Economics of Education Review 49 (2015) 110–128

Contents lists available at ScienceDirect

Economics of Education Review

journal homepage: www.elsevier.com/locate/econedurev

The impact of classroom peers in a streaming system☆

Arna Vardardottir*

Department of Economics, Copenhagen Business School, Frederiksberg 2000, Denmark

ARTICLE INFO

Article history:
Received 1 November 2014
Revised 15 September 2015
Accepted 15 September 2015
Available online 28 September 2015

JEL Classification:
I21
I24
I28

Keywords:
Education
Peer effects
Ability streaming

ABSTRACT

This paper investigates educational production with a focus on the influence that socio-economic status of class peers has on academic outcomes of students in a streaming system. Employing the Swiss subsample of the PISA data, I provide evidence that while classroom assignment is not random within schools or tracks it is random within tracks-by-schools. Track-by-school fixed effects therefore render peer group composition conditionally uncorrelated with students' characteristics, while track fixed effects and school fixed effects don't. Estimates based on track fixed-effects and school fixed-effects approaches are reduced sizably by employing a track-by-school fixed-effects approach while mean effects on test results in mathematics and problem solving remain significant.

1. Introduction

In 1967, Martin Luther King Jr. wrote that "the job of the school is to teach so well that family background is no longer an issue." However, it may not only be students' own socio-economic status that affects academic achievements, but also the socio-economic status of peers. Students of similar background tend to flock together; therefore, students of high quality will have peers of high quality and vice versa, which further exacerbates the importance of one's own socio-economic status for academic performance. King's remark reveals high expectations for the educational system that have not been reached yet, 48 years later. Policy changes that alleviate the importance of one's socio-economic status for academic achievement require a better understanding of how social interactions enter the education production.

In this paper, I exploit the educational setup of Switzerland to extract causal estimates of the impact of classroom peers on educational achievement. The extensive stratification of students creates an ideal setting for studying the role of peers in the educational production, because I can employ track-by-school fixed effects to capture all variation in students' backgrounds. The system features early streaming[1] of students into different types of education.[2] As will be discussed in detail, students are essentially randomly assigned to classes within tracks (types of education) in schools, although generally not within tracks or schools. Employing

☆ This paper was partially accomplished during my visiting years at UC Berkeley. I owe special thanks to David Card, Anna Godøy, Magnus Johannesson, Juanna Schrøter Joensen, Erik Ø. Sørensen, Andreas Steinhauer, Petra Maria Thiemann, Simon Wehrmüller, and Michael Zibrowius for valuable comments.

* Tel.: +45 9394399.
E-mail address: ava.eco@cbs.dk, arnavardar@gmail.com

http://dx.doi.org/10.1016/j.econedurev.2015.09.002
0272-7757/

[1] Streaming refers to separation of pupils by academic ability into groups for all subjects or certain classes and curriculum within a school or into different schools.

[2] In fact, the Swiss system is characterized by three major phases and the transition from each of them corresponds to a streaming point. The first streaming coincides with the transition from primary to lower secondary school. The second one occurs when compulsory schooling ends, i.e., between lower and upper secondary education. The final streaming corresponds to the transition from upper secondary to tertiary education or the labor market.

track-by-school fixed effects in the Swiss context therefore allows me to obtain credible estimates of the impact of classroom peers on educational outcomes.

Findings on the importance of social interactions between classmates vary widely across studies, and no general consensus exists concerning the magnitude and nature of these effects. Extracting consistent policy implications is therefore hard, and peer effects are a prominent argument whenever these policies are discussed. The debate concerns how schooling interventions affect both aggregate achievement and its distribution. Interventions such as streaming do not affect aggregate achievement if peers enter linearly in the educational production function, but it does if non-linear effects exist. However, even though schooling interventions such as streaming or segregation do not affect aggregate achievement, they can affect the equality of opportunities. If peers enter the education production function in a linear way, streaming will help some students but harm others.

From a public policy perspective, an accurate understanding of how peers affect one another is therefore important, irrespective of the functional form. This also further explains the interest social interactions between classmates have received in the literature on education production and the high value policy makers put on reliable measures of spillover effects.

I measure the quality of peers by their socio-economic status and focus on peer effects in lower-secondary school (students in 9th grade). In addition to focusing on the magnitude and direction of peers' influence, I also investigate whether it is symmetric or asymmetric, how certain subgroups are affected, and whether social heterogeneity affects students' educational outcomes. Furthermore, this study is one of the few to employ quantile regression methods to estimate peer effects in education (I am only aware of Levin, 2001; Schneeweis & Winter-Ebmer, 2007; Rangvid, 2007). The advantage of using this method is that it allows me to estimate differing effects over the entire PISA test score distribution, which is essential when assessing the effects of streaming and other schooling interventions on the aggregate achievement and its distribution. Finally, because I have data on students' performance in four different subjects, I am able to analyze differences between these subjects.

This paper complements the existing literature in two ways. First, my results show that students' school and track choices cannot satisfyingly describe the self-selection process in a streaming system. However, within tracks in schools, students are essentially randomly assigned to classes, and track-by-school fixed effects can be used to capture the effects of peers in such a system.

Second, in addition to the typical subjects studied within the peer effects literature, my data set includes results for problem solving, an outcome variable that the literature on peer effects in educational production has not investigated. I can therefore assess whether something in particular makes peer effects work differently in subjects such as problem solving, which strains one's "capacity to use cognitive processes to confront and resolve real, cross-disciplinary situations where the solution path is not immediately obvious and where the literacy domains or curricular areas that might be applicable are not within a single domain of mathematics, science or reading" (OECD, 2003, pp. 171–176). Peer effects might work differently in problem solving than in other subjects if students' interactions with clever peers enables them to correct their misconceptions or lack of understanding, make connections between new information and prior knowledge, and thereby foster constructive problem-solving skills and other forms of higher-level thinking.

My results from the track-by-school fixed effects in math and problem solving are significant, although I cannot reject the null hypothesis of no peer effects in reading and science. Furthermore, I find that heterogeneity among class peers has a positive and significant effect on math results, whereas this effect is not significant in other subjects. Using a track-fixed-effects method or a school-fixed-effects method generates sizable upward bias.

The remainder of the paper unfolds as follows. In the next section, I describe the data set and the institutional background. I cover the empirical approach in Section 3 and discuss the identification problems associated with capturing peer effects and how the literature has addressed this issue. Section 4 reports the main results and Section 5 presents concluding remarks.

2. Data and institutional setup

2.1. The Swiss education system

The Swiss education system (shown diagrammatically in Fig. 1) is characterized by federalism and decentralization. Each of the 26 cantons that form the country is responsible for the education of children within its jurisdiction and basically has its own education system, organized with substantial autonomy.

Compulsory education is nine years and admission age throughout the country is six. This level is divided into two phases: primary school and lower secondary school, but their structures are not uniform between cantons. Students are not tracked during their first years of mandatory schooling; streaming first occurs during the transition from primary to lower secondary school, which happens after four to six years, depending on the canton. Also depending on the canton, the lower secondary level has between one and four tracks, whereas the most common setup is composed of three tracks: pre-gymnasial, extended requirements, and basic requirements. Teachers are responsible for the selection of students into tracks; that is, based on the performance of students, they propose a track type they consider suitable for them.

After compulsory schooling, children enter upper secondary school where their options are already dependent on the previous type of education received. The upper secondary education is divided into three different types of schools: the matura schools, where students receive the matura degree,[3] which gives them direct access to all universities; specialized middle schools, which do not give direct access to universities but rather prepare pupils for higher vocational education (universities of applied sciences); and vocational education and training (apprenticeship). After completing

[3] Sitting for the final matura examination and getting the certification at any age is possible without attending a school. Private courses exist for supporting students in their preparation.