socio-emotional development, but due this restriction I use only the scale for pro-social behavior⁴.

Personality traits. The dataset also includes assessments of the child's personality traits by their parents and their teachers from one year after the initial interview. These assessments were done via the Big Five scale for personality traits (e.g. McCrae and Costa (1999)) in a short form that is also used in other large surveys.

Quality inputs:

Structural quality. In terms of structural quality indicators, the analyses use the child to teacher ratio, the space available per child (in square meters), the education of the teacher (whether he or she has a high school degree or not), the number of professional development activities of the teacher within the last year and a battery of items concerning materials for playing and learning that are available to the group. The measure used in the analyses is simply the average over ten items that were measured on a 5-point scale (from "not available" to "available for all children").

Orientation quality. Orientation quality is included in the analyses based on three measures. First, the teacher's opinion on the importance of skills. The teacher is asked about the importance of skills such as social skills but also certain cognitive skills. The measure is the mean of 10 items on the importance of skills on a 5-point scale. Second, the opinion of the teacher on who is supposed to foster skills, whether it should be done by parents or the ECEC institution. Again, this is the mean of 10 items on a 5-point scale. Third, the teachers' notion of primary school. This measure is the mean of four items with a four-point scale on how stressful the teacher perceives primary school to be.

⁴In fact, the peer-problems subscale is also included, but this is only given by teachers so it is left out for now.

The idea is that teachers with a more positive view towards institutionalized education also foster the necessary skills in a more efficient way.

Process quality. Process quality is measured by two item batteries, one on the number of trips and activities are done by the group outside the institution, such as trips into nature. The second one is on activities done within the group, such as singing or role-playing. The two measures are the mean of the 10 items in each battery which were measured on a 8-point scale.

While using these summary indices have some advantages in terms of reducing the number of conducted tests and thus for interpretability of the results, future research will also look at the individual quality items to assess which are the most likely driving factors.

[to be worked on]

5. Empirical strategy

ECEC quality is likely correlated with unobserved parental or child characteristics making correlations between quality and child non-cognitive skills unreliable as estimates of the corresponding causal effect. One obvious example of self-selection would be that parents who are more motivated to foster their child's skills may also be more likely to choose high quality ECEC services. There is evidence that ECEC quality is hard to observe for parents (among others Mocan (2007)). As mentioned above, this seems to be especially true for Germany (Camehl et al. (2016)).

To further mitigate the self-selection problem, I make use of the fact that the NEPS is sampled on the institution level, meaning that for every institution a relatively large number of child observations which additionally attend several different groups is available. Even if parents know the overall center quality, it is unlikely that they know the differential quality of the groups within the center. One obvious case where this may not hold is if the child already has an older sibling in the center. Another reason could be that parents talk to other parents and choose center and group according to this information. While this possibility can not be ruled out completely, there is evidence, that this may not be a severe problem in the German context⁵. Another issue may be neighborhood effects, but this is partly ruled out by using only within center variation in quality as well. Only in the case that centers in specific neighborhoods exhibit larger variation in

⁵Schober et al. (2016) report that only 3% of parents choose a center based on recommendations by other parents.

quality could there be a problem. I try to account for this by including a set of regional characteristics into the models.

So the estimated equation to analyze the effects of each ECEC quality indicator on each indicator for children's non-cognitive skills is:

$$Y_{igc} - Y_{gc} = (X_{gc} - X_c)\beta + Z_{igc}\gamma + \epsilon_{igc}$$

where i is the index for each individual, g the index for group and c the index for center. Y includes the non-cognitive skill measurement and X the quality measurement. The list of covariates which are included in Z is given in the descriptive results section. Group and center measures are estimated taking the mean over all available observations for this group or center. Since the data is not guaranteed to have the full population of children for groups and/or centers (for example due to unit non-response), this procedure is likely to generate measurement error. For the outcome variables this will be included in the error term and thus not lead to biased results under the assumption that these errors are uncorrelated with the covariates. Measurement error in the right-hand side variables will lead to attenuation bias. Another reason why this could appear is if the quality items are no perfect proxies for the actual quality. Taking these issues into account, any statistically significant results can therefore be interpreted as a lower bound of true effects.

I plan to explicitly include these issues in a more sophisticated latent factor model such as the one used by Heckman et al. (2006) and many other applications in economics that use latent constructs to estimate causes and effects of skills⁶. This does not change to my identification strategy. Identification will still result from the within variation in quality which I assume to be exogenous here.

[to be worked on]

6. Results

6.1. Descriptive statistics

As mentioned above, the analytical sample is constructed from two main sources. Information on covariates from both the teachers and the parents are used in the

⁶And which is closely related to the field of structural equation modelling (SEM) which is widely used in other social science disciplines, especially in psychology.

full models. This leads to a relatively restricted sample. While the overall number of observations in the dataset is 2947 children, the most restricted analytical sample comprises 1445 children. Table 1 presents the number of variables for the different samples as well as means of the covariates used in the empirical model. The first column shows the means of the covariates which are given by the parents, for the full sample for which parental information is available. In other words, information in the first column comes from the dataset of all parents that took part in the NEPS starting cohort 2. The second column similarly shows the means of the covariates provided by the teachers for the full set of teachers. The overall number of observations in the dataset is 2947, the numbers of observations for these two columns (2340 and 2186, respectively) thus show that there is no perfect overlap between these two datasets. So there are children for whom a teacher answered a questionnaire but not their parents and vice-versa. Since data on non-cognitive skills comes from two different years (SDQ: 2011 and Big 5: 2012) panel attrition also makes it necessary to use two different analytical samples when analyzing the different outcomes. The third column shows that means of covariates for the sample where information from both the parents and teachers is available and in addition, parents have answered the SDQ-question, the fourth column the same but for the Big 5 items.

The restriction of the sample is relatively large, but according to table 1 seems to be neither related to observable characteristics of the parents nor to those of the institutions. The largest differences are in the order of low single digits in percent.

6.2. *Main results*

Using the empirical strategy described above, table 2 presents the results using the three summary scales on quality. The top panel presents the results of OLS regressions as a benchmark case, the bottom panel the fixed effects results. The OLS coefficients show strongly statistically significant correlations between structural quality and pro-social behavior and emotional stability. Effect sizes are rather small, but in the context of non-cognitive this is not unusual (see e.g. Anger et al. (2017)). The rest of the correlations are either negligible or (relatively) imprecisely estimated. The only other statistically significant result is a negative correlation between openness and orientation quality. Indeed, this result also disappears when looking at the results of the fixed effects estimations. The effects of structural quality on pro-social behavior and emotional stability are smaller than the OLS-coefficients, but still statistically significant in my main specification.

Heterogeneous Effects

To further investigate the relationship between ECEC quality and child non-cognitive skills, the following section presents heterogeneous effects by gender of the child and by its mother’s education. Results by starting age are also shown. However, these can be only interpreted as first descriptive evidence, as starting age is likely to be an endogenous variable with respect to child non-cognitive skills. Table 3 presents the estimated effects of ECEC-quality on child non-cognitive skills by gender. The top panel shows the results for boys, the bottom for girls. While there are some differences in the precision and size of the estimates, there are no major differences. The effects of structural quality on social skills and emotional stability appear to be somewhat larger for boys, but these differences are unlikely to be statistically significant.

Table 4 presents the estimated effects of ECEC-quality on child non-cognitive skills by the education of the mother. High education in this case means that the mother has more than 13 years of schooling which in turn means that she has at least some tertiary education. Again, differences are not large, but the effect of structural quality on emotional stability appears to be larger for mothers with more years of education.

Lastly, table 5 presents the estimated effects of ECEC-quality on child non-cognitive skills by age of the child when it first entered an ECEC-institution. The top panel refers to children who entered an ECEC institution before age 2.5, the bottom panel to those who entered later. As mentioned above, care has to be taken when interpreting these effects, as the starting age is likely to be correlated with child non-cognitive skills prior to entering the institution. Nevertheless, the table hints that children who enter the ECEC-institution earlier are more likely affected by the quality of the institution. This is not surprising as these children were exposed to the quality for a longer period of time.

[to be worked on]

6.3. Robustness checks

The main challenge to identifying the causal effect of ECEC-quality on child non-cognitive skills is selection into different quality institutions based on unobserved parental characteristics. While this also seems to be less of a problem in the German context, I conduct robustness checks to address it. First, I can conduct the analyses presented above using only children without an older sibling in the same institution. The argument is that parents could have an incentive to choose a certain group within an institution if they already have another child in this group and thus are better informed than parents who come into contact with the ECEC-institution for the first time. Table 6 shows that there are no significant differences when looking at this subset compared to the full set of

children. The identification above rests on the assumption that within center variations in quality are exogenous given set of conditioning variables. Using the method proposed by Oster (2017), it can also be assessed how important other, unobserved characteristics would have to be to render the results insignificant.

[to be worked on]

7. Conclusion

In this paper, I analyze the effect of ECEC quality on child non-cognitive skills. More precisely, I study the effects of structural, orientation and process quality on children's social skills and their personality traits. The analyses are based on the National Educational Panel Study, a large and representative German longitudinal survey.

My identification strategy rests on the assumption that assignment into groups within an ECEC institution is exogenous for parents. Identification of the causal effect of quality on non-cognitive skills is thus achieved by using within center variation in quality indicators. This holds even in case of selective use of different quality ECEC-settings depending on unobserved parental characteristics. Findings suggest that ECEC quality has a beneficial effect on children's non-cognitive skills. In particular, the SDQ subscale for pro-social behavior and the personality trait emotional stability (the reverse of the Big 5 scale for neuroticism) are positively affected by structural quality indicators.

As mentioned above, the positive effects of structural ECEC quality on children's non-cognitive skills can be interpreted as a lower bound in light of the applied identification strategy and its methodological challenges. This paper therefore plans to use regional variation in quality due to differential regulations in an instrumental variable approach to estimate the effects of structural quality on children's non-cognitive skills. For orientation and process quality indicators this is not feasible as to the best of my knowledge neither regional data nor variations in regulations of these indicators exist in Germany. One further aim of the paper is to estimate interaction effects between duration of attendance and institution quality which likewise will be carried out using an instrumental variable approach using regional variation in attendance rates as an instrument for starting age which is likely to be endogenous.

References

- Almlund, M., Duckworth, A., Heckman, J., Kautz, T., 2011. Handbook of the Economics of Education. Amsterdam: Elsevier, Ch. Personality Psychology and Economics, pp. 1–181.
- Anger, S., Camehl, G., Peter, F., 2017. Involuntary Job Loss and Changes in Personality Traits. Accepted for publication in: Journal of Economic Psychology.
- Apps, P., Mendolia, S., Walker, I., 2013. The impact of pre-school on adolescents outcomes: Evidence from a recent English cohort. *Economics of Education Review* 37, 183–199.
- Baker, M., Gruber, J., Milligan, K., 2008. Universal child care, maternal labor supply, and family well-being. *Journal of Political Economy* 116 (4), 709–745.
- Baker, M., Gruber, J., Milligan, K., September 2015. Non-cognitive deficits and young adult outcomes: The long-run impacts of a universal child care program. Working Paper 21571, National Bureau of Economic Research.
- Barnett, W. S., 2011. Effectiveness of early educational intervention. *Science* 333 (6045), 975–978.
- Blossfeld, H., Rossbach, H., Maurice, J., 2011. Education as a Lifelong Process The German National Educational Panel Study (NEPS). VS Verlag für Sozialwissenschaften.
- Bundesamt, S., 2016. Statistiken der Kinder- und Jugendhilfe. Kinder und tätige Personen in Tageseinrichtungen und in öffentlich geförderter Kindertagespflege am 01.03.2015. Tech. rep., Wiesbaden.
- Camehl, G., 2016. Wie beeinflusst der Besuch einer Kindertageseinrichtung nicht-kognitive Fähigkeiten? . Tech. Rep. 105, DIW Berlin Roundup.
- Camehl, G., Schober, P., Spiess, C., 2016. Information Asymmetries Between Parents and Educators in German Day Care Institutions. Tech. rep., Mimeo.
- Campbell, F., Ramey, C., Pungello, E., Sparling, J., Miller-Johnson, S., 2002. Early Childhood Education: Young Adult Outcomes From the Abecedarian Project. *Applied Developmental Science* 6(1), 42–57.

- Cunha, F., Heckman, J., 2007. The technology of skill formation. Tech. Rep. 2550, IZA Discussion Paper.
- Datta Gupta, N., Simonsen, M., February 2010. Non-cognitive child outcomes and universal high quality child care. *Journal of Public Economics* 94 (1-2), 30–43.
- Datta Gupta, N., Simonsen, M., 2012. The effects of type of non-parental child care on pre-teen skills and risky behavior. *Economics Letters* 116 (3), 622–625.
- Felfe, C., Lalive, R., 2012. Early Child Care and Child Development: For Whom it Works and Why. Tech. Rep. 7100, IZA Discussion Paper.
- Felfe, C., Lalive, R., 2014. Does Early Child Care Help or Hurt Childrens Development? Tech. Rep. 8484, IZA Discussion Paper.
- Goodman, A., Sianesi, B., 2005. Early Education and Childrens Outcomes: How Long Do the Impacts Last? *Fiscal Studies* 26(4), 513–548.
- Goodman, R., 1997. The Strengths and Difficulties Questionnaire: A Research Note. *Journal of Child Psychology and Psychiatry* 38(5), 581–586.
- Heckman, J., Moon, S. H., Pinto, R., Savelyev, P., Yavitz, A., 2010. Analyzing social experiments as implemented: A reexamination of the evidence from the highscope perry preschool program. *Quantitative Economics* 1 (1), 1–46.
- Heckman, J., Pinto, R., Savelyev, P., October 2013. Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes. *American Economic Review* 103 (6), 2052–2086.
- Heckman, J. J., Stixrud, J., Urzua, S., July 2006. The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. *Journal of Labor Economics* 24 (3), 411–482.
- Herbst, C., 2016. The Impact of Quality Rating and Improvement Systems on Families Child Care Choices and the Supply of Child Care Labor. Tech. Rep. IZA DP, IZA DP.
- Herbst, C. M., Tekin, E., August 2010. Child care subsidies and child development. *Economics of Education Review* 29 (4), 618–638.
- Jensen, B., Jensen, P., Rasmussen, A. W., 2016. Does Professional Development of Preschool Teachers Improve Child Socio-Emotional Outcomes? Accepted for publication in: *Labour Economics*.

- Loeb, S., Bridges, M., Bassok, D., Fuller, B., Rumberger, R. W., 2007. How much is too much? the influence of preschool centers on children's social and cognitive development. *Economics of Education Review* 26 (1), 52–66.
- Magnuson, K. A., Ruhm, C., Waldfogel, J., 2007. Does prekindergarten improve school preparation and performance? *Economics of Education Review* 26 (1), 33–51.
- McCrae, R., Costa, P., 1994. The Stability of Personality: Observation and Evaluations. *Current Directions in Psychological Science* 3, 173–175.
- McCrae, R., Costa, P., 1999. A Five-Factor Theory of Personality: Theory and Research. Guilford, New York.
- Mocan, N., 2007. Can consumers detect lemons? an empirical analysis of information asymmetry in the market for child care. *Journal of Population Economics* 20 (4), 743–780.
- OECD, 2015. Economic Policy Reforms 2015 - Going for Growth. Paris: OECD publishing, Ch. Structural Policy Indicators.
- Oster, E., 2017. Unobservable selection and coefficient stability: Theory and validation. Accepted for publication: *Journal of Business Economics and Statistics*.
- Peter, F., Schober, P., Spiess, C., 2016. Early Birds in Day Care: The Social Gradient in Starting Day Care and Childrens Non-cognitive Skills. *CESifo Economic Studies* 62(4), 725–751.
- Schober, P., Spiess, C., Stahl, J., 2016. Gute Gründe für gute Kitas. Wer nutzt welche Qualität von Kindertageseinrichtungen und was bedeutet sie für die Vereinbarkeit von Familien- und Erwerbsarbeit? Tech. rep., Friedrich Ebert Stiftung Policy Report.
- Schweinhart, L., Montie, J., Xiang, Z., Barnett, W., Belfield, C., Nores, M., 2005. Lifetime Effects: The High/Scope Perry Preschool Study Through Age 40. High/Scope Press, Ypsilanti, MI.
- Spiess, C. K., 2008. Early Childhood Education and Care in Germany: The Status Quo and Reform Proposals. *Zeitschrift für Betriebswirtschaftslehre* 67, 1–20.
- Sylva, K., Siraj-Blatchford, I., Taggart, B., 2003. Assessing Quality in the Early Years: Early Childhood Environment Rating Scale. Trentham Books, Stoke on Trent, UK and Sterling, USA.

Tietze, W., Becker-Stoll, F., Bensel, J., Eckhardt, A., Haug-Schnabel, G., Kalicki, B., Keller, H., Leyendecker, B., 2012. NUBBEK. Nationale Untersuchung zur Bildung, Betreuung und Erziehung in der frühen Kindheit. Fragestellungen und Ergebnisse im Überblick. Berlin.

Tables

Table 1: Descriptive statistics

	Parents	Educators	Analytical SDQ	Analytical Big 5
Child female (%)	49.79	-	50.06	50.17
Child age (years)	5.21	-	5.20	5.19
ECEC entrance age (years)	2.64	-	2.68	2.68
Birthweight (in grams)	3343.95	-	3340.04	3346.01
Number of siblings	1.19	-	1.18	1.18
Mothers age (years)	35.87	-	35.82	36.27
Mothers education (years)	13.71	-	13.71	13.86
Mother's job: Full-time	14.99	-	15.57	15.69
Mother's job: Part-time	41.88	-	42.81	45.00
Mother occasionally working	8.25	-	8.36	8.26
Mother not working	34.87	-	33.25	31.04
HH income (Euros)	3398.78	-	3402.37	3388.89
Family climate (0-10)	6.16	-	6.16	6.14
Home activities (1-8)	4.23	-	4.25	4.23
Father answered (%)	9.06	-	9.03	8.93
Migration background (%)	20.45	-	18.82	17.64
East Germany (%)	-	15.75	15.73	15.16
Public institution (%)	-	36.82	37.50	37.56
Educator migration background (%)	-	12.71	11.80	11.78
Share of children with low SES	-	20.24	18.31	17.40
Share of children with medium SES	-	59.13	60.55	60.95
Share of children with high SES	-	16.80	17.34	18.11
Problems in the area (0-10)	-	3.53	3.52	3.48
N	2340	2186	1672	1445

Table 2: Correlations between quality features and observed factors

	Structural quality	Orientation quality	Process quality
Child female (%)	-0.055 (0.047)	-0.031 (0.054)	-0.013 (0.046)
Child age (years)	-0.054 (0.062)	-0.050 (0.074)	0.075 (0.063)
ECEC entrance age (years)	-0.042 (0.026)	-0.057** (0.028)	-0.054** (0.026)
Birthweight (in kilograms)	-0.078** (0.036)	0.070 (0.043)	0.018 (0.037)
Number of siblings	-0.033 (0.023)	0.022 (0.025)	0.006 (0.025)
Mothers age (years)	-0.004 (0.004)	-0.008 (0.005)	0.002 (0.004)
Mothers education (years)	0.009 (0.010)	0.009 (0.011)	0.010 (0.010)
Mother's job: Full-time	0.044 (0.061)	-0.034 (0.072)	0.058 (0.064)
Mother's job: Part-time	0.047 (0.047)	-0.078 (0.055)	0.042 (0.047)
Mother occasionally working	-0.019 (0.086)	-0.002 (0.114)	0.027 (0.084)
Mother not working	-0.070 (0.051)	0.107* (0.057)	-0.089* (0.049)
HH income (in 1000 Euros)	0.010 (0.007)	0.006 (0.008)	-0.007 (0.009)
Family climate (0-10)	-0.054 (0.074)	0.086 (0.083)	0.021 (0.067)
Home activities (1-8)	0.007 (0.026)	-0.001 (0.030)	-0.024 (0.028)
Father answered (%)	0.003 (0.094)	-0.026 (0.084)	0.027 (0.082)
Migration background (%)	0.038 (0.060)	-0.022 (0.065)	0.074 (0.062)
East Germany (%)	0.009 (0.062)	0.012 (0.061)	-0.038 (0.064)
Public institution (%)	0.007 (0.045)	-0.085 (0.052)	0.062 (0.046)
Educator migration background (%)	0.165*** (0.062)	-0.182*** (0.067)	0.056 (0.063)
Share of children with low SES	-0.001 (0.001)	0.000 (0.001)	0.001 (0.001)
Share of children with medium SES	-0.001 (0.001)	0.010 (0.001)	0.000 (0.001)
Share of children with high SES	0.002 (0.001)	0.000 (0.002)	0.000 (0.001)
Problems in the area (0-10)	0.011 (0.011)	0.001 (0.011)	0.003 (0.012)

Table 3: Main results

OLS						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.098*** (0.024)	0.036 (0.026)	-0.015 (0.024)	0.042 (0.030)	0.001 (0.027)	0.068*** (0.026)
Orientation quality	0.038 (0.032)	-0.062* (0.057)	-0.012 (0.035)	-0.013 (0.028)	-0.014 (0.037)	0.029 (0.032)
Process quality	-0.005 (0.024)	0.013 (0.027)	-0.014 (0.030)	0.044 (0.030)	-0.015 (0.025)	0.019 (0.026)
N	1672	1445	1445	1445	1445	1445
Fixed effects						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.057** (0.022)	0.036 (0.024)	-0.014 (0.027)	0.030 (0.029)	-0.005 (0.027)	0.051** (0.026)
Orientation quality	0.022 (0.025)	0.011 (0.029)	0.011 (0.035)	0.004 (0.030)	0.009 (0.036)	0.032 (0.031)
Process quality	-0.031 (0.024)	-0.002 (0.032)	-0.017 (0.028)	0.041 (0.031)	0.013 (0.029)	0.010 (0.027)
N	1672	1445	1445	1445	1445	1445

Note: Each cell includes results from one regression including covariates. Standard errors clustered at the institution level in parentheses. Significance levels: * <math>p<0.1</math>, ** <math>p<0.05</math>, *** <math>p<0.01</math>

Table 4: Heterogeneous effects by gender

Boy						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.065* (0.035)	0.019 (0.036)	-0.041 (0.036)	0.009 (0.039)	-0.015 (0.039)	0.068** (0.034)
Orientation quality	0.015 (0.036)	0.028 (0.035)	0.028 (0.042)	-0.008 (0.048)	-0.018 (0.048)	0.055 (0.043)
Process quality	-0.065* (0.035)	-0.006 (0.037)	0.032 (0.044)	0.020 (0.038)	-0.024 (0.034)	0.027 (0.036)
N	835	720	720	720	720	720
Girl						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.051* (0.031)	0.054* (0.031)	0.002 (0.039)	0.046 (0.037)	-0.004 (0.034)	0.040 (0.034)
Orientation quality	0.025 (0.033)	-0.022 (0.040)	-0.033 (0.054)	0.002 (0.042)	0.037 (0.055)	-0.005 (0.039)
Process quality	0.008 (0.032)	-0.003 (0.041)	-0.086** (0.037)	0.065 (0.043)	0.053 (0.043)	0.001 (0.039)
N	837	725	725	725	725	725

Note: Each cell includes results from one regression including covariates. Standard errors clustered at the institution level in parentheses. Significance levels: * <0.1, ** p<0.05, *** p<0.01

Table 5: Heterogeneous effects by mother's education

Low						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.063** (0.028)	0.038 (0.035)	-0.018 (0.036)	0.014 (0.041)	0.025 (0.030)	0.021 (0.036)
Orientation quality	0.020 (0.033)	0.053 (0.038)	0.025 (0.046)	0.026 (0.038)	0.029 (0.042)	0.057 (0.043)
Process quality	-0.042 (0.030)	-0.001 (0.041)	-0.010 (0.032)	0.046 (0.041)	0.031 (0.034)	0.019 (0.033)
N	1030	865	865	865	865	865
High						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.053 (0.038)	0.041 (0.038)	-0.039 (0.048)	0.047 (0.041)	-0.049 (0.045)	0.079** (0.040)
Orientation quality	0.006 (0.045)	-0.024 (0.039)	-0.044 (0.051)	-0.012 (0.052)	-0.038 (0.059)	-0.003 (0.047)
Process quality	-0.019 (0.046)	-0.001 (0.045)	-0.041 (0.058)	0.026 (0.040)	-0.034 (0.047)	-0.011 (0.049)
N	600	555	555	555	555	555

Note: Each cell includes results from one regression including covariates. Standard errors clustered at the institution level in parentheses. Significance levels: * <0.1, ** p<0.05, *** p<0.01

Table 6: Heterogeneous effects by starting age

Early						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.080** (0.036)	0.055 (0.040)	-0.035 (0.053)	0.077* (0.043)	0.002 (0.045)	0.068* (0.041)
Orientation quality	0.086** (0.043)	-0.017 (0.049)	0.069 (0.068)	0.099* (0.052)	0.037 (0.060)	0.104* (0.055)
Process quality	-0.067* (0.036)	0.016 (0.055)	0.033 (0.050)	0.101* (0.058)	0.003 (0.045)	0.108** (0.055)
N	858	743	743	743	743	743
Late						
	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.048 (0.031)	0.022 (0.029)	0.003 (0.026)	-0.005 (0.038)	-0.018 (0.035)	0.033 (0.033)
Orientation quality	-0.007 (0.037)	0.023 (0.037)	-0.033 (0.045)	-0.042 (0.035)	0.002 (0.048)	-0.013 (0.031)
Process quality	-0.006 (0.033)	-0.021 (0.038)	-0.050 (0.033)	-0.013 (0.037)	0.012 (0.035)	-0.064** (0.029)
N	814	702	702	702	702	702

Note: Each cell includes results from one regression including covariates. Standard errors clustered at the institution level in parentheses. Significance levels: * <0.1, ** p<0.05, *** p<0.01

Table 7: Robustness: Only children without siblings in an ECEC institution

	Prosocial Behavior	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional Stability
Structural quality	0.075** (0.031)	0.034 (0.037)	0.027 (0.040)	0.052 (0.043)	-0.009 (0.037)	0.064* (0.034)
Orientation quality	0.055* (0.033)	-0.042 (0.039)	0.051 (0.054)	-0.009 (0.049)	0.002 (0.043)	0.081* (0.047)
Process quality	-0.008 (0.035)	0.013 (0.043)	0.027 (0.044)	0.091* (0.052)	0.028 (0.043)	0.025 (0.038)
N	932	687	687	687	687	687

Note: Each cell includes results from one regression including covariates. Standard errors clustered at the institution level in parentheses. Significance levels: * <0.1, ** p<0.05, *** p<0.01