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Extracurricular educational programs and school readiness: Evidence from a quasi-experiment with preschool children

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Abstract

The paper adds to the literature on extracurricular early childhood education and child development by exploiting unique data on an educational project in Germany, the Junior University (JU). By utilizing a quasi-experimental study design we estimate the causal short-term effect of JU enrollment and show that attending JU significantly leads to higher school readiness, i.e. higher cognitive and non-cognitive abilities. Although the effect of attending JU on school readiness is quite small, the results are plausible and pass various robustness checks.

Keywords: early childhood education, school readiness, treatment effect

JEL Classification: I20, I21, I28

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1. Introduction

Early childhood conditions and development have been shown to be of great importance for educational attainment, earnings, and the probability of employment (Almond/Currie 2011). Early investments yield high returns, as has been argued in a fast growing literature (among others Cunha et al. 2006; Currie 2001; Duncan/Magnuson 2013; Lochner 2011). Moreover, negative shocks in early childhood result in more long-term damage if the child has a disadvantaged background (Currie/Hyson 1999). Whether early disadvantages can be cured, and in particular whether they can be cured by early intervention programs, is still an open debate. However, there is some evidence that they can (Duncan/Magnuson 2013; Ruhm/Waldfoegel 2012; Belfield et al. 2006; Heckman et al. 2010; Deming 2009). International studies find long-lasting effects of child care on schooling attainment and other non-schooling outcomes (Heckman/Raut 2013), even if the effect of child care on cognitive test scores might not be long-lasting (Blau/Currie 2006). While quality and the structure of formal child care and schooling are on the agenda (Hanushek 1997, 2003; Krueger 2003; Eberts/Hollenbeck/Stone 2002; Lavy 2002), additional voluntary (educational) activities have not yet been the focus of research. Although leisure activities like sports aside kindergarten, preschool or school and their effects on educational attainment have been studied (e.g. Stevenson 2010; Pfeifer/Cornelißen 2010; Felfe/Lechner/Steinmayr 2011), effects and channels of other out-of-school activities have not been fully understood and evaluated yet. Moreover, since extracurricular educational activities cause additional costs, it does not suffice to identify positive effects, but issues of cost effectiveness arise.

Not only in Germany but also in many other countries science labs and children's universities were established for children and youths.¹ These institutions offer classes to foster interest in science and research. Typically the courses are short-termed, e.g. single courses during school vacations or after school, and target children in primary or secondary school. Whether attending these classes has positive effects on schooling or even later-life educational and labor market outcomes is an open question. The evaluation of voluntary extracurricular programs is often impeded by selectivity issues, as the participation decision is not random. Moreover, the courses are rather short-termed, unrelated to school life, and, due to a lack of sanctions, children can opt out easily once they lose interest. Thus, it is unclear if there are any causal effects of this type of short-time stimuli and, if any, how they could be identified.

¹ For example HandsOn Science in the UK or the US, ScienceLab Kinder.Wissen.Mehr in Germany (Schettler 2010). Children's universities can be found across Europe, especially in Germany and the UK.

The present paper adds to the literature on extracurricular early childhood education and child development by exploiting unique data on an educational project in Germany, the Junior University. The Junior University² (JU) is a unique educational non-profit institution, which is explicitly meant to be an additional organization complementary to kindergarten³ and school. In this paper we study the short-term effect of JU enrollment on the school readiness of children. To measure JU's return to educational outcomes we use data from different sources. In addition, we can exploit a quasi-experimental design to estimate a causal effect. Our results show that attending JU leads to higher school readiness, i.e. higher cognitive and non-cognitive abilities. Although the effect of JU attendance on school readiness is quite small, the results are plausible and pass various robustness checks.

The paper is organized as follows. In Section 2 we give some more details on the Junior University. Section 3 describes the data and in Section 4 we discuss our empirical strategy. Section 5 presents the results, robustness checks and some tentative cost benefit analysis. Finally, we close in Section 6 with some concluding remarks and a brief discussion of the results.

2. The Junior University

The Junior University (JU) was launched in December 2008 as a permanent private non-profit institution, entirely financed by private sponsoring. It is located in Wuppertal, a major city with about 350,000 citizens in the German federal state of North Rhine-Westphalia. The JU offers courses on different topics with a main focus on natural sciences, mathematics, and engineering. With its pedagogical concept, developed by a renowned physicist with longtime experience in creating science TV-shows for children (e.g. Löwenzahn (Dandelion)) and his wife, a school teacher familiar with teaching disadvantaged children, the JU aims at raising children's interest in science offering mainly hands-on experimental courses. And unlike the existing children's universities in Germany, the JU is not a temporary institution within a University but an independent permanent institution. Furthermore, in comparison to most of the science labs in Germany, it is not targeted at gifted and advantaged students only. It is open for all children between the age of four and 18 (usually until end of secondary school) and independent of their educational or social background. The courses offered run either in

² Full name: *Junior Uni - Wuppertaler Kinder- und Jugend-Universität für das Bergische Land gGmbH* (gGmbH = non-profit company with limited liability). More information (in German) on the Junior University is available via the website www.junioruni-wuppertal.de.

³ The majority of children in Germany attends *kindergarten* at age three and leaves *kindergarten* at the age of six, when primary school begins. The last year in kindergarten is called *preschool (class)*. Hence, in comparison to the US, the terms kindergarten and preschool are used the other way round.

four, six, or eight ninety minute units, either weekly or as a full day course. The courses are targeted at different age groups (4-6, 7-10, 11-14, and 14 and older) and the classes are not taught by school teachers, but ‘experts’ like university professors, undergraduate and graduate students, local entrepreneurs, or citizens with special interests and skills. The course fee is low and varies between 5 and 10 Euros (depending on the duration of the course), which is by far not sufficient to cover costs. The low fee was chosen to attract children from low income families. However, if families cannot pay the fee, a private sponsor (like a local company) will take over the costs. Hence, there are no financial entry barriers for children from low income families.

Enrollment at the JU can be either on an individual level or as a group. In particular kindergarten preschool classes (last year before primary school entry) enroll at the JU. For instance, from December 2008 until spring 2012 the JU offered 1,091 courses and received 13,648 applications. 232 (21.26%) of the courses were offered for preschool groups with a total number of 2,964 registered preschool children. Since the JU courses are quite popular and the number of applicants exceeds the number of places each year, allocation is based on a first come first serve basis.

In the following we restrict our attention to children of kindergarten groups that are attending the JU with the entire preschool class and the preschool teacher. In 2011 Wuppertal has had 185 daycare institutions (including private parental initiatives and public kindergartens) of which 84 have sent at least one preschool class to the JU. But note that since these 84 kindergartens are not a positive selection of all kindergartens, the JU participants are not a positive selection of preschoolers. The level of ethnic and social segregation in Wuppertal is high and many of the participating kindergartens are located in highly disadvantaged districts of the city. The average share of immigrant children in the participating kindergartens is 0.32 (minimum is 0 and the maximum is 1). Hence, the social composition of the participants is more diverse at the JU than in many other science labs or children’s universities.

3. Data

To estimate the causal effect of the Junior University (JU) attendance on cognitive and non-cognitive abilities before school entry we generate a unique dataset which, in a quasi-experimental setting, allows us to distinguish between the treatment group (children enrolled at JU with the entire kindergarten preschool class) and the control group (peers of the same kindergarten who did not participate at the JU). The data stem from various sources and

include individual-level data, residential city block information and income information on a postal code level. The individual level data are drawn from the *Schuleingangsuntersuchung* (school entrance medical examination (SEM)) and provide information on ability measures, kindergarten enrollment and further individual characteristics like age, gender, residence, and ethnic origin. We supplement this data by a large set of administrative data on the city block level to describe the children's residential milieu. A city block is a small administrative unit of about 150 residents on average and Wuppertal has about 2,400 city blocks with residents (some city blocks are not inhabited, e.g. parks or industrial sites). These data provide detailed information on the population by ethnicity, employment, and welfare reciprocity. To further enrich our city block data, we add income indicators that are available on the slightly more aggregated eight-digit postal code level. The different data sources are described in more detail in the following sections.

3.1. School entrance medical examination

The school entrance medical examination (SEM) is a compulsory and standardized examination, which is taken at the age of 5y6m to 6y. Hence, it is a census of all preschool children. It is conducted to assess the health and mental status of preschoolers to attest school readiness. The data include the past and present health status (e.g. birth weight, obesity, ear and eye condition, social and emotional development) and the cognitive and non-cognitive abilities (e.g. eye-hand coordination, plural forming, gross motor skills). In addition, individual characteristics like age, gender, residence, and ethnic origin are included as well as information on the kindergarten and the prospective primary school.

In our analysis we use data on two cohorts of in total 5,669 preschool children born between 2003 and 2005 who were examined in the SEM between 2009 and 2011.⁴ The childrens' abilities were assessed using state-wide standardized tests.⁵ Theoretically, the lowest possible score to achieve is zero (no task completed) and the maximum depends on the number of task within a test area. The test areas which correspond to different abilities and the minimum and maximum number of tasks to be completed are listed below:

- *hec*: hand-eye coordination (0, 1, ..., 12)
- *saf*: salience/attention focusing (0, 1, ..., 29)
- *cou*: counting (0, 1, ..., 20)

⁴ The first cohort comprises 2,809 children born between September 2003 and August 2004. The first cohort underwent the SEM in 2009 and 2010. The second cohort of 2,860 children was born between September 2004 and September 2005. The SEM for the second cohort took place in 2010 and 2011.

⁵ For technical reasons we are not allowed to publish the tests.

- *scr*: simultaneous recording and quantitative comparison (0, 1, ..., 16)
- *vpd*: visual perception and deductive reasoning (0, 1, ..., 15)
- *pre*: preposition (0, 1, ..., 8)
- *plu*: plural forming (0, 1, ..., 7)
- *muw*: made-up words (0, 1, ..., 6)
- *gms*: gross motor skills (0, 1, ...)

Note that the range of gross motor skills is not restricted as it represents the number of trials within a given time.

On the basis of these nine test results and the child's health status physicians decide on whether a child should be enrolled in primary school or held back for a year. And, as the results of all tests jointly determine the assessment of school readiness, they represent a one-dimensional latent scale of *school readiness*. Hence, for the analysis we reduce the nine dimensions of ability to a one-dimensional scale of school readiness. To generate this scale we run an exploratory factor analysis and predict the scores of school readiness using the regression method. The results of the analysis confirm the conjecture of a one-dimensional factor; about 97% of the variance in the ability items is explained by the first factor (Table 1). Hence, in the following, we use the factor of school readiness as our outcome variable. To better interpret the estimation results we transform the factor to a scale from 0 to 100. The highest value of school readiness of 100% then corresponds to a score of 129 completed tasks.⁶ The distribution of school readiness for the full sample ($n = 5,669$) is shown in Figure 1.

-- Table 1 and Figure 1 about here --

The performance bands in Figure 1 characterize five different groups: the very low performing 5%, low performing 20%, average 50%, high performing 20%, and the very high performing 5%. The average school readiness is 79.7% (SD = 12.6%) and the variable is left-skewed. The weakest 5% reach no more than 56%, the medium 50% between 74% and 89% of school readiness.

In addition to information on abilities, there is a large set of complementary information in the SEM data. Table 2, column (1) summarizes the SEM data and column (2) differentiates between the two cohorts. The sample comprises 5,669 children, 51.08% are

⁶ The score of 129 results from the sample and, hence, is the empirical maximum. Theoretically, the highest possible value of school readiness cannot be calculated as the range of gross motor skills is not restricted.

boys and 36.57% are immigrants, where migration status is defined by the language spoken with the child during the first four years. If the parents report a language other than German, the child is said to have a migration background.

-- Table 2 about here --

On average, the children attended kindergarten for 2.74 years, which is common in Germany. About 46.60% have one sibling; only 4.25% have four or more siblings. The share of overweight or obese children is slightly larger than the share of (severely) underweight children. About 78% have a healthy weight. As Table 2, column (2) shows, there are only few significant differences between the two cohorts. The difference in ‘age at SEM exam’ and ‘years in kindergarten’ is plausible and due to an earlier cutoff date for primary school enrollment in North Rhine-Westphalia in 2011. Due to the earlier cutoff date, the second cohort comprises 13 months of births with on average younger children than those of the first cohort. The significant difference in ‘behavioral problems’ can be explained by the different sizes of the cohorts, too. To assess behavioral problems is not compulsory in the SEM, and due to the larger second cohort the checkup was omitted more often (there is an increase in the category “examination was not possible”). As there is no apparent justification for the difference in ‘partial hearing loss’ we control for this variable in the estimations.

3.2. *Administrative data on socio-economic status*

The child’s address information is used to match individual data (from the SEM) and information on socio-economic status by assigning every child to the city block or postal code area in which he or she is living. The additional data provides information on the neighborhood of each child and describes the probability of a specific group affiliation. For instance, if 20% of the city block children live in low income families a child living in this city block has a 20% probability to live in a low income family. Enriching the individual level data by city block data is important because the SEM data does not provide individual-level information on the financial and social status. Thus, we use the city block information as a proxy for a child’s socio-economic status. We describe the residential milieu for example by the risk of poverty (defined as the share of welfare dependent private households⁷), the unemployment rate and the share of immigrants.

⁷ In Germany, people in need receive benefit payments either because they are (1) long-term unemployed or (2) unemployable or (3) employed but the income is lower than the subsistence level.

Since the city block data only indicates low status (like unemployment, poverty, etc.), variables that describe medium or high level socio-economic status neighborhoods have to be added. Here we use additional data on purchasing power per household in Euros⁸ to better distinguish between families at the medium and top level of socio-economic status. This data is not available at the city block level, but the eight-digit postal code area⁹ which defines 368 areas in Wuppertal (Figure 2).

-- Figure 2 about here --

Table 2 reports descriptive statistics for the city block and postal code variables, too. The average share of welfare recipients with children in a city block is 29.08%, the share of immigrant children in a city block is on average 53.66%, and the average purchasing power amounts to 38.79 thousand Euros per year. The decreasing welfare dependency between the cohorts reflects a global trend. Between 2008 and 2010 the overall welfare dependency rate in Wuppertal declined from 20.26% in 2008 to 18.58% in 2010.

4. Empirical strategy

To analyze the effect of the JU courses on school readiness we use two cohorts of preschool children examined in the SEM (SEM in 2009/2010 and SEM in 2010/2011) and the one-dimensional factor of school readiness discussed above (Section 3.1). Using children of two cohorts, we can exploit variation *within* kindergartens with respect to JU attendance, because we observe children in preschool classes which attended JU with the entire class in one year but not in the other year. We use this within kindergarten variation to estimate the causal effect of the JU by comparing children of preschool classes within kindergartens. The estimated effect can indeed be interpreted as a causal effect, because JU attendance is exogenous. The exogeneity of the treatment is discussed in the following section.

4.1. Exogeneity of the treatment

The structure of our data is illustrated in Figure 3. As Figure 3 shows, our data comprises 5,669 children examined in the SEM, 1,273 of which have attended at least one course at the JU (22.46%). Most of these children (1,055; 82.88%) were enrolled in a four-week course

⁸ The data is provided by the microm GmbH. The microm Micromarketing-Systeme und Consult GmbH provides micro-geographical and spatial data for marketing and research purposes at different regional levels (like municipalities or postal code areas).

⁹ The postal code areas are defined by the microm.

only with their preschool class (no private enrollment). These children and their kindergarten peers are suited for the analysis, as they are not affected by self-selection issues. Kindertartens typically enroll the entire preschool class of on average 14 children at the JU. Hence, as we have two cohorts of children, we observe (1) *within* kindergarten variation in participation because a class attends the JU and another does not; these children who did not attend JU are labeled ‘untreated’. And (2) we observe *within* preschool *within* cohort variation because some children attend JU with their preschool class but take the SEM exam prior to the attendance; this group of children is labeled ‘placebo group’.

-- Figure 3 about here --

Note that for neither group selectivity into a kindergarten is an issue. The children in the sample enrolled at kindergarten before the JU was launched and also before preschool-courses were established. Hence, there is no self-selection of children in kindertartens or preschool classes due to JU participation. Even if parents want their children to enroll at JU, they will not change kindergarten. First, if the child’s kindergarten does not participate at the JU, the children can be individually enrolled for classes anyway. And second, parental choice of kindergarten and in particular change of kindergarten might not be possible. Wuppertal, like many other cities in Germany, has an insufficient daycare capacity and parents have to apply for a free slot quite early, e.g. one to two years before the child’s third birthday. Hence, to change a kindergarten, in particular only because JU enrollment is desired, is difficult due to limited supply.

Besides self-selection into kindergarten, potential selectivity into the treatment, the placebo, and the untreated group within a kindergarten and a cohort has to be discussed. To support the exogeneity of the treatment assumption, we do mean comparison tests for the control variables between all these groups (treatment vs. untreated group; treatment vs. placebo group, and placebo vs. untreated group). As our sample of interest ($n = 1,896$, Figure 3) includes children of 70 Wuppertal’s kindertartens¹⁰, we have to calculate clustered tests. As mentioned in Section 2, the city of Wuppertal is segregated and this is reflected in kindergarten segregation as well. Thus, observations within kindertartens are likely to be correlated. Standard χ^2 -tests or t-tests for the control variables would be biased upwards, and we would get downwardly biased p-values. Hence, to account for within kindergarten

¹⁰ 14 of 84 kindertartens were eliminated from the analysis as they report only one participant or only one non-participant in two cohorts. Here within kindergarten variation cannot be utilized.

correlations we calculate cluster-adjusted tests as discussed in Donner/Klar (2000) where the kindergarten is the cluster variable.¹¹ Table 3 presents the results of mean comparison tests.

-- Table 3 about here --

For the untreated group (children not enrolled at the JU) and for the placebo group (children examined in the SEM before enrolling at the JU) there are no obvious selectivity issues. The treatment depends only on the decision of the kindergarten teacher to send the entire preschool class to JU. It does not depend on individual characteristics. However, to be examined in the SEM before or after attending the JU, that is, to belong to the treatment or the placebo group, may be potentially affected by the date of birth. Note that all children are requested to participate in the SEM exam at age 5y6m. Hence, the children participating in the same course will take the SEM on different dates. Moreover, older children are potentially more likely to be examined before attending the JU and hence to be in the placebo group. If assignment to treatment or placebo is, indeed, conditional on birth date, we expect to see relevant and significant differences between those groups by age (they should be older [age equals the difference between date of birth and date of SEM]) and average years in kindergarten (should be lower [years in kindergarten is the difference between date of kindergarten entry and date of SEM]). But, as Table 3 column (2) shows, there is no significant difference between age and average years in kindergarten. Moreover, children of the placebo group are even slightly younger. Hence, as we do not observe any difference in those variables, we can assume that the placebo group is not a selective group (due to age) of all children or children of the treatment group. And this, indeed, is plausible. Children usually do not attend the SEM at the time they are requested to. Parents are allowed to arrange different appointments for their child's SEM, e.g. according to working hours, and do practice this very often (overall average age at SEM exam is 5.95 (Table 2, column (1))). Hence, children of the treatment and the placebo group are equally likely to receive the treatment before or after the SEM.

Besides selectivity issues conditional on age, there are two significant and few insignificant, but possibly relevant differences between the treatment and the placebo group (Table 3). For example, we find a significant difference between the treatment and the placebo group for the variable 'vaccine certificate presented'. Newborns receive a certificate

¹¹ Note for Table 2: The results do not change considerably if we account for within-kindergarten correlation, but the significant difference between cohort 1 and 2 in 'average years in kindergarten' and 'average % of welfare recipients with children in city block' disappears.

of vaccination in which all vaccinations are reported. Parents are requested to bring this certificate along to the SEM exam. About 90.75% of children of the placebo group presented the certificate of vaccination, but 94.68% of the treatment group. In addition, the percentage of children with tetanus vaccination¹² significantly differs between these two groups as well. As we can only determine the share of vaccinated children for children who presented the certificate, the estimated difference is plausible. Note, that the differences between the treatment and the placebo group (Table 3, column (2)) and between treatment and untreated group (Table 3, column (1)) are not statistically significant, albeit they are apparent. Provided that bringing in the required medical documents is correlated with social status, the comparison groups might be on average less advantaged. Parents bring in the requested certificates less often, the children tend to have a lower birth weight and they tend to live in neighborhoods with a higher proportion of immigrants. However, this does not threaten our identification strategy, because JU attendance does not depend on these variables (the kindergarten may decide who participates in a JU class, but not on when children take the SEM) and hence is still exogenous. Nevertheless, in our models we control for these background variables, for possible non-linear and indirect effects, and run different robustness checks to support the exogeneity assumption.

4.2. Estimation approach

To analyze the effect of the JU we use our endogenous variable ‘school readiness’ bounded between 0 and 100 as introduced in Section 3.1. To estimate the causal effect of the JU on school readiness, we formulate a fixed effects model where we explain school readiness by a dummy representing JU participation (JU ; 1=treated, 0=untreated), the exogenous individual information and regional controls discussed above (Table 3):

$$y_{ick} = \alpha + \beta X_{ick} + \gamma JU_{ick} + \mu_k + \lambda_c + \varepsilon_{ick}, \quad (1)$$

where y_{ick} is the school readiness of child i of cohort c in preschool k . X_{ick} are background characteristics of child i of cohort c in preschool k (e.g. dummy for being a boy), and JU_{ick} is the dummy indicating that child i attended JU courses with the preschool class in cohort c and kindergarten k . μ_k reflects unobserved time-invariant preschool characteristics, including shared preferences of parents and kindergarten quality, and λ_c represents cohort specific characteristics. ε_{ick} is the individual error term.

Although we have argued that JU attendance is exogenous conditional on kindergarten and the control variables, our model and data may suffer from a lack of relevant individual-

¹² In Germany, most children are likely to receive tetanus vaccination.

level information which may further affect school readiness. This is in particular the case for the families' socio-economic status. To approximately account for socio-economic status we include information on the city block level and income information on postal code basis as discussed in Section 3.2. The individual controls used are taken from the SEM, hence, the data were collected post-treatment. This might affect the quality of some controls. The time-invariant or pre-treatment variables like gender, immigration status or birth weight are clearly not affected. Other variables, that are assessed during the SEM and are exogenous to the treatment but not to the outcome (like number of siblings or obesity), can also be included in equation (1). Other variables, however, cannot be used in the estimation either because they are endogenous to other exogenous variables or to the outcome.

4.3. Robustness checks

To check for robustness of our results, we estimate the JU effect using different groups. In our first check we estimate equation (1) using data on the placebo and the untreated group only. As the placebo group consists of children who did attend the JU with their preschool class after their own SEM, we do not expect a significant effect of the JU treatment, as their school readiness cannot be affected by the JU courses. On the contrary, if we estimate a significant coefficient for the JU dummy, the treatment is more likely to capture unobserved preschool or family characteristics rather than a causal effect of JU attendance on school readiness. In this case our model would be misspecified.

The second robustness check is done by comparing the placebo group to the treatment group. If there is a causal effect of JU attendance on school readiness, children attending the JU before their SEM (treatment) should have a significantly higher school readiness than children whose abilities measured at the SEM could not be affected by a JU course (placebo), simply because they are attending JU after their SEM took place.

In other words: if we are measuring a causal effect of JU attendance on cognitive outcomes, the coefficient for the JU dummy in the sample of the untreated and the placebo group must be equal to zero. Doing the analysis for the treatment and the placebo group, the coefficient must not be zero and similar to the coefficient in equation (1) for the treatment and the untreated group.

The third robustness check is done by comparing the regression results and the results of the first and second robustness check to results of a matching estimator. As discussed in Section 3, there are differences in some exogenous variables between the defined groups, though most of the differences are non-negligible but insignificant. To rule out that these

differences hint at a selectivity problem which may bias our estimated JU effect, we estimate the average treatment effect of the treated using different propensity score matching methods.

5. Results

5.1. *Junior University effect*

Table 4 shows seven models which quantify the effect of the JU participation on school readiness.

-- Table 4 about here --

We start with a basic model in column (1). The model is estimated by OLS and includes kindergarten and cohort fixed effects. We regress school readiness on the treatment dummy (JU participation, 1 = treated/0 = untreated), a gender dummy (male = 1) and a dummy for immigrant status (immigrant = 1/native = 0). In addition, we control for linear age effects. As the dependent variable is standardized, the effects of all variables can be interpreted as changes (*ceteris paribus*) in school readiness in percentage points. In the first model the JU treatment variable is positive and statistically significant. Children attending JU courses with their preschool class perform better than their kindergarten peers which did not enroll at the JU. The additional achievement of 3.36 percentage points corresponds to about 4.34 (of 129) tasks completed in the several SEM-tests. The negative coefficients for boys and immigrants are statistically significant as well and plausible. Girls and natives perform better on the SEM exam.¹³

Nevertheless, there are some other variables not included in (1) which may as well affect school readiness and have to be controlled for (see Sections 3 and 4). Therefore we supplement model (1) by additional variables and different specifications, like non-linear age effects and interaction effects. In model (2) we exclude age and include age at kindergarten entry to avoid multicollinearity with kindergarten duration. In addition we include the number of siblings. We observe a decrease in the JU dummy to 2.73, which amounts to 3.52 solved tasks. However, the JU effect remains highly significant. In model (3) we add information on

¹³ By this basic model we already achieve a relatively high R^2 . Using four variables (treatment, gender, immigrant status and age in months) and kindergarten and cohort fixed effects we explain about 26.36% of variation – which is remarkable. One might think that this is mostly due to the fixed effects, but it is not. If we exclude kindergarten and cohort fixed effects we still get an R^2 of about 16%. And this is due to the fact, that gender, age and especially immigrant status already explain a lot of the variance in school readiness. For instance, a model without fixed effects and with the regressor ‘immigrant’ only already explains 11.65% of variation.

the health status. Health status includes the following dummy variables: low birth weight, obesity/overweight, (severely) underweight, no health certificate presented, U7a¹⁴ conducted, no vaccine certificate presented, with tetanus vaccination, reduced visual acuity, partial hearing loss, behavioral problems. Model (4) includes the socio-economic information at the city block and postal code area level. The city block information covers the share of households with children receiving welfare payments and the share of migrant children under the age of six. The postal code information covers the average purchasing power per household in 10,000 Euros. In both models, (3) and (4), the estimated treatment effect drops only slightly. In model (5) we exclude city block information and generate an index for low economic and social status from the city block data. The index comprises the following variables weighted by principal factor analysis: share of immigrants, share of immigrant children under the age of six, employment share (employees subject to social insurance contributions), unemployment share, share of welfare recipients, share of households with children receiving welfare, and the share of not employable inhabitants. The results are similar to those of model (4). To control for non-linear effects we include second, third and fourth order polynomials of age at kindergarten entry, kindergarten duration, city block social status index and average purchasing power in models (6) and (7). In model (7) we also add interactions of gender and immigrant status, and kindergarten duration and immigrant status. Hereby we try to saturate the model with possible non-linear and indirect effects. However, the results of models (2) to (7) show that the estimated effect of attending JU is robust and highly significant. In model (7) the JU effect still amounts to 2.79 tasks completed additionally.

5.2. Robustness checks

As discussed in Section 3, the data does not include individual-level information on the economic and social situation of the child's family. Socio-economic status is an important predictor of educational success, in particular in Germany. Hence, it may turn out that our models suffer from an omitted variable bias. However, exploiting our study-design, we can check the robustness by comparing different groups of children and a supplementary matching estimator.

5.2.1. Placebo group

¹⁴ Medical screening conducted at the age of 34 to 36 months to attest the physical condition.

As discussed in Section 4, we can compare the treatment and the untreated group to the placebo group (children enrolled at the JU after their own SEM). For the first comparison (treated vs. placebo) we expect non-zero JU coefficients which are similar to the coefficients in Table 4. We expect this result only if the model is correctly specified and JU attendance is exogenous. For the second comparison (untreated vs. placebo) the coefficients should be equal to zero. If these hypotheses are confirmed, the treatment variable is exogenous and the models in Table 4 are correctly specified. In that case, the models are suitable to estimate the causal effect of the treatment on school readiness.

The results of the robustness check using the treatment and placebo group are presented in Table 5, results for placebo vs. untreated are given in Table 6.

-- Tables 5 and 6 about here --

Our first hypothesis for the placebo and treatment group - JU coefficient not equal to zero and similar to the one in Table 5 - is confirmed. Only if children attend JU before the SEM, we measure an effect. Hence selectivity into JU does not explain the better performance of the treated, because the placebo group participates in the JU, too – but after school readiness has been assessed. As discussed in Section 3 (Table 3), the placebo group is not a selective group of all children. The groups are similar with respect to the relevant variables and there are no age effects which may explain short-term differences in school readiness. Hence our results suggest JU attendance being significantly and causally related to higher outcomes at the SEM exam. In addition, note that the coefficient for the treatment variable is not only similar to the one in Table 4 in each model specification, but the R^2 are similar.

Table 6 summarizes the results of the second robustness check, the comparison of the placebo and the untreated group. Again, our hypothesis is confirmed. The JU coefficient is statistically not different from zero at any significance level and regardless of the specification. The coefficients of the other variables, their significance levels, and the R^2 are similar to those in the model specifications in Tables 4 and 5.

5.2.2. Matching results

As discussed in Section 3 there are some insignificant but possibly non-negligible differences in the control variables between the placebo and the treatment group and the untreated and treated group. Hence, as an additional robustness check, we estimate the average treatment effects of the treated (ATT) using propensity score matching. We use model (7) (Tables 4, 5,

and 6) and different specifications of the matching estimator to account for the variance/bias trade-off. Table 7 summarizes the results for all groups.

-- Table 7 about here --

The matching results for the main comparison group (treated vs. untreated) differ according to the varying specifications of the k -nearest neighbor algorithm and different number of observations on support. However, the results are qualitatively similar and, in addition, similar to the OLS results in Table 4. The results for the placebo and the untreated group are qualitatively similar to the results in Table 6, too. This indicates no treatment effects of the treated of attending JU after the SEM and, hence, supports our exogeneity assumption.

Applying matching to the placebo and the treatment group, gives slightly different results. The variation in the different ATT specifications (with or without caliper, value of caliper, with or without replacement) is higher than for the other group comparisons. In addition, the ATT in the fourth specification (Table 7, column (4)) is lowest and the estimated effect fails to be significant (t-value is $|1.84|$). But note that in this specification, which has very strict requirements for the matching process, the number of observations is small compared to the other specifications. Hence, the low significance of this single specification is not surprising.

Overall, the matching results qualitatively do not differ from the OLS results in neither specification. In addition, note that we do already have a quasi-experimental design and a fairly well saturated model in (7) (Table 4), hence the matching results can be interpreted as a confirmation of the results in Section 5.1. As the presented robustness checks confirm our assumption on the exogeneity of the treatment and its impact on school readiness we do, in fact, measure a short-term causal effect of an additional educational input for preschool children on their cognitive and non-cognitive outcomes.

5.3. Does the investment pay off?

Several studies have shown that early investments pay off in later life. This is in particular true for disadvantaged children (Duncan/Magnuson 2013; Belfield et al. 2006; Heckman et al. 2010). At this point, we cannot quantify the potential long-term effect of the JU. However, doing some back-of-the-envelope calculations we can present some estimates regarding the relative cost effectiveness of the JU.

For preschool children enrolling at the Junior University the monetary investment is 5 Euros. In addition, there are travel costs for the kindergarten teacher of about 20 Euros – which amount to 1.4 Euros per child. The Junior University managing board has calculated costs of about 100 Euros per child and course. This covers the teacher salary, course materials and fixed costs (including rental fee for the course rooms, office staff, etc.). There are no additional costs, because the kindergarten teacher salary is paid anyway (the courses take place during regular kindergarten time) and travel costs for children are covered by the course fee. Hence, the total monetary investment per child and a regular four-week course is about 106 Euros. Compared to that, the Federal Statistical Office (2012) reports total costs for publicly funded day care of about 6,100 Euros per year and child. Hence a day in kindergarten costs about 17 Euros per child.

Next, look at the returns to JU. Consider, for example, model (4) in Table 4. The JU effect on school readiness amounts to 2.96 tasks completed (2.2937% of 129 tasks) in the SEM. If we compare this to the return to kindergarten – for simplicity we assume constant and linear kindergarten effects – the same increase in completed tasks requires additional kindergarten attendance of about five months. Hence, JU attendance is as valuable for achievement as about 16% of the average time in kindergarten (2.74 years, Table 2). To compensate for JU attendance, kindergarten attendance for the untreated has to be 3.16 years instead of 2.74 years. This increase in kindergarten duration results in additional costs of about 2,550 Euros per child. Compared to the 2,550 Euros, the costs of a JU course of about 106 Euros are much lower.

Clearly, the Junior University cannot and does not replace or compensate kindergarten attendance. But our analysis shows that innovative educational concepts can be combined with regular preschool education to significantly improve cognitive and non-cognitive skills of children. Children are better prepared for school if they get additional (exciting) educational input. In addition, compared to investments in other intervention or early childhood programs (Duncan/Magnuson 2013), the investment of about 106 Euro per child and course at the Junior University is quite small.

6. Conclusion and Discussion

Early childhood education and returns to early investments have been on the research agenda for several years. Many studies analyze the impact of early childhood education on educational attainment, earnings and the probability of employment but only few studies focus on out-of-school activities and their impact on educational success. In this paper, we

contribute to this topic by analyzing the effect of a unique educational project in Germany on school readiness of children. The Junior University (JU) in Wuppertal is a private educational institution which is meant to be supplementary to kindergarten and schools. Besides private enrollment, kindergartens are allowed to enroll their entire preschool classes (last year before school entry) at the JU and to participate in mainly hands-on experimental courses. Using within kindergarten variation of enrollment, we analyze the effect of participation on school readiness of preschoolers.

Our main findings suggest that attending classes at the JU significantly and causally increases the cognitive and non-cognitive abilities of preschool children by about 2.16%. To check the robustness of our results we compare the treatment group to a placebo group of children, which receive the treatment after their school readiness was assessed and compare all results to matching estimates. The estimated JU effect passes all robustness checks.

There are at least two possible explanations for this finding. First, the JU courses are typically unconventional hands-on experimental courses to which children are typically not exposed in kindergarten or at home, e. g. building volcanoes of sand and blasting them up with peas. The event character may increase attention and active participation, which is transformed to an increase in cognitive and non-cognitive abilities. In addition, it is possible that the JU effect is further enforced by kindergarten teachers and parents. By talking about the courses, repeating the experiments, and discussing what has been learned, a short-term course can be a long lasting experience. Second, the children in our data are rather young (between five and six years of age) and accumulation of skills and knowledge is known to be higher in early life (e.g. Cunha et al. 2006). Hence, doing a little bit more than other children significantly improves school readiness.

7. Literature

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Figure 1 School readiness of full sample (n = 5,669), density and performance bands

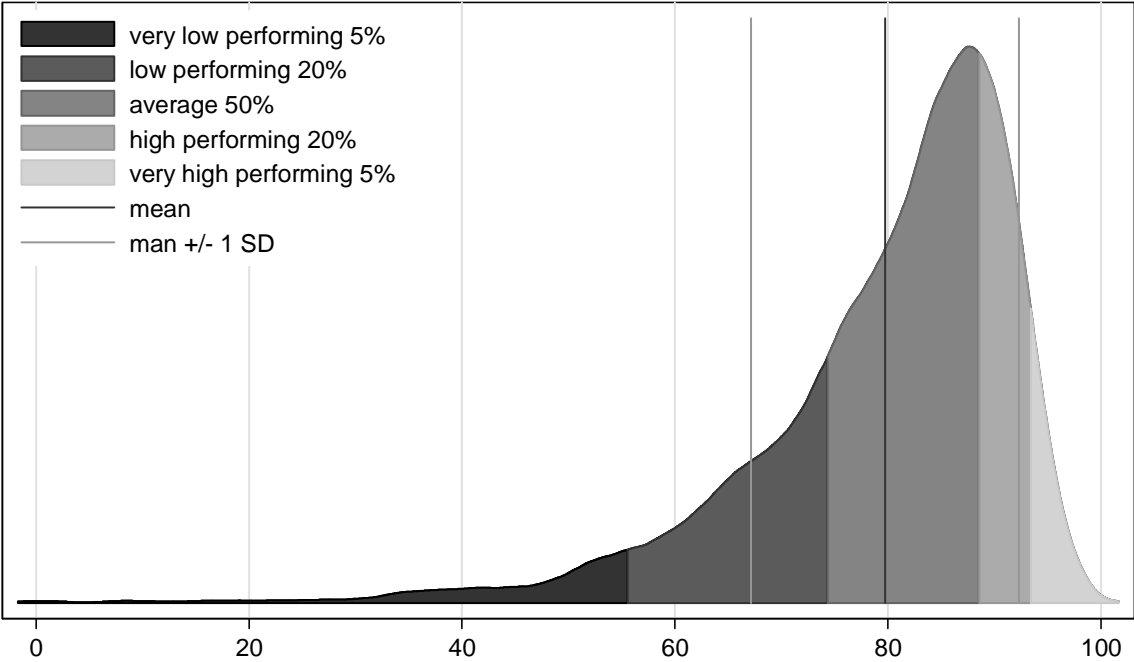


Figure 2 Average purchasing power per household (hh) in Euros in Wuppertal's postal code areas

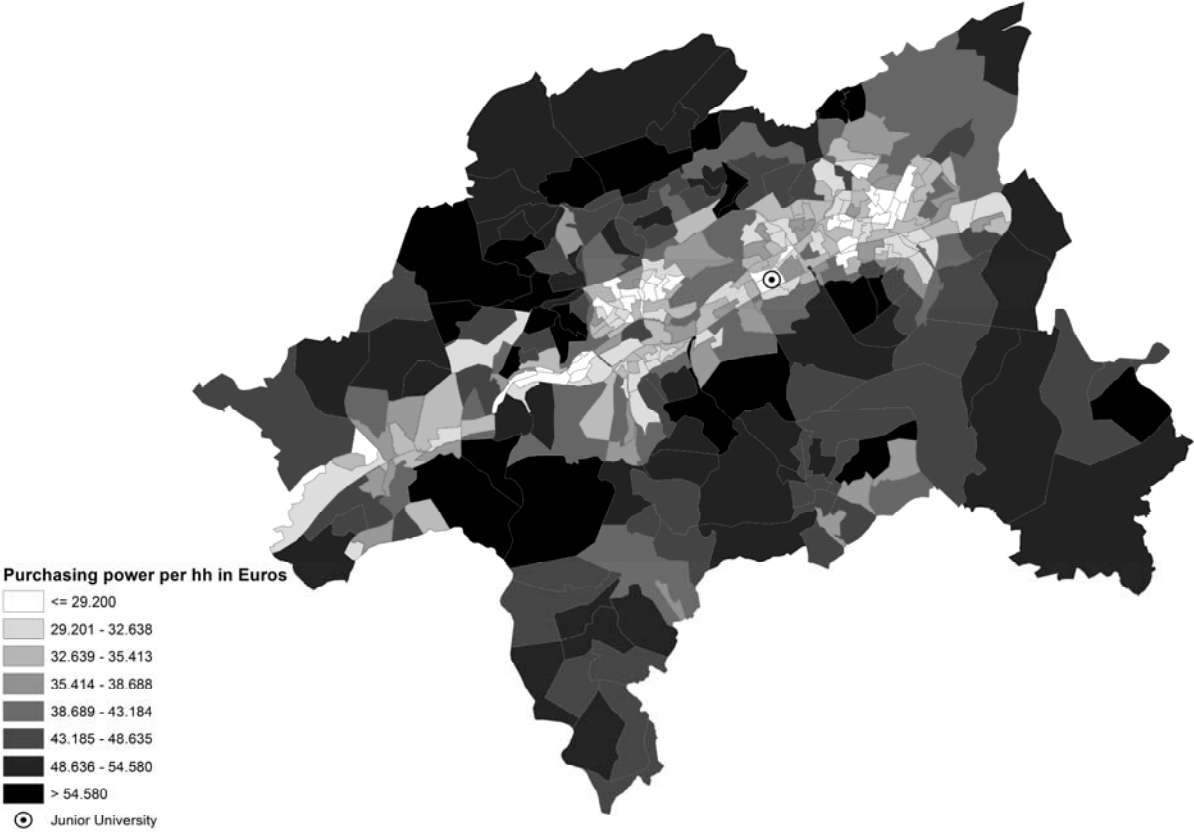


Figure 3 Study design

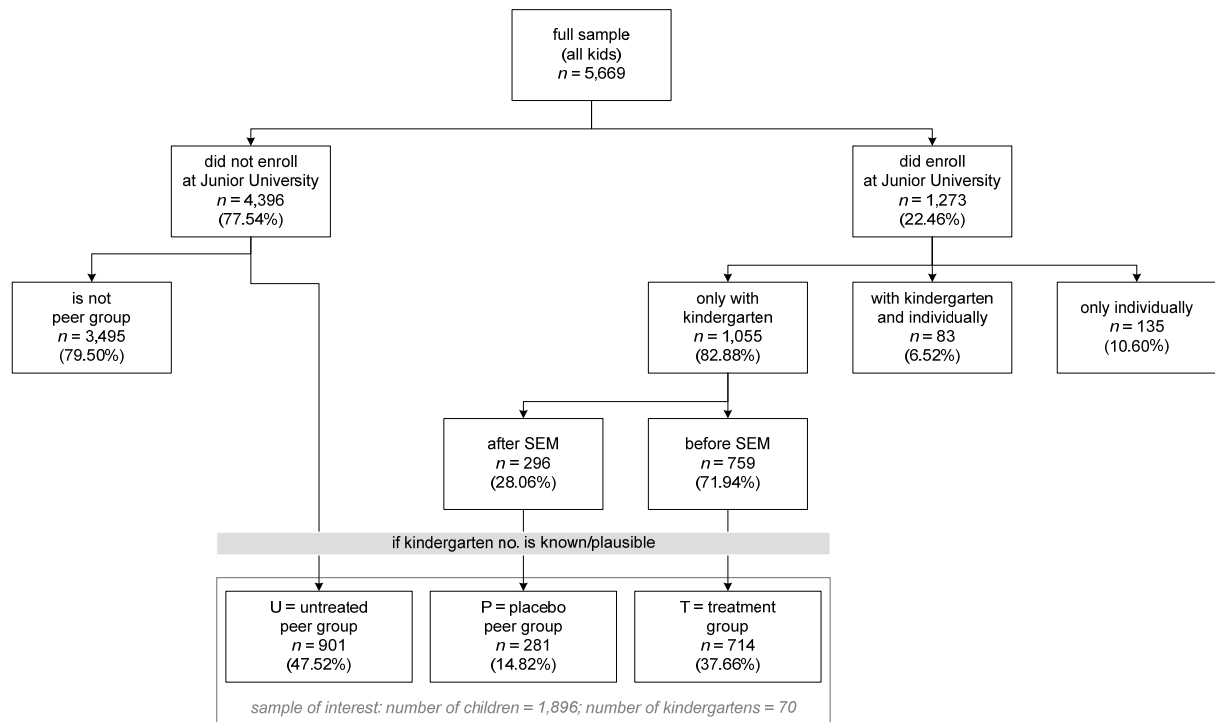


Table 1 Factor analysis results and Kaiser-Meyer-Olkin-criterion (KMO), full sample (n = 5,669)

Variable	hec	saf	cou	src	vpd	pre	plu	muw	gms
Factor loading	0.5744	0.5302	0.6241	0.6693	0.6177	0.6854	0.6530	0.4016	0.3582
KMO	0.8780	0.8970	0.8769	0.8603	0.8976	0.7205	0.7070	0.9251	0.8870

Note: Unique factor solution with eigenvalue $\lambda = 3.0158$ and a 96,65% explanation of variance; overall-KMO: 0.8285.

Table 2 Characteristics of the full sample and cohort comparison

	(1)		(2)	
	Total	Cohort		
		1	2	
full sample size	5,669	2,809	2,860	
average age at examination	5.95 (0.2077)	5.96 (0.2139)	5.94 (0.2010)	
% boys	51.08	50.44	51.71	
% with migration background	36.57	36.67	36.47	
average years in kindergarten	2.74 (0.7519)	2.79 (0.7481)	2.68 (0.7519)	
number of siblings in %				
	0	21.86	21.72	21.99
	1	46.60	47.24	45.98
	2	20.14	20.08	20.21
	3	7.14	6.51	7.76
	4 or more	4.25	4.45	4.06
BMI category in %				
	severely underweight	2.77	2.48	3.05
	underweight	6.48	6.68	6.28
	normal (healthy weight)	78.37	78.39	78.36
	overweight	6.84	7.04	6.64
	obese	5.54	5.40	5.67
% low birth weight	7.35	7.76	6.95	
% health certificate presented	93.91	94.16	93.67	
% with U7a (medical screening at age 34-36 months)	87.22	87.46	86.99	
% vaccine certificate presented	92.59	93.09	92.10	
% with tetanus vaccination	91.69	91.81	91.57	
% reduced visual acuity	21.50	22.11	20.91	
% partial hearing loss	8.08	9.97	6.22	
% with behavioral problems	6.28	8.37	4.23^{a)}	
Average % of welfare recipients with children in city block	29.08 (21.03)	30.15 (21.48)	28.02 (20.52)	
Average % of immigrant children (< 6 years) in city block	53.66 (28.86)	53.34 (28.96)	53.96 (28.76)	
average household income (in 10,000 Euros) in postal code area	3.8788 (0.8940)	3,8870 (0.8912)	3.8707 (0.8968)	

Notes: Standard deviation in parentheses; bold figures indicate significant differences between groups ($p \leq 0.05$) based on t-tests (for age, kindergarten, city block and postal code information) and χ^2 -tests (for other variables); ^{a)}due to a high increase in the category 'examination was not possible' (assessment is not compulsory).

Table 3 Characteristics of the treatment, untreated, and placebo group and exogeneity checks

	(1)		(2)		(3)	
	Treatment (T) vs. untreated (U)		Treatment (T) vs. placebo (P)		Placebo (P) vs. untreated (U)	
	U	T	P	T	U	P
full sample size	901	714	281	714	901	281
average age at examination	5.94 (0.0092)	5.96 (0.0099)	5.94 (0.0153)	5.96 (0.0093)	5.94 (0.0098)	5.94 (0.0168)
% boys	51.50	46.64	50.89	46.64	51.50	50.89
% with migration background	38.29	36.69	38.43	36.69	38.29	38.43
average years in kindergarten	2.78 (0.0447)	2.86 (0.0463)	2.77 (0.0770)	2.86 (0.0467)	2.78 (0.0415)	2.77 (0.0694)
number of siblings in %						
0	22.09	23.11	22.06	23.11	22.09	22.06
1	43.29	50.00	48.75	50.00	43.29	48.75
2	22.09	18.77	20.28	18.77	22.09	20.28
3	7.99	5.32	6.05	5.32	7.99	6.05
4 or more	4.55	2.80	2.85	2.80	4.55	2.85
BMI category in %						
severely underweight	2.73	2.13	4.10	2.13	2.73	4.10
underweight	7.29	5.96	7.46	5.96	7.29	7.46
normal (healthy weight)	77.79	80.14	76.49	80.14	77.79	76.49
overweight	6.72	7.52	7.46	7.52	6.72	7.46
obese	5.47	4.26	4.48	4.26	5.47	4.48
% low birth weight	7.76	5.86	7.89	5.86	7.76	7.89
% health certificate presented	93.56	95.66	92.53	95.66	93.56	92.53
% with U7a (medical screening)	85.89	88.10	86.12	88.10	85.89	86.12
% vaccine certificate presented	92.67	94.68	90.75	94.68	92.67	90.75
% with tetanus vaccination	92.01	93.98	89.32	93.98	92.01	89.32
% reduced visual acuity	22.20	19.33	19.22	19.33	22.20	19.22
% partial hearing loss	8.88	6.30	9.25	6.30	8.88	9.25
% with behavioral problems	6.66	5.60	4.63	5.60	6.66	4.63
Average % of welfare recipients with children in city block	29.67 (1.4863)	29.68 (1.5295)	31.14 (2.2657)	29.68 (1.3782)	29.67 (1.3576)	31.14 (2.2500)
Average % of immigrant children (< 6 years) in city block	53.98 (3.5603)	49.95 (3.5925)	52.77 (4.8068)	49.95 (2.8951)	53.98 (3.1419)	52.77 (5.0998)
average household income (in 10,000 Euros) in postal code area	3.8465 (0.1333)	3.9737 (0.1342)	3.8794 (0.1843)	3.9737 (0.1108)	3.8465 (0.1216)	3.8794 (0.1967)

Notes: Bold figures indicate significant differences between groups ($p \leq 0.05$) based on clustered t-tests (for age, kindergarten, city block and postal code information) and clustered χ^2 -tests (for other variables); cluster-adjusted standard errors in parentheses.

Table 4 Junior University effect on school readiness, treatment vs. untreated group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Junior University treatment (yes = 1/no = 0)	3.3618*** (0.8499)	2.7252*** (0.6622)	2.3069*** (0.5645)	2.2937*** (0.5525)	2.2349*** (0.5513)	2.1976*** (0.5441)	2.1623*** (0.5448)
Gender (male = 1)	-2.6622*** (0.4883)	-2.6081*** (0.4682)	-1.9167*** (0.4227)	-1.8872*** (0.4159)	-1.9067*** (0.4266)	-2.0126*** (0.4291)	-2.1445*** (0.4590)
Immigrant (yes = 1)	-5.7063*** (0.7011)	-5.0087*** (0.7165)	-4.6248*** (0.7029)	-4.4213*** (0.7771)	-4.2113*** (0.7383)	-4.2155*** (0.7317)	-6.8217*** (2.4482)
Age at kindergarten entry (in months)		0.3835*** (0.1135)	0.3704*** (0.1052)	0.3977*** (0.1062)	0.3948*** (0.1075)	-1.4091 (1.4642)	-1.3761 (1.4802)
Kindergarten duration (in months)		0.5216*** (0.1195)	0.4573*** (0.1111)	0.4768*** (0.1104)	0.4758*** (0.1119)	1.4510 (2.7572)	1.4240 (2.8272)
Constant	46.6193*** (10.0380)	51.3582*** (9.1582)	51.6384*** (8.9530)	47.2260*** (9.2210)	48.1247*** (9.3292)	-19.1311 (94.6656)	-11.5994 (95.4531)
Age in months	✓						
Number of siblings		✓	✓	✓	✓	✓	✓
Health status			✓	✓	✓	✓	✓
City block information				✓			
Buying power in postal code area				✓	✓	✓	✓
SES-Index (city block)					✓	✓	✓
kindergarten, Age, SES-index, and buying power polynomials						✓	✓
Age, gender, immigrant and kindergarten duration interactions							✓
Observations	1,556	1,508	1,455	1,455	1,455	1,455	1,455
Kindergartens	70	70	70	70	70	70	70
R ²	0.2636	0.2938	0.3622	0.3663	0.3671	0.3746	0.3754
adjusted R ²	0.2268	0.2548	0.3206	0.3235	0.3248	0.3270	0.3268

Notes: OLS estimates with kindergarten and cohort fixed effects; dependent variable is school readiness score; standard errors in parentheses are clustered at the kindergarten level; ⁺ $p < 0.10$, ^{**} $p < 0.05$, ^{***} $p < 0.01$; SES = socio-economic status.

Table 5 Robustness check: Junior University effect on school readiness, treatment vs. placebo group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Junior University treatment (yes = 1/placebo = 0)	3.1431*** (0.9841)	3.0452*** (1.0652)	2.9329*** (1.0387)	2.8858*** (1.0325)	2.7921*** (1.0201)	2.7524*** (1.0085)	2.7258*** (0.9936)
Gender (male = 1)	-2.3839*** (0.6909)	-2.3168*** (0.6983)	-2.0029*** (0.6161)	-1.9141*** (0.6168)	-1.9169*** (0.6227)	-2.0450*** (0.6128)	-2.5659*** (0.7949)
Immigrant (yes = 1)	-5.2800*** (1.0335)	-4.6744*** (1.0196)	-4.4245*** (0.9779)	-3.8430*** (1.0591)	-3.8122*** (0.9607)	-4.0179*** (1.0239)	-5.1447+ (2.7310)
Age at kindergarten entry (in months)		0.3998 (0.2416)	0.3930+ (0.2008)	0.4436** (0.2042)	0.4315** (0.2017)	3.1005 (3.0766)	3.1921 (3.0882)
Kindergarten duration (in months)		0.4936** (0.2406)	0.4560** (0.2008)	0.4962** (0.2033)	0.4854** (0.2013)	-0.0545 (4.0683)	-0.0022 (3.9884)
Constant	41.5609** (19.3535)	48.5884** (18.4639)	48.6718*** (16.2955)	43.0090** (17.1223)	44.3782** (16.7701)	-144.1923 (95.9849)	-138.4654 (96.9796)
Age in months	✓						
Number of siblings		✓	✓	✓	✓	✓	✓
Health status			✓	✓	✓	✓	✓
City block information				✓			
Buying power in postal code area				✓	✓	✓	✓
SES-Index (city block)					✓	✓	✓
kindergarten, Age, SES-index, and buying power polynomials						✓	✓
Age, gender, immigrant and kindergarten duration interactions							✓
Observations	968	926	900	900	900	900	900
Kindergartens	70	70	70	70	70	70	70
R ²	0.2941	0.3026	0.3659	0.3747	0.3780	0.3906	0.3917
adjusted R ²	0.2356	0.2375	0.2962	0.3034	0.3079	0.3118	0.3113

Notes: OLS estimates with kindergarten and cohort fixed effects; dependent variable is school readiness score; standard errors in parentheses are clustered at the kindergarten level; + $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; SES = socio-economic status.

Table 6 Robustness check: Junior University effect on school readiness, placebo vs. untreated group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Junior University treatment (placebo = 1/no = 0)	0.8973 (1.2154)	-0.4218 (1.0064)	-0.7299 (0.9528)	-0.7968 (0.9197)	-0.7617 (0.9474)	-0.7848 (0.9371)	-0.7244 (0.9413)
Gender (male = 1)	-2.6524*** (0.6352)	-2.7307*** (0.6033)	-1.9389*** (0.5213)	-1.8703*** (0.5251)	-1.9085*** (0.5316)	-1.9899*** (0.5254)	-2.1914*** (0.6061)
Immigrant (yes = 1)	-5.2727*** (0.7585)	-4.3774*** (0.7572)	-3.9149*** (0.7872)	-3.5352*** (0.8658)	-3.5699*** (0.8176)	-3.4013*** (0.7838)	-8.7186*** (3.1289)
Age at kindergarten entry (in months)		0.4968*** (0.1649)	0.4259** (0.1624)	0.4622*** (0.1605)	0.4466*** (0.1619)	-0.5700 (1.4199)	-0.6266 (1.4004)
Kindergarten duration (in months)		0.6660*** (0.1740)	0.5353*** (0.1724)	0.5648*** (0.1685)	0.5536*** (0.1696)	0.0665 (3.2439)	0.1285 (3.4879)
Constant	36.4820*** (13.1927)	39.1773*** (12.6884)	41.6392*** (13.0980)	36.6429*** (13.6848)	36.7877*** (13.5855)	-189.1900 (152.1291)	-181.5392 (151.7735)
Age in months	✓						
Number of siblings		✓	✓	✓	✓	✓	✓
Health status			✓	✓	✓	✓	✓
City block information				✓			
Buying power in postal code area				✓	✓	✓	✓
SES-Index (city block)					✓	✓	✓
kindergarten, Age, SES-index, and buying power polynomials						✓	✓
Age, gender, immigrant and kindergarten duration interactions							✓
Observations	1,126	1,078	1,027	1,027	1,027	1,027	1,027
Kindergartens	70	70	70	70	70	70	70
R ²	0.2630	0.2999	0.3830	0.3896	0.3886	0.3995	0.4019
adjusted R ²	0.2111	0.2445	0.3244	0.3295	0.3291	0.3325	0.3337

Notes: OLS estimates with kindergarten and cohort fixed effects; dependent variable is school readiness score; standard errors in parentheses are clustered at the kindergarten level; ⁺ $p < 0.10$, ^{**} $p < 0.05$, ^{***} $p < 0.01$; SES = socio-economic status.

Table 7 Robustness check: matching results for OLS models (7), k-nearest neighbor matching with varying specifications

		(1)	(2)	(3)	(4)	(5)	(6)
Groups and treatment status	multiple neighbors:	yes	yes	yes	yes	yes	yes
	replacement:	with	with	with	without	without	without
caliper:		$c = 0.001$	$c = 0.002$	--	$c = 0.001$	$c = 0.002$	--
treatment (1) vs. untreated (0)	ATT	2.6888	2.8518	2.7247	3.0233	3.3729	3.1387
	t-statistic	2.56	2.77	2.22	2.98	3.63	5.11
	treated on support	319	435	626	234	277	626
	untreated on support	791	791	791	791	791	791
	average difference in propensity score	0.0004 (0.0003)	0.0007 (0.0005)	0.0019 (0.0028)	0.0004 (0.0003)	0.0007 (0.0006)	0.3238 (0.3068)
placebo (1) vs. treatment (0)	ATT	-3.0111	-4.4234	-4.4793	-2.4309	-4.3333	-3.6029
	t-statistic	-2.27	-3.46	-3.54	-1.84	-3.39	-3.43
	placebo on support	143	180	236	122	154	236
	treated on support	543	543	543	543	543	543
	average difference in propensity score	0.0004 (0.0003)	0.0006 (0.0005)	0.0017 (0.0026)	0.0004 (0.0003)	0.0007 (0.0005)	0.0663 (0.1230)
placebo (1) vs. untreated (0)	ATT	-1.1533	-1.5752	-0.8707	-0.7922	-1.3436	-0.1144
	t-statistic	-0.58	-0.92	-0.53	-0.39	-0.77	-0.09
	placebo on support	86	114	214	80	99	214
	untreated on support	606	606	606	606	606	606
	average difference in propensity score	0.0003 (0.0003)	0.0006 (0.0005)	0.0058 (0.0121)	0.0003 (0.0003)	0.0005 (0.0006)	0.2114 (0.2595)

Notes: Propensity matching estimation; outcome variable is school readiness score; standard errors in parentheses; ATT = average treatment effect of the treated.