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ABSTRACT

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Using data from the German Socio-Economic Panel, this paper analyses the effects of spending part of adolescents' leisure time on playing music or doing sports, or both. We find that while playing music fosters educational outcomes compared to doing sports, particularly so for girls and children from more highly educated families, doing sports improves subjective health. For educational outcomes, doing both activities appeared to be most successful. The results are subjected to an extensive robustness analysis including instrumental variable estimation and a formal sensitivity analysis of the identifying assumptions, which does not reveal any serious problems.

JEL Classification: Z28, Z29, I12, I18, J24, L83, C21

Keywords: child development, leisure time activities, matching estimation, SOEP

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1 Introduction

Music and sports are currently the most important education-oriented extracurricular activities of children in many developed countries. For example, 64% of Europeans between 15 and 24 years old regularly do sports (European Commission 2014, p. 11), making this their most common leisure activity (Eurostat 2009, p. 165). Among the 15 to 30 year olds, 10% learn to play a musical instrument (European Commission 2007, p. 19). The literature appears to broadly agree that both activities affect child development positively compared to 'not doing them' (see literature review below). For this and other reasons, both activities receive substantial public subsidies in many (European) countries. Unfortunately, these positive findings are unable to help a parent, child, or adolescent decide on how to spend a fixed amount of available leisure time on these activities. Using individual-level data from Germany, we therefore try to shed light on the *differential* effects of doing sports versus doing music.

In fact, a large literature studies the isolated effects of sports and music activities for school children. For example, in the fields of psychology and music education, there is a considerable research investigating the link between playing music and cognitive skill development. These empirical analyses find that music practice or training is associated with a higher IQ (Vaughn and Winner 2000), enhanced reading ability (Besson et al. 2007, Loui et al. 2011), increased attention (Shahin et al. 2008) and better memory (Ho et al. 2003). Although basic socio-demographic background characteristics are controlled for in a majority of these studies, for most of them the issue of non-random selection into the group of individuals playing music or taking music lessons is not considered a major concern (Winner et al. 2013). One of the few researchers identifying causal effects of music lessons in an experimental study is Schellenberg (2004). He finds that children attending instrumental music or vocal lessons improve their cognitive ability compared to children receiving theatre lessons or children simply not attending such lessons. This finding has been confirmed in further experi-

mental studies for children (Bilhartz, Bruhn and Olson 1999, Nering 2002, Neville 2008), but not for adults (Bialystock and De Pape 2009, Schellenberg and Moreno 2010). While many proponents of music lessons claim that music also benefits the development of non-cognitive skills, so far there is no robust empirical evidence on such effects (Winner et al. 2013). The effects of music on children's development were rarely studied by researchers in economics and sociology, two exceptions being Southgate and Roscigno (2009), as well as Hille and Schupp (2015). By accounting for selection by observables to a substantial extent, both studies find that music fosters the development of both cognitive and non-cognitive skills (compared to not playing music).

There is also substantial research on the influence of sports participation on skill development. Studies carried out with US data find that sports participation improves educational achievements, even though some of these results might be affected by unobserved heterogeneity (Anderson 2001, Eide and Ronan 2001, Lipscomb 2007, Rees and Sabia 2010, Stevenson 2010). For Germany, Felfe, Lechner and Steinmayr (2011) show that childhood sports activities improve school grades and non-cognitive skills. Moreover, participating in sports increases the probability to complete upper secondary school and to attend university (Pfeifer and Cornelissen 2010). Furthermore, labour-market outcomes are positively affected by sports participation in the US and Canada (e.g. Cabane and Clark 2013, Ewing 2007, Lechner and Sari 2014, Long and Caudill 1991), but also in Europe (e.g. Lechner 2009, Lechner and Downward 2013). This literature conjectures that the main channels responsible for these effects are an increase in human capital (cognitive and non-cognitive skills) as well as health improvements.[1] While the papers mentioned are published in economics journals, other disciplines, such as epidemiology, sociology and sport science investigate the impact of sports participation on children as well. In a recent survey reviewing research papers in these fields,

[1] See the survey of Cabane and Lechner (2015) for a more complete review of this literature.

Singh et al. (2012) find evidence of a positive relationship between physical activities and performance at school, for example.

There are also papers considering various leisure time activities including music and sports to study the role of extracurricular activities in general (e.g. Covay and Carbonaro 2010, Feldman and Matjasko 2012). Typically, these studies compare individuals who are involved with at least one extracurricular activity compared to those who are not. Similarly, Del Boca, Monfardini and Nicoletti (2012) consider music and sports along with any other activity that "improves the child's human capital" as a substitutable form of child input. Obviously, one drawback of that approach is that effects are implicitly averaged over possibly heterogeneous activities.

A common feature of the papers mentioned above is that the explicit or implicit counterfactual, to which 'playing music' or 'doing sports' (or any aggregation of these) is compared, is vaguely defined as 'not doing the particular activity'. No study explicitly compares the effects of alternatively using the available time for doing music or doing sports, although this question appears very relevant given the time and budget constraints of parents and their children.

This is what we do in this paper though. We use the German Socio-Economic Panel (SOEP) (Wagner, Frick and Schupp 2007) to measure sports or music activities during childhood and adolescence at age 17. We group adolescents into those doing sports only, doing music only, doing both, and doing none of the above.[2] While the latter group is ignored for the further analysis, we compare the former with each other with respect to the adolescents' educational achievements, cognitive and non-cognitive skills, subjective health measures, and measures of personality traits. In order to improve the causal interpretability of these associa-

[2] We vary the exact definitions of these activities to ensure that the type of engagement is comparable, but this does not affect the results in any important aspects. Thus, these results are referred to the appendix.

tions between sports or music and later-in-life outcomes, we use a selection-on-observables approach and control for a wealth of individual, parental (including measures of parents' personality, education, activity, etc.), and family characteristics. This strategy exploits the fact that the SOEP is a longitudinal and very informative data set, which allows to link children to their parents. The estimation is performed using semi-parametric matching estimators, which allow for flexible effect heterogeneity and avoid unnecessary functional form assumptions as much as possible. Here, allowing for individual effect heterogeneity appears to be particularly relevant, as we expect different children to react differently according to their parental background and other factors.

Our results indicate that the different activities have indeed different effects. While doing music appears to foster educational success more than sports, particularly so for girls, the reverse is true for health, for which sports seems more beneficial. Maybe somewhat surprisingly, it turns out that with respect to educational success, doing sports and music jointly is even more beneficial. A substantial robustness analysis, which includes an IV estimation as well as formal sensitivity analyses of the matching assumptions, supports the claim that the results have indeed a causal interpretation.

The paper is organized as follows. In the next section we discuss the relevance of musical and sports education for children's development. Some basic descriptive facts are provided and the mechanisms behind the effects on youth development of those activities are reviewed. The description of the data used is contained in Section 3, while Section 4 discusses the identification strategy and briefly reviews the estimation methods used. Section 5 contains the results and Section 6 draws conclusions. Appendix A contains more details on the data, while Appendix B presents additional estimation results. Appendix C details the estimator and its implementation. Finally, Appendix D contains results from an alternative identification

strategy, as well as a formal sensitivity analysis for the chosen identification strategy. Note that all Appendices are contained in the discussion paper version of this paper only.

2 Sports and music activities of children

2.1 Prevalence

As already mentioned above, sports and music are the two most important non-formal educational activities of school-age children in most developed countries. Among the 64% of the 15 to 24 year olds who do sports on a regular basis,[3] 42% are members of a fitness centre or sports club (European Commission 2014, p. 46). Playing music and doing related artistic activities is less common than doing sports. Nevertheless, in addition to the 10% of individuals between 15 and 30 years who had music lessons, about one third of all Europeans are regularly engaged with artistic activities in general (European Commission 2011, p. 12).

In Germany, the country in the focus of the empirical analysis below, non-formal extracurricular activities have a long tradition and are predominantly organized in some sort of institution. Concerning music, there exists a country-wide network of 929 public and numerous private music schools (Verband deutscher Musikschulen 2014). For sports, there are 91,000 non-commercial sports clubs, which are organized in a well-structured network and cover the entire country (Deutsche Sportjugend 2014).

Doing sports and exercise is the most popular leisure time activity in Germany. 80% of girls and 90% of boys do sports when they are children, a share which decreases slightly until early adulthood (Grgic and Züchner 2013). Music is also an important extracurricular activity. According to the German Youth Institute, 25% of all Germans of age 18 to 24 played a musical instrument in 2012. At a younger age, music is even more prevalent. In the same year,

[3] 'On a regular basis' means at least 3 times per week.

music was played by 36% of those aged 13 to 17, and by 44% of those aged 9 to 12 (Grgic and Züchner 2013).

Youth music and sports activities have steadily increased in the last ten years. While only 10% of German adolescents attended paid music lessons outside of school in 2001, this number rose to 18% in 2012. Similarly, for sports, the share of adolescents of the same age, who regularly took part in sports competitions, has risen from 29% to 34% (Hille, Arnold and Schupp 2014). The engagement with music and sports remained constant after most federal states increased the number of hours students must spend in upper secondary school in a recent school reform (Dahmann and Anger 2014).

2.2 How does music and sports influence child development?

Which differences should we expect between the influence of sports and music on skill development? As stated in the introduction, previous research suggests that music improves cognitive skills, whereas sports improves educational achievement, measured by school grades, completion of secondary school and university attendance, as well as labour market outcomes. Further tentative evidence states that outcomes such as non-cognitive skills could be affected by music and sports as well.[4]

Comparing existing research provides only limited hints about differences in their effects. The reason for that is threefold. First, outcome variables are usually not comparable between studies of extracurricular music and sports activities. While the music literature focuses on channels, measured by skills, the sports literature concentrates rather on outcomes such as educational and labour market success. In this paper, we compare the effect of both activities on a common set of outcomes. We analyse the differential impacts of sports and

[4] More than cognitive skills, non-cognitive skills are considered to be malleable during childhood and youth (Cobb-Clark and Schurer 2012, Donnelan and Lucas 2008, Heckman and Kautz 2012, Specht, Egloff and Schmukle 2011).

music on children's educational achievements, as well as on cognitive skills, non-cognitive skills and health.

Second, a direct comparison between the results found in studies on each activity might be misleading, because participants in sports and music activities are not necessarily comparable. The question is whether different effects are due to differences in the activity or differences in the composition of the adolescents enrolled. Indeed, the decision to take up musical or athletic activities is not made randomly. For example, some adolescents might learn team capabilities better by playing football rather than by playing violin (in an orchestra) because of their different socio-economic background. Moreover, as section 3.4 will show, boys are more likely to play team sports and girls are more likely to play a musical instrument. Therefore, girls might be more likely to learn team capabilities when playing in an orchestra, whereas boys might acquire the same skills while playing football.

Third, the composition of the control group differs between studies on music and sports due to the lacking information on the counterfactual use of time. Implicitly, these studies compare those active in music or sports to all other individuals, irrespective of how they spend their time. Therefore, the control groups in studies on sports participation includes people who play music, and vice versa. Hence, comparing the estimated effects would require information on the alternative use of time.

While previous research on causal effects of music and sports can only provide us with limited guidance on expected effect differences, we can derive hypotheses from theoretical considerations. Music and sports may affect child development through a variety of channels. Some of these may be similarly activated by both activities. Schellenberg (2011) discusses mechanisms according to which music training influences subdomains of cognitive functioning, which leads to improvements in cognitive skills. Singh et al. (2012) list three potential physiological effects that link physical activity to benefits in cognition: i) an increase in blood

and oxygen flow to the brain; ii) a reduction of stress and a mood improvement due to an increase in levels of norepinephrine and endorphins; and iii) an increase in growth factors related to new nerve cells creation and to support of synaptic plasticity. Cognitive skills could thus be affected by both music and sports.

In addition, as a potential link between music or sports and non-cognitive skills, Schumacher (2009) highlights the potential of these activities to teach individuals to judge their own abilities and development. The ability to perform may improve attitudes towards school (Eccles et al. 2003), or at least raise awareness that hard work leads to success (Winner et al. 2013). Moreover, playing music or sports after school usually involves close interactions with teachers and peers. Thereby, adolescents engaged in these activities might acquire social skills as well as cultural capital (Lareau 2011, Schumacher 2009). Finally, even in absence of a causal link between music or sports and skill development, being engaged in these activities might send a positive or negative signal to school teachers (Lareau 2011). Thus, the adolescent could receive school grades that deviate from their actual level of competence due to the extracurricular engagement.

Since no study has yet directly compared music and sports, we are unable to observe whether these mechanisms are activated by both activities to the same extent. For example, sports are more often carried out in teams (see Section 3.4). Therefore, social skills might be acquired more effectively doing sports than playing music. In contrast, musically active adolescents are more likely to receive instruction from a teacher than sports participants, although trainings supervised by coaches are also frequent in adolescent sports. In particular, musically active adolescents are more likely to take part in lessons alone or in a small group similar to non-team or small team sports. Hence, skills acquired through the close interaction with a teacher might be developed among music participants more effectively.

Finally, the acquisition of some capabilities is specific to either music or sports. For example, playing sports improves the level of fitness and leads to a better health status (e.g. Felfe, Lechner and Steinmayr 2011). As a consequence, athletically active adolescents might be better able to concentrate, learn skills and succeed in school. By contrast, the occupation with music increases musical self-efficacy (Ritchie and Williamson 2010) and induces the formation of a musical self-concept (Spychiger, Gruber and Olbertz 2009). Few studies focus on these activity-specific channels. Rather, the findings of the previous literature are consistent with both the activity specific and the general channels presented above. Nonetheless, in most cases, these results are misleadingly presented as being activity-specific.

3 Data

3.1 The German Socioeconomic Panel

This paper uses data from the German Socio-Economic Panel (SOEP). The SOEP is a representative sample of German households interviewed every year since 1984. Interview questions cover numerous aspects of life, including socio-demographic background, work, housing as well as opinions and attitudes. The number of households interviewed has been increasing constantly and has attained almost 15,000 in 2014 (for a detailed description of the SOEP, see Wagner, Frick and Schupp 2007).

In the 2000s, a particular focus on the children has been developed, which led to the creation of several specialized questionnaires addressing child development. One of these questionnaires, the youth questionnaire, constitutes the main data source for this paper. Since the year 2000, all adolescents in SOEP households receive specific survey questions in the year they turn 17 years old. In their answers to the youth questionnaire, they share their educational achievements and plans, their objectives for career and private life, their relation to

the parents, as well as opinions and personality traits (see Weinhardt and Schupp 2011 for details on this questionnaire).

Most relevant for this study, the youth questionnaire contains questions on the participation in extracurricular sports and music activities (see Table 3.1). For each activity, individuals answer five questions describing their involvement during their youth.

Table 3.1: Music and sports in the SOEP Youth Questionnaire

Questions 16-20 of SOEP Youth Questionnaire	Questions 21-25 of SOEP Youth Questionnaire
16. Do you play a musical instrument or pursue singing seriously?	21. Do you play sports?
17. What type of music do you play?	22. Which is the most important type of sports you play?
18. Do you do this alone or in a group?	23. Where do you play this sport?
19. At which age did you start?	24. At which age did you start this sport?
20. Do you have music lessons outside of school?	25. Do you regularly participate in sports competitions?

Note: SOEP v29, 2001-2012.

In addition to the information about participation in music and sports, the youth questionnaire contains questions related to educational achievement and plans, as well as cognitive skills, non-cognitive skills and opinions. This information is used to assess the effects of these activities, i.e. to create the outcome variables for the empirical analysis below. In particular, educational success is measured with adolescents' school types and whether they plan to attend university.[5] Moreover, adolescents provide their latest school grades in the subjects of mathematics, German and a foreign language.

Cognitive skills were assessed with standardized tests in three categories: word analogies, figures and mathematics operators (Schupp and Herrmann 2009). In addition to cognitive skills, the SOEP Youth Questionnaire measures a variety of non-cognitive skills. These include the Big Five personality traits: conscientiousness, openness, extraversion, neuroticism and agreeableness (McCrae and Costa 1999, Lang et al. 2011). In addition, we know the de-

[5] In Germany, students have to choose among various secondary school types at age 10 or 12, depending on the federal state. The most common school types are upper secondary school (*Gymnasium)*, *Realschule* and *Hauptschule*. Attaining an upper secondary school degree (*Abitur*) is the prerequisite to attend university.

gree to which each adolescent agrees to statements of legitimate and illegitimate means of success, as well as the individual's risk aversion, trust in other people and preference for the present. Finally, we measure the individual's perceived control, which can be described as the degree to which one believes to be able to influence one's own destiny (Specht, Egloff and Schmukle 2013). Some health measures as well as a variable indicating university attendance were taken from the individual questionnaire, which survey participants answer for the first time when they are 18 years old.

In addition to this substantial amount of information, the household structure of the SOEP allows us to observe many socio-demographic background characteristics of the family members. These characteristics potentially determine the selection between the relevant activities. We obtain this information by combining the data on 17-year-olds with information from the household and individual questionnaires of the adolescent's parents and their household. Among others, these questionnaires contain information about parental education and income, as well as household composition and the parents' personality.

3.2 Selection of the estimation sample

Our sample used in the empirical analysis consists of all adolescents who answered the SOEP Youth Questionnaire between 2001 and 2012.[6] We drop less than 1% of the observations, for whom we have no answers to the questions on athletic and musical involvement during their youth. The data from the youth questionnaire is merged with data on the adolescent's household and parents. This leads to a sample of 3,835 individuals, consisting of 13 cohorts of 17 years-olds (see Table A.1.1 in Appendix A.1 for further details on the selection of the sample).

[6] Those who answered the Youth Questionnaire in 2000 are not part of our sample, because musical activities have not been asked about in that first version of the questionnaire.

3.3 Definition of 'doing sports' and 'doing music'

Using the answers to the questions about musical and athletic involvement described in Table 3.1, we define being musically or athletically active in the following way (for details see also Table A.1.2 in Appendix A.1). We consider as musically active those adolescents who match the following two criteria: i) they state playing a musical instrument when answering the youth questionnaire (at age 16 or 17), and ii) they have started to play music at the age of 14 or earlier. With the latter, we aim to capture a somewhat substantial exposure to the activity (3 years at least).[7] As robustness checks (see Section 5.4), we also consider more restrictive definitions that require following *paid* music lessons outside of school or playing at least on a monthly basis, which applies to 80% of those who play music. For sports, we define two levels of sports intensity.[8] For both levels, we require the adolescents to be active in sports at age 16 or 17 (i.e. when answering the youth questionnaire) and to have started their main sports no later than at age 14. With the aim to capture another, more structured and intense dimension of sports, we separately examine those who regularly take part in sports competitions, in addition to having started to play sports at or before age 14 and still doing so at age 17.

With these definitions, we are able to define the different groups and resulting comparisons as detailed in Table 3.2. In a first step, both activities are compared to each other. However, in particular sports participation may be heterogeneous with respect to formality and intensity of the involvement. Therefore, a second estimation compares adolescents active in music with those who regularly take part in sports competitions. As shown in Section 3.4 below, this equalizes the effort and time investment with which the activities are carried out.

[7] There is no information on music or sports practice of adolescents who stopped these activities before answering the SOEP Youth Questionnaire at age 17.

[8] This is possible for sports but not for music because of the larger number of adolescents active in sports.

To complete the picture, a third and fourth comparison contrasts adolescents who engage in both music and sports with those who do only one activity.[9]

Table 3.2: Comparisons of different activities

	'Active' group	Comparison group
Comparison 1 – music vs. sports: Playing music only versus playing sports only		
Play music	Yes	No
Play sports (competitively and non-competitively)	No	Yes
Comparison 2 – music vs. sports (competitive): Playing music only versus playing sports at a high intensity level only		
Play music	Yes	No
Play sports (only competitively)	No	Yes
Comparison 3 – both vs. sports: Playing music and sports versus playing sports only		
Play music	Yes	No
Play sports (competitively and non-competitively)	Yes	Yes
Comparison 4 – both vs. music: Playing music and sports versus playing music only		
Play music	Yes	Yes
Play sports (competitively and non-competitively)	Yes	No

Note: For exact activity definitions see Table A.1.2.

3.4 Descriptive statistics

Table 3.3 describes how the respective activity is carried out among adolescents who play music only, sports only, as well as those who play both music and sports. The table indicates details such as the average starting age or the share of individuals carrying out their activity in a team or in a non-formal context.

Playing music is associated with a more thorough commitment than sports, both in terms of time and formal instructions. 40% of the musically active state that they play every day, almost 80% take lessons. For sports – competitive and non-competitive combined – these numbers are only 29% and 64%. By contrast, adolescents who regularly take part in sports competitions engage at a similar level as those who play music. Around 80% of them take part in formal instructions, a share similar to those who play music. Also the frequency at

[9] We do not report the results of two possible comparisons: Sports (competitively and non-competitively) versus sports (only competitively) and sports (only competitively) versus both activities because the former is overlapping and the later less interesting. Finally, in the empirical results it turned out that the two different types of sport activities led to few differences in the results. Therefore, the results concerning sports with competition are referred to Appendix B.2.

which the respective activity is carried out is comparable between music and competitive sports participants.

Table 3.3: Characteristics of musical and athletic activities

	Music only	Sports only (competitive and non-competitive)	Competitive sports only	Both: music + sports (competitive and non-competitive)	
				music	sports
	(1)	(2)	(3)	(4)	
Average starting age	8.8	9.1	8.6	8.6	9.1
Share doing sports/music in team (%)	53	63	79	52	59
Share with lessons/instructions (%)	79	64	83	78	67
Share playing sports/music daily (%)	40	29	37	38	29
Number of adolescents in sample	333	1640	884	501	

Note: SOEP v29, 2001-2012, own calculations. Column (3) is a subgroup of column (2), otherwise each column contains distinct individuals, who carry out either music (1), sports (2 with subgroup 3) or both (4). The exact definitions of sports and music participation are given in Table A.1.2. Separate tables by gender can be found in the appendix (Tables A.2.3 and A.2.4).

One would think that engaging in both music and sports reduces the level of commitment an adolescent is willing to dedicate to each of these activities. However, as described in column (4) of Table 3.3, adolescents active in both activities are just as likely to play music and sports daily or to take part in formal lessons as those who only participate in one activity. Thus, for them, music and sports seem to be rather complements than substitutes.

In addition to differences related to the level of intensity, adolescents who play sports start to become active at a later age and are more likely to play in a team than those who play music. Team sports are particularly prevalent among boys and among those who regularly participate at competitions.[10] While only slightly more than half of the musically active adolescents play music with other people (in an orchestra or a band), almost 80% of those who do sports competitively take part in team sports.

Table 3.4 shows the distribution of the most important sports types among those who play sports according to the various definitions described above. All numbers indicate the percentage of adolescents who state to play the type of sports defined in the first column

[10] Other than the higher share of boys carrying out team sports, there are no important gender differences in the characteristics of music and sports participation (see Table A.2.3).

among the group of adolescents defined in the column heading. Unsurprisingly, soccer and handball are typical sports that are carried out in competitions. On the contrary, fitness training, biking, swimming and walking are usually carried out alone, as indicated by the lower share among adolescents taking part in sports competitions.

Table 3.4: Types of sports (in % of all sports)

	Sports (competitive and non-competitive)	Sports (competitive)	Sports (in addition to music, competitive and non-competitive)
	(1)	(2)	(3)
Basketball	4.4	3.6	4.0
Bicycling	5.0	0.6	5.4
Dancing (except ballet)	5.5	4.8	9.6
Equestrian sport	5.4	4.3	8.2
Fitness training	2.2	0.1	2.0
Handball	5.2	8.5	4.8
Jogging	3.8	1.3	3.8
Soccer	31.2	41.5	15.2
Swimming, diving	5.2	2.5	5.4
Volleyball	4.9	5.6	8.4

Note: SOEP v29, 2001-2012, own calculations. The table shows the percentage of adolescents who state to play the type of sports defined in the first column among the group of adolescents defined in the column heading. The exact definitions of sports participation are given in Table A.1.2. Separate tables by gender can be found in the appendix (Tables A.2.5 and A.2.6).

There are clear gender differences with respect to the most important types of sports (see Table A.2.4). Almost 60% of all boys who regularly take part in sports competitions name soccer as their main sport. The most important sports types among girls are dancing, equestrian sports and volleyball, each being considered as most important for more than 10% of female sports participants. However, the relative importance of sports types is similar among boys and girls, irrespective of whether sports is carried out in a competitive environment or whether music is played in addition.

Column (3) of Table 3.4 lists the most preferred sports types of adolescents who play sports in addition to music. Given that these include individuals who take part in competitions and those who do not, the distribution is relatively similar to that of column (1). However, female sports (dancing, equestrian sports and volleyball) are overrepresented, and soccer is

underrepresented among the group of adolescents active in both sports and music. This is consistent with the observation that adolescents who play music and sports are considerably more likely to be female than adolescents who play sports only, as described in the following.

Table 3.5: Selected descriptive statistics by treatment status

	Not active	One activity			Both activities
		Sports (competitive and non-competitive)	Sports (competitive only)	Music	
Characteristics					
Female (%)	55	41	35	59	56
At least one parent with university degree (%)	19	31	35	47	51
Average monthly labour market income of parents present in household (EUR)	1181	1443	1512	1681	1920
Household lives in rural area (%)	28	24	24	29	22
Mother's conscientiousness (scale from 0 to 1)	0.87	0.87	0.87	0.86	0.85
Recommendation for upper secondary school (%)	25	38	44	55	68
Outcomes					
Adolescent attends upper secondary school (%)	23	38	44	57	66
Adolescent repeated a class (%)	27	22	20	14	09
Average grade (higher grade is better)	-0.15	-0.02	0.01	0.20	0.32
Average cognitive skills	-0.24	0.00	0.13	0.19	0.36
Conscientiousness	-0.09	0.03	0.03	-0.05	0.13
Perceived control	-0.16	0.06	0.17	0.10	0.18
Preference for the present	0.15	0.00	0.07	-0.11	-0.21

Note: SOEP v29, 2001-2012, own calculations. The exact definitions of each activity are given in Table A.1.2. All outcome variables except the first two are normalised to have mean 0 and a standard deviation of 1 for the entire sample. Tables with all covariates and outcomes can be found in the appendix (Tables A.2.1 and A.2.2).

As one might expect, adolescents who engage with music differ with respect to background characteristics and outcomes from inactive individuals, as well as from those who engage with sports. Table 3.5 illustrates these differences. As stated above, the share of girls is higher among adolescents who play both music and sports than among those who only play sports. Moreover, adolescents who play sports usually come from social backgrounds that are less advantaged than those of the musically active youth, but more advantaged than those of individuals who play neither sports nor music. For example, in 47% of the families of musically active adolescents, at least one parent has a university degree, while this is true only for 31% of the athletically active's families and for 19% of the parents among inactive individuals.

The same pattern between musically active, athletically active and inactive adolescents is observed with respect to educational achievements and cognitive skills. For example, 57% of the adolescents who play music attend an upper secondary school (Gymnasium), whereas only 38% of those who play sports and 23% of those who are not active do so.

Furthermore, more competitively active adolescents come from a more favourable social background than those who are less involved. Individuals, who are engaged in sports at a high intensity level (who regularly take part in sports competitions), are more similar to those who play music than those who do sports at a lower level of intensity. Most remarkably, adolescents active in both music and sports have wealthier and more educated parents than all other groups of adolescents.

With respect to non-cognitive skills, adolescents who play music, sports or none of the two are rather similar, both when comparing their parents and when comparing themselves. The Big Five personality traits of mothers and fathers are almost identical along all activity types. For the adolescents themselves, the only notable difference concerns the individual's time preference: Adolescents who play music have a lower preference for the present.

4 Econometrics

4.1 Identification

This paper investigates the differential impact of practicing sports or music during childhood on the development of various skills, health, and personality traits. The challenge for identifying causal differences is related to the fact that the decision to play music rather than doing sports is not made randomly. We therefore have to disentangle the effect of participating in a specific activity from the influence of differences in socio-demographic and other background characteristics, given participation in at least one of those activities. In other words, we need to take into account selection effects involved in comparing adolescents car-

rying out one or the other activity (or both). Given that we are not aware of any specific exogenous institutional features that could be used for identification (like in a difference-in-difference or regression discontinuity design), the potential identification strategies are either based on instrumental variables type of assumptions or on assuming selection-on-observables. We discuss both options in turn.

As described above, the SOEP contains rich socio-demographic information on the adolescents and their parents. Therefore, selection-on-observables is an attractive identification strategy. The main requirement is that we are able to control for all variables affecting treatment (sports or music participation) and outcomes simultaneously, given participation in at least one of the activities. If we assume that the decision process is a two-stage process in which the first stage is a decision to be active or not, and the second stage is about the type of activity, the potentially selective decision to take up music or sports practice rather than not being active at all does not play any role for the identification of the effects of such comparisons.

To justify selection-on-observables as a strategy to identify causal effects, we need to discuss the determinants of choosing between music and sports, or even carrying out both at once. The choice of engaging with either activity can be motivated by taste, and expected costs and gains. Moreover, there might be constraints hindering a child to pursue the activity of interest. Finally, we only observe adolescents who play music or sports at age 17.Since we consider adolescents as active if they started their activity at age 14 or earlier, being in the 'treatment group' also depends on the adolescent's willingness to pursue the activity until age 17. In the following, we discuss the driving factors for each of these dimensions, as well as how they might differ between music and sports. Moreover, we explain how our identification strategy takes these potential confounders into account.

The choice to start music or/and sports activities can be considered as a common decision by child and parents. The decision most likely depends on utility gains and taste (Hille and Schupp 2015). In addition to current pleasure, the former includes the desire to invest in the child's future skills (Eide and Ronan 2001, Lareau 2011). A priori, neither parents nor child can judge which activity more effectively provides pleasure or stimulates skill development. Therefore, they can only form their opinion according to their own experience and taste and the information obtained from others (usually friends). These factors are approximated by socio-economic status (Garboua and Montmarquette 1996).

Even more than sports, high-brow cultural activities such as playing music can be used by individuals from higher social classes as a costly signal to assert their status (Menninghaus 2011, Ormel et al. 1999). A similar argument could justify the desire of parents to enrol their child for two activities rather than one. Similarly, music might be played more often by adolescents from particular socio-economic groups, because the offer of artistic activities for children might be adapted to the tastes of the more highly educated (Lunn and Kelly 2009).

To take these determinants into account, we control for the parents' socio-economic background, which reflects both their eagerness to invest in the child's future skills, as well as their taste. We hold socio-economic background constant by controlling for the parents' level of education and income, as well as detailed information about the job they carried out when the adolescent was 17 years old.[11] The latter includes both parents' work hours, their sector of activity, whether their job required training, as well as their socio-economic status. In addition to these objective indicators, parenting style is likely to affect the motivation to invest in the child's skill development. We proxy parenting style by controlling for the Big Five personality traits of mother and father, as well as an indicator of their willingness to take risks.[12] Fi-

[11] A list of all the variables used is available in the Table A.2.1 of the Appendix.

[12] Ideally, to avoid that covariates are influenced by participation in music or sports, we would have liked to include the parents' Big Five from before the child started doing music or sports. Unfortunately, personality questions have only been

nally, since ethnicity is an important determinant of socio-economic status and taste, we include the information on the possible migration background of the parents.

Even though willing to enrol their child at the local music school or sports club, parents might face constraints hindering them to do so. Gustafson and Rhodes (2006) point out that extracurricular activities require parental support, both financially and logistically. Parents might face financial constraints if they cannot or do not want to afford the costs for lessons, club membership, as well as musical instruments or sports equipment. Moreover, parents might not be able to provide the necessary logistical support, especially if they have other children or work full-time (Lareau 2011). Also, the child's position in the birth order plays an important role for the educational investments made by the parents (Black, Devereux and Salvanes 2005).

For most parents in Germany, financial constraints are unlikely to be the crucial determinant of the decision to sign up at a music school or sports club. Among families with children, 57% report that they have regular expenses for non-formal educational activities. On average, these families spend 51 EUR per month for the athletic and musical activities of their children (Schröder, Spieß and Storck 2015). Concerning expenditures for music, fees vary strongly between music schools and have accounted for 47 percent of the overall budget of German public music schools in 2013 (MIZ 2014).[13] However, the German association of public music schools (Verband deutscher Musikschulen) stipulates that their members should provide reduced fees for children from poor families (VDM 2011). In contrast, membership fees in sports clubs are very low on average. For adolescents, the median membership fee was just 3.10 euros per month in 2013 (Breuer and Feiler 2015). In addition, the "Educational package" – a policy introduced by the German federal government in 2011 – subsidizes

asked in the SOEP individual questionnaire in 2005 and 2009. However, we do not worry about the timing of the measurements because personality is considered to be stable among adults (Pervin, Cervone and John 2005).

[13] Another 48% of their revenues stems from public subsidies (MIZ 2014).

membership fees in sports clubs or music schools for poor families in the amount of 10 euros per month (BMAS 2015).

The extent to which the abovementioned constraints vary between music and sports depends on factors such as household income, the number of children in the household and birth order, but also on the institutional context in which the activity is carried out. We control directly for the first three factors, whereas the latter cannot be observed in our data. Depending on living area and time, as well as the organizational structure of the local music school or sports club, material investments might be more substantial for music or for sports. We approximate these factors by including state and birth year fixed effects, as well as an indicator of whether the household lives in a rural area.

To be observed as either playing sports or music, adolescents in our sample need to pursue these activities until they answer the SOEP Youth Questionnaire at age 17. In addition to motivation and constraints, the willingness not to give up before age 17 therefore constitutes an important dimension in the non-random selection into one of the activity groups. Whether an individual gives up music or sports during adolescence is likely to depend on encouragement by the parents, as well as own motivation, the opportunity costs of time, and the perceived returns in general. According to Farrell and Shields (2002) and Raudsepp (2006), parents as role models can motivate children to play music and sports, and might determine whether they pursue these activities until age 17. Whether parental encouragement leads the child to prefer music to sports probably depends on parental taste, which we control for as explained above.

Moreover, carrying out music or sports throughout adolescence requires motivation and time. Adolescents who struggle at school are unlikely to be able to dedicate time to these activities in their leisure time. The individual characteristics determining whether adolescents can pursue their extracurricular activities are difficult to take into account, given that we ob-

serve only few individual characteristics before the age of 17. To approximate these characteristics, we control for gender and an indicator whether the adolescent has received a recommendation for upper secondary school by her primary school teacher (in grade 4, at age 9 to 10). The latter serves as a proxy for ability. Furthermore, if the remaining unobserved reasons for giving up sports and music before the age of 17 are similar, this does not pose a threat to identification.

Several reviews investigate the determinants and correlates of physical activity among children and adolescents in empirical studies (Craggs et al. 2011, van der Horst et al. 2007, Sallis, Prochaska and Taylor 2000). They underline two points: i) the determinants vary between children (aged 4 to 12 years old) and adolescents (aged 13 to 18 years old), and ii) the identification of the determinants of a change in physical activity levels often suffers from reverse causality. Our study focuses on individuals who decided to engage or to quit sport while being children and then adolescents. Therefore, we are interested in determinants of sports and of a change of the sports activity for both age categories. Previous findings on these determinants are consistent with the arguments described above. Light (2010) suggests that friendship is an important determinant of the child's decision to remain in a competitive club. We cannot control for such individual characteristics. However, as mentioned above, there is a potential reverse causality issue that would have prevented us to use such information as a control. Moreover, we believe that these unobserved factors are similar for music and sports.

An alternative identification strategy is instrumental variables (IV). A crucial characteristic of a valid instrument is that it affects educational outcomes only by affecting music and/or sports participation (the so-called exclusion condition). Indeed some of the commonly used instruments (e.g. height or school characteristics) may be questionable in this respect.[14]

[14] Instrumental variables used to handle selection problems in sports economics are schools characteristics (Anderson 2001, Barron, Ewing and Waddell 2000), height (Eide and Ronan 2001, Rees and Sabia 2010) and distance to sports infrastructures (e.g. as a robustness check in Felfe, Lechner and Steinmayr 2011).

Therefore, we use an alternative instrument, namely parental artistic activities, which arguably fulfil the requirements for an IV. They are a strong predictor for adolescents' music participation and – conditioning on further covariates – unlikely to directly influence the outcomes. However, this instrument is not available for the entire sample, which implies a further reduction of the number of observations, which in turn drastically reduces the precision of the estimates. Therefore, we will use this IV as a robustness check only.[15]

4.2 Estimation

Our study compares the effects of different activities with each other. This corresponds to the multiple treatment setting discussed in Imbens (2000) and Lechner (2001). Therefore, the sample reduction results of Lechner (2001) apply. Thus, to estimate the effects of one activity compared to another by a selection-on-observables approach, participants in activity groups other than those two under explicit consideration are deleted for the purpose of this particular estimation. For example, for the estimation of the effect of being active in sport compared to music, individuals who do both activities play no role.

For performing the pairwise comparisons, we use the propensity score matching estimator proposed by Lechner, Miquel and Wunsch (2011). This estimator performed well in the large-scale simulation study by Huber, Lechner and Wunsch (2013). It is described in detail in Appendix C. Such semi-parametric estimators are based on estimating a parametric model (e.g. probit) for the probability of belonging to one of the groups compared to another, conditional on the above mentioned control variables. The relation between the outcomes, activity types, and confounders, however, are left unspecified (non-parametric). Therefore, such estimators have the advantage that they allow for very flexible effect heterogeneity (contrary to regression models, for example).

[15] Results based in this instrument as well as the extensive arguments why it is probably valid are contained in Appendix D.

For each outcome variable, having four groups of activity (music, sports, competitive sports and both) leads to up to 6 different estimates for each treatment effect, like the average treatment effect (ATE), the average treatment effect on the treated (ATET) and the average treatment effect on the non-treated (ATENT). However, an implication of treating the estimation problem as many single pair-wise problems is that the reference population for these effects is specific to each single comparison. For example, the standard ATE refers to the union of the respective treatment and control groups in the particular comparison. However, the characteristics of those groups will not be the same for different comparisons. Therefore, we follow the approach advocated and implemented by Lechner and Wunsch (2009) in a similar situation to keep the 'target' or 'reference' distribution the same for the different comparisons. In this case, there is an additional matching step. Matching is performed such that the implied weighting scheme leads to matched covariate distributions of treated and controls in all comparisons that resemble those in the 'target' population. Thus, the various estimation results presented below always refer to the same population (and thus the same distribution of confounding characteristics) and thus are comparable in that sense. In our case, a natural candidate for the target population is the union of sports and music participants.

5 Results

5.1 Propensity scores

We investigate the differential effects of music and sports in this paper by examining the consequences of playing music instead of doing sports, as well as playing music and sports instead of doing one activity only. All estimations were carried out separately for four comparisons. These comparisons were chosen with the aim to distinguish between two types of outcome differences: i) the effects resulting from playing music rather than sports, and ii)

the effects related to being active at different levels of intensity. Detailed definitions of the treatment and control group for each comparison are given in Table 3.2.

Table 5.1 shows the average marginal effects of the estimation of the propensity score for three of these four comparisons for selected covariates.[16] Since the results for competitive sports are very similar to sports in general, these results are referred to Appendix B. Generally, the results confirm the (unconditional) summary statistics of Section 3.4. Adolescents who engage with music tend to come from more advantaged social backgrounds. Still, parental education plays a much smaller role in choosing between sports and music than in the general decision to become musically or athletically active. Note that parental income is not statistically significant and that other parental characteristics play only a minor role. For example, a higher willingness to take risks among parents is associated with a lower probability that their child plays music rather than sports. The strong effect of openness both for mothers and fathers can be explained with the fact that openness towards artistic experiences is used as one of the items assessing this personality dimension.

Two important predictors of playing music rather than sports are the adolescent's gender and whether she or he received a recommendation for upper secondary school at the end of primary school. Girls are 10% more likely to play music instead of or in addition to sports than boys, all other covariates held constant. As a proxy for prior abilities, the recommendation for upper secondary school is especially important in determining who carries out two activities rather than one. The probability to play music and sports rather than just one of the two is 14% higher among adolescents who received such a recommendation.

[16] All covariates have a small number of missing observations (around 5% for most covariates). To account for non-randomness among the missing observations, we include indicators which turn on if at least one variable in a group of similar covariates is missing. The missing covariate value is coded to 0 for binary variables and to the mean of the non-missing observations otherwise.

Table 5.1: Selected results of propensity score estimation

	Music only vs. sport only (1)		Music + sport vs. sport only (3)		Music + sport vs. music only ()	
	Marginal effects	p-value in %	Marginal effects	p-value in %	Marginal effects	p-value in %
Female	*0.106*	0	*0.096*	0	-0.035	31
Recommendation for upper secondary school	0.044	2	*0.148*	0	*0.141*	0
Birth order	-0.033	1	*-0.040*	0	0.004	88
Number of siblings in SOEP	0.023	1	*0.032*	0	0.011	49
Household lives in rural area	*0.039*	10	0.011	65	-0.055	23
Monthly labour market income of parents who live in household	-0.001	88	0.005	61	0.017	33
Working hours (mother)	-0.001	22	-0.002	2	-0.001	59
Working hours (father)	0.001	13	0.002	3	0.001	71
Willingness to take risks (mother)	*-0.008*	7	*-0.008*	7	0.005	61
Willingness to take risks (father)	-0.011	2	-0.011	2	0.002	80
At least one parent with … university degree	0.004	90	*0.048*	7	0.035	54
… upper secondary schooling degree	0.039	14	0.033	21	-0.038	47
… migration background	-0.023	36	0.027	29	0.078	13
Big Five (mother) - Agreeableness	-0.162	3	*-0.129*	9	0.130	45
- Conscientiousness	0.010	91	-0.092	30	-0.243	19
- Extraversion	-0.081	22	-0.088	24	-0.041	78
- Neuroticism	-0.025	67	-0.042	48	-0.058	62
- Openness	0.142	2	*0.120*	8	-0.065	63
Big Five (Father)- Agreeableness	0.079	32	0.124	12	0.054	71
- Conscientiousness	0.048	57	0.120	18	0.179	35
- Extraversion	-0.072	30	-0.077	30	0.059	68
- Neuroticism	*0.157*	1	0.087	15	-0.099	44
- Openness	*0.141*	6	0.172	3	-0.034	82
Efron's R^2 (in %)	11		16		7	
Number of observations	1973		2141		834	

Note: SOEP v29, 2001-2012, own calculations. Probit model estimated. Average marginal effects presented. Inference is based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The exact definitions of each activity (dependent variable) are given in Table 3.2 and A.1.2. The following are also included in this specification: Constant term, year of birth, single parent household, dummies for the federal states, household net overall wealth, age of mother at birth, indicators for mothers working in services, fathers working in services, mothers working in manufacturing or agriculture, fathers working in manufacturing or agriculture, at least one parent with vocational degree, ISEI socio-economic status ('higher' for both parents), current job did not require training (mother), current job did not require training (father), indicators for missing values in willingness to take risks (mother), and willingness to take risks (father). The full results are given in Appendix B (Table B.1.1).

Using the coefficients from Table 5.1, we predict the probability for each individual to belong to the respective activity group. In order to eliminate differences in covariate distributions between the groups, we match both groups on the propensity score and on gender (to fully remove all gender difference that deem to be particularly important in this application),

as described in Section 4.2. After matching, all covariates are balanced (see Table B.1.2). The cut-off for the common support with respect to the target distribution is the 99% quantile of the respective propensity score distribution. Different cut-off values are considered as robustness check (more details are given in section 5.4. on robustness check).

5.2 Effects of music compared to sports

Table 5.2 shows the average effects for the four contrasts of music and sports described in the previous section.[17] In all comparisons, the results are reweighted with respect to the characteristics of adolescents who are active in music or sports or both, as described in section 4.2.[18] While Table 5.2 displays the key outcome variables, Appendix B.2 contains results for the additional outcomes. It also contains the results for the comparison of music versus competitive sports, because those results turned out to be very similar to the ones that included all types of sports and thus removed from the tables in the main body of the text.

Column (1) of Table 5.2 presents effects of playing music only compared to doing sports only: Musically active adolescents obtain better school grades in languages, scoring about one sixth of a standard deviation above athletically active adolescents. This tendency of music leading to better skills exists for most of the school achievement and cognitive skills variables, although these differences are not always statistically significant. Furthermore, adolescents who play music are eight percent more likely than sports participants to attend upper secondary school, and ten percent more likely to aim at going to university.

[17] Further results in particular about further personality traits are referred to Appendix B for the sake of brevity. Note also that cognitive skills as well as some non-cognitive skills (e.g. Big Five personality traits and risk aversion) were only measured from 2006 onwards (Weinhardt and Schupp 2011), while all other outcomes were available from 2001 onwards. Thus, for those variables, the sample size is considerably smaller and the results refer to the later period only. Whether an individual is part of this later subsample is essentially determined by the adolescent's year of birth.

[18] However, the results are similar if we weight them according to the characteristics of the overall population of active and inactive individuals (see Table B.3.9).

When comparing the results for doing both activities to only one of them (columns 2 and 3), the results for the educational outcomes show that doing both activities jointly is more beneficial than just a single one. For example, adolescents playing both music and sports outperform those who only play sports by more than one fifth of a standard deviation in the cognitive skills test. This effect is similarly positive in comparison to those who play music only. In addition, individuals active in music and sports have better school grades, although only one of the four grade effects is significantly different from zero for each comparison.[19]

As described in Section 3.4, adolescents who play music and sports carry out each activity with a time commitment similar to those who are only active in one of them. Irrespective of potential benefits from music or sports, playing both activities might impede school achievement due to the large amount of time spent on this extracurricular involvement. However, the abovementioned results suggest that on average doing both activities does not put so much strain on the adolescents as to negatively affect their educational success, but quite the opposite.

With respect to personality, we observe several statistically significant differences between musically and athletically active adolescents. The positive effect of music on openness is statistically significant and substantial at more than one third of a standard deviation. This is related to the fact that openness to artistic experiences is one of the three items assessing this personality dimension in our data. Musically active adolescents are less willing to take risks than those who play sports. Finally, adolescents who do sports in addition to music are more than one quarter of a standard deviation more extravert than those who play music only.

[19] However, comparing adolescents who play both music and sports to those who only do one activity involves a more important risk of selection based on unobservable characteristics than the single-activity comparisons described above. Being this much engaged in extracurricular activities requires particular investments. Students with weak school performance or students who have work after school will probably not find the necessary time to play music and sports. Let alone the particular financial and emotional support that is necessary from parents and teachers.

Table 5.2: Average effects of music vs. sports

Outcome variables	Music only vs. sport only (1) Effect	p-value in %	Music + sport vs. sport only (3) Effect	p-value in %	Music + sport vs. music only (4) Effect	p-value in %
Cognitive skills and school achievements at age 17						
Cognitive skills - Average	0.012	90	*0.233*	1	0.230	5
- Analogies	0.054	58	0.216	1	0.169	15
- Figures	0.053	59	*0.276*	0	*0.229*	5
- Math	-0.045	63	0.070	45	0.123	30
School grades - Average	0.034	66	0.151	3	0.123	20
- Maths	-0.119	14	0.113	12	0.233	2
- German	0.172	2	0.113	11	-0.051	59
- 1st for. lang.	0.063	42	0.103	13	0.046	63
Attends upper secondary school	0.081	4	*0.135*	0	0.063	18
Aim to enrol at university	0.106	1	*0.187*	0	*0.087*	6
Attends university at age 20	0.024	48	0.084	1	0.065	13
Personality at age 17						
Big 5: Conscientiousness	-0.114	21	0.059	51	0.165	14
Extraversion	-0.165	9	0.128	13	*0.294*	1
Neuroticism	0.103	31	0.013	88	-0.090	47
Openness	*0.407*	0	*0.349*	0	-0.058	63
Agreeableness	0.048	60	0.206	2	0.152	17
Willingness to take risk	-0.211	4	-0.181	6	0.021	87
Subjective health and life style at age 18						
Satisfaction with health	-0.119	45	-0.143	28	-0.050	80
Current health situation	-0.138	4	-0.048	39	0.083	30
Currently smoking	-0.007	88	*-0.110*	0	*-0.107*	5
Other leisure activities at age 17						
Watching TV daily	*-0.099*	0	*-0.115*	0	-0.016	71
Playing computer games daily	-0.075	2	-0.044	14	0.029	47
Reading daily	0.067	5	*0.127*	0	0.062	14

Note: Effects presented are average treatment effects for the target population. Inference is based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised to mean zero and variance 1 (higher value of grades is better). All other outcome variables are binary, except for 'satisfaction with health' (0 "worst" to 10 "best") and 'current health situation' (1 "bad" to 5 "very good"). The full set of results is contained in Table B.2.1 in Appendix B.2.

The third block of results in Table 5.2 shows that being athletically active leads to improved health outcomes. Adolescents who play sports in addition to or instead of music are more satisfied with their health and also report a better subjective health status. Of course, given our data, it remains a somewhat open, although maybe philosophical question whether this gain in subjective health translates into objective health measures of this young population (which is of course healthier than the population at large). Considering additional effects of doing two activities versus one, it turns out that adolescents who do both activities are ten percent less likely to smoke than whose who only done of those activities.

Finally, adolescents active in music and sports differ with respect to their leisure time occupations, as described in the lower panel of Table 5.2. Adolescents who play music are more likely to read and less likely to watch TV or play computer games every day than those doing sports. If we believe that playing computer games and watching TV is on average not supportive of educational success while reading fosters it, then these results are in line with the findings for the educational outcomes and may provide at least a partial explanation of these findings.

5.3 Heterogeneity

Next, we investigate heterogeneities in the effects for different subgroups of the target population with respect to gender and socio-economic background (for detailed results see Tables B.3.1 to B.3.9 in Appendix B). According to the literature as well as to the descriptive statistics shown in Section 3.4, male and female sports are different. Our main results take this specificity into account by matching adolescents by gender (but of course subsequently averaging their effects). In the following, we estimate the outcome differences between musically and athletically active adolescents for each gender separately to understand gender-specific differences between both activities. Before going into detail, note however that most of the following comparisons, documented in Appendix B.3, suffer from a loss of power, the magnitude of which varies between small and substantial. This loss is due to the reduced sample sizes within the additional strata.

With respect to cognitive skills and school grades, music seems to be more beneficial for girls, while sports may rather help boys. Girls see their language-related skills and grades improve by one fourth of a standard deviation when playing music, while athletically active boy obtain better results in mathematics. Other differences between music and sports are driven by male adolescents only. The positive effect of music on ambition is stronger for

males than for females. Finally, male sports participants increase their degree of extraversion compared to male musicians. This difference cannot be observed among women.

In order to investigate outcome differences between music and sports for different levels of socio-economic status, we estimated these differences in various subgroups. These sub-groups stratify the full sample by parental labour market income, parental education, as well as the adolescent's abilities, as measured by the recommendation for upper secondary school received from their primary school teacher. In summary, we find that adolescents with richer or more highly educated parents, as well as adolescents with higher ability, have an advantage from playing music rather than sports for a variety of outcomes. For them, music is associated with higher cognitive skills and school grades. This is even more the case if the adolescent is active in two activities rather than one. In other words, while music and sports are similarly beneficial for children from disadvantaged social backgrounds, those from richer and more highly educated families do better with music than with sports. They also do better with two rather than one activity. One possible explanation relates to Bourdieu's cultural reproduction hypothesis. According to Bourdieu and Passeron (1990), parents from higher socio-economic status have access to better quality cultural education, leading their children to more strongly benefit from playing music.

5.4 Robustness

One advantage of propensity score matching in comparison to OLS is related to the possibility to verify the common support between treatment and control group. If both groups are very different in their covariates, linear estimations might be sensitive to minor changes in the specification (Imbens, 2014). All our estimations have common support along the distribution of the propensity score between treatment and control groups as well as the target population. Even though we control for a large number of individual and parental background character-

istics, we can identify control observations along the entire distribution of propensity scores in the treatment group, and vice versa.

Our estimations are robust to various modifications in treatment definition and estimation method. For example, all effects are slightly stronger if we restrict the sample of musically active adolescents to those who take music lessons outside of school. Moreover, our results are robust to the alternative definitions of being active in music or sports, in which we disregard those who state to be active less than once a month. The results of these estimations are presented in Tables B.4.1 and B.4.2 in Appendix B.

We also checked the robustness of the results with respect to the particular method used for the bias correction step in the matching estimator.[20] It turns out that, here, the bias correction does not matter. Similarly, varying the criteria to define the common support from 99% to 97% does not change in any relevant way (see Table B.4.3).

Panel attrition and item non-response do not appear to threaten our results either. We check this by creating on additional outcome variable measuring non-response. The effects on this missing indicator are small and statistically insignificant (see Table B. 4.4). In addition, the results are robust to using survey weights or not (see Table B.4.5).

We believe that the large number of informative and relevant individual and family characteristics included in our estimations is likely to make the conditional independence assumption (CIA) plausible. Thus our estimates have a causal interpretation. Still, we cannot entirely exclude the possibility that unobserved characteristics determine the choice between music and sports and simultaneously affect adolescents' outcomes. Although, of course, the CIA cannot be empirically tested in a statistical sense, we run two plausibility tests to shed some light on the potential validity of this assumption and the effects of deviating from it.

First, we used an instrumental variable to model the choice between music and sports. As instrument, we took an indicator of whether either parent played a musical instrument in

[20] Results are available on request; all tables presented in this paper are based on a linear bias correction.

their youth. This instrument arguably has no direct impact on children's outcome other than influencing the parents' taste with respect to their child's leisure activity conditional on the covariates (for a more detailed discussion, see Appendix D). The empirical results do not contradict our main findings. However, this test is not very powerful, because the IV results are subject to substantial sampling noise.

Second, we ran the formal sensitivity test as developed by Ichino, Mealli and Nannicini (2008) and implemented by Lechner and Downward (2013). This test is based on a simulation exercise to evaluate the sensitivity of the results with respect to potential violations of the CIA. It turns out that the results appear not to be sensitive to the investigated misspecifications (the details of the procedure used and the results are discussed in Appendix D.2).

6 Conclusions

Using the data of the German Socioeconomic Panel, this paper analyses the effects of spending part for adolescents' leisure time on playing music or doing sports, or both. Concentrating on those two competing uses of leisure time has the advantage of explicitly recognising that doing one of those potentially beneficial activities may crowed out the other due to lack of sufficient free time. Thus, the estimated effects have more obvious and useful interpretation than in the previous literature that compared essentially each of those activities separately to 'not doing that particular activity'. There is also an econometric advantage, because selection effects resulting from the parents' or child's decisions to spend time on one of these major extracurricular activities are irrelevant. If selection into these activities can be thought of as a two stage process, with a first stage decision on spending time and money on one of the two, and a second stage decision about the particular type, then only the second stage is of potential concern. Thus, identification will be greatly improved.

The main results indicate that the two activities may have indeed quite different implications. Playing music appears to foster academic performance and academic ambition compared to doing sports, in particular for girls and children from more highly educated families. It also goes along with additional time spent reading and less time spent on watching TV and playing computer games. Doing sports on the other hand improves adolescents' subjective health. Since the positive effects on academic performance as well as the positive health effects should improve future labour market performance (and life satisfaction), it is not clear which of the two activities should be preferred, for example, by a parent interested in maximising life-time utility of their off-spring. Thus, there is no straightforward policy conclusion on which of those two activities should be preferred by public policy (or parents). Interestingly, when comparing the effects of doing both activities together against doing only one of them, positive effects appear as well for doing both.

An extensive robustness analysis based on a semiparametric instrumental variable estimation and a formal sensitivity analysis suggests that these results are robust with respect to several possible violations of key identifying assumptions, as well as various plausible values of the tuning parameters of the estimator.

An interesting avenue for future research consists in understanding the reasons ('mediators') behind those findings. Such an endeavour will however require larger samples than the ones available for the current study.

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Appendix A: Data

A.1 Selection of sample and activity definition

Table A.1.1: Sample selection

Step	Remaining # of observations
Pooled data of all individuals who have answered the SOEP Youth Questionnaire when they were 17 (complete youth data contains survey years 2000 to 2012)	4,190
Drop survey year 2000 (music-related questions were not asked)	3,958
Drop individuals with missing information on music or sports participation (missing answers to questions 16, 19, 21, 24 and 25, see Table 3.1)	3,835
Missing information on the outcomes	
Sample with no missing information on cognitive skills: Cognitive skills were measured since 2006, however, some individuals from survey years 2004 and 2005 were also given the opportunity to take the test. Moreover, the test can only be administered among survey participants with a personal interview (test is not possible for adolescents who answered the questionnaire alone for themselves on paper or on a computer). Therefore, for estimations using cognitive skills as outcome measures, the following individuals are dropped: - survey years 2001 to 2003 - individuals who did not have the opportunity to take the test (telephone interview or self-administered interview) - individuals who refused to take the test	1,806
Sample with no missing information on outcomes only measured since 2006: Big Five personality traits, risk aversion, trust and time preferences were only measured since 2006. Therefore, in all estimations using these variables as outcomes, the following individuals were dropped: - individuals who answered youth questionnaire between 2001 and 2005 - individuals who refused to provide answers to the questions	1,742
Sample with no missings on health measures at age 18. Individuals were dropped who were no longer part of the SOEP at age 18 or who refused to provide an answer on any of the outcomes.	2,166
Sample with no missings on standard outcome measures. For all other outcomes (school type attended, class repeated, school grades, opinions about means of success and perceived control), individuals were dropped, who did not provide an answer on at least one of the outcomes.	3,345

Table A.1.2: Definitions of musical and athletic activities

Activity	Definition
Music	- Play music at age 16 or 17 (answer "yes" to Question 16 of Youth Questionnaire) - Have started to play music at age 14 or earlier (answer "14" or less to Question 19 of Youth Questionnaire)
Sports (competitively and non-competitively)	- Play sports at age 16 or 17 (answer "yes" to Question 21 of Youth Questionnaire) - Have started to play sports at age 14 or earlier (answer "14" or less to Question 24 of Youth Questionnaire)
Sports (only competitively)	- Play sports at age 16 or 17 (answer "yes" to Question 21 of Youth Questionnaire) - Have started to play sports at age 14 or earlier (answer "14" or less to Question 24 of Youth Questionnaire) - Regularly take part in sports competitions (answer "yes" to Question 25 of Youth Questionnaire)

Note: SOEP v29, 2001-2012. Detailed questions of Youth Questionnaire are described in Table 3.1. The question numbers used here refer to that table.

A.2 Descriptive statistics

Table A.2.1: Covariates by type of activity

	Not active	One activity			Both activities
		Sports	Sports (competitive)	Music	
Female (share)	0.55	0.41	0.35	0.59	0.56
Recommendation for upper secondary school (share)	0.25	0.38	0.44	0.55	0.68
Difference: birth year - 1981	6.96	7.61	7.65	8.07	8.44
Birth year 1982 or 1983 (share)	0.10	0.06	0.06	0.07	0.04
Birth order	1.68	1.72	1.70	1.65	1.72
Single parent household (share)	0.26	0.22	0.22	0.17	0.17
Number of siblings in SOEP	2.26	2.27	2.28	2.32	2.41
Household lives in rural area (share)	0.28	0.24	0.24	0.29	0.22
North West Germany (share)	0.13	0.15	0.14	0.12	0.16
North Rhine Westphalia (share)	0.2	0.23	0.22	0.17	0.18
Hesse (share)	0.06	0.08	0.08	0.05	0.07
Berlin and Brandenburg (share)	0.09	0.07	0.06	0.08	0.05
Saxony (share)	0.07	0.06	0.06	0.08	0.07
South East Germany (share)	0.09	0.08	0.08	0.09	0.04
City states: Bremen, Hamburg, Berlin (share)	0.05	0.04	0.03	0.06	0.06
Household net overall wealth (in 100,000 euros)	1.46	2.05	2.39	2.64	3.02
Log of labor market income (both parents)	6.13	6.59	6.69	6.99	7.16
Age of mother at birth	26.81	27.40	27.52	28.38	29.19
Hours working (mother)	21.15	22.10	23.18	23.14	21.16
Hours working (father)	37.64	39.48	40.41	42.44	42.91
Mother working in services (share)	0.52	0.58	0.61	0.65	0.63
Father working in services (share)	0.29	0.34	0.35	0.44	0.45
Mother working in manufacturing or agriculture (share)	0.11	0.11	0.11	0.12	0.11
Father working in manufacturing or agriculture (share)	0.32	0.35	0.36	0.32	0.32
ISEI socio-economic status (highest among parents, scale from 0 to 90)	39.06	44.66	46.41	52.00	53.95
Mother's job requires no training (share)	0.25	0.21	0.19	0.16	0.16
Father's job requires no training (share)	0.18	0.13	0.13	0.08	0.07
Mother's willingness to take risks (scale from 0 to 10)	4.01	4.19	4.29	4.06	4.04
Father's willingness to take risks (scale from 0 to 10)	4.85	5.11	5.15	4.93	4.99
Missing: mother's willingness to take risks (share)	0.09	0.06	0.06	0.08	0.05
Missing: father's willingness to take risks (share)	0.26	0.21	0.21	0.16	0.15
At least one parent with university degree (share)	0.19	0.31	0.35	0.47	0.51
At least one parent with vocational degree (share)	0.77	0.75	0.73	0.67	0.68
At least one parent with upper secondary school degree (share)	0.17	0.30	0.34	0.49	0.52
At least one parent with migration background (share)	0.24	0.20	0.18	0.14	0.17

Note: Table A.2.1 to be continued.

Table A.2.1 continued

	Not active	One activity			Both activities
		Sports	Sports (competitive)	Music	
Agreeableness (mother, scale from 0 to 1)	0.80	0.81	0.81	0.80	0.80
Conscientiousness (mother, scale from 0 to 1)	0.87	0.87	0.87	0.86	0.85
Extraversion (mother, scale from 0 to 1)	0.72	0.72	0.72	0.72	0.71
Neuroticism (mother, scale from 0 to 1)	0.59	0.59	0.60	0.59	0.58
Openness (mother, scale from 0 to 1)	0.65	0.65	0.65	0.68	0.67
Agreeableness (father, scale from 0 to 1)	0.75	0.75	0.75	0.76	0.77
Conscientiousness (father, scale from 0 to 1)	0.86	0.86	0.86	0.85	0.86
Extraversion (father, scale from 0 to 1)	0.67	0.68	0.68	0.67	0.68
Neuroticism (father, scale from 0 to 1)	0.55	0.54	0.54	0.54	0.53
Openness (father, scale from 0 to 1)	0.61	0.62	0.62	0.65	0.65

Note: SOEP v29, 2001-2012, own calculations. The exact definitions of each activity are given in Table A.1.2.

Table A.2.2: Outcomes by type of activity

	Not active	One activity			Both activities
		Sports	Sports (competitive)	Music	
Cognitive skills and school achievement					
Cognitive skills - Average	-0.24	0.00	0.13	0.19	0.36
Cognitive skills - Analogies	-0.23	-0.03	0.08	0.26	0.39
Cognitive skills - Figures	-0.13	0.02	0.17	0.08	0.15
Cognitive skills - Math	-0.25	0.02	0.07	0.17	0.35
School grades - Average	-0.15	-0.02	0.01	0.2	0.32
School grades - Maths	-0.13	-0.03	-0.02	0.29	0.24
School grades - German	-0.12	0.03	0.08	0.02	0.22
School grades - 1st for. lang.	-0.11	-0.03	-0.03	0.18	0.26
Attends upper sec. school	0.23	0.38	0.44	0.57	0.66
Attends university at age 20	0.13	0.20	0.21	0.30	0.36
Aim to enrol at university	0.17	0.29	0.34	0.51	0.60
Personality					
Big 5: Conscientiousness	-0.09	0.03	0.03	-0.05	0.13
Big 5: Extraversion	-0.11	0.04	0.11	-0.16	0.19
Big 5: Neuroticism	0.03	-0.03	-0.13	0.09	-0.03
Big 5: Openness	-0.15	-0.09	-0.11	0.34	0.34
Big 5: Agreeableness	-0.07	-0.03	0.00	0.05	0.17
Willingness to take risk	-0.10	0.08	0.16	-0.05	0.00
Preference for the present	0.15	0.00	0.07	-0.11	-0.21
Trust in other people	-0.20	0.05	0.12	-0.01	0.26
Legitimate means of success	0.07	-0.02	-0.04	0.00	-0.10
Illegitimate means of success	-0.06	0.05	0.05	-0.04	0.02
Perceived control	-0.16	0.06	0.17	0.10	0.18

Note: Table A.2.2 to be continued.

Table A.2.2 continued

	Not active	One activity			Both activities
		Sports	Sports (competitive)	Music	
Health and life style at age 20					
Satisfaction with health	7.72	7.93	7.87	7.52	7.65
Current health situation	3.90	4.01	4.02	3.85	3.93
# of doctor visits	1.48	1.56	1.58	2.05	1.99
Currently smoking	0.40	0.32	0.29	0.25	0.21
Other leisure activities at age 17					
Watching TV daily	0.81	0.80	0.79	0.69	0.67
Listening to music daily	0.88	0.88	0.88	0.88	0.91
Playing music weekly	0.12	0.16	0.15	0.83	0.80
Playing sports weekly	0.36	0.84	0.90	0.60	0.93
Playing theatre weekly	0.14	0.22	0.21	0.20	0.29
Reading daily	0.22	0.22	0.21	0.35	0.39
Voluntary engagement weekly	0.10	0.17	0.20	0.19	0.27
Hanging out daily	0.32	0.27	0.24	0.32	0.29
Surfing the internet daily	0.52	0.55	0.57	0.59	0.58
Going to church monthly	0.14	0.18	0.18	0.24	0.38
Playing computer games daily	0.26	0.30	0.31	0.200	0.21

Note: SOEP v29, 2001-2012, own calculations. The exact definitions of each activity are given in Table A.1.2. The exact measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "worst" to 10 "best"), current health situation (1 "bad" to 5 "very good") and # of doctor visits (number).

Table A.2.3: Characteristics of musical and athletic activities by gender

	(1)	(2)	(3)	(4)	
	Music only	Sports only (competitive and non-competitive)	Competitive sports only	Both: music and sports (competitive and non-competitive)	
				Music	Sports
Boys					
Average starting age	9.3	8.8	8.2	9.1	9.0
Share doing sports/music in team (%)	60	73	86	56	65
Share with lessons/instructions (%)	76	64	81	77	67
Share playing sports/music daily (%)	50	32	39	44	39
Number of adolescents	135	973	577	220	
Girls					
Average starting age	8.5	9.6	9.4	8.1	9.2
Share doing sports/music in team (%)	48	49	66	48	54
Share with lessons/instructions (%)	81	63	86	80	67
Share playing sports/music daily (%)	33	25	33	34	22
Number of adolescents	198	667	307	281	

Note: SOEP v29, 2001-2012, own calculations. Column (3) is a subgroup of column (2), otherwise each column contains distinct individuals, who carry out either music (1), sports (2 with subgroup 3) or both (4). The exact definitions of sports and music participation are given in Table A.1.2.

Table A.2.4: Types of sports by gender (in % of all sports)

	(1) Sports (competitive and non-competitive)	(2) Sports (competitive)	(3) Sports (in addition to music, competitive and non-competitive)
Boys			
Basketball	5.3	3.8	4.1
Bicycling	5.3	0.7	7.7
Dancing (except ballet)	1.0	1.0	0.5
Equestrian sport	0.5	0.7	0.5
Fitness training	2.9	0.2	4.1
Handball	5.1	7.3	4.6
Jogging	1.7	1.2	3.6
Soccer	47.5	57.0	28.6
Swimming, diving	3.6	1.9	4.6
Volleyball	2.0	2.8	6.4
Girls			
Basketball	3.2	3.3	3.9
Bicycling	4.5	0.3	3.6
Dancing (except ballet)	12.1	11.8	16.8
Equestrian sport	12.5	11.2	14.3
Fitness training	1.2	0.0	0.4
Handball	5.4	10.8	5.0
Jogging	6.9	1.3	3.9
Soccer	7.4	12.1	4.6
Swimming, diving	7.5	3.6	6.1
Volleyball	9.2	10.8	10.0

Note: SOEP v29, 2001-2012, own calculations. The table shows the percentage of adolescents who state to play the type of sports defined in the first column among the group of adolescents defined in the column heading. The exact definitions of sports participation are given in Table A.1.2.

Appendix B: Further estimation results

B.1 Results of the estimation of the propensity score

Table B.1.1: Average marginal effects of the estimation of the propensity score

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
	Marginal effects	p-value in %	Marginal effects	p-value in %	Marginal effects	p-value in %	Marginal effects	p-value in %
Constant	*-0.743*	0	*-0.531*	0	*-0.729*	0	-0.187	40
Female (binary)	*0.106*	0	*0.250*	0	*0.096*	0	-0.035	31
Recommendation for upper secondary school (binary)	0.044	2	*0.089*	0	*0.148*	0	*0.141*	0
Difference: birth year - 1981	*0.007*	1	0.006	14	0.006	3	0.000	94
Birth year 1982 or 1983 (binary)	0.053	22	0.006	91	-0.053	17	-0.138	13
Birth order	*-0.033*	1	-0.043	2	*-0.040*	0	0.004	88
Single parent household (binary)	-0.007	78	0.005	89	0.018	50	0.021	71
Number of siblings in SOEP	*0.023*	1	0.030	2	*0.032*	0	0.011	50
Household lives in rural area (binary)	*0.039*	9	*0.058*	8	0.011	65	-0.055	23
North West Germany (binary)	*-0.056*	1	*-0.105*	0	-0.051	4	0.056	30
North Rhine Westphalia (binary)	*-0.058*	1	*-0.100*	0	*-0.092*	0	-0.020	72
Hesse (binary)	-0.058	4	-0.064	19	-0.060	5	0.041	55
Berlin and Brandenburg (binary)	-0.031	45	-0.044	51	*-0.095*	0	-0.094	37
Saxony (binary)	0.070	11	*0.133*	1	*0.074*	9	-0.047	51
South East Germany (binary)	0.008	82	-0.075	14	*-0.089*	1	-0.166	5
City states: Bremen, Hamburg, Berlin (binary)	0.083	17	*0.239*	0	0.141	2	-0.003	98
Household net overall wealth (in 100,000 euros)	0.001	80	-0.002	47	0.001	73	0.000	100
Log of labour market income (both parents)	-0.001	89	0.012	28	0.005	59	0.017	35
Age of mother at birth	0.005	3	*0.011*	0	*0.009*	0	0.004	42
Hours working (mother)	-0.001	19	-0.002	5	*-0.002*	1	-0.001	60
Hours working (father)	0.001	13	0.002	12	0.002	4	0.001	70
Mother working in services (binary)	*0.073*	1	0.056	17	*0.056*	6	-0.051	38
Father working in services (binary)	-0.005	88	-0.028	58	-0.019	60	-0.044	52
Mother working in manufacturing or agriculture (binary)	*0.120*	1	0.138	2	*0.077*	9	-0.056	48
Father working in manufacturing or agriculture (binary)	-0.020	55	-0.072	15	-0.041	25	-0.061	37
ISEI socio-economic status (highest among parents, scale from 0 to 90)	0.001	51	0.000	85	0.001	31	0.001	70
Mother's job requires no training (binary)	-0.033	15	0.008	83	-0.008	76	0.036	47
Father's job requires no training (binary)	-0.014	62	-0.062	13	-0.042	17	-0.021	77

Note: Table B.1.1 to be continued.

Table B.1.1 continued

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
	Marginal effects	p-value in %	Marginal effects	p-value in %	Marginal effects	p-value in %	Marginal effects	p-value in %
Mother's willingness to take risks (scale from 0 to 10)	*-0.008*	7	-0.015	3	*-0.008*	8	0.005	61
Father's willingness to take risks (scale from 0 to 10)	*-0.011*	1	-0.015	2	*-0.011*	1	0.002	80
Missing: mother's willingness to take risks (binary)	0.107	3	0.132	2	*0.080*	10	-0.046	58
Missing: father's willingness to take risks (binary)	*-0.056*	6	*-0.118*	1	-0.045	18	0.016	82
At least one parent with university degree (binary)	0.004	90	0.012	76	*0.048*	9	0.035	55
At least one parent with vocational degree (binary)	-0.021	38	-0.003	92	0.035	12	0.061	20
At least one parent with upper secondary school degree (binary)	0.039	14	0.050	18	0.033	21	-0.038	47
At least one parent with migration background (binary)	-0.023	34	0.015	68	0.027	31	0.078	12
Agreeableness (mother, scale from 0 to 1)	-0.162	3	*-0.288*	1	*-0.129*	10	0.130	42
Conscientiousness (mother, scale from 0 to 1)	0.010	91	-0.041	76	-0.092	31	-0.243	17
Extraversion (mother, scale from 0 to 1)	-0.081	22	-0.152	12	-0.088	21	-0.041	77
Neuroticism (mother, scale from 0 to 1)	-0.025	66	-0.106	21	-0.042	48	-0.058	61
Openness (mother, scale from 0 to 1)	0.142	3	0.227	2	*0.120*	8	-0.065	63
Agreeableness (father, scale from 0 to 1)	0.079	32	0.184	12	0.124	11	0.054	73
Conscientiousness (father, scale from 0 to 1)	0.048	57	0.120	37	0.120	18	0.179	37
Extraversion (father, scale from 0 to 1)	-0.072	30	-0.075	46	-0.077	29	0.059	68
Neuroticism (father, scale from 0 to 1)	*0.157*	1	0.099	28	0.087	17	-0.099	45
Openness (father, scale from 0 to 1)	0.141	5	0.243	2	0.172	2	-0.034	82
Efron's R Square	0.111		0.186		0.160		0.069	
Number of observations	1973		1463		2141		834	

Note: SOEP v29, 2001-2012, own calculations. The exact definitions of each activity are given in Table 3.2. Inference based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10%/5%/1% level.

Table B.1.2: Balancing of covariates after matching

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
	Std. bias in %	p-value in %	Std. bias in %	p-value in %	Std. bias in %	p-value in %	Std. bias in %	p-value in %
Female (binary)	0.0	100	0.0	100	0.0	100	0.0	100
Recommendation for upper secondary school (binary)	-0.8	80	-2.5	40	-1.7	59	-1.7	59
Difference: birth year - 1981	-2.9	33	3.3	27	0.4	89	0.5	87
Birth year 1982 or 1983 (binary)	-0.1	98	-1.0	75	-1.0	76	-1.0	76
Birth order	1.3	67	0.8	78	-1.0	74	-1.1	73
Single parent household (binary)	-0.2	96	1.1	71	0.9	77	0.9	77
Number of siblings in SOEP	1.5	62	0.5	87	-0.8	80	-0.8	80
Household lives in rural area (binary)	-0.6	83	1.7	58	0.9	76	1.0	75
North West Germany (binary)	-0.9	77	1.2	70	1.5	63	1.5	63
North Rhine Westphalia (binary)	-4.5	13	-1.4	65	-1.8	56	-1.8	56
Hesse (binary)	1.2	70	0.8	78	-0.4	91	-0.4	91
Berlin and Brandenburg (binary)	0.5	85	-0.7	80	0.0	99	0.0	99
Saxony (binary)	0.0	100	1.4	63	0.2	94	0.2	94
South East Germany (binary)	-0.1	96	-0.5	87	-2.2	49	-2.2	49
City states: Bremen, Hamburg, Berlin (binary)	1.4	65	1.1	72	-0.2	96	-0.2	96
Household net overall wealth (in 100,000 euros)	1.2	69	0.2	96	-1.0	74	-1.1	73
Log of labour market income (both parents)	-2.9	33	-2.0	50	-5.5	8	-5.5	8
Age of mother at birth	1.8	54	1.4	64	1.3	69	1.3	68
Hours working (mother)	-0.7	82	-1.2	69	-2.9	36	-2.8	37
Hours working (father)	0.3	91	0.9	77	-0.4	91	-0.4	90
Mother working in services (binary)	-1.0	74	-0.9	76	-0.5	87	-0.4	89
Father working in services (binary)	-1.6	59	-0.4	89	-1.8	57	-1.8	56
Mother working in manufacturing or agriculture (binary)	0.6	85	0.3	93	-1.8	56	-1.8	56
Father working in manufacturing or agriculture (binary)	1.6	60	0.6	83	-0.7	83	-0.6	84
ISEI socio-economic status (highest among parents, scale from 0 to 90)	-1.4	63	-2.3	44	-4.4	16	-4.4	15
Mother's job requires no training (binary)	1.5	62	0.1	98	-4.7	13	-4.7	13
Father's job requires no training (binary)	-1.2	69	-1.6	59	-1.7	58	-1.7	58
Mother's willingness to take risks (scale from 0 to 10)	-0.7	82	-0.8	78	-4.2	18	-4.1	19
Father's willingness to take risks (scale from 0 to 10)	1.6	58	2.1	48	-1.6	61	-1.6	60

Note: Table B.1.2 to be continued.

Table B.1.2 continued

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
	Std. bias in %	p-value in %	Std. bias in %	p-value in %	Std. bias in %	p-value in %	Std. bias in %	p-value in %
Missing: mother's willingness to take risks (binary)	0.7	82	1.6	60	-1.6	62	-1.6	61
Missing: father's willingness to take risks (binary)	-0.6	83	2.3	43	2.3	46	2.3	46
At least one parent with university degree (binary)	-1.0	73	-0.4	90	-1.3	68	-1.3	68
At least one parent with vocational degree (binary)	1.1	71	-0.8	79	-0.1	97	-0.2	95
At least one parent with upper secondary school degree (binary)	-2.0	51	-1.5	62	-1.9	55	-1.9	55
At least one parent with migration background (binary)	-2.1	49	0.1	97	2.5	43	2.5	43
Agreeableness (mother, scale from 0 to 1)	-1.8	54	-1.8	54	-0.9	78	-0.9	77
Conscientiousness (mother, scale from 0 to 1)	-1.4	64	-2.0	51	0.6	84	0.6	85
Extraversion (mother, scale from 0 to 1)	-2.1	48	-2.3	43	-3.1	32	-3.1	33
Neuroticism (mother, scale from 0 to 1)	0.2	94	1.6	59	0.8	79	0.8	79
Openness (mother, scale from 0 to 1)	-1.5	63	-0.9	75	0.4	89	0.4	89
Agreeableness (father, scale from 0 to 1)	-2.5	41	-1.1	71	-3.7	23	-3.8	23
Conscientiousness (father, scale from 0 to 1)	-1.3	67	-2.4	42	-1.1	72	-1.1	73
Extraversion (father, scale from 0 to 1)	0.5	86	-1.6	59	0.3	93	0.1	97
Neuroticism (father, scale from 0 to 1)	-0.3	93	-1.3	67	1.1	73	1.1	72
Openness (father, scale from 0 to 1)	-0.2	93	-1.1	72	-0.2	95	-0.2	94

Note: SOEP v29, 2001-2012, own calculations. The table indicates the standard bias (including the p-value) between treatment and control group after matching when estimating the Average Treatment Effect on the Treated (ATET). The biases for the estimation of the Average Treatment Effect on the Non-treatet (ATENT) are not significant for any of the covariates either and can be provided by the authors on request. The exact definitions of each activity are given in Table 3.2. Inference based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10%/5%/1% level.

B.2 Full set of effects

Table B.2.1: Average effects of music vs. sports

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.012	90	0.073	48	*0.233*	1	0.230	5
Cognitive skills - Analogies	0.054	58	0.143	17	0.216	1	0.169	15
Cognitive skills - Figures	0.053	59	0.108	26	*0.276*	0	*0.229*	5
Cognitive skills - Math	-0.045	63	-0.065	51	0.070	45	0.123	30
School grades – Average	0.034	66	0.091	19	0.151	3	0.123	20
School grades - Maths	-0.119	14	-0.075	30	0.113	12	0.233	2
School grades - German	0.172	2	*0.196*	0	0.113	11	-0.051	59
School grades - 1st for. lang.	0.063	42	*0.130*	6	0.103	13	0.046	63
Attends upper sec. school	0.081	4	0.083	2	*0.135*	0	0.063	18
Aim to enrol at university	0.106	1	*0.115*	0	*0.187*	0	*0.087*	6
Attends university at age 20	0.024	48	0.085	2	0.084	1	0.065	13
Personality at age 17								
Big 5: Conscientiousness	-0.114	21	-0.053	60	0.059	51	0.165	14
Big 5: Extraversion	-0.165	9	*-0.171*	8	0.128	13	*0.294*	1
Big 5: Neuroticism	0.103	31	0.104	26	0.013	88	-0.090	47
Big 5: Openness	*0.407*	0	*0.348*	0	*0.349*	0	-0.058	63
Big 5: Agreeableness	0.048	60	0.032	73	0.206	2	0.152	17
Willingness to take risk	-0.211	4	*-0.239*	1	-0.181	6	0.021	87
Preference for the present	*-0.155*	9	-0.150	11	-0.092	35	0.062	61
Trust in other people	0.016	88	-0.051	62	*0.211*	1	*0.194*	10
Legitimate means of success	0.042	54	-0.019	76	-0.045	50	-0.082	35
Illegitimate means of success	0.046	51	-0.099	14	-0.074	30	-0.118	20
Perceived control	0.109	13	-0.069	29	0.099	14	-0.007	93
Health and life style at age 18								
Satisfaction with health	-0.119	45	-0.341	2	-0.143	28	-0.050	80
Current health situation	-0.138	4	*-0.195*	0	-0.048	39	0.083	30
# of doctor visits	0.403	44	*0.769*	7	0.081	72	-0.291	59
Currently smoking	-0.007	88	0.008	83	*-0.110*	0	*-0.107*	5
Other leisure activities at age 17								
Watching TV daily	*-0.099*	0	*-0.080*	1	*-0.115*	0	-0.016	71
Listening to music daily	0.011	66	0.015	45	0.020	36	0.009	75
Playing theatre weekly	-0.053	4	-0.004	88	0.007	79	*0.063*	6
Reading daily	0.067	5	*0.134*	0	*0.127*	0	0.062	14
Voluntary engagement weekly	-0.018	53	0.023	41	0.068	2	0.089	1
Hanging out daily	-0.005	88	*0.059*	7	0.024	46	0.034	42
Surfing the internet daily	0.067	17	-0.026	58	0.033	47	-0.034	56
Going to church monthly	0.040	33	0.049	23	*0.169*	0	0.126	2
Playing computer games daily	-0.075	2	*-0.099*	0	-0.044	14	0.029	47

Note: Effects presented are average treatment effects for the target population. Inference is based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised to mean zero and variance 1 (higher value of grades is better). All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

B.3 Heterogeneity of the effects

Table B.3.1: Average effects of music vs. sports (female adolescents)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	**0.250**	5	-0.018	89	-0.042	73	**-0.282**	5
Cognitive skills - Analogies	**0.267**	3	0.150	27	0.076	48	-0.184	18
Cognitive skills - Figures	0.210	14	-0.067	63	-0.021	86	-0.220	15
Cognitive skills - Math	0.139	26	-0.056	68	-0.120	39	*-0.255*	9
School grades – Average	0.103	28	-0.145	42	0.087	27	-0.011	91
School grades - Maths	0.003	96	-0.233	10	-0.028	76	-0.029	84
School grades - German	**0.248**	2	0.043	62	0.102	24	-0.139	22
School grades - 1st for. lang.	0.017	84	-0.110	59	0.108	19	0.094	41
Attends upper sec. school	0.073	12	0.014	75	0.014	76	-0.055	41
Attends university at age 20	0.036	50	0.027	55	0.041	41	0.007	92
Aim to enrol at university	0.054	26	0.038	41	0.057	18	0.006	89
Personality at age 17								
Big 5: Conscientiousness	0.001	96	-0.162	28	0.110	29	0.108	49
Big 5: Extraversion	-0.049	70	-0.053	76	0.029	79	0.081	61
Big 5: Neuroticism	-0.024	86	0.193	25	0.124	46	0.150	43
Big 5: Openness	*0.468*	0	*0.251*	8	0.105	44	-0.359	13
Big 5: Agreeableness	0.093	52	-0.014	90	0.188	13	0.092	56
Willingness to take risk	-0.004	96	-0.143	27	-0.078	47	-0.071	61
Preference for the present	-0.265	11	-0.188	17	-0.162	17	0.100	59
Trust in other people	0.088	57	-0.043	79	0.164	20	0.076	69
Legitimate means of success	-0.014	91	-0.075	63	-0.046	53	-0.030	81
Illegitimate means of success	**-0.223**	2	*-0.278*	0	-0.134	15	0.092	42
Perceived control	0.037	81	*-0.405*	0	-0.108	25	-0.141	32
Health and life style at age 18								
Satisfaction with health	-0.070	75	-0.178	31	-0.204	29	-0.130	63
Current health situation	-0.047	71	-0.073	37	-0.115	17	-0.061	69
# of doctor visits	0.232	47	0.181	72	0.271	33	0.042	89
Currently smoking	-0.066	14	0.001	96	-0.023	63	0.042	50
Other leisure activities at age 17								
Watching TV daily	-0.065	13	-0.026	52	-0.009	75	0.055	25
Listening to music daily	-0.012	73	0.005	84	0.041	16	0.053	12
Playing theatre weekly	-0.057	19	0.012	78	0.074	11	**0.132**	2
Reading daily	*0.149*	0	*0.132*	0	*0.132*	0	-0.016	78
Voluntary engagement weekly	0.026	47	*0.073*	5	**0.083**	4	0.059	20
Hanging out daily	0.049	29	**0.121**	1	-0.026	56	-0.072	17
Surfing the internet daily	-0.037	65	-0.094	20	*-0.119*	5	-0.079	33
Going to church monthly	0.025	69	*0.124*	6	*0.191*	0	**0.166**	2
Playing computer games daily	-0.028	32	-0.009	74	-0.027	44	0.001	96

Note: Effects presented are average treatment effects for the target population. Inference is based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.2: Average effects of music vs. sports (male adolescents)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	-0.246	15	-0.001	97	0.216	42	0.467	20
Cognitive skills - Analogies	-0.119	57	0.141	33	0.315	21	0.436	24
Cognitive skills - Figures	-0.204	28	-0.007	95	0.055	82	0.265	40
Cognitive skills - Math	*-0.235*	8	-0.125	54	0.043	87	0.282	35
School grades – Average	-0.109	41	-0.017	89	0.208	19	0.319	14
School grades - Maths	*-0.234*	8	-0.117	27	0.123	31	*0.357*	6
School grades - German	0.146	25	0.066	61	0.144	43	0.001	97
School grades - 1st for. lang.	-0.205	36	0.015	90	0.191	22	0.397	17
Attends upper sec. school	0.048	55	0.012	85	**0.138**	2	0.093	36
Attends university at age 20	0.048	38	*0.081*	8	**0.186**	5	0.138	15
Aim to enrol at university	*0.122*	7	*0.121*	1	*0.172*	1	0.051	59
Personality at age 17								
Big 5: Conscientiousness	-0.167	29	-0.233	26	0.068	67	0.235	30
Big 5: Extraversion	*-0.310*	7	**-0.283**	4	0.108	53	**0.421**	4
Big 5: Neuroticism	0.138	48	0.106	41	0.056	72	-0.084	72
Big 5: Openness	***0.480***	0	***0.482***	0	***0.481***	0	0.003	97
Big 5: Agreeableness	0.072	65	-0.076	61	0.066	56	-0.005	95
Willingness to take risk	-0.304	13	-0.171	28	-0.174	54	0.135	58
Preference for the present	0.184	54	-0.133	43	-0.194	17	-0.379	23
Trust in other people	-0.076	64	-0.053	71	0.021	93	0.098	70
Legitimate means of success	0.109	60	-0.042	68	-0.042	82	-0.153	47
Illegitimate means of success	-0.080	51	-0.054	62	-0.133	38	-0.054	76
Perceived control	0.105	42	0.065	53	0.043	84	-0.057	76
Health and life style at age 18								
Satisfaction with health	0.139	46	-0.015	90	-0.291	51	-0.428	29
Current health situation	-0.073	42	-0.055	46	-0.102	45	-0.029	88
# of doctor visits	-0.134	77	-0.187	54	0.307	54	0.431	50
Currently smoking	-0.073	55	-0.008	93	*-0.106*	7	-0.033	80
Other leisure activities at age 17								
Watching TV daily	0.003	95	-0.044	31	*-0.162*	1	*-0.166*	5
Listening to music daily	*0.063*	0	0.035	18	0.052	17	-0.011	73
Playing theatre weekly	-0.035	41	0.010	84	0.067	33	0.102	16
Reading daily	0.045	40	0.050	42	*0.101*	9	0.056	47
Voluntary engagement weekly	**-0.077**	5	-0.035	32	0.076	17	**0.153**	2
Hanging out daily	0.017	84	0.044	34	-0.008	90	-0.024	84
Surfing the internet daily	*0.153*	9	0.038	60	*0.176*	1	0.025	78
Going to church monthly	-0.001	96	0.027	61	*0.131*	8	0.134	16
Playing computer games daily	0.050	76	0.002	95	-0.083	17	-0.133	39

Note: Effects presented are average treatment effects for the target population.). Inference is based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 “Worst” to 10 “Best”), current health situation (1 “Bad” to 5 “Very good”) and # of doctor visits (number).

Table B.3.3: Average effects of music vs. sports (adolescents without recommendation for upper secondary school at the end of primary school)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.120	57	-0.032	89	-0.170	43	-0.292	31
Cognitive skills - Analogies	0.137	51	0.186	41	-0.021	89	-0.161	53
Cognitive skills - Figures	0.058	74	0.022	92	-0.258	36	-0.320	28
Cognitive skills - Math	0.100	59	*-0.235*	9	-0.172	46	-0.271	39
School grades – Average	-0.051	65	-0.005	95	0.035	78	0.093	53
School grades - Maths	-0.194	13	**-0.235**	3	-0.131	32	0.068	66
School grades - German	*0.180*	8	0.156	12	0.038	74	-0.138	29
School grades - 1st for. lang.	-0.076	59	0.088	44	0.139	26	0.218	22
Attends upper sec. school	0.032	49	0.017	67	0.045	35	0.014	81
Attends university at age 20	0.015	76	0.034	42	0.056	29	0.044	45
Aim to enrol at university	0.012	80	0.023	54	*0.081*	9	0.069	27
Personality at age 17								
Big 5: Conscientiousness	-0.222	27	-0.407	24	-0.059	65	0.141	52
Big 5: Extraversion	-0.230	24	***-0.405***	1	0.100	41	0.340	15
Big 5: Neuroticism	0.160	50	0.028	86	-0.187	26	-0.367	21
Big 5: Openness	0.191	22	0.156	34	**0.235**	4	0.019	91
Big 5: Agreeableness	0.049	82	0.033	85	-0.069	70	-0.127	57
Willingness to take risk	-0.091	67	-0.092	54	-0.080	66	0.009	96
Preference for the present	0.214	24	0.135	67	-0.152	33	-0.358	17
Trust in other people	-0.015	95	0.078	71	*0.222*	10	0.225	42
Legitimate means of success	0.038	71	0.023	85	*-0.247*	7	*-0.279*	9
Illegitimate means of success	0.074	51	0.008	94	-0.124	39	-0.197	35
Perceived control	-0.045	74	-0.157	16	-0.028	85	0.026	90
Health and life style at age 18								
Satisfaction with health	-0.288	40	-0.210	28	-0.261	44	0.019	94
Current health situation	-0.121	20	*-0.183*	6	-0.078	43	0.041	76
# of doctor visits	0.358	76	-0.351	44	0.006	96	-0.363	75
Currently smoking	-0.022	81	-0.042	49	**-0.147**	3	-0.126	25
Other leisure activities at age 17								
Watching TV daily	0.017	69	-0.005	89	-0.026	62	-0.044	40
Listening to music daily	0.027	33	0.015	55	**0.073**	2	0.045	17
Playing theatre weekly	*-0.084*	5	*-0.071*	7	0.078	40	**0.163**	3
Reading daily	0.025	58	***0.126***	0	0.068	23	0.044	54
Voluntary engagement weekly	-0.054	12	-0.007	85	0.127	13	**0.182**	3
Hanging out daily	0.011	82	***0.147***	1	*0.105*	6	0.096	25
Surfing the internet daily	0.135	17	0.070	37	-0.023	74	-0.157	17
Going to church monthly	*-0.094*	1	-0.002	95	*0.196*	0	*0.286*	0
Playing computer games daily	0.054	34	0.031	53	-0.007	90	-0.063	47

Note: Effects presented are average treatment effects for target population (.). Inference based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.4: Average effects of music vs. sports (adolescents with recommendation for upper secondary school at the end of primary school)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.095	48	0.002	95	**0.186**	4	0.085	46
Cognitive skills - Analogies	0.209	12	0.173	26	*0.183*	9	-0.030	85
Cognitive skills - Figures	0.171	17	0.000	97	**0.190**	2	0.010	94
Cognitive skills - Math	-0.094	57	-0.124	39	0.092	31	0.183	27
School grades – Average	-0.094	70	0.049	64	0.011	92	0.099	49
School grades - Maths	-0.195	35	0.111	50	0.078	52	*0.270*	6
School grades - German	-0.034	87	0.008	92	-0.035	67	-0.007	96
School grades - 1st for. lang.	0.030	74	-0.028	85	-0.029	72	-0.064	54
Attends upper sec. school	**0.092**	1	0.039	34	*0.099*	0	0.009	78
Attends university at age 20	0.022	72	-0.006	96	0.058	30	0.037	55
Aim to enroll at university	*0.160*	0	*0.099*	6	*0.143*	0	-0.017	71
Personality at age 17								
Big 5: Conscientiousness	-0.095	52	-0.181	58	0.081	39	0.181	34
Big 5: Extraversion	-0.109	56	-0.143	31	*0.224*	7	**0.318**	3
Big 5: Neuroticism	0.125	31	*0.247*	9	0.053	59	-0.078	53
Big 5: Openness	*0.548*	0	*0.480*	0	*0.429*	0	-0.119	35
Big 5: Agreeableness	-0.042	74	-0.140	33	*0.215*	6	*0.259*	7
Willingness to take risk	-0.158	24	-0.201	13	-0.020	86	0.135	33
Preference for the present	*-0.210*	5	**-0.283**	4	-0.131	39	0.075	66
Trust in other people	-0.182	24	-0.027	86	*0.152*	9	**0.333**	5
Legitimate means of success	0.090	41	0.004	95	0.099	51	0.010	92
Illegitimate means of success	-0.079	46	-0.017	96	-0.107	17	-0.031	81
Perceived control	0.061	48	0.015	90	-0.055	56	-0.118	24
Health and life style at age 18								
Satisfaction with health	0.218	27	-0.053	77	0.071	80	-0.150	41
Current health situation	-0.143	14	-0.055	48	-0.006	95	0.135	39
# of doctor visits	0.111	57	0.519	25	0.582	34	0.496	36
Currently smoking	-0.028	71	0.055	30	-0.055	24	-0.027	81
Other leisure activities at age 17								
Watching TV daily	-0.075	15	**-0.095**	3	*-0.069*	7	0.005	92
Listening to music daily	-0.018	63	-0.009	75	0.004	85	0.022	59
Playing theatre weekly	-0.015	76	0.055	21	0.024	49	0.039	44
Reading daily	**0.109**	4	*0.102*	7	*0.118*	0	0.006	91
Voluntary engagement weekly	0.060	23	0.031	53	*0.091*	0	0.031	58
Hanging out daily	-0.012	81	-0.029	70	-0.056	16	-0.043	45
Surfing the internet daily	0.025	71	-0.089	19	0.036	46	0.017	80
Going to church monthly	0.095	17	*0.104*	10	*0.148*	0	0.051	53
Playing computer games daily	**-0.092**	4	-0.070	10	*-0.058*	7	0.033	47

Note: Effects presented are average treatment effects for the target population (.). Inference based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.5: Average effects of music vs. sports (adolescents with parents who did not receive an upper secondary school degree)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.099	43	0.050	68	-0.062	79	-0.160	47
Cognitive skills - Analogies	0.087	52	0.101	46	0.030	85	-0.054	77
Cognitive skills - Figures	0.134	26	0.021	87	-0.070	78	-0.203	33
Cognitive skills - Math	0.039	78	-0.019	89	-0.203	36	-0.242	30
School grades – Average	0.034	78	-0.035	75	-0.057	60	-0.091	52
School grades - Maths	-0.051	67	-0.103	30	0.012	91	0.070	69
School grades - German	0.075	55	0.007	94	-0.145	34	-0.221	11
School grades - 1st for. lang.	0.044	76	-0.055	60	-0.047	68	-0.099	56
Attends upper sec. school	0.067	25	0.017	71	**0.138**	3	0.075	53
Attends university at age 20	-0.017	73	0.053	13	0.051	44	0.069	27
Aim to enrol at university	0.065	23	0.041	33	0.065	25	0.006	92
Personality at age 17								
Big 5: Conscientiousness	-0.123	32	-0.028	86	-0.097	59	0.024	91
Big 5: Extraversion	*-0.260*	5	-0.111	40	**0.277**	4	***0.535***	0
Big 5: Neuroticism	0.235	12	*0.228*	7	-0.092	49	-0.327	11
Big 5: Openness	**0.337**	2	***0.419***	0	0.207	18	-0.130	51
Big 5: Agreeableness	0.172	27	0.115	35	0.085	39	-0.083	64
Willingness to take risk	**-0.355**	4	-0.103	52	0.127	22	**0.481**	3
Preference for the present	-0.148	27	-0.242	13	-0.156	16	-0.011	94
Trust in other people	-0.127	34	-0.116	32	0.274	11	*0.407*	7
Legitimate means of success	-0.029	88	-0.029	73	-0.198	12	-0.166	26
Illegitimate means of success	-0.124	24	-0.141	13	-0.174	42	-0.047	81
Perceived control	0.017	91	-0.148	14	0.097	37	0.075	66
Health and life style at age 18								
Satisfaction with health	0.115	56	-0.176	29	-0.430	37	-0.553	30
Current health situation	*-0.128*	9	*-0.151*	9	-0.040	66	0.089	41
# of doctor visits	-0.015	95	0.252	50	0.420	31	0.462	42
Currently smoking	0.033	84	0.008	90	-0.106	13	-0.139	41
Other leisure activities at age 17								
Watching TV daily	-0.060	25	-0.056	17	-0.022	68	0.036	60
Listening to music daily	-0.017	74	0.033	22	*0.078*	0	*0.095*	8
Playing theatre weekly	-0.071	23	-0.023	48	-0.020	69	0.051	53
Reading daily	0.078	18	**0.102**	3	0.060	24	-0.022	77
Voluntary engagement weekly	-0.034	31	0.016	60	*0.129*	10	**0.164**	4
Hanging out daily	-0.029	68	*0.127*	1	0.021	71	0.050	52
Surfing the internet daily	0.062	38	0.017	81	0.091	23	0.030	73
Going to church monthly	0.097	22	0.107	12	**0.209**	2	0.111	20
Playing computer games daily	-0.051	41	-0.024	58	0.011	92	0.065	51

Note: Effects presented are average treatment effects for the target population (.). P-values are based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.6: Average effects of music vs. sports (adolescents with parents who have an upper secondary school degree)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	-0.103	45	-0.146	34	0.136	31	0.235	14
Cognitive skills - Analogies	-0.018	86	-0.004	95	0.093	56	0.107	50
Cognitive skills - Figures	-0.156	25	-0.169	24	0.073	53	0.233	15
Cognitive skills - Math	-0.068	65	-0.148	37	0.146	39	0.207	20
School grades – Average	-0.055	53	0.029	77	0.026	89	0.079	59
School grades - Maths	*-0.194*	5	-0.098	33	-0.036	82	0.156	33
School grades - German	0.049	69	0.029	81	-0.013	95	-0.063	61
School grades - 1st for. lang.	0.051	57	0.149	13	0.126	26	0.072	59
Attends upper sec. school	*0.074*	8	-0.018	72	0.029	55	-0.045	51
Attends university at age 20	0.080	21	-0.033	79	0.036	56	-0.042	63
Aim to enrol at university	*0.113*	1	0.078	13	0.078	16	-0.036	58
Personality at age 17								
Big 5: Conscientiousness	-0.069	63	0.066	65	0.016	89	0.081	63
Big 5: Extraversion	-0.254	18	-0.098	55	0.044	80	0.294	16
Big 5: Neuroticism	0.035	86	-0.068	73	0.013	93	-0.014	93
Big 5: Openness	*0.322*	7	*0.334*	0	*0.350*	0	0.027	90
Big 5: Agreeableness	-0.073	60	-0.072	53	0.169	41	0.236	25
Willingness to take risk	-0.089	55	-0.063	84	*-0.276*	6	-0.185	28
Preference for the present	-0.045	73	-0.045	79	-0.049	79	-0.005	95
Trust in other people	0.168	26	-0.087	59	0.138	33	-0.036	85
Legitimate means of success	-0.093	45	-0.028	75	-0.127	33	-0.031	77
Illegitimate means of success	-0.086	45	-0.110	35	-0.098	22	-0.012	91
Perceived control	0.061	58	-0.045	71	-0.030	72	-0.090	53
Health and life style at age 18								
Satisfaction with health	-0.253	27	-0.004	97	0.058	77	0.312	27
Current health situation	**-0.196**	5	-0.035	75	-0.129	11	0.070	52
# of doctor visits	0.024	93	-0.100	73	-0.126	46	-0.148	53
Currently smoking	-0.086	10	-0.023	61	*-0.094*	10	-0.008	89
Other leisure activities at age 17								
Watching TV daily	-0.014	83	-0.020	72	-0.028	71	-0.015	78
Listening to music daily	-0.022	69	0.015	61	0.013	56	0.035	43
Playing theatre weekly	0.015	79	0.050	25	0.003	95	-0.011	85
Reading daily	*0.094*	8	*0.123*	1	*0.117*	1	0.023	72
Voluntary engagement weekly	-0.033	56	-0.036	45	0.048	32	0.079	21
Hanging out daily	-0.031	56	0.064	12	-0.021	59	0.009	88
Surfing the internet daily	0.059	41	0.052	54	-0.011	86	-0.071	33
Going to church monthly	-0.019	80	0.026	75	0.101	39	0.118	11
Playing computer games daily	**-0.094**	3	-0.014	75	0.003	94	*0.096*	8

Note: Effects presented are average treatment effects for the target population (.). Inference based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.7: Average effects of music vs. sports (adolescents with parents having an average labour market income below 1500 euros per month)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.063	63	0.003	96	-0.243	46	-0.301	32
Cognitive skills - Analogies	0.192	23	0.065	62	-0.019	90	-0.204	37
Cognitive skills - Figures	0.049	67	0.026	87	-0.201	43	-0.245	33
Cognitive skills - Math	-0.048	71	-0.078	68	-0.364	33	-0.315	28
School grades – Average	-0.013	91	-0.014	91	0.127	35	0.145	47
School grades - Maths	-0.121	32	-0.072	45	0.035	73	0.157	30
School grades - German	0.146	15	0.093	29	0.083	52	-0.056	69
School grades - 1st for. lang.	-0.058	63	-0.054	76	0.146	44	0.208	39
Attends upper sec. school	**0.105**	3	0.051	23	**0.098**	2	-0.006	92
Attends university at age 20	-0.003	92	0.078	11	0.037	55	0.041	40
Aim to enrol at university	**0.092**	5	**0.094**	2	**0.119**	1	0.028	68
Personality at age 17								
Big 5: Conscientiousness	-0.186	22	-0.085	55	0.077	72	0.262	28
Big 5: Extraversion	-0.231	12	-0.166	19	0.063	61	*0.292*	5
Big 5: Neuroticism	**0.326**	2	*0.314*	8	-0.118	33	***-0.444***	1
Big 5: Openness	0.273	14	**0.282**	3	*0.196*	6	-0.080	71
Big 5: Agreeableness	*0.239*	5	0.082	59	0.183	23	-0.059	77
Willingness to take risk	*-0.332*	7	-0.275	12	0.016	93	*0.349*	6
Preference for the present	-0.116	46	*-0.303*	5	-0.284	10	-0.168	42
Trust in other people	-0.024	84	-0.139	25	0.201	13	0.223	16
Legitimate means of success	0.097	33	0.036	66	-0.078	46	-0.172	23
Illegitimate means of success	-0.075	50	-0.072	49	-0.019	87	0.055	74
Perceived control	0.042	67	*-0.189*	7	0.093	32	0.051	68
Health and life style at age 18								
Satisfaction with health	-0.272	22	-0.404	13	0.305	34	0.573	17
Current health situation	**-0.192**	2	-0.131	12	0.093	38	**0.284**	4
# of doctor visits	0.442	36	0.253	46	0.039	90	-0.413	44
Currently smoking	-0.084	11	-0.018	74	***-0.146***	0	-0.062	31
Other leisure activities at age 17								
Watching TV daily	**-0.100**	3	-0.044	37	-0.053	30	0.047	48
Listening to music daily	-0.001	95	0.034	28	**0.070**	2	0.072	14
Playing theatre weekly	-0.048	19	0.002	93	0.053	25	*0.103*	5
Reading daily	*0.130*	0	**0.110**	2	***0.181***	1	0.053	49
Voluntary engagement weekly	0.001	95	0.020	50	*0.091*	8	0.092	11
Hanging out daily	-0.040	41	**0.094**	3	0.029	66	0.069	29
Surfing the internet daily	0.033	60	0.020	73	0.074	28	0.042	62
Going to church monthly	0.006	92	*0.122*	8	*0.172*	0	**0.166**	3
Playing computer games daily	-0.003	94	0.032	52	-0.032	49	-0.030	68

Note: Effects presented are average treatment effects for the target population (). Inference based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.8: Average effects of music vs. sports (adolescents with parents having an average labour market income above 1500 euros per month)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.031	88	0.006	96	**0.328**	1	0.297	15
Cognitive skills - Analogies	0.076	76	0.079	70	**0.314**	2	0.237	40
Cognitive skills - Figures	0.134	67	0.050	73	**0.305**	1	0.171	50
Cognitive skills - Math	-0.090	64	-0.069	63	0.182	15	0.274	19
School grades – Average	-0.107	71	-0.057	84	0.117	30	0.225	26
School grades - Maths	-0.256	17	-0.259	20	0.012	93	0.269	12
School grades - German	0.147	30	0.094	48	0.149	15	0.002	98
School grades - 1st for. lang.	-0.090	64	0.052	76	0.120	35	0.211	16
Attends upper sec. school	0.013	83	-0.020	69	0.041	51	0.029	66
Attends university at age 20	0.072	28	**0.140**	5	0.047	36	-0.024	75
Aim to enrol at university	0.061	35	0.059	27	0.102	10	0.041	56
Personality at age 17								
Big 5: Conscientiousness	-0.293	31	0.029	83	0.183	14	*0.475*	7
Big 5: Extraversion	-0.063	76	-0.180	25	0.239	11	*0.304*	9
Big 5: Neuroticism	-0.006	96	-0.019	93	0.143	32	0.150	39
Big 5: Openness	0.233	22	***0.478***	1	***0.454***	0	0.223	37
Big 5: Agreeableness	*-0.297*	10	-0.130	38	0.189	18	***0.487***	1
Willingness to take risk	-0.122	46	-0.250	11	**-0.521**	2	*-0.399*	6
Preference for the present	0.083	73	-0.114	38	**-0.271**	4	-0.353	21
Trust in other people	0.201	42	0.096	66	0.088	53	-0.111	67
Legitimate means of success	0.115	40	-0.082	36	-0.119	16	-0.235	12
Illegitimate means of success	-0.043	69	-0.112	21	-0.071	43	-0.028	83
Perceived control	-0.079	58	-0.076	32	0.034	68	0.112	40
Health and life style at age 18								
Satisfaction with health	0.094	69	-0.064	78	-0.207	28	-0.303	25
Current health situation	-0.094	25	-0.044	72	-0.115	15	-0.022	84
# of doctor visits	0.251	40	0.171	32	0.157	47	-0.092	79
Currently smoking	-0.033	61	0.013	82	0.059	71	0.092	34
Other leisure activities at age 17								
Watching TV daily	-0.030	64	-0.042	38	-0.019	78	0.011	88
Listening to music daily	-0.036	33	-0.026	45	0.013	67	0.048	21
Playing theatre weekly	-0.011	85	0.003	94	-0.006	88	0.006	92
Reading daily	0.076	15	***0.158***	1	***0.115***	0	0.040	52
Voluntary engagement weekly	-0.014	75	-0.017	61	0.024	67	0.037	49
Hanging out daily	-0.022	69	0.018	69	-0.050	24	-0.028	65
Surfing the internet daily	0.028	72	-0.059	44	0.018	77	-0.010	89
Going to church monthly	-0.031	61	0.052	34	0.090	20	*0.121*	6
Playing computer games daily	-0.063	23	-0.067	12	-0.016	75	0.047	49

Note: Effects presented are average treatment effects for the target population (.). Inference based on 499 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.3.9: Average effects of music vs. sports (target population: all adolescents)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.058	54	0.021	84	*0.181*	6	0,123	27
Cognitive skills - Analogies	0.171	11	0.109	22	0.161	16	-0.010	95
Cognitive skills - Figures	-0.001	99	0.045	64	*0.172*	8	0.173	18
Cognitive skills - Math	-0.008	93	-0.076	48	0.069	51	0.077	56
School grades – Average	0.070	37	0.055	45	0.172	3	0.101	30
School grades - Maths	-0.159	13	-0.078	30	0.101	16	0.260	4
School grades - German	0.236	1	0.142	4	0.112	11	-0.124	20
School grades - 1st for. lang.	0.135	19	0.088	18	*0.124*	18	-0.011	93
Attends upper sec. school	*0.065*	11	*0.082*	7	*0.123*	0	0.058	24
Aim to enrol at university	*0.079*	6	*0.109*	1	*0.157*	0	0.078	14
Attends university at age 20	0.029	44	0.097	3	*0.100*	1	0.071	12
Personality at age 17								
Big 5: Conscientiousness	-0.212	15	-0.109	39	0.054	56	*0.266*	10
Big 5: Extraversion	-0.099	38	-0.238	5	0.208	4	*0.307*	1
Big 5: Neuroticism	0.097	38	0.150	11	-0.075	59	-0.172	24
Big 5: Openness	*0.370*	0	0.219	20	*0.333*	0	-0.037	77
Big 5: Agreeableness	0.025	84	0.085	37	0.075	70	0.050	76
Willingness to take risk	-0.113	33	-0.234	4	-0.028	79	0.084	56
Preference for the present	-0.064	58	-0.202	4	-0.022	92	0.042	82
Trust in other people	-0.038	70	-0.117	31	0.054	73	0.092	60
Legitimate means of success	0.053	45	0.027	73	-0.060	41	-0.113	25
Illegitimate means of success	-0.015	86	-0.053	46	-0.063	41	-0.049	68
Perceived control	0.030	73	-0.058	37	0.054	49	0.023	82
Health and life style at age 18								
Satisfaction with health	-0.457	3	-0.240	23	-0.203	25	0.255	33
Current health situation	-0.081	42	-0.168	4	-0.061	45	0.020	87
# of doctor visits	0.425	33	0.452	12	0.252	28	-0.173	71
Currently smoking	-0.018	72	-0.005	91	-0.036	41	-0.017	78
Other leisure activities at age 17								
Watching TV daily	*-0.064*	6	-0.066	3	*-0.077*	2	-0.013	78
Listening to music daily	0.005	83	0.041	20	0.020	45	0.015	69
Playing theatre weekly	*-0.082*	0	-0.003	91	0.051	14	*0.133*	1
Reading daily	*0.106*	0	*0.174*	0	*0.134*	0	0.027	56
Voluntary engagement weekly	-0.030	43	0.022	46	0.052	11	*0.081*	1
Hanging out daily	0.013	69	0.043	38	0.020	55	0.007	88
Surfing the internet daily	0.088	15	-0.027	57	0.009	84	-0.078	33
Going to church monthly	-0.010	88	*0.074*	9	*0.157*	0	*0.167*	0
Playing computer games daily	-0.068	5	*-0.070*	2	-0.059	2	0.008	85

Note: Effects presented are average treatment effects for all individuals, irrespective of whether they are active or not. Inference is based on 4999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 “Worst” to 10 “Best”), current health situation (1 “Bad” to 5 “Very good”) and # of doctor visits (number).

B.4 Robustness analysis

Table B.4.1: Average effects of music vs. sports (additional requirement for being considered to play music: take music lessons outside of school)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.122	32	0.156	22	**0.262**	2	0.162	26
Cognitive skills - Analogies	0.186	15	**0.226**	2	**0.256**	2	0.089	55
Cognitive skills - Figures	0.159	18	*0.189*	9	*0.339*	0	0.198	17
Cognitive skills - Math	-0.009	94	0.001	98	0.073	52	0.100	47
School grades – Average	0.063	47	0.116	11	*0.239*	0	*0.192*	6
School grades - Maths	-0.113	23	-0.008	91	*0.254*	0	*0.371*	0
School grades - German	*0.229*	0	*0.195*	1	*0.123*	7	-0.086	39
School grades - 1st for. lang.	0.060	49	0.100	15	*0.140*	9	0.094	41
Attends upper sec. school	*0.140*	0	*0.097*	1	*0.173*	0	0.052	29
Attends university at age 20	*0.073*	10	*0.075*	8	*0.122*	0	0.056	29
Aim to enrol at university	*0.169*	0	*0.139*	0	*0.227*	0	0.071	16
Personality at age 17								
Big 5: Conscientiousness	-0.079	48	0.044	59	0.105	24	0.176	17
Big 5: Extraversion	**-0.245**	2	**-0.223**	4	0.057	53	**0.300**	2
Big 5: Neuroticism	0.081	51	**0.267**	2	0.081	32	0.001	98
Big 5: Openness	*0.392*	0	*0.401*	0	*0.392*	0	-0.001	97
Big 5: Agreeableness	0.119	28	0.125	14	*0.264*	0	0.142	33
Willingness to take risk	-0.181	11	*-0.303*	0	-0.109	25	0.063	68
Preference for the present	-0.098	37	*-0.237*	1	*-0.164*	10	-0.067	65
Trust in other people	**0.250**	5	0.005	95	**0.256**	1	0.009	94
Legitimate means of success	0.028	73	-0.040	56	-0.030	67	-0.054	56
Illegitimate means of success	0.017	86	0.037	78	-0.083	27	-0.094	54
Perceived control	*0.173*	6	0.000	98	0.094	19	-0.062	71
Health and life style at age 18								
Satisfaction with health	-0.243	14	-0.211	15	-0.091	61	0.132	59
Current health situation	*-0.131*	10	*-0.119*	8	0.032	61	*0.161*	8
# of doctor visits	0.103	69	0.297	35	-0.127	53	-0.192	46
Currently smoking	-0.071	12	-0.038	31	*-0.102*	0	-0.041	45
Other leisure activities at age 17								
Watching TV daily	**-0.096**	2	*-0.111*	1	*-0.139*	0	-0.045	37
Listening to music daily	-0.001	96	0.016	49	0.010	80	0.011	77
Playing theatre weekly	-0.036	27	0.001	95	*0.053*	9	**0.090**	2
Reading daily	**0.102**	2	*0.126*	0	*0.120*	0	0.024	65
Voluntary engagement weekly	-0.025	46	-0.009	82	*0.090*	1	**0.119**	1
Hanging out daily	-0.015	70	0.048	25	0.008	81	0.027	55
Surfing the internet daily	0.031	61	-0.009	87	0.030	57	0.004	97
Going to church monthly	0.024	60	0.049	25	*0.230*	0	*0.201*	0
Playing computer games daily	*-0.120*	0	*-0.101*	0	**-0.074**	3	0.040	59

Note: Effects presented are average treatment effects for the target population (.). Inference based on 999 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.4.2: Average effects of music vs. sports (in addition to standard definition, adolescents are considered as active if they play music or sports at least monthly)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.082	41	-0.050	60	0.209	2	0.128	26
Cognitive skills - Analogies	0.182	15	0.098	26	*0.255*	0	0.076	56
Cognitive skills - Figures	-0.003	97	0.013	90	*0.326*	0	*0.329*	1
Cognitive skills - Math	0.030	76	*-0.171*	6	-0.042	70	-0.073	60
School grades – Average	0.038	57	*0.159*	6	*0.172*	1	0.137	10
School grades - Maths	-0.110	14	-0.014	84	*0.141*	5	0.248	1
School grades - German	0.154	2	*0.218*	0	0.127	3	-0.021	79
School grades - 1st for. lang.	0.079	31	0.180	3	0.119	4	0.046	60
Attends upper sec. school	0.100	1	0.055	12	*0.146*	0	0.049	27
Attends university at age 20	0.056	16	0.077	2	*0.073*	5	0.020	71
Aim to enrol at university	*0.115*	0	*0.105*	0	*0.171*	0	0.059	18
Personality at age 17								
Big 5: Conscientiousness	-0.169	18	-0.003	98	0.091	47	0.259	4
Big 5: Extraversion	-0.223	4	-0.239	1	0.194	4	*0.417*	0
Big 5: Neuroticism	0.087	40	0.056	58	-0.098	31	-0.186	18
Big 5: Openness	*0.495*	0	*0.357*	0	*0.443*	0	-0.052	66
Big 5: Agreeableness	-0.044	69	0.096	29	0.144	15	0.188	12
Willingness to take risk	-0.100	35	-0.243	4	0.019	87	0.117	41
Preference for the present	-0.057	64	-0.168	19	-0.162	10	-0.106	39
Trust in other people	*-0.195*	10	-0.077	42	*0.169*	10	*0.364*	1
Legitimate means of success	-0.059	50	-0.010	89	-0.047	55	0.012	92
Illegitimate means of success	-0.093	21	-0.026	71	-0.003	97	0.089	44
Perceived control	0.065	44	0.017	84	0.082	26	0.017	85
Health and life style at age 18								
Satisfaction with health	-0.002	98	*-0.238*	9	-0.002	97	0.001	98
Current health situation	-0.065	58	-0.150	2	-0.015	82	0.049	65
# of doctor visits	0.403	16	0.712	40	0.387	46	-0.022	96
Currently smoking	*-0.115*	0	-0.057	10	-0.066	16	0.047	52
Other leisure activities at age 17								
Watching TV daily	-0.081	3	*-0.094*	0	*-0.074*	5	0.006	90
Listening to music daily	-0.004	89	-0.003	87	0.033	4	0.037	11
Playing theatre weekly	*0.086*	9	0.057	4	*0.091*	1	0.006	92
Reading daily	0.105	2	*0.155*	0	*0.131*	0	0.025	58
Voluntary engagement weekly	0.050	14	0.069	2	*0.147*	0	0.097	4
Hanging out daily	0.006	84	*0.109*	1	0.023	53	0.017	73
Surfing the internet daily	*-0.091*	10	*-0.164*	0	-0.065	13	0.028	66
Going to church monthly	0.068	15	0.063	14	*0.208*	0	0.140	2
Playing computer games daily	-0.057	12	*-0.096*	0	-0.049	13	0.007	87

Note: Effects presented are average treatment effects for the target population (.). Inference based on 999 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.4.3: Average effects of music vs. sports (using a different common support rule)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.100	28	0.103	27	*0.302*	0	*0.213*	6
Cognitive skills - Analogies	0.080	58	0.198	5	*0.269*	0	0.201	10
Cognitive skills - Figures	0.161	10	0.167	5	*0.345*	0	0.191	10
Cognitive skills - Math	0.029	74	-0.065	48	0.126	15	0.107	32
School grades – Average	0.058	44	*0.124*	8	*0.193*	0	*0.152*	8
School grades - Maths	-0.086	26	-0.025	72	0.175	2	*0.264*	1
School grades - German	0.171	2	*0.204*	0	0.137	4	-0.012	89
School grades - 1st for. lang.	0.068	36	*0.132*	6	0.106	26	0.055	52
Attends upper sec. school	*0.081*	6	*0.097*	1	*0.190*	0	0.123	3
Attends university at age 20	0.056	15	0.073	3	*0.128*	0	*0.078*	9
Aim to enrol at university	*0.126*	0	*0.118*	0	*0.218*	0	0.103	4
Personality at age 17								
Big 5: Conscientiousness	-0.054	53	-0.047	63	0.106	23	*0.168*	9
Big 5: Extraversion	-0.121	27	*-0.173*	7	0.114	17	0.250	5
Big 5: Neuroticism	0.014	92	0.139	14	0.032	70	0.003	97
Big 5: Openness	*0.411*	0	*0.377*	0	*0.413*	0	-0.003	96
Big 5: Agreeableness	0.022	82	0.080	38	*0.327*	0	0.319	2
Willingness to take risk	-0.114	28	*-0.236*	1	-0.151	25	-0.026	84
Preference for the present	-0.154	12	-0.139	14	-0.185	3	-0.035	79
Trust in other people	0.028	84	0.001	99	0.249	1	*0.228*	5
Legitimate means of success	0.044	57	0.045	48	-0.007	93	-0.063	48
Illegitimate means of success	0.038	80	-0.047	49	-0.098	31	-0.132	52
Perceived control	0.108	25	-0.081	22	0.042	49	-0.056	62
Health and life style at age 18								
Satisfaction with health	-0.134	37	*-0.421*	0	-0.015	89	0.128	43
Current health situation	*-0.119*	9	*-0.175*	0	-0.039	51	0.084	26
# of doctor visits	0.352	52	0.942	2	0.031	90	-0.320	60
Currently smoking	-0.040	43	-0.022	53	*-0.104*	0	-0.075	25
Other leisure activities at age 17								
Watching TV daily	-0.097	2	*-0.096*	0	*-0.122*	0	-0.028	49
Listening to music daily	0.018	47	0.026	20	0.009	80	-0.009	87
Playing theatre weekly	-0.029	34	0.011	71	0.010	85	0.043	32
Reading daily	0.082	3	*0.147*	0	*0.126*	0	0.051	21
Voluntary engagement weekly	0.019	52	0.020	50	*0.109*	0	0.091	3
Hanging out daily	0.020	57	*0.062*	6	0.008	82	-0.009	83
Surfing the internet daily	0.041	41	-0.023	63	0.027	55	-0.020	72
Going to church monthly	0.053	20	*0.073*	8	*0.197*	0	*0.148*	0
Playing computer games daily	-0.072	1	*-0.088*	0	-0.064	2	0.006	88

Note: Effects presented are average treatment effects for the target population (.).The common support quantile is now fixed to 97%. Inference based on 999 bootstrap replications (except column 2, in which p-values do not take into account that the propensity score is estimated). Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table B.4.4: Average effects of music vs. sports on missing outcomes

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Indicators: 1 if at least one outcome in the respective group is missing								
Missing cognitive skills	-0.006	88	0.037	61	-0.044	24	-0.039	38
Missing: One of the outcomes measured since 2006	-0.012	58	-0.001	97	0.026	28	0.037	21
Missing on health outcomes at age 18	0.061	11	0.026	38	0.008	79	-0.051	25
Missing on normal outcomes from survey year	-0.023	46	0.001	96	0.015	60	0.037	26

Note: Effects presented are average treatment effects for the target population (.). Inference based on 4999 bootstrap replications. Numbers in *italics* / **bold** / ***bold italics*** indicate significance at the 10% / 5% / 1% level.

Table B.4.5: Average effects of music vs. sports (using survey weights)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)		Music and sport vs. Music only (4)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
Cognitive skills and school achievement at age 17								
Cognitive skills - Average	0.169	16	0.008	93	*0.267*	0	0.100	45
Cognitive skills - Analogies	0.246	4	0.093	36	*0.292*	0	0.047	74
Cognitive skills - Figures	0.184	16	0.051	62	0.184	4	0.002	99
Cognitive skills - Math	0.020	85	-0.114	27	0.107	26	0.088	50
School grades – Average	-0.006	95	0.070	39	0.122	10	0.135	18
School grades - Maths	-0.175	19	-0.036	60	0.090	22	0.263	1
School grades - German	0.168	3	0.115	16	0.084	20	-0.072	44
School grades - 1st for. lang.	0.039	63	0.096	19	0.095	21	0.063	52
Attends upper sec. school	*0.131*	0	*0.065*	9	*0.156*	0	0.032	53
Attends university at age 20	0.023	73	0.084	1	*0.111*	0	*0.088*	7
Aim to enrol at university	0.097	4	*0.093*	0	*0.182*	0	*0.090*	7
Personality at age 17								
Big 5: Conscientiousness	-0.161	15	-0.027	77	0.107	19	0.263	3
Big 5: Extraversion	-0.219	4	-0.181	3	*0.174*	1	*0.390*	0
Big 5: Neuroticism	*0.172*	9	*0.173*	5	-0.002	96	-0.175	12
Big 5: Openness	*0.355*	0	*0.379*	0	*0.377*	0	0.023	86
Big 5: Agreeableness	0.099	43	0.094	30	*0.234*	1	0.135	32
Willingness to take risk	-0.070	54	-0.227	3	-0.019	83	0.053	70
Preference for the present	-0.048	61	*-0.263*	0	-0.208	1	-0.152	17
Trust in other people	-0.083	41	-0.013	92	0.197	2	0.283	3
Legitimate means of success	0.043	54	-0.041	55	*-0.131*	9	*-0.174*	6
Illegitimate means of success	-0.014	89	*-0.129*	9	-0.032	62	-0.020	82
Perceived control	0.035	69	0.020	80	0.073	19	0.035	72
Health and life style at age 20								
Satisfaction with health	-0.357	19	-0.140	28	0.125	48	0.481	1
Current health situation	-0.188	4	-0.093	12	0.024	76	0.214	2
# of doctor visits	0.709	58	0.238	46	-0.051	86	-0.750	22
Currently smoking	-0.046	32	-0.050	14	*-0.128*	0	*-0.083*	9
Other leisure activities at age 17								
Watching TV daily	*-0.060*	8	-0.080	1	*-0.093*	0	-0.034	43
Listening to music daily	0.017	51	*0.035*	10	0.021	39	0.005	87
Playing theatre weekly	*-0.054*	6	-0.022	50	*0.051*	8	*0.104*	1
Reading daily	*0.091*	1	*0.137*	0	*0.144*	0	0.057	22
Voluntary engagement weekly	-0.020	57	-0.006	87	*0.070*	1	*0.094*	1
Hanging out daily	0.002	94	0.072	1	0.018	55	0.017	69
Surfing the internet daily	0.045	43	-0.016	75	0.019	64	-0.027	68
Going to church monthly	0.013	76	0.052	26	*0.197*	0	*0.184*	0
Playing computer games daily	-0.074	4	-0.066	1	*-0.053*	7	0.020	64

Note: Effects presented are average treatment effects for the target population (.). Inference based on 499 bootstrap replications (except columns 1 and 4, in which p-values do not take into account that the propensity score is estimated). Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10% / 5% / 1% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Appendix C: Details on the matching estimator

Table C.1 gives the detailed matching protocol used. See Huber, Lechner, and Wunsch (2013) and Huber, Lechner, and Steinmayr (2012) for further details on the implementation and the properties of this estimator, including trimming and common support rules.

Table C.1: Matching protocol for the estimation of a counterfactual outcome and the effects

Step A-1	Choose one observation in the subsample defined by *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 $(x), \tilde{x}$. '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 maximum distance (*dist*) obtained for any comparison between a member of the reference distribution and matched comparison observations.
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. Normalise 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: $\sum_{i=1}^{N} \frac{(1-d_i) w_i \hat{y}^0(x_i)}{N_0} - \frac{d_i \hat{y}^0(x_i)}{N_1}$.
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 $E(Y^0 \mid D = 1)$.

Note: *R* is set to 150%. Gender is used as additional matching variable ($\tilde{x}$). The weight of the propensity score coming from the Mahalanobis metric is multiplied by 5. Control observations with weights larger than 5% are removed.

Table C.1 shows how to compute the average treatment effects on the treated (ATET). The average treatment effects on the non-treated (ATENT) are computed in the same way but the role of treated and controls are reversed in the algorithm. The average treatment effect (ATE) is computed by aggregating both effects using the treatment share (*ATE = ATET x P(D=1) + ATENT x P(D=0)*). These estimations are performed for each of the six subsamples separately. The weights used to aggregate these estimates over specific groups or the population are proportional to the number of treated (for the ATET) / controls (ATENT) / populations (ATE) in the respective subsamples.

See also Huber, Lechner, and Steinmayr (2012) for operational details of this estimator. The particular version of this estimator used is the RAD_MATCH Gauss package version

3.2.1. It has the feature that sampling weights may be accounted for in general. Furthermore, bootstrap inference as described in Huber, Lechner and Steinmayr (2012) is based on weights that are combination of sampling weights, matching weights as well as regression weights. The improved bootstrap smoother as proposed by Racine and MacKinnon (2007) is used to economize on the required bootstrap replications. In addition, the variable *gender* is used as additional variables in the Mahalanobis step, in which the propensity score is overweighed by a factor of 5. The distance measure is set to 150%.

Appendix D: Robustness with respect to the validity of the selection-on-observables assumption

D.1 Instrumental variable estimation

Concepts and instruments used

We need an instrumental variable (IV) as an exogenous source of variation in the choice of an extracurricular activity. This IV should induce the individual to choose music rather than sports: we use an indicator of whether either parent played a musical instrument in their youth.[21] It is a binary indicator coded to "1" if either parent declares having played a musical instrument, "0" otherwise.[22] In order to identify a causal effect, this IV must be *strong* and *valid*.

We argue that parental engagement in musical activities during their own adolescence is a *strong* IV for the child's decision to play music rather than or in addition to sports. The relevance of that variable can be justified both theoretically and empirically. Parents play an important role in choosing their children's extracurricular activities, given that they provide financial, logistic and psychological support (Gustafson and Rhodes 2006). Following a classical Becker-type reasoning (Becker 1965), the decision to enrol in music classes or a sports club is likely to be motivated by maximizing utility, both with respect to current pleasure and future investments in skills.[23] Assuming that individuals have imperfect information, personal

[21] While no age is specified for this question in the questionnaire, it is preceded by other questions concerning the period when the individual was 15 years old.

[22] This question relative to adolescent leisure activities has been asked in the SOEP Biography Questionnaire since 2001, a questionnaire that is completed by all survey participants in the year they enter the SOEP. Therefore, the instrument is only available for parents who entered the SOEP in 2001 or later. This is problematic, since it dramatically reduces our sample size. New households enter the SOEP due to the decision to increase the overall sample size of the study. The year of entry into the panel study is therefore unrelated and exogenous to our question of interest. Approximately half of our sample entered the SOEP in 2001 or later and answered the relevant question in the SOEP Biography Questionnaire.

[23] In such models of family decisions, the utility of the parent and the utility of the child are often considered to be the same.

experience is likely to influence their choice with respect to their child's leisure activity. In addition, the choice of activity is likely to depend on taste. This reinforces the relevance of our IV. Taste is shaped either by education or repeated consumption (Garboua and Montmarquette 1996, Lunn and Kelly 2009, Seaman 2006). Hence, the child is likely to share the same taste as her parents. Hille and Schupp (2015) argue that the parents' taste for the arts is a very strong predictor of their child's enrolment into music practice.

The crucial assumption for an IV to be *valid* is that it has no direct effect on the outcome. This assumption is known as exogeneity or mean exclusion restriction (Frölich 2007). The mean exclusion restriction may be invalid due to reverse causality, observable and unobservable characteristics determining the IV as well as a direct effect of the IV through a channel other than the treatment. We discuss each of these potential violations in the following.

Reverse causality can be ruled out since the IV is measured prior to the child's birth. Still, the IV – childhood musical activity of the parents – may affect the outcome due to the influence of its determinants. If education or other parental characteristics – besides providing an incentive to engage with music – influence the child's skill development, the exogeneity assumption is violated. Parental participation in artistic activities is linked to their level of education and their socio-economic environment. These characteristics are correlated with their labour-market success and thus with their child's development. We take this endogeneity into account by adding covariates (the same we use for in the selection-on-observables framework in the main part of this paper).[24]

A final source of violation of the exogeneity assumption exists, if the IV has a direct effect on the outcomes due to the effects of parental activities on parental skills. If being active in music has affected parental skill development differently than being active in sports and if

[24] We need to control for these characteristics only if they are different between sports and music or if their influence on child outcomes differ. Conversely, if the determinants of parental sports and music activities as well as their effect on child outcomes are the same, we can ignore them in our estimation. In this case, they would characterize both treated and non-treated in the same way and thereby mechanically offset each other's effect.

this has consequences on the child's skill development, our IV is no longer exogenous. Music activities might have benefited the parents' skills during childhood and youth. While personality has been found malleable during childhood (e.g. Cobb-Clark and Schurer 2012, Donnellan and Lucas 2008, Heckman and Kautz 2012, Specht, Egloff and Schmukle 2011), it is considered stable among adults (Pervin, Cervone and John 2005). We control for parental personality, which may have been affected by childhood leisure activities. Some of the advantages resulting from parental differences in past leisure activity are taken into account by controlling for education, income and labour market situation as described above.

Finally, the identification of the local average treatment effect using IV requires the assumption of monotonicity (Frölich 2007). We need to assume that no adolescent chooses to become active in sports rather than music, even though their parents were engaged in artistic activities several years before. While we cannot rule out the existence of rebellious children, we argue that, given the age at which children decide between music and sports, they are unlikely to drive our results and that the monotonicity assumption is satisfied due to our sample choice.[25]

Sample selection and descriptive statistics

The subsample for which the IV is available is roughly half the size of the original sample and somewhat different. The high-income group is overrepresented and immigrants as well as East Germans are underrepresented. Being part of the SOEP design, these differences in sample composition are exogenous to our questions of interest. We expect mean outcomes to differ from the original sample.

[25] Active adolescents are mostly less rebellious than their inactive peers. Given that our sample is restricted to individuals who engage in at least one activity or sample contains those who are more likely to follow the choices of their parents.

Results

As suggested by Frölich (2007), we estimate the LATE non-parametrically by using a propensity score to reduce dimensionality. This is necessary, given that the sample is relatively small and that we need to control for a large number of covariates. The estimation of the LATE with covariates (propensity score in our case) is equivalent to the computation of two matching estimators: the effect of the instrument on the outcome divided by the effect of the instrument on the treatment (conditional on a set of covariates). This effect concerns solely the subpopulation of compliers: individuals who react to the instrument (i.e. adolescents who play music because at least one of their parents was artistically active at the age of 16).

The results of the estimations are reported in table D.1. The first stage represents the effect of the instrument on the probability of being treated. The fact that at least one of the parents played a musical instrument during their adolescence is a good predictor of the probability that the adolescent herself is engaged in music. As stated above, the LATE is different from the ATE; therefore, the results cannot be directly compared to the main results of the paper.[26] We find that practicing music instead of sports has a detrimental effect on school grades in mathematics for the complier population (columns 1 and 2 of Table D.1.). Last, practicing music instead of doing sport competitively increases the openness of the adolescent.

[26] Moreover, the samples on which the estimations are run are different.

Table D.1: Average effects of music vs. sports (IV estimations)

	Music only vs. Sport only (1)		Music only vs. Sport (competitive) only (2)		Music and sport vs. Sport only (3)	
Outcome variables	Effect	p-value in %	Effect	p-value in %	Effect	p-value in %
First stage	*0.071*	1	*0.144*	0	*0.099*	0
Cognitive skills and school achievement						
Cognitive skills - Average	0.593	89	0.293	88	0.424	94
Cognitive skills - Analogies	-2.460	65	-1.214	60	-1.760	66
Cognitive skills - Figures	-0.962	84	-0.475	81	-0.688	85
Cognitive skills - Math	4.456	54	2.199	48	3.188	81
School grades – Average	-0.907	17	-0.448	13	-0.649	23
School grades - Maths	*-2.614*	6	-1.290	2	-1.870	18
School grades - German	-0.326	68	-0.161	63	-0.234	67
School grades - 1st for. lang.	-0.226	79	-0.112	76	-0.162	88
Attends upper sec. school	0.126	75	0.062	69	0.090	81
Attends university at age 20	-0.561	18	-0.277	11	-0.402	22
Aim to enrol at university	-0.057	86	-0.028	85	-0.041	88
Personality						
Big 5: Conscientiousness	-0.130	56	-0.064	50	-0.093	75
Big 5: Extraversion	-0.014	94	-0.007	94	-0.010	96
Big 5: Neuroticism	0.150	48	0.074	40	0.107	66
Big 5: Openness	0.297	26	*0.147*	9	0.213	27
Big 5: Agreeableness	0.213	27	0.105	18	0.152	67
Willingness to take risk	0.944	69	0.466	66	0.676	71
Preference for the present	-0.315	26	-0.156	16	-0.226	39
Trust in other people	-0.143	46	-0.071	42	-0.102	56
Legitimate means of success	-0.054	61	-0.027	54	-0.039	63
Illegitimate means of success	0.103	44	0.051	39	0.074	64
Perceived control	0.082	55	0.041	45	0.059	69
Health and life style at age 20						
Satisfaction with health	-0.429	86	-0.212	83	-0.307	87
Current health situation	-0.313	75	-0.155	72	-0.224	83
# of doctor visits	2.641	43	1.304	35	1.889	50
Currently smoking	-0.334	55	-0.165	49	-0.239	61
Other leisure activities at age 17						
Watching TV daily	-0.092	82	-0.045	79	-0.066	84
Listening to music daily	0.147	56	0.072	52	0.105	68
Playing theatre weekly	0.047	89	0.023	88	0.034	92
Reading daily	0.371	48	0.183	37	0.266	42
Voluntary engagement weekly	0.475	17	0.235	13	0.340	49
Hanging out daily	-0.023	95	-0.011	95	-0.017	96
Surfing the internet daily	0.722	43	0.356	30	0.516	77
Going to church monthly	0.572	35	0.282	23	0.409	57
Playing computer games daily	0.412	43	0.203	30	0.294	75

Note: Inference based on 399 bootstrap replications. Numbers in *italics* / bold / ***bold italics*** indicate significance at the 10%/5%/1% level. Contrary to the estimations in other tables of this paper, school grades, cognitive skills and personality are not normalised, but measured from 0 to 20 for cognitive skill, from 6 to 1 for school grades and from 0 to 1 for personality. The measurement of all other outcomes is described in Table E.1. Expectations are measured in percentage points. All other outcome variables are binary, except for some health measures as indicated.

D.2 Sensitivity test – Ichino, Mealli and Nannicini (2008)

The test relies on the simulation of a confounder, *U*, that is correlated to the outcomes and to the treatment. The sensitivity of the specification to a violation of the CIA is assessed by comparing results with the simulated confounder *U* and results without. The confounder U is binary and independent of included covariates.[27] The confounder is simulated such that its probability (p^{ij}) for taking a value of 1 varies for the four strata defined by the outcome and the treatment i.e. $p^{ij}=P(U=1/D=i, Y=j), i,j\in\{0,1\}$ (*Y* denotes the outcome variable and *D* denotes the treatment). Setting p^{ij} to 0.5 for all cases would therefore be the same as simulating a confounder *U* that does not bias the results. This probability scenario is similar to the "without the confounder *U*" scenario (scenario 1). It is used as the baseline when comparing results. To simulate a confounder *U* which p^{ij} varies with treatment and outcome, we use the correlation pattern of an important observed confounder: gender (scenario 2). In other words, the probability (p^{ij}) is similar to the probability for gender, which varies among the strata (and among the different treatments that we use). By doing so we test the sensitivity of our specification to a missing unobserved confounder that is correlated to treatment and potential outcome in the same way as gender is. We choose gender because it is the most important confounder in terms of size and significance in the p-score. Furthermore, we believe that the unobserved confounders are closely related to gender (behaviours, parents' education and preferences, for example). A third scenario is simulated in which we use the correlation pattern of another important covariate: the recommendation for upper secondary school (scenario 3). This covariate is also an important confounder which is used as a proxy for cognitive skills. We believe that the unobserved confounders might be correlated with this proxy.

Following Ichino, Mealli and Nannicini (2008) suggestion, we repeat the simulations several times and take the mean of the effects over the simulations. We draw 19 times *U* (i.e.

[27] We choose this specific framework for simplification. However, the results should hold with a continuous confounder and without covariates.

we have 19 random realisations of U for each observation) within each bootstrap replication and use 99 bootstrap replications for each scenario. Then, we compare the results between the baseline ($p^{ij} = 0.5, \ \forall i,j$) and the two biased scenario (scenario 2 and 3). The deviations from the baseline results and their significance are reported in Table D.2.1 for scenario 2 and in Table D.2.2 for scenario 3. The deviation is computed for the ATE for the target population with linear bias correction for the 4 treatments. The deviation is never significant at the 5% threshold. Our specification is not sensitive to a violation of the CIA in the tested scenario.

Table D.2.1: Average effects of music vs. sports (scenario 2: a confounder similar to gender)

	Music only vs. Sport only	Music only vs. Sport (competitive) only	Music and sport vs. Sport only	Music and sport vs. Music only
	(1)	(2)	(3)	(4)
Outcome variables	Difference to baseline	Difference to baseline	Difference to baseline	Difference to baseline
Cognitive skills and school achievement at age 17				
Cognitive skills - Average	0.007	-0.020	0.001	-0.015
Cognitive skills - Analogies	-0.028	-0.025	0.031	-0.003
Cognitive skills - Figures	0.005	0.011	-0.008	-0.017
Cognitive skills - Math	0.033	-0.027	-0.012	-0.006
School grades – Average	-0.004	0.024	0.008	-0.016
School grades - Maths	-0.012	0.002	0.014	-0.016
School grades - German	-0.001	0.038	0.005	-0.019
School grades - 1st for. lang.	0.008	0.009	0.001	-0.005
Attends upper sec. school	-0.008	-0.011	0.003	0.014
Attends university at age 20	0.003	-0.007	-0.006	0.028
Aim to enrol at university	0.001	-0.002	0.005	0.012
Personality at age 17				
Big 5: Conscientiousness	0.013	0.004	-0.034	0.012
Big 5: Extraversion	0.040	0.018	-0.041	0.085
Big 5: Neuroticism	0.007	-0.007	0.031	0.007
Big 5: Openness	-0.024	0.008	-0.012	0.081
Big 5: Agreeableness	0.015	-0.013	-0.006	-0.008
Willingness to take risk	0.035	0.002	-0.006	0.028
Preference for the present	-0.030	-0.002	0.008	0.032
Trust in other people	0.006	0.058	0.006	-0.029
Legitimate means of success	-0.006	0.009	0.022	-0.034
Illegitimate means of success	-0.016	0.033	0.008	0.008
Perceived control	-0.008	0.030	-0.023	0.039
Health and life style at age 20				
Satisfaction with health	-0.008	-0.050	0.026	0.052
Current health situation	0.017	0.015	-0.003	-0.032
# of doctor visits	0.036	0.228	0.072	0.119
Currently smoking	-0.010	0.001	0.003	0.007
Other leisure activities at age 17				
Watching TV daily	0.001	-0.005	0.001	0.010
Listening to music daily	0.005	-0.004	-0.001	-0.003
Playing theatre weekly	0.002	0.007	0.001	-0.006
Reading daily	-0.002	-0.009	-0.008	0.015
Voluntary engagement weekly	-0.010	-0.001	-0.005	-0.005
Hanging out daily	0.000	-0.006	0.010	0.003
Surfing the internet daily	-0.015	-0.010	0.022	0.011
Going to church monthly	0.002	-0.019	-0.001	-0.012
Playing computer games daily	0.004	-0.010	-0.004	0.001

Note: Difference of effects in confounding scenario to baseline scenario. For the confounding scenario, a confounder U is simulated with probabilities: P(U=1|Y=1,D=1); P(U=1|Y=0,D=1); P(U=1|Y=1,D=0); P(U=1|Y=0,D=0) according to those of the variable *gender*. Inference based on 99 bootstrap replications and 19 draws of simulated binary confounder; quantile method, smoothed version, linear bias adjustment, symmetric p-values used. None of the differences are statistically significant at the 10% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Table D.2.2: Average effects of music vs. sports (scenario 3: a confounder similar to the recommendation for upper secondary school)

	Music only vs. Sport only	Music only vs. Sport (competitive) only	Music and sport vs. Sport only	Music and sport vs. Music only
	(1)	(2)	(3)	(4)
Outcome variables	Difference to baseline	Difference to baseline	Difference to baseline	Difference to baseline
Cognitive skills and school achievement at age 17				
Cognitive skills - Average	-0.027	0.004	-0.011	0.010
Cognitive skills - Analogies	-0.033	0.002	0.001	0.005
Cognitive skills - Figures	-0.009	0.015	-0.017	-0.033
Cognitive skills - Math	-0.020	-0.007	-0.014	0.026
School grades – Average	0.002	-0.014	0.008	-0.002
School grades - Maths	0.003	-0.012	0.007	-0.006
School grades - German	0.004	-0.008	0.001	0.001
School grades - 1st for. lang.	-0.005	-0.014	0.012	0.007
Attends upper sec. school	-0.011	-0.007	-0.003	0.007
Attends university at age 20	-0.018	-0.001	-0.015	0.016
Aim to enrol at university	-0.008	-0.001	0.000	0.001
Personality at age 17				
Big 5: Conscientiousness	-0.026	0.027	-0.014	0.000
Big 5: Extraversion	0.009	-0.026	-0.020	0.092
Big 5: Neuroticism	0.032	-0.008	0.007	0.015
Big 5: Openness	0.007	-0.003	-0.030	0.028
Big 5: Agreeableness	0.034	-0.011	0.000	-0.081
Willingness to take risk	0.025	-0.048	-0.009	0.064
Preference for the present	-0.009	-0.007	0.013	0.059
Trust in other people	0.012	0.022	-0.009	-0.018
Legitimate means of success	-0.004	-0.014	0.014	-0.028
Illegitimate means of success	0.025	0.023	-0.005	-0.029
Perceived control	0.000	0.017	-0.013	0.046
Health and life style at age 20				
Satisfaction with health	0.012	-0.024	0.001	0.064
Current health situation	0.015	0.002	-0.012	-0.019
## of doctor visits	-0.062	0.010	0.003	-0.088
Currently smoking	-0.007	0.000	0.004	0.007
Other leisure activities at age 17				
Watching TV daily	-0.013	0.002	0.000	0.033
Listening to music daily	-0.004	-0.003	0.000	0.007
Playing theatre weekly	-0.004	0.005	0.007	-0.007
Reading daily	0.001	0.003	-0.011	0.003
Voluntary engagement weekly	-0.008	0.000	0.001	0.005
Hanging out daily	-0.018	0.001	0.005	0.020
Surfing the internet daily	0.000	-0.017	0.019	0.016
Going to church monthly	0.010	-0.012	0.008	-0.023
Playing computer games daily	0.006	-0.006	0.004	0.000

Note: Difference of effects in confounding scenario to baseline scenario. For the confounding scenario, a confounder U is simulated with the following probabilities: P(U=1|Y=1,D=1); P(U=1|Y=0,D=1); P(U=1|Y=1,D=0); P(U=1|Y=0,D=0) according to those of the variable *recommendation for upper secondary school*. Inference based on 99 bootstrap replications and 19 draws of simulated binary confounder; quantile method, smoothed version, linear bias adjustment, symmetric p-values used. None of the differences are statistically significant at the 10% level. The measurement of all outcomes is described in Table E.1. School grades, cognitive skills and personality are normalised. All other outcome variables are binary, except for the following: Satisfaction with health (0 "Worst" to 10 "Best"), current health situation (1 "Bad" to 5 "Very good") and # of doctor visits (number).

Appendix E: Measurement of outcome variables

Table E.1: Description of outcome variables

Outcome variables	Description
	Cognitive skills and school achievement at age 17
Cognitive skills - Average	Mean value of analogies, figures and math (see below)
Cognitive skills - Analogies	Identify word pairs (e.g. forest – tree is equivalent to meadow - ? [grass])
Cognitive skills - Figures	Identify the following symbol in a row of symbols
Cognitive skills - Math	Insert maths operators in small calculus problems
School grades – Average	Mean value of maths, German and foreign language grade (see below)
School grades - Maths	Mathematics grade in latest school report (self-reported)
School grades - German	German grade in latest school report (self-reported)
School grades - 1st for. lang.	1st foreign language grade in latest school report (self-reported)
Attends upper sec. school	The adolescent attends an upper secondary school at age 17
Aim to enroll at university	Self-reported aim (at age 17) to attend higher education
Attends university at age 20	Available for adolescents who are still part of the SOEP at age 20 (about 2/3 of full sample)
	Personality at age 17
	Big 5: Mean value of 3 or 4 items. For each, the adolescent states the degree of approval on a 7-point Likert scale. The items are: "I see myself as someone who..."
Big 5: Conscientiousness	…does a thorough job; …does things effectively; …tends to be lazy *(reversed)*
Big 5: Extraversion	…is communicative, talkative; …is outgoing, sociable; …is reserved *(reversed)*
Big 5: Neuroticism	…worries a lot; …gets nervous easily; …is relaxed, handles stress well *(reversed)*
Big 5: Openness	…is original, comes up with new ideas; …values artistic experiences; …has an active imagination; …is eager for knowledge
Big 5: Agreeableness	…is sometimes somewhat rude to others *(reversed)*; …has a forgiving nature; …is considerate and kind to others
Willingness to take risk	0 (not at all willing to take risks) … 10 (very willing to take risks)
Preference for the present	Mean value of 2 items, measured on a 7-point Likert scale: "I rather have fun today without thinking about tomorrow"; "I do without something today to be able to afford more tomorrow" *(reversed)*
Trust in other people	Mean value of 3 items, measured on a 7-point Likert scale: "In general, one can trust people"; "Nowadays one cannot trust anyone anymore" *(reversed)*; "When dealing with strangers, one should rather be vary before trusting them" *(reversed)*
Legitimate means of success	Mean value of 5 items, measured on a 4-point Likert scale: To be successful and climb the social ladder… "…one has to work hard and make an effort"; "…one has to be talented and intelligent"; "…one has to have special knowledge in ones area of expertise"; "…one has to have a good school degree"; "…one has to be dynamic and take initiatives"
Illegitimate means of success	Mean value of 7 items, measured on a 4-point Likert scale: To be successful and climb the social ladder… "…one has to exploit others"; "…one has to stem from the right family"; "…one has to have money and wealth"; "…one has to be inconsiderate and tough"; "…one has to know the right people"; "…one has to get involved with politics on the right side"; "…one has to have the right gender"
Perceived control	Mean value of 7 items, measured on a 7-point Likert scale: "How my life goes, depends on myself"; "Compared to others, I have not achieved what I deserved" *(reversed)*; "What one achieves is mainly a question of luck and fate" *(reversed)*; "I often have the experience that others make decisions regarding my life" *(reversed)*; "When I encounter difficulties I have doubts about my abilities" *(reversed)*; "Opportunities in life are determined by social conditions" *(reversed)*; "I have little control over the things that happen in my life" *(reversed)*

Note: Table E.1 to be continued.

Table E.1 (continued)

Outcome variables	Description
	Health and life style at age 20
Satisfaction with health	0 (not at all satisfied) … 10 (very satisfied)
Current health situation	1 “bad” 2 “less good” 3 “satisfactory” 4 “good” 5 “very good”
# of doctor visits	In the last 3 months
Currently smoking	Yes/no
	Other leisure activities at age 17
Watching TV daily	Yes/no
Listening to music daily	Yes/no
Playing theatre weekly	Yes/no
Reading daily	Yes/no
Voluntary engagement weekly	Yes/no
Hanging out daily	Yes/no
Surfing the internet daily	Yes/no
Going to church monthly	Yes/no
Playing computer games daily	Yes/no