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How learning a musical instrument affects the development of skills

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ABSTRACT

Despite numerous studies on skill development, we know little about the effects of extracurricular music activities on cognitive and non-cognitive skills. This study examines how music training during childhood and youth affects the development of cognitive skills, school grades, personality, time use and ambition using data from the German Socio-Economic Panel (SOEP). Our findings suggest that adolescents with music training have better school grades, are more conscientious, open and ambitious. These effects are stronger among adolescents from lower socio-economic status. In order to address the non-random selection into playing music, we take into account detailed information on the child and its parents, which may determine both the decision to pursue music lessons and educational outcomes. While lacking truly exogenous variations in music activities, our results are robust to a large range of sensitivity tests. We thereby approach causality better than previous observational studies.

1. Introduction

Publicly subsidized projects offering extracurricular music lessons are increasingly popular among policy makers. Having originated in Venezuela with the famous *El Sistema* (FMSB, 2013), such projects exist in many countries today. In Germany, the Federal Ministry of Education has launched *Kultur macht stark* (culture makes you strong), a new initiative in 2013 with 50 million euros of funding per year (BMBF, 2012). On the regional level, the government of North Rhine-Westphalia provides annual support to the project *Jedem Kind ein Instrument* (an instrument for every child) in the amount of 10 million euros (JeKi, 2014). As stated in their official descriptions, these projects aim to improve educational opportunities, in particular for disadvantaged children and youth (e.g. BMBF, 2013).

The aim of reducing inequalities in educational opportunity through social policies promoting music education implicitly relies on the assumption that music fosters the development of cognitive and non-cognitive skills. The importance of these skills for educational and labor market success has been widely recognized (e.g. Almlund, Duckworth, Heckman, & Kautz, 2011; Heckman & Kautz, 2012; Heckman, Stixrud, & Urzua, 2006; Heineck & Anger, 2010). According to findings on the "technology of skill formation", skills developed at younger ages promote later skill attainment (Cunha & Heckman, 2007; Cunha, Heckman, & Schennach, 2010). In particular, the productivity of investments in subsequent stages increases as a result of previously acquired skills. Moreover, sociologists highlight that cultural capital – the familiarity with the codes and modes of conduct of particular social environments – influences success in education

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and the labor market (Bourdieu & Passeron, 1990; Lareau, 2011; Lareau & Weininger, 2003) and works as a mechanism for the reproduction of social inequality.

Numerous studies argue that music affects a variety of indicators of skill development (Winner, Goldstein, & Vincent-Lancrin, 2013). They argue that music induces brain reactions that stimulate the development of cognitive skills (Schellenberg, 2011). Moreover, both cognitive skills and school grades may be improved through the influence of music on personality traits such as conscientiousness, openness, and perceived control (Schumacher, 2009). A positive effect on the latter may also lead the musically trained to be more ambitious. Lareau (2011) highlights the fact that music practice, similar to other extracurricular activities, enhances educational success by sending positive signals to school teachers and by fostering children's acquisition of some elements of cultural capital. In addition, playing in an orchestra or a band can promote the development of social skills as well as the sense of belonging to a group. Finally, extracurricular activities consume time, which is then no longer available for other potentially beneficial or harmful activities (Felfe, Lechner, & Steinmayr, 2011). Of course, leisure time occupations other than music can influence some of these outcomes similarly or even more effectively. Part of the challenge is to distinguish their differential effect.

The assumed positive effects of music, which even motivate social policy-makers, stand in contrast to a lack of causal research on this topic. Observational studies face the difficulty that the decision to learn a musical instrument is not made randomly. Causal studies must distinguish the effect of music from outcome differences related to observed and unobserved background characteristics. So far, only a small number of experimental studies are able to identify true causal effects. For example, Schellenberg (2004) finds that music lessons enhance general intelligence of children, but do not affect their social skills. This finding has been confirmed in further experimental studies for children (Bilhartz, Bruhn, & Olson, 1999; Nering, 2002; Neville, 2008), but not for adults (Bialystok & DePape, 2009; Schellenberg & Moreno, 2010).[1] However, as these studies are experimental, they focus on short-term music training within non-representative samples of voluntary participants. While many claim that music also benefits the development of non-cognitive skills, no study has yet proven that this is the case (Winner et al., 2013). To our knowledge, music as an extracurricular activity has not been studied by economists so far.

This paper examines how learning a musical instrument during childhood and adolescence affects the development of cognitive and non-cognitive skills using data from the German Socio-Economic Panel (SOEP). We investigate the effect of long-term exposure to music by restricting the treatment group to those who play music at age 17, have started to do so at age 8 or before, and have received music lesson outside of school. Outcomes are measured at age 17 and include cognitive skills, school grades, personality traits (Big Five and perceived control), time use, ambition and optimism about future success.

We address the non-random selection into music practice by controlling for a large number of individual and parental background characteristics. These are likely to influence the decision to engage with music, the constraints related to such a decision, as well as the willingness to carry on playing music until age 17. In particular, we control for parental income and education, household composition, the parents' personality and school involvement as well as the parents' taste for the arts. Moreover, we control for the adolescent's recommended and realized choice of upper secondary school track, as well as the predicted probability to give up music before age 17. We take these variables into account using propensity score matching.

Our findings suggest that learning a musical instrument during childhood and adolescence is associated with school grades which are one sixth of a standard deviation above those of musically inactive adolescents. Moreover, young adults with music training are more conscientious, open and ambitious. Outcome differences in school grades and personality are much stronger among adolescents from families with lower cultural capital. The effects of music are larger than those of playing sports, an activity which has been found an important input for skill development (Barron, Ewing, & Waddell, 2000; Felfe et al., 2011; Pfeifer & Cornelissen, 2010; Stevenson, 2010). The causal interpretation of our findings depends on the conditional independence assumption. We discuss the plausibility of this assumption and conclude that the outcome differences we find are probably not entirely due to unobservable characteristics or reverse causality.

Our contributions to the literature can be summarized as follows. First, our study approaches causality better than previous observational studies on the effects of music. While we cannot entirely exclude the possibility that unobserved confounders drive our results, we account for more background characteristics than others have before. Moreover, sensitivity tests suggest that our results are robust to reverse causality. Second, we use a random sample of German adolescents to investigate our research question. This makes our results more generalizable than the experimental work which has been carried out mainly by psychologists. In particular, we are the first to use the SOEP to study this question, which contains parental background information even from when the adolescent was still a child. Third, our study examines the effects of music on a broader range of outcomes than previous studies have looked at. In addition to cognitive skills, we observe school grades, personality, time use and ambition. Fourth, contrary to previous observational and experimental studies in this field, we examine the effects of long-term exposure to music. We investigate the development of skills among adolescents who play music at age 17, have started to do so at age 8 or before and have taken instrumental music lessons. Our data allow us to construct alternative treatment definitions, to which our results are

[1] In addition, numerous studies in the fields of psychology and music education detect positive correlations between playing music and cognitive skill development. They find that music practice or training is associated with a higher IQ (Vaughn & Winner, 2000), an enhanced reading ability (Besson, Schon, Moreno, Santos, & Magne, 2007; Loui, Kroog, Zuk, Winner, & Schlaug, 2011), increased attention (Shahin, Roberts, Chau, Trainor, & Miller, 2008) and a better memory (Ho, Cheung, & Chan, 2003). Some of these relations remain after holding basic socio-demographic background characteristics constant (Schellenberg, 2006; Southgate & Roscigno, 2009). Still, most studies do not accurately address the issue of non-random selection into playing music and therefore detect correlations rather than causality (Winner et al., 2013).