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SPORTS AND CHILD DEVELOPMENT

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ABSTRACT

Sports and Child Development*

Despite the relevance of cognitive and non-cognitive skills for professional success, their formation is not yet fully understood. This study fills part of this gap by analyzing the role of sports club participation, one of the most popular extra-curricular activities, on children's skill development. Our results indicate positive effects: school performance improves by 0.20 standard deviations and overall non-cognitive skills by 0.09 standard deviations. The results are robust when using alternative datasets as well as alternative estimation and identification strategies. The effects can be partially explained by increased physical activities replacing passive leisure activities.

JEL Classification: J12, J13 and J24
Keywords: non-cognitive skills, physical activity, semi-parametric estimation and skill formation

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Sports and Child Development

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Abstract: Despite the relevance of cognitive and non-cognitive skills for professional success, their formation is not yet fully understood. This study fills part of this gap by analyzing the role of sports club participation, one of the most popular extra-curricular activities, on children's skill development. Our results indicate positive effects: school performance improves by 0.20 standard deviations and overall non-cognitive skills by 0.09 standard deviations. The results are robust when using alternative datasets as well as alternative estimation and identification strategies. The effects can be partially explained by increased physical activities replacing passive leisure activities.

Keywords: Skill formation, non-cognitive skills, physical activity, semi-parametric estimation

JEL classification: J24, J13, I12

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1 Introduction

The importance of cognitive and non-cognitive skills in explaining socio-economic success is widely acknowledged both in academics and in public (Murnane, Willett, & Levy, 1995; Cawley, Heckman, Lochner, & Vytlacil, 2000; Heckman, Stixrud, & Urzua, 2006; Borghans, Meijers, & ter Weel, 2008). Moreover, it is well established that both cognitive and non-cognitive abilities are shaped early in life (Cunha, Heckman, Lochner, & Masterov, 2006; Heckman & Masterov, 2007; Currie & Almond, 2011). Yet, while the role of school investments in the skill production function has been widely studied (Altonji, 1995; Cunha, Heckman, Lochner, & Masterov, 2006), the relevance of extra-curricular activities for children's human capital formation is not yet well understood.

One of the most popular extra-curricular activities among children is sports. According to the National Alliance for Youth Sports (NAYS), approximately 65% of children worldwide are involved in sports activities. While 55% of American children are involved in youth sports, among German children who are the target of this analysis, this number is somewhat higher: about 70% of all children aged 6-14 are engaged in sports activities (Kutteroff & Behrens, 2006). Moreover, in many countries such activities are supported by substantial public subsidies.

Despite the popularity of sports as a leisure activity, there exists only little empirical evidence on the relation between sports participation and children's skill formation. Thus, by analyzing the effect of sports participation on the

development of children's cognitive and non-cognitive skills we shed more light on this topic.

So far, the economic literature has mainly focused on sports activities among adolescents.[1] A positive link between participation in high school sports and educational attainment, on the one hand, and professional success, on the other hand, is well established (Barron, Ewing, & Waddell, 2000; Eide & Ronan, 2001; Pfeiffer & Cornelissen, 2010; Stevenson, 2010). Yet, the underlying mechanism is not yet well understood. Rees & Sabia (2010), for instance, hardly detect any improvement in university students' overall grades and only a modest impact on students' educational ambitions. Thus, the question when and through which mechanism sports exerts its influence on people's educational and professional success remains open.

When addressing this question it is crucial to bear in mind that success later in life may be explained by cognitive and non-cognitive abilities acquired already early in life (Cunha, Heckman, Lochner, & Masterov, 2006; Heckman & Masterov, 2007; Carneiro, Crawford, & Goodman, 2007). Thus, while sports participation during adolescence may leave cognitive skills unaffected, it may well be the case that sports participation during childhood enhances the formation of cognitive skills and additionally of non-cognitive skills. For this purpose, we analyze the impact of sports participation during Kindergarten and primary school on several measures of children's human capital development.

[1] Notice, however, that in other fields, such as psychology or paediatrics, much attention has been devoted to the role of sports during school age - for an overview please refer to Strong et al. (2005). The focus of this body of research is, however, mainly on health-related outcomes, such as health measures and health behaviour. Moreover, this literature acknowledges a lack of research on the effects of sports on cognitive and non-cognitive skills (Strong, et al., 2005).

To be more precise, we focus on participation in sports club among children aged 3 to 10 years in Germany. The reasons why we focus mainly on sports exercised in clubs, in contrast to sports exercised elsewhere, are as follows: first, in Germany sports clubs are the key institutions organizing sport activities of children (according to the German Olympic Association (DOSB, Deutscher Olympischer Sportbund, 2009), 76% boys and 59% girls aged 7 to 14 are doing sports in a club). In contrast for example to the U.S., where youth sports is heavily organized in high schools, in Germany most child and youth sports, both for leisure and competition, is organized in clubs. Schools play only a minor role. Second, the content as well as the objectives of sports exercised in clubs can be more clearly defined than sports exercised not in clubs. Finally, self-reported physical activity in sports clubs may be less prone to reporting bias than self-reported physical activity in general – particularly, if parents answering these questions would like to be considered as being 'responsible and caring'.

We use a cross-sectional (medical) survey for Germany, the so-called "German Health Interview and Examination Survey for Children and Adolescents" (henceforth KiGGS) and employ matching methods to estimate the effect of sports on a wide array of children's cognitive and non-cognitive skill measures (5,632 children).

The major challenge for any empirical study focusing on this topic is the inherent selection problem. Selection may arise if parents, who are more concerned with the development of their children, may be more likely to send their children to sports activities. Of course, such parents are very likely to be characterized by further characteristics that enhance their children’s skill development per se. In our study, we argue that the very detailed information on

background characteristics makes a selection-on-observables strategy credible. Nevertheless, for the purpose of robustness, we supplement this strategy by a semi-parametric instrumental variable approach, where the local availability of sports facilities serves as an instrument for participation in sports clubs. Unfortunately, using this approach leads to a substantial loss in precision. We therefore take advantage of the panel dimension of a further dataset, the so-called German Child Panel (henceforth GCP). The longitudinal nature of this dataset allows us to correct for selection into sports by controlling for lagged human capital indicators as well as past sports status. Its small sample size (1,498 children), however, prevents any reasonable heterogeneity analysis, which constitutes an important part of this paper. Overall, our results are robust.

Our findings indicate strong positive effects of participation in sports on children's cognitive and non-cognitive skills: overall school grades improve by 0.20 standard deviations (sd) and overall non-cognitive skills improve by 0.09 sd, the latter effect being mainly driven by a reduction in emotional problems (0.09 sd) and in peer problems (0.16 sd). The fact that children who engage in sports fare also better in terms of health (0.08 sd) and general well-being (0.05 sd) support these findings. An increase in sports activity seems to lead to a reduction in TV consumption, which might explain part of the results.

The reminder of the paper is structured as follows. The following section describes briefly the organization and the financing of sports-related activities among children in Germany. Section 3 introduces both the KiGGS as well as the GCP and provides descriptive statistics for the samples used in this study. Section 4 explains our identification strategy and the respective estimation strategies, while Section 5 presents the estimation results. Section 6 finally concludes

and discusses the policy relevance of our findings. Three appendices as well as an internet appendix (downloadable from the website of the paper at www.sew.unisg.ch/lechner/kispo) contain additional information on the data and the estimation.

2 Institutional background

Doing sports is the second most popular leisure activity among German boys: 59% of all boys indicate that spending time with their best friend is their favorite leisure activity, closely followed by doing sports (53%). For girls, doing sports ranks still among the most popular leisure activities, behind spending time with friends or listening to music, but only 33% of the girls consider doing sports as their most preferred leisure activity (Tietjens, 2001).

Table 1: Participation in sports in general and sports explicitly in clubs

Age	Sports in General		Sports Explicitly in Clubs	
	Male	Female	Male	Female
3	0.57	0.58	0.25	0.29
4	0.62	0.70	0.32	0.42
5	0.71	0.74	0.44	0.50
6	0.76	0.74	0.54	0.51
7	0.83	0.76	0.62	0.56
8	0.83	0.81	0.67	0.62
9	0.85	0.77	0.71	0.58
10	0.83	0.73	0.66	0.55
11	0.95	0.88	-	-
12	0.92	0.87	-	-
13	0.94	0.84	-	-
14	0.92	0.78	-	-
15	0.89	0.76	-	-
16	0.86	0.71	-	-
17	0.83	0.63	-	-

Note: The numbers presented above are based on own calculations using the KiGGS data.

Participation rates among children in physical activities are rather high (see Table 1). The engagement in sports activities rises steadily until age 8/9 (from 57% for the 3-year-old boys and 58% for the 3-year-old girls, to 85% for the 9-year-old boys and 81% for the 8-year-old girls). While at the beginning of secondary school (age 11) sports participation reaches its peak with 95% of all boys engage in sports and 88% of all girls engage in some sports, at the end of secondary school (age 17) still 83% of all boys and 63% of all girls participate in some sports activities.

The participation rates in sports clubs show that sports clubs constitute the major institution where children, in particular school age children, practice sports: around 80% of all sportive school-age boys and around 75% of all sportive school age girls are member of a sports club. The participation rates based on our dataset resemble closely official registrations in sports club. The German Olympic Association (DOSB, Deutscher Olympischer Sportbund, 2006), for instance, reports club participation rates of 76% among 7-14 year old boys in the year 2009, and of 59% among 7-14 year old girls. Clubs seem to serve as site for the most popular sports. Boys' favorite sport, soccer, is exercised by 45% of all boys aged 7-14, followed by gymnastics (14%), tennis (5%), handball (5%), and athletics (5%). Girls' favorite sports are gymnastics (37%), soccer (11%), horse riding (8%), athletics (7%), and swimming (6%). Thus, sports club participation may capture an important part of the overall level of physical activity among children.

Not only the high participation rates, but also the provision of public funds highlights the relevance of sports in the German society. Total public expenditures for the provision of sports-related goods and services amount to

0.2% of the German GDP (4.84 bio €).[2] 77% of this amount is used for the provision of sports-related services (e.g. maintenance of sports institution, salaries of instructors) and 23% is spent on administration (e.g. management, sports events).

3 Data

The empirical analysis draws upon two different datasets. The first dataset is the "German Health Interview and Examination Survey for Children and Adolescents" (henceforth KiGGS), which is a comprehensive, Germany-wide, representative interview and examination survey for the age group 0-17 years.[3] Between May 2003 and May 2006 17,641 participants were interviewed and examined (Kurth, et al., 2008). The second dataset is the "German Child Panel" (henceforth GCP), which includes observations of 2,709 children up to three times. The first interview took place in 2002, when children were between 5 and 8 years old, the third and last interview took place in 2005, when children were consequently between 8 and 11 years old.

The KiGGS dataset constitutes the main dataset of this study. It includes objective measures of children's physical health as well as subjective measures regarding children's human capital development (cognitive and non-cognitive skills as well as well-being measures). Crucial for our analysis is also the information on children's sports activity. Finally, it provides us with rich

[2] To put that number into perspective, note that Germany spends on average 6.2% of GDP on education, including early childcare, Kindergarten, obligatory school system as well as higher education and research. Of course, some of this spending may be related to school based sports as well.

[3] For more information about KiGGS, please refer to http://www.kiggs.de/service/english/index.html.

information on the family background, such as demographic features, socio-economic characteristics, and measures for parenting styles. Thus, it allows us to study the relation between children's sports participation and their human capital development while conditioning on a rich set of potentially confounding variables, i.e. factors, which simultaneously influence children's participation in a sports club and children's development.

In addition, we collect detailed information on the available sports facilities in each of the 167 communities included in KiGGS.[4] Based on the exact address of both, the sports facilities as well as the children included in KiGGS, we computed the distance to the closest sports facility. Thus, these combined data enable us also to correct for possible endogeneity of children's sports involvement by employing an instrumental variable technique (where the individual distance to the next sports facility serves as instrument conditional on a set of individual, family and regional background characteristics[5] - see Section 4 for more details).

The GCP, due to its longitudinal nature, enables us to tackle the issue of selection into sports from a different angle. We use sports participation and outcome measures from the second wave and take advantage exclusively of the first wave as a source for control variables, such as lagged outcome measures as well as individual and family background characteristics (see Section 4 for details).

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[4] A detailed description of how this data is collected is provided in Steinmayr, Felfe, and Lechner (2011).

[5] Information about regional characteristics is available on the municipality level and is taken from the INKAR (Indikatoren und Karten zur Raum- und Stadtentwicklung) database. For more information please refer to http://www.bbsr.bund.de.

The KiGGS data records all information on children's sports activities by a set of questions that differ according to children's age. Given that our interest lies on participation in sports clubs and that this question was only asked for children in the age range 3 to 10, our analysis is restricted to this age range and, thus, to 8,023 children. Due to missing information on the individual participation in a sports club (325 observations), our sample is further restricted. Additionally, we exclude all foreigners[6] from our analysis (1,025 observations), because some ethnic groups can be expected to behave differently in terms of engagement in social activities and in particular in sports activities (especially when their child is a girl). Requiring the availability of the information about children's cognitive and non-cognitive development as well as on the exact residential location, our final sample contains 5,632 children.

Employing the same approach when defining our sample based on the GCP, 1,449 children remain. Due to its much larger sample size as well as the superior quality of some health and skill measures, the KiGGS data serves as our main dataset. Thus, if not mentioned otherwise the following empirical analysis refers to the KiGGS data. Yet, outcome measures, treatment, and control variables in the GCP are created analogously to the respective variables in the KiGGS data (with minor exceptions).

Concerning the information on sports, parents answered a question about the frequency with which their child was performing sports activities in a club. They could choose between 5 different categories: "never", "less than once per

[6] The classification of being a "foreigner" depends on the country of birth and the origin of the parents. For an exact definition of "foreigner" please refer the documentation of the KiGGS database: http://www.kiggs.de/experten/downloads/dokumente/KiGGS_migration[1].pdf.

week", "once or twice a week", "3-5 times and a week" and "almost daily". Table 2 shows that there are two groups of children: those who do not join a sports club on a regular basis (45%) and those who attend at least once a week a lesson in a sports club (55%). Consequently, we aggregate this information and distinguish between participating in a sports club on a regular basis (at least once per week) and not participating in a sports club on a regular basis (less than once per week).

Table 2: Frequency of participation in a sports club

	Sports in a Club	
Frequency	Observations	Share in %
More than 5 times/week	50	1
3-5 times/ week	331	6
1-2 times/ week	2,723	48
Less than once per week	330	6
Never	2,198	39

Note: Computed from our estimation sample of KiGGS.

As mentioned above, KiGGS contains a vast set of objective and subjective measures for children's development. The measures can be grouped into cognitive skills, non-cognitive skills, health, and well-being. Table 3 displays the descriptive statistics for all skill-related variables, Table 4 for all health-related variables as well as the respective numbers for all well-being measures.

Cognitive skills are measured by the overall school grade, which is reported by the parents. It is coded from 1 ("very good performance") to 5 ("bad performance").[7] Notice that information about academic performance is only reported for school-age children. The age when children start receiving grades varies, moreover, across federal states. Thus, the number of observations with

[7] The overall school grade corresponds to the unweighted average of the grades reported for Math and German.

information on cognitive skills is considerably lower than the total sample size (1698 children).

The questionnaire includes 25 questions to allow for a screening of children's non-cognitive skills. These questions belong to the so-called Strength- and Difficulties Questionnaire (SDQ), a behavioral screening questionnaire that was developed by Robert Goodman (1997).[8] The SDQ has been validated and rated as a very reliable tool to gauge children's emotional symptoms, conduct problems, hyperactivity, peer relationship problems, and pro-social behavior (Muris, Meesters, & van den Berg, 2003; Goodman, Meltzer, & Bailey, 1998). Each score ranges from 0 to 10, with 0 indicating no problems and 10 indicating severe problems in the respective dimension. The total difficulties score corresponds to the sum of the first four dimensions.

For interpretational convenience, we standardize all measures for children's cognitive and non-cognitive skills to mean zero and variance one.[9] To allow for a homogenous interpretation across all scores we also invert the pro-social score and call it antisocial behavior. Thus, generally for all indicators presented lower values signify a better performance of the child.

Table 3 shows that children performing sports in a club perform generally better in school. The difference between children engaging in sports versus children not engaging in sports amounts to -0.28 sd. Physically active children

[8] The questionnaire and the scoring information can be found in the Internet Appendix IA.1. For more information please refer to http://www.sdqinfo.org/a0.html.

[9] To allow for comparison with the findings of the previous literature on children's skill formation, we report all our results using standardized measures (mean zero and variance of one). Tables IA.2 and IA.3 provide descriptive statistics as well as estimations results using the measures in levels.

score significantly lower in the strength and difficulties questionnaire (-0.24 sd), implying that they are less hyperactive and have fewer peer, emotional, behavioral or conduct problems than physically inactive children. Moreover, children enrolled in a sports club act less antisocial. Parents answer furthermore a battery of questions (24 items) belonging to the so-called KINDL-R test, developed by Ravens-Sieberer and Bullinger (1998) and designed to assess a child's well-being.[10] The different dimensions of this test cover aspects of physical and emotional well-being, self-worth and well-being related to the family, friends, and school. Moreover, the KINDL-R test allows for construction of an aggregated index signifying a child's total quality of life. Again, we normalize each score in the same way as described above.

Table 3: Descriptive statistics for children's cognitive and non-cognitive skills

	No Sports	Sports	Sports – No Sports		Obs.
	Mean	Mean	Difference	p-val. %	
Cognitive Skills					
Overall Grade	0.18	-0.10	-0.28	*0*	1698
Non-cognitive Skills					
Overall Score	0.13	-0.11	-0.24	*0*	5632
Emotional Problems	0.06	-0.05	-0.10	*0*	5632
Behavioral Problems	0.08	-0.06	-0.14	*0*	5632
Hyperactivity	0.10	-0.08	-0.18	*0*	5632
Peer Problems	0.14	-0.12	-0.26	*0*	5632
Antisocial Behavior	0.07	-0.06	-0.12	*0*	5632

Note: All outcome variables are standardized to mean zero and variance one. A lower value corresponds to a better outcome. The lower number of observations for grades appears because not all children are enrolled in school and not all school-age children receive grades. p-values stem from two-sided t-tests comparing the means for children doing and not doing sports in a club.

Finally, the KiGGS data contains a large amount of health-related information. In addition to the interview, a physical examination of the child was

[10] For the questionnaire and the scoring method please refer to the Internet Appendix IA.1.

conducted. Thus, we possess objective measures for children's height, weight, skin fold (examined at the back), and the resting pulse rate. Additionally, parents ranked the health status of their child choosing on an integer scale from 1 to 5, where 1 indicates very good health and 5 a very bad health. As before, we standardized all variables.

Table 4: Descriptive statistics for children's well-being and health

	No Sports	Sports	Sports - No Sports		Obs.
			Difference	p-val. %	
Well-being					
Total Well-being	0.03	-0.02	-0.05	*0*	5632
Well-being: body	0.04	-0.03	-0.07	*1*	5632
Well-being: soul	0.01	-0.01	-0.02	*42*	5632
Well-being: self	0.00	0.00	0.00	*87*	5632
Well-being: family	-0.07	0.06	0.13	*0*	5632
Well-being: friends	0.04	-0.03	-0.06	*2*	5632
Well-being: school	0.08	-0.06	-0.14	*0*	5091
Health					
BMI	0.00	0.00	0.01	*75*	5632
Overweight	0.18	0.15	0.03	*0*	5632
Obese	0.04	0.03	0.01	*8*	5632
Skinfold	0.05	-0.04	-0.08	*0*	5632
Pulse	0.20	-0.16	-0.36	*0*	5632
Subjective Health	0.07	-0.06	-0.13	*0*	5632

Note: Note that all values, except overweight and obese (which are binary variables) are standardized to mean zero and variance one. A lower value corresponds to a better outcome. The lower number of observations for well-being in school can be attributed to the fact that this question was only asked to parents whose children were enrolled in school or at least in Kindergarten.

Table 4 shows that the overall well-being of children who participate in a sports club is on average better than the well-being of children who do not participate in a sports club - the difference amounts to 0.05 sd. The biggest differences are observed with respect to children's well-being in school, physical well-being, and relationships with friends. Surprisingly, well-being within the family is rated slightly worse among physically active children than among physically inactive children. With respect to children’s health, we observe the following: first, the means of the BMI of both groups are comparable. Yet, the

BMI constitutes a rather poor measure for children's tendency to be overweight (Gallagher, 1996). The share of overweight children is 3 percentage points lower among children who perform sports in a club. Children joining a sports club have on average a significantly lower resting pulse rate and less body fat (skin-fold). Moreover, their parents rate their health significantly better.

Taken together, the raw differences between children who engage in sports and children who do not engage in sports draw a clear picture: physically active children outperform physically inactive children in all dimensions. Yet, these unconditional comparisons do not address the question whether the differences are really the consequence of sports participation or rather reflect sorting of children with a priori better conditions into sports. In fact, the background characteristics of the two groups show substantial differences (see Table A.1 in Appendix A for the detailed results). Physically active children are older and taller; their parents are better educated, more likely to be working and more likely to engage with their children; their families are more likely to belong to a better social class; and they are more likely to live in urban areas. These differences with respect to the background characteristics highlight the importance to condition on potentially confounding variables when analyzing the impact of sports participation on children's human capital development.

4 Conceptual Framework and Econometrics

This section clarifies what we mean by the causal effect of sports club participation on children’s skill formation, discusses the assumptions underlying our identification strategies, and introduces the different empirical strategies.

The causal effect of sports club participation on the skill formation of a particular child is defined as the difference of the child's skills in case the child participates in a sports club on a regular basis and the skills the same child would have if it would not participate in a sports club on a regular basis.

The effect of sports club participation may work through different mechanisms. The first way through which sports club participation may exert its effect on children's human capital is direct: e.g. the physical exercise, the pedagogical content of the sports lesson, the team experience, etc. The second way is rather indirect by crowding out alternative activities, e.g. doing sports outside a club, taking music lessons, doing homework, watching TV, etc. While distinguishing between the underlying mechanisms is beyond the scope of this paper, we devote, however, some time to discussing the counterfactual activities – the activities children are reducing on when participating in a sports club (see Section 5.2).

4.1 Identification

The previous section highlighted the need to take selection into sports seriously. We therefore employ first a selection-on-observables strategy, second an instrumental variable (IV) strategy, and third, we exploit the panel structure of the GCP. Yet, before explaining the respective estimation methods, we discuss the identifying assumptions underlying the different empirical strategies.

The main identifying assumption of the selection-on-observable strategy is the so-called *Conditional Independence Assumption* or *No Confounding Assumption* - henceforth CIA (Rosenbaum & Rubin, 1983). The CIA requires that potential outcomes and treatment are independent conditional on a set of suitable observable characteristics. In other words, we need to control for all

variables, which simultaneously determine children's development and children's participation in a sports club. The selection of these variables is based on the underlying theory and empirical evidence for the determinants of children's development.

According to the seminal work by Leibowitz (1974) children's cognitive and non-cognitive skills are determined by the investments made by their parents, school, and social environment. Empirical research has put forward the following determinants of children's development: families' socio-economic status (Blau, 1999; Case, Lubotsky, & Paxson, 2002; Currie, 2009; Currie & Almond, 2011), parental education (Black, Devreux, & Salvanes, 2005), and children's initial endowments (Black, Devreux, & Salvanes, 2005). The psychological literature has also put forward the relevance of parents' attitudes and parenting practices for their children's human capital development (Williams & Sternberg, 2002).

Given that a similar set of factors is likely to influence children's probability to participate in sports activities, we control for a comprehensive set of child, family and regional characteristics. The following blocks of variables mean to proxy these three dimensions. With respect to children's characteristics, we consider the following information. We use birthweight as a proxy for a child's health status early in life (Currie & Almond, 2011). Besides age and gender, we also condition on children's height, which has been shown to be associated with higher levels of sports participation as well as better outcomes later in life (Persico & Postlewaite, 2004). To describe the family background, we include several measures for a family's socio-economic status, such as parental education, labor force participation and occupation, household income and an aggregated index for so-

cio-economic status. While we lack information about parents' own physical activities, we use parents' BMI to approximate their physical fitness. Furthermore we include a broad range of measures for parenting style, such as the enforcement of rules or how much family members care about each other. We supplement the latter variable block by information about how often the child brushes its teeth and whether the mother smoked during pregnancy. Finally, since the quality of the neighborhood might as well be a confounder in this case, we also use several measures of regional and neighborhood characteristics such as municipality size, availability of recreation areas or tax income of the municipalities. Given the extreme richness of our dataset, which does not only provide us with the usual information on children's individual and family background characteristics, but also includes detailed information on the home environment and parenting practices, we strongly believe that the CIA is fulfilled in our context.

Nevertheless, additional estimation strategies help us to provide further evidence that our estimates are not plagued by reversed causality or endogenous control variables – in other words, it addresses the potential criticism that our results are driven by the fact that children endowed with better skills are more likely to engage in sports activities.

In a first step, we address some potential concerns related to the cross-sectional character of our main dataset, the KiGGS data. One concern and source of a potential bias is the existence of unobservable variables, which have a rather permanent impact on the outcome variables. Employing longitudinal data, such as the GCP, and conditioning on lagged values of the outcome variable could

remove much of the resulting bias.[11] Thus, by comparing GCP results with and without lagged control variables we can assess the sensitivity of the estimates to their exclusion.

Another issue in any cross-sectional study is that control variables, treatment variables, and outcome variables are measured at the same time. In other words, when relying only on the KiGGS data we cannot exclude a potential bias arising due joint determination of several the covariates - parenting styles, for instance – and sports club participation. Yet, using the GCP enables us to implement the strategy suggested by Lechner (2009) and thus to avoid such biases: this strategy suggests to restrict the sample to children who in period 1 all have the same level of sports participation and then to analyze the effect of their sports participation in period 2 on outcomes in period 2. Doing so removes the endogeneity problem: by construction, covariates cannot be differentially influenced by sports participation in period 1 as every child has the same participations status in period 1.

While addressing the issue of endogeneity due to unobservable time constant characteristics, this approach does not allow us to address the problem of unobserved time varying characteristics. For this reason, we implement an instrumental variable (IV) estimator (using again the KiGGS data). This method relies on a variable which significantly predicts children's sports participation (strong instrument), but does not influence children's development directly (valid instrument). We suggest the individual distance from a child's home to the

[11] See for example Lechner and Wunsch (2010) and the references cited therein for an analysis of such issues in the context of evaluating active labour market programs.

closest sports facility as an instrumental variable. Living closer to a facility should obviously reduce the costs of doing sports, at least in terms of transportation costs. Transportation costs come in terms of monetary costs as well as time costs for the child but more importantly time costs for the parent. A negative relation between distance to the closest facility and sports club participation can therefore be expected. There may be two concerns with respect to the validity of the local supply of sports facilities as an instrumental variable: first, the availability of sports facilities might be the result of the lobbyism of local citizens and second, parents' location choice might be based on the amenities offered by the neighborhood. However, according to the so-called Golden Plan (Hübner, 2003) - a major effort of the German government to extend and improve sports facilities - the majority of sports facilities was constructed from 1960 to 1990. Hence, we are confident that the availability of local sports facilities is exogenous to any individual political efforts. Regarding the moving behavior, we condition on variables usually thought to determine moving behavior, like various individual socio-economic characteristics, and features of the local economy. Conditional on these control variables it appears credible that the local supply of sports facilities is uncorrelated with families' location choice and thus, serves as a valid instrument.

4.2 Estimation

Since we argued above that controlling for (almost) all potentially relevant confounding factors identifies the average effect of sports club participation, an econometric matching estimator is a natural choice to avoid unnecessary biases coming from potentially incorrectly specified parametric econometric models. Any matching estimator relies on the comparison of children who

participate and who do not participate in a sports club and who are similar in their observable characteristics. A way to guarantee "similarity" in observable characteristics is to condition on an estimate of the conditional participation probability, also called propensity score (Rosenbaum & Rubin, 1983). Here, we follow the convention in the literature and use a binary probit model to estimate the propensity score. The full specification and the coefficient estimates for the propensity score model of our main specification are provided in Table A.1 in Appendix A. [12] We perform tests against misspecification (non-normality, heteroscedasticity, omitted variables), which are available upon request. [13] The exact matching procedure used in this paper was suggested by Lechner, Miquel, & Wunsch (2011) and is the one that appeared as one of the best, if not the best, matching procedure in a large scale simulation exercise by Huber, Lechner, & Wunsch (2010). The exact structure of this estimator is explained in Table B.1 in Appendix B.

Two issues affecting the appropriateness of matching estimators are common support and match quality. In the case of insufficient common support, we would deal with a subset of observations without appropriate matches. For this reason, we discard any observation in one state having a higher or lower propensity score estimate than, respectively, the maximum or the minimum in the other

[12] The specification and coefficient estimates for the propensity score models using the GCP and for the semi-parametric LATE are provided in the tables of Appendix C. Notice that the effects on cognitive outcomes are estimated on smaller samples and thus, the coefficients of their propensity score models might slightly alter. Coefficient estimates of the corresponding propensity score models are available upon request.

[13] We also provide results from an estimation with an alternative specification of the propensity score. This specification includes interaction terms between the child's sex and age and drops the variable height (since it is not available in the GCP). As you can see in Table IA.4 in the Internet-Appendix, our main results are robust to this alternative specification.

state. Moreover, we remove all observations with a normalized weight larger than 6% (Huber, Lechner, & Wunsch, 2010). Notice that in case discarded observations systematically differ from the original sample this selection affects the population the causal effects refer to. If the common support restriction leads to a considerable reduction in sample size, one might argue that the effects are not representative for the target population any more. Fortunately, this is not a serious issue in the present study as common support is given for approximately 99% of observations in our main specification and for at least 91% in all our subgroup analyses. The match quality concerns the question about the balance of the distribution of the confounders in the different treatment states. Checking the means and medians of potential confounders for matched individuals in different treatment states suggests that the after-match balance is high for all comparisons of treatment states.[14]

When exploiting the longitudinal nature of the GCP, we structure the estimation problem analogously and thus the same estimator is employed (but subsamples and control variables may differ as explained above).

Extending the local average treatment effects approach by Imbens and Angrist (1994), Frölich (2007) shows that a semi-parametric instrumental variable estimator, that needs to condition on control variables, can be expressed as a ratio of two propensity score matching estimators. The nominator corresponds to the effect of the instrument on the outcome variable (children's skill measures)

[14] The internet appendix includes after-match t-statistics and standardized difference tests (see Rosenbaum and Rubin, 1985) for the variables in the probit specifications as well as χ^2-statistics for joint independence of the regressors and the participation state in the respective matched sample (see Tables IA.6 to IA.8). None of the test statistics points to covariate imbalance after matching.

and the denominator corresponds to effect of the instrument on the treatment (children's sports participation). He also shows that it is optimal to appropriately recode a continuous instrument into a binary instrument. Notice, however, that the identified effect is the causal effect of sports club participation for the subpopulation of individuals who start doing sports only when they have a sports facility close enough in their neighborhood (the complier population).[15]

The remaining question in our setting is how to define 'living close to a sports facility'. The selection of our threshold is based on the results of non-parametric and parametric analyses of children's propensity to engage in sports activities presented in Steinmayr, Felfe, and Lechner (2011). As displayed in their study, the share of children being member in a sports club remains stable over the first 2.5 km and starts quickly decreasing thereafter before it stabilizes again. This result holds true unconditionally and conditionally on covariates. Based on this insight, we define the binary instrumental variable to be equal to one when living closer than 2.5 km to the next sports hall and equal to zero when living further than 2.5 km. [16]

[15] Of course, the specification of the propensity score used for the matching estimator in the selection on observables framework is different from the one used in the IV framework, as the latter contains only those variables jointly related to outcomes and distance to sports facilities, while in the matching framework the control variables are those jointly related to the outcomes and sports participation. The specification and the coefficients of the propensity score estimation for the IV approach are shown in Table C.2 in Appendix C.

[16] The binary setting can easily be extended to allow for the effect of various differences in distances. However, the results in Steinmayr, Felfe, and Lechner (2011) strongly suggests there exist only two groups and thus, such extension would not lead to any relevant gain.

5 Results

The results are organized in the following way. Section 5.1 presents our main results for children's cognitive and non-cognitive skills using the KiGGS data. We additionally show estimates for related outcomes, such as well-being and health, also obtained from KiGGS, and test furthermore the robustness of our estimates with respect to selection into sports clubs (using both datasets, KiGGS and GCP). Section 5.2 discusses which activities are crowded out when children engage in sports clubs and whether the effects of sports participation differ across subgroups.

5.1 Main results

Participation in sports clubs during childhood has strong effects on children's cognitive and non-cognitive development. Table 5 displays the mean potential outcomes for all skill dimensions (column 1 if participating in a sports club and column 2 if not participating in a sports club), the average effect (column 3) and the respective significance levels (column 4). Notice once again that all scores are defined such that lower values imply a better performance.

Table 5: Matching estimates for cognitive and non-cognitive skills (KiGGS)

	Average Outcome if Participating	Average Outcome if Not Participating	Average Effect	p-val. %
Cognitive Skills				
Overall Grade	-0.08	0.12	-0.20	*0*
Non-cognitive Skills				
Emotional Problems	-0.02	0.07	-0.09	*0*
Behavioral Problems	0.01	0.03	-0.02	*53*
Hyperactivity	-0.01	0.00	-0.01	*75*
Peer Problems	-0.08	0.07	-0.16	*0*
Overall Score	-0.03	0.05	-0.09	*0*
Antisocial Behavior	0.00	0.02	-0.02	*59*

Note: Effect presented is the average treatment effect (ATE). p-values are computed by bootstrapping p-values of the t-statistic with 4999 replications. Note that all variables are standardized to mean zero and variance one.

While the overall performance in school improves by -0.20 sd, the overall strength and difficulties score decreases by 0.09 sd (both effects are significant at any conventional significance level). The improvement in non-cognitive skills is mainly driven by a reduction in children's problems with their peers (-0.16 sd) as well as in emotional problems (-0.09 sd). Notice that in comparison to widely studied governmental interventions during childhood, such as for instance early childcare centers or targeted educational programs, these are non-negligible effects.[17]

Table 6: Additional matching estimates for related outcomes (KiGGS)

	Average Outcome if Participating	Average Outcome if Not Participating	Average Effect	p-val. %
Well-being				
Total Well-being	-0.02	0.03	-0.05	*18*
Well-being: body	-0.03	0.03	-0.06	*11*
Well-being: soul	0.00	0.03	-0.03	*42*
Well-being: self	-0.03	0.01	-0.03	*29*
Well-being: family	0.05	-0.04	0.09	*1*
Well-being: friends	-0.04	0.06	-0.10	*0*
Well-being: school	-0.03	0.03	-0.06	*7*
Health				
BMI	0.00	0.01	-0.01	*78*
Overweight	0.15	0.17	-0.02	14
Obese	0.04	0.04	0.00	64
Skinfold	-0.01	0.03	-0.04	*29*
Pulse	-0.05	0.07	-0.12	*0*
Subjective Health	-0.05	0.03	-0.08	*0*

Note: The presented effect is the average treatment effect (ATE). P-values are computed by bootstrapping p-values of the t-statistic with 4999 replications. Note that all values, except overweight and obese (which are binary variables) are standardized to mean zero and variance one.

The results for children's well-being go hand in hand with the results for children's skill development. As we can see in Table 6, children participating in

[17] Head Start, one of the most studied educational programs in the U.S., has, for instance, been shown to lead to improvements in children's non-cognitive skills of around 0.2 sd and in children's cognitive skills of around 0.06 sd (Currie & Almond, 2011). Using the GCP, Felfe and Lalive (2011) reveal an improvement in children's non-cognitive skills by 0.1 sd after having attended a childcare centre during early childhood.

sports feel not only significantly more comfortable in school, which supports the finding of an improved academic performance, but also feel better-off among friends, which is in line with children's reduced peer problems. The respective effects of sports club participation amount to -0.06 and -0.10 sd. Yet, surprisingly, doing sports in a club deteriorates children's relationship with their family - a finding that is surprising. Investigating the single components entering the index of family well-being reveals that the deterioration of family well-being is mainly driven by a worsening in the understanding between child and parents and by an increased propensity of dispute. Whether a child feels comfortable or patronized at home is unaffected by sports club participation.[18] Since these finding may have many interpretations that cannot be analyzed further with our data, we refrain from speculations. Notice, however, that this finding is not confirmed when using the GCP, and thus might be a result of the way the questions were posed in the KiGGS.[19]

Table 6 also displays the estimation results for a selected set of health-related outcomes. Overall, children's health is rated significantly better when doing sports (-0.08 sd), a finding which is in line with the improved physical well-being (-0.06 sd). The results for the different objectively measured health variables may furthermore help to eliminate doubts whether our results so far are driven by subjectivity bias – a bias, which arises in case parents of children who participate in a sports club systematically report better cognitive and non-cognitive skills. There are no surprises with respect to the objectively measured health

[18] Estimation results regarding the different components of the family well-being indicator are available upon request.

[19] The results for well-being using the GCP can be found in Table IA.1 in the Internet Appendix.

outcomes: children doing sports are 2% less likely to be overweight (but only marginally significant), but not to be obese. Finally, sport participation reduces children's pulse (-0.12 sd).

Despite the rich set of control variables, one may still cast into doubt whether we manage to take into account all determinants of children's participation in a sports club. It may be the case that children who are a priori better in school, or have less emotional, behavioral or peer problems, join sports clubs more frequently. To test the main set of results for selection into treatment, we perform the robustness checks that have been explained above.

Table 7: Comparison of matching estimates using KiGGS and GCP

	KiGGS		GCP A		GCP B		GCP C	
	Effect	p-val. %	Effect	p-val. %	Effect	p-val. %	Effect	p-val. %
Cognitive Skills								
Overall Grade	-0.20	*0*	-0.15	*3*	-0.09	*11*	-0.19	*7*
Non-cognitive Skills								
Emotional P.	-0.09	*0*	-0.08	*27*	-0.03	*59*	0.00	*98*
Behavioral P.	-0.02	*53*	-0.09	*12*	-0.07	*25*	-0.07	*52*
Hyperactivity	-0.01	*75*	0.08	*21*	0.07	*18*	0.20	*16*
Peer P.	-0.16	*0*	-0.19	*0*	-0.11	*5*	-0.22	*5*
Overall Score	-0.09	*0*	-0.10	*9*	-0.05	*32*	-0.02	*83*
Antisocial B.	-0.02	*59*	-0.02	*75*	-0.07	*22*	-0.06	*59*

Note: The results in the first column (KiGGS) correspond to our main set of results based on the KiGGS data and displayed in Table 6. GPC A to C are based on the GCP data. In GPC A we perform a pure replication of the KiGGS results where we use only the second wave of the GCP for both outcome and control variables. GCP B presents the results when we control additionally for the set of lagged cognitive and non-cognitive skills and replace all control variables by the respective control variables from wave 1. In GPC C we repeat the strategy employed under (B) but restrict the sample to children who do not participate in a sports club in wave 1. The presented effect is the average treatment effect (ATE). p-values are computed by bootstrapping p-values of the t-statistic with 4999 replications.

Our first robustness check allows us to tackle endogeneity due to unobservable time constant characteristics. Since this approach draws upon the GCP data, we first replicate our main results from KiGGS using the GCP data. The comparison between column 1 (KiGGS) and column 2 (GCP A) of Table 7, which display the matching estimates applied to the KiGGS data and the GCP

data, reveals that results are remarkably robust across the different datasets. Similar to our main results, we observe an improvement in children's overall academic performance, which amounts now to a point estimate of -0.15 sd in comparison to previously -0.20 sd, and children's overall non-cognitive score, where the effect corresponds to -0.10 sd in contrast to the previously estimated effect of -0.09 sd. Moreover, the improvement in non-cognitive skills stems again mainly from the reduction in peer problems. While the reduction in emotional problems still amounts to the same magnitude, it is, however, no longer statistically significant.

When additionally including children's lagged outcome variables and replacing the control variables by control variables exclusively measured prior to treatment, the effects decrease slightly and accordingly loose statistical significance, but the main picture remains (see GCP B): children when participating actively in a sports club experience improvements in their cognitive and non-cognitive skills. It is furthermore important to point out that children's lagged skill measures do not explain their active participation in sports clubs – the respective coefficients are insignificant in the propensity score estimation (see Table C.1, Appendix C). Thus, it is unlikely that children equipped with a priori better skills sort disproportionately into sports clubs.

The last column (GCP C) displays the estimates corrected for time constant unobserved heterogeneity by conditioning on sports-participation in the first wave of the panel. As we can see, the main results are robust to this correction: children's school performance improves by 0.19 sd (in comparison to 0.20 sd according to our baseline estimates), and children's peer problems reduce by 0.22 sd (in comparison to 0.16 sd according to our baseline estimates).

Finally, we employ an IV strategy as additional robustness check. As already explained above the individual distance to the closest sports facility serves as our instrument for participation in a sports club, which we argued is a valid instrument conditional on a set of individual and regional confounding variables. As discussed above, a further concern may be the strength of the chosen instrument. Steinmayr, Felfe, and Lechner (2011) discuss extensively the relation between local availability of sports facility and children's sports club participation. Using the same data as in this study, they only find a strong relation between sports participation and distance to the next facility among children living in the countryside.[20] Thus, here we estimate the IV effects only for that subpopulation. In order to allow for a 'fair' comparison between the matching estimates and the semi-parametric IV estimates, we first re-do the matching estimation using the subsample of children living on the countryside only and then correct for potential endogeneity of sports club participation using individual distance to the closest sports facility as an instrumental variable.

The first stage estimate (share of compliers shown at the bottom of Table 8) suggests that about an additional 10% of the kids in the countryside would start doing sports if they would live closer to a sports facility (defined as living less than 2.5 km to the closest facility - the threshold which is used to define the binary instrument). Although this complier population appears to be reasonably large and well determined (F-statistic: 9.7), compared to the matching estimates, the loss of precision of the IV estimates is dramatic (see Table 8). Thus, even if

[20] Notice that the definition of urban (medium towns and cities) and rural (villages and small towns) areas is based on INKAR (Indikatoren und Karten zur Raum- und Stadtentwicklung) and is a combination of population size, density, political and administrative relevance, etc. For a more detailed description please refer to http://www.bbsr.bund.de.

our main estimates all lie within the confidence intervals of the IV estimation, the loss of precision prevents us to derive clear conclusions. However, this problem is exacerbated because the matching estimates suggest that there are hardly any effects for children living on the countryside anyway, a point to which we come back to in the next chapter.

Table 8: Comparison of average effects of matching and IV results (KiGGS)

	Matching All		Matching Countryside		IV Countryside		
	Effect	p-val. %	Effect	p-val. %	Effect	95% CI	
Cognitive Skills							
Overall Grade	-0.20	*0*	-0.13	*11*	0.37	-3.03	3.75
Non-cognitive Skills							
Emotional Problems	-0.09	*0*	-0.01	*82*	-1.0	-3.78	0.72
Behavioral Problems	-0.02	*53*	0.00	*94*	0.06	-1.94	1.40
Hyperactivity	-0.01	*75*	0.03	*39*	-0.61	-2.62	0.78
Peer Problems	-0.16	*0*	-0.13	*0*	0.38	-1.25	2.06
Overall Score	-0.09	*0*	-0.03	*48*	-0.52	-2.69	0.94
Antisocial Behavior	-0.02	*59*	-0.03	*55*	-0.19	-2.14	0.98
Share of Compliers	-	-	-	-	0.1	0.04	0.15

Note: 'Matching All' displays our main estimates resulting from the matching estimation using the full sample. 'Matching Countryside' uses only the subsample of children living in the countryside. 'IV Countryside' shows the results using semi-parametric IV estimation, which is also based on the subsample of children living in the countryside and on the individual distance to the closest sports facility as an instrumental variable. The first stage reveals a complier effect of 10% with a standard error of 0.03. Effects presented for the matching results are the average treatment effects (ATE). Effects presented for semi-parametric IV estimation are local average treatment effects (LATE). p-values are computed by bootstrapping p-values of the t-statistic with 4999 replications.

Summarizing the results so far, sports club participation relates positively to children's human capital development. While we are confident that our main results, an improvement in children's academic performance and children's social network, are robust to unobserved time constant heterogeneity, we cannot fully exclude that time varying unobserved characteristics may bias our results. Yet, it is important to point out that unobserved leaps in children's development only, which simultaneously stimulate or dampen their participation in a sports club, could really lead to a severe bias of our main estimates.

5.2 Alternative Activities and Effect Heterogeneity

Important questions from a policy perspective are on the one hand, what kind of activities children are ”sacrificing” when participating in sports club and on the other hand, whether the "right children" participate in sports, meaning whether those children who participate are those who benefit most from participation.

To shed some light on the first question, we additionally investigate the impact of sports club participation on alternative activities undertaken by children. Table 9 shows that the reported level of sports activities done outside a club is the same among children who participate in a sports club and among children who do not. Given this result, it seems safe to say that sports club participation stimulates children’s overall physical activity.

Yet, perhaps more interestingly, our results provide evidence that sports club participation leads to a small, but significant crowding out of TV consumption by 6 minutes on a weekday and 5 minutes on Saturdays and Sundays. Putting this finding into relation with the average attendance of children at a sports club (1-2 times per week), we can infer that exercising approximately 1-2 hours per week in a sports club leads to a reduction of 40 minutes TV watching per week. It seems however unlikely that this finding can fully explain the substantial improvements in children’s cognitive and non-cognitive skills due to sports club participation. Unfortunately, KiGGS does not provide us with any further information about children’s leisure activities nor about their time devoted to school-related activities, such as homework. Therefore, we may con-

clude that sports club participation crowds out some "passive" activities, [21] but we do know whether it stimulates further "active" or "development stimulating" activities.

Table 9: Average effects on alternative activities (KiGGS)

	Participants	Nonparticipants	Avg. Effect	p-val.%
Physical activity				
Sports outside a club	0.53	*0.52*	0.01	*56*
Passive activities				
Watching TV on a week day	0.99	1.05	-0.06	*0*
Watching TV on weekend	1.62	1.68	-0.05	*9*
Using PC on a week day	0.21	0.21	0	*81*
Using PC on the weekend	0.44	0.41	0.02	*22*

Note: P-values are computed by bootstrapping p-values of the t-statistic with 4999 replications. Sports exercised outside a club is measured as a binary variable, where 1 indicates a child is doing at least once per week sports outside a club. All other activities are measured as hours per day.

To address the question whether the participants gain most from participation, we discuss, in addition to the average treatment effect (ATE), the average treatment effect on the treated (ATET) and the average treatment effect on the non-treated (ATENT). The ATET refers to the effect of sports participation on children who do engage in sports, while the ATENT refers to the effects on children, who do not participate, if they actually would participate (see Table 10). While for overall grades and peer problems the ATENT is somewhat larger, the overall picture remains mixed and the effects are not statistically different from each other at any conventional level. Thus, it does not seem that any of the two types of children would benefit significantly more from sports participation than the other type of children.

[21] According to recent studies TV consumption per se does not seem to have any measurable effect on children's development (Gentzkow & Shapiro, 2008; Munasib & Bhattacharya, 2010). Thus, the substitution of TV consumption by sports does not necessarily crowd out a leisure activity which influences children's human capital in a negative manner, but a leisure activity which does not seem to stimulate children's human capital formation in any significant manner.

Table 10: Average effects for participants and nonparticipants (KiGGS)

	Participants	p-val. %	Nonparticipants	p-val. %
Cognitive Skills				
Overall Grade	-0.17	*4*	-0.26	*0*
Non-cognitive Skills				
Emotional Problems	-0.12	*0*	-0.05	*20*
Behavioral Problems	-0.04	*22*	0.01	*71*
Hyperactivity	0.00	*95*	-0.02	*63*
Peer Problems	-0.13	*0*	-0.19	*0*
Overall Score	-0.10	*2*	-0.08	*4*
Antisocial Behavior	-0.03	*42*	0.00	*100*

Note: p-values are computed by bootstrapping p-values of the t-statistic with 4999 replications.

Table 11 presents further effect heterogeneities with respect to other observable characteristics. It contains the pair wise comparison of boys and girls, younger and older children, children from families with a lower social status and children from families with a higher social status, and finally children who live in cities and children who live in the countryside.

The strongest differences exist when comparing children living in a city with children living in the countryside. "City" children who engage in a sports club experience a remarkable improvement in their non-cognitive skills (-0.19 sd). This improvement is mainly driven by a reduction in peer problems, emotional problems, and hyperactivity. Interestingly, we also observe improved peer relations among "country" children when engaging in a sports club, yet no gain in any other dimension of non-cognitive skills. When consulting the additional outcomes, it becomes, moreover, clear that children who live in a city do not only benefit from sports club participation in terms of their well-being, but also in terms of health (e.g. significantly reduced body fat).[22] Children who live on the countryside, however, do not gain much in terms of health when participat-

[22] Results from the heterogeneity analysis for the additional outcomes are available upon request.

ing in a sports club. The underlying reason for the heterogeneous effects with respect to the degree of urbanization may be the respective counterfactual. While for children living in the city it might be rather difficult to be physically active - the reason being simply a lack of outdoor space - children living on the country-side might be more physically active in general and thus, have a relatively lower gain from participating in a sports club than children living in a city.[23]

There exist significant differences between girls and boys as well as between children from the lower and the upper half of the socio-economic distribution in terms of their cognitive and non-cognitive skills. Yet, sports participation does not seem to eliminate these differences. Although girls generally score much better than boys on most of these indicators, sports club participation seems to equally affect boys and girls, with the exception of a slightly stronger effect on girls' pro-social behavior. Likewise, although children from the lower half of the socio-economic distribution have much worse skill levels than those from the upper half of the socio-economic distribution, there appear to be no differential gains. These findings are in line with the previous literature, which found little heterogeneity in the treatment effects of sports participation (Stevenson, 2010).

[23] Notice that when using the country sample only, we also do not observe a significant crowding out of sports outside a club due to sports in a club. Yet, the available measure may not necessarily capture general physical activity, such as running around, playing outside, etc. and thus, does not allow us to find empirical evidence for the statement made above.

Table 11: Heterogeneity with respect to other characteristics

	Average Outcome		Avg.	p-val.	Average Outcome		Avg.	p-val.
	Part.	Not Par.	Effect	%	Part.	Not Part.	Effect	%
				Panel A				
	City				Countryside			
Cognitive Skills								
Overall Grade	-0.03	0.13	-0.16	*18*	-0.1	0.03	-0.13	*11*
Non-cognitive Skills								
Emotional Problems	-0.05	0.14	-0.19	*0*	-0.02	-0.01	-0.01	*82*
Behavioral Problems	-0.01	0.06	-0.07	*20*	-0.02	-0.03	0.00	*94*
Hyperactivity	-0.04	0.04	-0.08	*8*	0.00	-0.04	0.03	*39*
Peer Problems	-0.10	0.12	-0.22	*0*	-0.09	0.05	-0.13	*0*
Overall Score	-0.06	0.12	-0.19	*0*	-0.04	-0.02	-0.03	*48*
Antisocial Behavior	-0.04	-0.05	0.01	*80*	0.01	0.04	-0.03	*55*
				Panel B				
	Boys				Girls			
Cognitive Skills								
Overall Grade	-0.02	0.12	-0.14	*25*	-0.14	0.11	-0.25	*0*
Non-cognitive Skills								
Emotional Problems	-0.07	-0.01	-0.06	*27*	-0.01	0.09	-0.1	*3*
Behavioral Problems	0.08	0.13	-0.05	*4*	-0.15	-0.09	-0.06	*15*
Hyperactivity	0.09	0.15	-0.05	*29*	-0.12	-0.15	0.03	*38*
Peer Problems	0.04	0.21	-0.17	*0*	-0.22	0.03	-0.25	*0*
Overall Score	0.06	0.17	-0.11	*1*	-0.17	-0.05	-0.11	*0*
Antisocial Behavior	0.19	0.17	0.02	*83*	-0.25	-0.14	-0.11	*0*
				Panel C				
	Young (3-6 years)				Old (7-10 years)			
Cognitive Skills								
Overall Grade	n.a.	n.a.	n.a.	n.a.	-0.08	0.12	-0.2	*0*
Non-cognitive Skills								
Emotional Problems	-0.12	-0.06	-0.06	*11*	0.05	0.18	-0.13	*1*
Behavioral Problems	0.06	0.03	0.03	*48*	-0.09	0.02	-0.11	*3*
Hyperactivity	-0.01	-0.02	0	*93*	-0.03	0.07	-0.1	*15*
Peer Problems	-0.13	0.02	-0.15	*0*	-0.07	0.19	-0.26	*0*
Overall Score	-0.07	-0.01	-0.05	*15*	-0.04	0.16	-0.2	*0*
Antisocial Behavior	0.11	0.07	0.04	*47*	-0.15	-0.04	-0.11	*6*
				Panel D				
	Lower social status				Upper social status			
Cognitive Skills								
Overall Grade	0.18	0.4	-0.21	*1*	-0.31	-0.18	-0.13	*32*
Non-cognitive Skills								
Emotional Problems	0.1	0.14	-0.04	*41*	-0.11	-0.01	-0.11	*3*
Behavioral Problems	0.14	0.15	-0.02	*80*	-0.14	-0.06	-0.08	*8*
Hyperactivity	0.22	0.23	-0.01	*82*	-0.22	-0.17	-0.06	*25*
Peer Problems	0	0.22	-0.22	*0*	-0.17	0.01	-0.18	*0*
Overall Score	0.18	0.27	-0.09	*8*	-0.23	-0.09	-0.14	*0*
Antisocial Behavior	0.07	0.07	-0.01	*92*	-0.05	0	-0.05	*44*

Note: The distinction between city and countryside is based on INKAR and is a combination of population size, density, political and administrative relevance, etc. The definition of lower and higher social status is based on the Winkler Index. This index comprises parental education, occupation and income. The distinction between upper and lower social status corresponds to the upper and lower half of the distribution of this index. The presented effect is the average treatment effect (ATE). P-values are computed by bootstrapping p-values of the t-statistic with 4999 replications.

When analyzing the impact of sports club participation on the non-cognitive skills of younger and older children, we only observe a slightly stronger effect for older children, the difference is, however, not significant. Whether this slightly stronger impact on older children may be due to the fact that sports starts losing its playful character and rather becomes competitive when children grow older cannot be answered given the available data. Moreover, it is not a priori clear if a stronger effect of sports on the skill development of older children may be due the cumulative nature of the skill formation - it may be well the case that skills promoted during sports participation during early life may beget the skill formation later in life (Cunha, Heckman, Lochner, & Masterov, 2006).

6 Conclusion

While the importance of cognitive and non-cognitive skills for outcomes later in life is well acknowledged in different disciplines, the factors that shape the formation of such skills are not yet fully understood. To contribute to the understanding of human capital formation, we investigate the effect sports activity on human capital formation. Since recent research has shown that cognitive and non-cognitive skills are most malleable during early childhood, we focus on children 3 to 10 years old.

Our results indicate positive effects of participation in sports on children's skills: overall, school grades, and non-cognitive skills improve substantially, where the latter effect is mainly driven by a reduction in emotional problems and in peer problems. These findings are supported by the fact that children who engage in sports fare also better in terms of health and general well-being. Results are robust when using different data and empirical strategies.

Our results highlight the importance of physical activities for children's development. Encouraging children to participate in sports and providing the necessary infrastructure should therefore be, and in many countries is, an important policy objective, although this statement has to be qualified by a cost-benefit analysis. In this context the first stage of the IV estimates are interesting per se, as they suggest that at least in the countryside bringing facilities closer to the children might increase their sports participation.

Our results provide also evidence that the positive effects of doing sports in a club are partially explained by an increase in physical activity as sports club participation does not crowd out other sports activities. The effects are strongest in cities, where children have fewer opportunities to be physically active outside of sports clubs – as well as by a reduction in passive activities such as watching TV. Nevertheless, "doing sports in a club" has still many more dimensions, which, given the data at hand, we are not able to explore. Participating in a sports club exposes children to cooperation with other children in a team, which may make them better *team players* also in other situations in life and, thus, may explain the reduction in peer problems. Doing sports in a club comes often along with participation in competitions. Victory in competition may raise children's self-esteem while defeat, despite eventual negative effects on children's self-esteem, may teach them how to deal with such a situation. Future research should therefore try to dig deeper into the mechanisms through which sports activities may influence skill formation and disentangle the various channels through which the effect may work.

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Appendix A: Tables and Figures

Table A.1: Descriptive Statistics of the control variables and coefficients of the propensity score estimation (probit)

		No Sports	Sports	Sports - No Sports		Probit Coefficient	
				Diff.	p-val. %	Coef.	p-val. %
Child characteristics							
Male		0.50	0.52	0.02	*13*	0.06	*8*
Age:	3 years	0.17	0.05	-0.11	*0*	-0.73	*0*
	4 years	0.15	0.09	-0.07	*0*	-0.4	*0*
	5 years	0.13	0.11	-0.02	*5*	-0.12	*12*
	6 years	0.13	0.13	0.01	*52*	ref.	
	7 years	0.11	0.15	0.04	*0*	0.16	*3*
	8 years	0.10	0.15	0.05	*0*	0.26	*0*
	9 years	0.11	0.16	0.06	*0*	0.30	*0*
	10 years	0.10	0.14	0.04	*0*	0.16	*13*
Height in cm		121.0	127.6	6.6	*0*	0.00	*21*
Birthweight in grams		3346.7	3361.6	14.9	*40*	0.00	*98*
Mother's characteristics							
Education:	Basic	0.20	0.15	-0.05	*0*	-0.16	*0*
	Intermediate	0.49	0.47	-0.03	*5*	ref.	
	High school	0.12	0.18	0.06	*0*	0.08	*14*
	University	0.14	0.19	0.05	*0*	0.02	*76*
	Other	0.04	0.01	-0.03	*0*	-0.63	*0*
LFP:	Not working	0.17	0.18	0.01	*29*	-0.07	*24*
	Unemployed	0.14	0.06	-0.08	*0*	-0.11	*14*
	Maternal leave	0.10	0.10	-0.01	*24*	0.00	*98*
	Part time	0.37	0.51	0.14	*0*	ref.	
	Fulltime	0.20	0.15	-0.06	*0*	-0.17	*0*
Job:	Unskilled	0.24	0.19	-0.06	*0*	-0.17	*0*
	Semiskilled	0.45	0.53	0.08	*0*	ref.	
	Highskilled	0.06	0.08	0.02	*0*	-0.05	*56*
	Self employed	0.06	0.07	0.01	*0*	-0.08	*34*
	Other job	0.03	0.01	-0.02	*0*	ref.	
	Housewife	0.13	0.11	-0.02	*0*	-0.09	*16*
BMI:	Underweight	0.03	0.03	0.00	*79*	0.03	*81*
	Normal	0.61	0.67	0.06	*0*	ref.	
	Overweight	0.23	0.21	-0.02	*10*	-0.02	*70*
	Obese	0.12	0.09	-0.03	*0*	-0.05	*40*

Note: Table A.1 to be continued.

Table A.1 continued

		No Sports	Sports	Sports - No Sports		Probit Coefficient	
				Diff.	p-val. %	Coef.	p-val. %
Father's characteristics							
Education:	Basic	0.24	0.24	0.00	*72*	0.03	*55*
	Intermediate	0.40	0.32	-0.08	*0*	ref.	
	High school	0.08	0.12	0.04	*0*	0.14	*4*
	University	0.19	0.28	0.10	*0*	-0.02	*75*
	Other	0.03	0.01	-0.02	*0*	-0.03	*84*
LFP:	Not working	0.02	0.02	0.00	*91*	0.22	*10*
	Unemployed	0.10	0.04	-0.07	*0*	-0.13	*13*
	Paternal leave	0.00	0.00	0.00	*70*	ref.	
	Parttime	0.03	0.03	0.00	*48*	-0.03	*78*
	Fulltime	0.79	0.89	0.10	*0*	ref.	
Job:	Unskilled	0.14	0.08	-0.06	*0*	-0.13	*5*
	Semiskilled	0.51	0.47	-0.04	*0*	ref.	
	Highskilled	0.14	0.24	0.11	*0*	0.10	*12*
	Self employed	0.12	0.17	0.04	*0*	0.08	*18*
	Other job	0.01	0.01	0.00	*82*	ref.	
	Houseman	0.01	0.00	-0.01	*0*	ref.	
BMI:	Underweight	0.00	0.00	0.00	*50*	ref.	
	Normal	0.35	0.40	0.05	*0*		
	Overweight	0.38	0.43	0.05	*0*	0.04	*34*
	Obese	0.12	0.09	-0.03	*0*	-0.11	*11*
	Missing	0.15	0.09	-0.06	*0*	-0.25	*0*
Family characteristics							
Social class:	Low	0.31	0.15	-0.16	*0*	-0.15	*1*
	Medium	0.46	0.49	0.03	*2*	ref.	
	High	0.22	0.36	0.14	*0*	0.00	*97*
Total household income		2024.9	2336.1	311.2	*0*	0.00	*0*
	> 5000 (binary)	0.02	0.06	0.04	*0*	0.53	*0*
	Missing (binary)	0.04	0.04	0.00	*78.5*	0.28	*1*
Single parent household		0.13	0.08	-0.04	*0*	0.03	*70*
Siblings in household		1.13	1.12	-0.01	*82*	-0.09	*0*
Older sibling in household (binary)		0.50	0.49	-0.01	*47*	0.02	*60*
Mold at home		0.06	0.03	-0.02	*0*	-0.22	*1*

Note: Table A.1 to be continued.

Table A.1 continued

		No Sports	Sports	Sports - No Sports		Probit Coefficient	
		Mean	Mean	Diff.	p-val. %	Coef.	p-val. %
Parenting style							
Smoking during pregnancy:	regularly	0.06	0.03	-0.04	*0*	-0.39	*0*
	occasionally	0.15	0.11	-0.04	*0*	-0.12	*4*
	never	0.77	0.85	0.08	*0*	ref.	
Family cares:	no	0.01	0.00	0.00	*35*	0.06	*67*
	rather no	0.02	0.02	0.00	*21*		
	rather yes	0.40	0.43	0.03	*1*	0.10	*2*
	yes	0.57	0.55	-0.02	*12*	ref.	
Few rules:	no	0.47	0.51	0.04	*0*	ref.	
	rather no	0.26	0.26	0.00	*75*	-0.03	*49*
	rather yes	0.19	0.16	-0.03	*1*	-0.10	*7*
	yes	0.08	0.06	-0.02	*3*	-0.08	*29*
Strict rules:	no	0.14	0.11	-0.03	*0*	-0.10	*8*
	rather no	0.32	0.28	-0.03	*1*	-0.09	*3*
	rather yes	0.46	0.52	0.06	*0*	ref.	
	yes	0.08	0.08	0.00	*85*	0.07	*33*
Listen to each other:	no	0.01	0.00	0.00	*26*	0.09	*38*
	rather no	0.04	0.04	0.00	*91*		
	rather yes	0.50	0.52	0.02	*19*	ref.	
	yes	0.45	0.44	-0.01	*33*	0.08	*6*
	missing	0.01	0.00	0.00	*10*		
Toothbrush 2 times daily		0.77	0.84	0.07	*0*	0.19	*0*
Regional characteristics							
Municipality size:	<5K	0.44	0.36	-0.07	*0*	0.03	*66*
	5-20K	0.11	0.12	0.01	*36*	-0.08	*27*
	20-100K	0.27	0.33	0.06	*0*	ref.	
	>100K	0.18	0.18	0.00	*90*	-0.25	*0*
	East * <5K					-0.15	*14*
	East * 5-20K					-0.07	*64*
	East * 20-100K					ref.	
	East * >100K					0.19	*16*
Recreation area		45.62	37.77	-7.84	*0*	ref.	
East *	1. tercile	0.16	0.09	-0.07	*0*	-0.01	*91*
	2. tercile	0.16	0.09	-0.07	*0*	ref.	
	3. tercile	0.17	0.07	-0.10	*0*	-0.04	*61*
West *	1. tercile	0.17	0.26	0.09	*0*	-0.04	*47*
	2. tercile	0.17	0.25	0.08	*0*	ref.	
	3. tercile	0.16	0.25	0.08	*0*	-0.06	*27*
Tax income/Capita		481.2	569.9	88.7	*0*	0.00	*56*
Employed in	I. Sector	3.80	2.80	-1.00	*0*	ref.	
	II. Sector	34.43	35.54	1.11	*1*		
	III. Sector	61.77	61.66	-0.11	*0*	0.00	*2*
Population growth 2002-07		-1.75	-0.46	1.29	*0*	0.02	*15*
East * Population growth		-1.73	-0.58	1.15	*0*	-0.00	*88*
East		0.49	0.25	-0.24	*0*	-0.57	*0*

Note: Almost empty groups have been omitted in the estimation or have been combined with another group. Efron's R^2 for the probit estimation is 0.2.

Appendix B: Further details on the estimator used

Appendix B.1 Matching

This appendix describes the baseline matching protocol used for the matching and the instrumental variable estimators.

Table B.1: A matching protocol for the estimation of a counterfactual outcome and the effects

Step A-1	Choose one observation in the subsample defined by treatment *d*=1 and delete it from that pool.
Step B-1	Find an observation in the subsample defined by *d*=0 that is as close as possible to the one chosen in step A-1) in terms of $p(x), \tilde{x}$. 'Closeness' is based on the Mahalanobis distance.
Step C-1	Repeat A-1) and B-1) until no observation with *d*=1 is left.
Step D-1	Compute the distribution of distances obtained for any comparison between a member of the reference distribution and matched comparison observations. Obtain the distance at quantile *Q* (*dist*).
Step A-2	Repeat A-1).
Step B-2	Repeat B-1). If possible, find other observations in the subsample of *d*=0 that are at least as close as $R * dist$ to the one chosen in step A-2). Do not remove these observations, so that they can be used again. Compute weights for all chosen comparisons observations that are proportional to their distance. Normalize the weights such that they add to one.
Step C-2	Repeat A-2) and B-2) until no participant in *d*=1 is left.
Step D-2	D-2) For any potential comparison observation, add the weights obtained in A-2) and B-2).
Step E	Using the weights $w(x_i)$ obtained in D-2), run a weighted linear regression of the outcome variable on the variables used to define the distance (and an intercept).
Step F-1	Predict the potential outcome $y^0(x_i)$ of every observation using the coefficients of this regression: $\hat{y}^0(x_i)$.
Step F-2	Estimate the bias of the matching estimator for $E(Y^0 \mid D=1)$ as: $\sum_{i=1}^{N} \frac{d_i \hat{y}^0(x_i)}{N_1} - \frac{(1-d_i) w_i \hat{y}^0(x_i)}{N_0}$.
Step G	Using the weights obtained by weighted matching in D-2), compute a weighted mean of the outcome variables in *d=0*. Subtract the bias from this estimate to get $\widehat{E(Y^0 \mid D=1)}$.

Note: *R* is set to 90%, Q is set to 90..

The parameters used to define the radius for the distance-weighted radius matching are set to 0.9 for both, *R* and Q. This value refers to the distance of the worst match in a one-to-one matching and is defined in terms of the propensity score. Different values for *R* and *Q* are checked in the sensitivity analysis in Lechner, Miquel, and Wunsch (2011) as well as in the simulation study by Hu-

ber, Lechner, and Wunsch (2010). They showed a considerable robustness of the results with respect to the choice of *R* and *Q*.

Appendix B.2 Semi-parametric IV

This appendix gives a more technical introduction into the estimator used for the semi-parametric LATE:

We use procedures that take the form of a ratio of two propensity score matching estimators. Such procedures were proposed by Frölich (2007). Under our maintained assumption of effect heterogeneity, the LATE is the causal effect of a change in the distance for the subpopulation of individuals who would react to such a change with a change in sports activity status.

It is an extension to the framework of Imbens and Angrist (1994) who discuss identification for an unconditionally valid instrument to the case when the instrument Z is only valid conditional on observed factors X . For simplicity, assume the instrument, i.e. the distance to sports facility would be binary, e.g. a long versus a short distance. Let $p_Z(x)$ denote $\Pr(Z=1 \mid X=x)$, the conditional probability of short distance given the observed factors. The LATE is given by

$$\gamma = \frac{\int \left(E[Y \mid p_Z(X)=p_Z(x), Z=1] - E[Y \mid p_Z(X)=p_Z(x), Z=0] \right) f_{p_Z(X)}(p_Z(x)) dp_z(x)}{\int \left(E[D \mid p_Z(X)=p_Z(x), Z=1] - E[D \mid p_Z(X)=p_Z(x), Z=0] \right) f_{p_Z(X)}(p_Z(x)) dp_z(x)}$$

where Y is the child's outcome, D denotes the sports state, and $f_{p_Z(X)}(p_Z(x))$ denotes the density of $p_Z(X)$.

Thus, the LATE can be estimated by (i) matching the outcomes Y in the subgroups $Z=1$ and $Z=0$ on the estimated $p_Z(X)$, (ii) matching the employ-

ment states D in the subgroups $Z=1$ and $Z=0$ on the estimated $p_Z(X)$, and (iii) computing the ratio of the former to the latter. Frölich (2007) shows that this method is consistent and asymptotically normal under standard regularity conditions. Here, $p_Z(X)$ is estimated by a probit regression (the specification and coefficient estimates are provided in Appendix C). For either matching step, we use the same methods as for estimation under the CIA. Note that the matching procedure for the numerator yields the estimate for the intention to treat effect (ITT), while the one for the denominator estimates the proportion of the compliers. Thus, the LATE is equal to the ITT inflated by the share of compliers. While identification is only feasible if compliers exist, estimation is only precise if the share of compliers is not too small, implying that the instrument is sufficiently relevant.

Appendix C: Further estimation results

Table C.1: Propensity score estimation (probit) using the GCP dataset

		GCP A		GCP B		GCP C	
		Coef.	p-val. %	Coef.	p-val. %	Coef.	p-val. %
Constant		0.00	*100*	-1.51	*6*	-0.62	*60*
Child characteristics							
Male		0.19	*1*	0.19	*1*	0.25	*3*
Age:	6 years	-0.03	*74*	-0.07	*53*	-0.07	*64*
	9 years	0.30	*0*	0.38	*15*	0.12	*73*
	10 years	0.30	*0*	0.31	*24*	-0.28	*39*
Birthweight in grams		0.07	*54*	0.09	*46*	0.19	*32*
Child outcomes in wave 1							
Health:	Very good			0.05	*58*	-0.01	*96*
	Sufficient			-0.18	*16*	-0.05	*76*
Well-being: Soul				0.00	*25*	0.00	*49*
	Self			0.00	*98*	0.00	*68*
	Family			-0.01	*8*	0.00	*51*
	Friends			0.02	*1*	0.00	*57*
	School			0.00	*23*	0.00	*38*
Non-cognitive skills							
	Emotional Problems			-0.02	*62*	0.00	*100*
	Behavioral Problems			0.02	*16*	0.02	*48*
	Hyperactivity			0.00	*86*	-0.02	*56*
	Peer Problems			0.05	*9*	0.00	*95*
	Antisocial Behavior			0.01	*76*	0.03	*33*
Mother's characteristics							
Education: Basic		-0.37	*0*	-0.34	*0*	-0.03	*82*
	High school	0.06	*57*	0.04	*73*	0.25	*16*
	University	-0.08	*48*	-0.07	*53*	-0.10	*59*
LFP:	Not working	-0.03	*78*	0.06	*62*	0.05	*81*
	Unemployed	-0.18	*24*	-0.29	*16*	0.13	*66*
LFP:	Fulltime	-0.36	*0*	-0.47	*0*	-0.49	*1*
Job:	Self employed	0.49	*0*	0.52	*1*	0.78	*1*
	Civil servant	0.64	*1*	0.61	*3*	1.10	*2*
	Employed	0.26	*1*	0.21	*10*	0.34	*11*
Health:	Very good	-0.06	*55*	-0.15	*13*	-0.22	*17*
	Ok	0.02	*87*	0.07	*48*	0.09	*56*
	Sufficient	0.05	*78*	-0.10	*60*	-0.19	*49*
Smoking: Sometimes		-0.15	28				
	Daily	-0.10	*32*				

Note: Table C.1 to be continued.

Table C.1 continued

			GCP A		GCP B		GCP C	
			Coef.	p-val. %	Coef.	p-val. %	Coef.	p-val. %
Father's characteristics								
Education:	Intermediate		0.03	*81*	0.03	*84*	0.26	*19*
	University		-0.09	*56*	-0.14	*34*	0.04	*87*
	Other		0.16	*20*	0.11	*39*	0.13	*55*
	Missing		0.04	*80*	0.71	*1*	0.81	*4*
LFP:	Not working		-0.21	*56*				
	Unemployed		-0.49	*0*	0.22	*36*	0.06	*86*
	Parttime		-0.41	*2*	-0.36	*9*	-0.35	*36*
	Missing		-0.24	*27*	0.15	*50*	0.06	*81*
Job:	Self employed		-0.15	*66*	-0.07	*72*	-0.03	*93*
	Civil servant		-0.16	*66*	-0.13	*59*	-0.31	*39*
	Employed		-0.10	*78*	-0.04	*84*	-0.07	*80*
	Missing		-0.13	*72*				
Health:	Very good		0.08	*56*	-0.05	*68*	-0.09	*66*
	Ok		0.03	*78*	-0.13	*27*	-0.32	*12*
	Sufficient		0.17	*43*	-0.04	*88*	-0.20	*65*
	Missing		-0.17	*9*	-0.88	*0*	-1.01	*0*
Family characteristics								
Total household income			0.00	*5*	0.00	*0*	0.00	*4*
	> 5.000 (binary)		0.70	*0*				
	Missing (binary)		0.34	*7*	0.59	*0*	0.40	*23*
Siblings in household			-0.11	*2*	-0.18	*0*	-0.13	*2*
Older sibling in household (binary)			-0.11	*15*	-0.07	*40*	-0.12	*36*
Single parent household			0.08	*74*	-0.21	*39*	-0.04	*89*
Parenting style								
Smoking during pregnancy:		Daily	-0.16	*32*	-0.29	*5*	-0.31	*19*
		Sometimes	-0.13	*37*	-0.20	*17*	-0.24	*25*
Mother cares (binary)					0.15	*6*	0.04	*73*
Strict rule:	Not at all		-0.12	*33*				
	Rather not		0.02	*81*				
	Yes		0.13	*40*				
Family cares:	Sometimes		0.16	*35*				
	Always		0.15	*6*				

Note: Table C.1 to be continued.

Table C.1 continued

		GCP A		GCP B		GCP C	
		Coef.	p-val. %	Coef.	p-val. %	Coef.	p-val. %
Regional characteristics							
Municipality size: < 5k		0.08	*52*	0.04	*71*	-0.13	*48*
	5-20k	-0.02	*91*	-0.06	*66*	-0.01	*96*
	>100k	-0.37	*0*	-0.37	*0*	-0.45	*1*
East * Municipality size: < 5k		-0.38	*27*	-0.20	*58*		
	5-20k	0.21	*47*	0.30	*32*		
	<20k					-0.09	*82*
	>100k	1.08	*0*	1.14	*0*	0.55	*21*
Recreation area							
East *	1. tercile	0.63	*4*	0.65	*5*	-0.23	*56*
	3. tercile	-0.01	*98*	0.05	*84*	0.09	*79*
West *	1. tercile	0.07	*48*	-0.01	*95*	-0.04	*77*
	3. tercile	0.26	*1*	0.20	*6*	-0.02	*90*
Tax income/Capita		0.00	*71*	0.00	*83*	0.00	*13*
Employed in III. Sector		0.00	*40*	0.00	*49*	0.00	*99*
Population growth 2002-07		-0.02	*14*	-0.03	*13*	0.03	*13*
East		-0.96	*0*	-1.07	*0*	-0.60	*6*
Efron's R^2:		0.17		0.19		0.16	

Note: The columns GCP A, B, and C correspond to the respective columns in Table 7. In GCP A we use only the second wave of the GCP for both outcome and control variables, in GCP B, we control additionally for the set of lagged cognitive and non-cognitive skills and replace all control variables by the respective control variables from wave 1. Last, we restrict the sample to children who do not participate in sports in a club in wave 1 (GCP C). Due to changes in the available variables between wave 1 and 2 and several almost empty groups when restricting the sample to children who did not participate in sports in a club in wave 1, specifications differ slightly from each other.

Table C.2: Propensity score estimation (probit) for the semi-parametric LATE

		Coef.	p-val. %
Constant		-0.57	*63*
Child characteristics			
Male		0.03	*59*
Age:	3 years	-0.06	*58*
	4 years	0.04	*76*
	5 years	0.05	*64*
	7 years	-0.08	*45*
	8 years	-0.05	*67*
	9 years	-0.06	*55*
	10 years	-0.01	*91*
Mother's characteristics			
Education: Basic		0.07	*45*
	High school	-0.11	*25*
	University	0.02	*86*
BMI:	Overweight	0.03	*65*
	Obese	0.03	*74*
Father's characteristics			
Education: Basic		-0.18	*3*
	High school	0.10	*38*
	University	0.12	*32*
Family characteristics			
Social class: Low		-0.10	*19*
	High	-0.05	*65*
Single parent household		0.22	*4*
Regional characteristics			
East *	log Population density	0.87	*0*
	log Recreation area/Capita	0.39	*0*
	log Tax income/Capita	-1.00	*0*
	log Employed in III. Sector	0.27	*16*
West *	log Population density	0.53	*0*
	log Recreation area/Capita	-0.39	*0*
	log Tax income/Capita	-0.21	*31*
	log Employed in III. Sector	0.46	*0*
	log Population growth 2002-07	16.12	*0*
East		-0.24	*86*
Efron's R^2		0.30	

Note: Estimation is based on the 'countryside' sample using the KiGGS data.