Teacher Quality and Within-Family Spillovers in Academic Achievement

Javaeria A. Qureshi[1]
University of Illinois at Chicago

Several studies have estimated the intergenerational spillover effects of education on a range of child outcomes e.g. birth outcomes (Currie and Moretti, 2003), education (Black, Devereux, and Salvanes, 2005; Oreopoulos et. al, 2006), and test scores (Rosenzweig and Wolpin, 1994) among others. Yet there is little research on intra-household education spillovers other than those flowing from parents' education to children's outcomes. This study attempts to fill this gap in the literature by investigating how children are affected by the learning of their older siblings. I utilize variation in the older sibling's teacher quality to estimate spillover effects on learning of children in the U.S.

Apart from the studies analyzing impact of parents' education on children outcomes, the literature on intra-household spillovers is scant. Kuziemko (2011) documents positive and negative spillovers on parents resulting from shocks to their children's human capital in the U.S. In Qureshi (2012), I find evidence for significant beneficial effects of increasing older sister's schooling on the schooling, enrollment, literacy and numeracy of younger brothers in rural Pakistan. The underlying mechanisms for how older siblings might affect younger siblings are likely to be different in rural Pakistan versus the U.S. My study in Pakistan looked at the impact of oldest sister's years of schooling whereas this paper explores the spillover effects from increased learning of older sisters and older brothers. The positive spillovers from older sister's schooling in Pakistan were closely tied to the role of the older sister as a childcare provider, and the fact that she is the most important source of help with studies. Since such gendered division of household responsibilities is much less pronounced in the U.S., this study analyzes the potential impacts of older sisters and older brothers. I will investigate whether there are heterogeneous treatment effects by gender of the older sibling and if there are meaningful differences in the spillovers for same- versus opposite-gender sibling pairs.

This paper investigates the potential spillover effects of increased learning of older siblings as measured by their test score performance. Having an older sibling with higher human capital can affect the younger siblings' learning outcomes through several possible channels. An older sibling with higher human capital can potentially provide his/her younger siblings help with studies and homework and the quality of that help might presumably be better as well. There could also be role model effects through increased motivation, gains in information, and reduction in psychic costs for the younger sibling. An older sibling performing better in school might lead to a potential reduction in time spent interacting with the younger sibling (suppose the older sibling engages in a different set of after-school activities or decides to spend more time studying by himself/herself), a reallocation of household production among siblings, and a behavioral response on part of the parents which may impact the learning of younger siblings adversely. If parents invest efficiently rather than equitably across children, they might increase relative investments in the older child

[1] Contact: javaeria@uic.edu. The author is an Assistant Professor in the Economics department at the University of Illinois at Chicago. This project is funded by a research grant from the Spencer Foundation. Mailing address: 601 S. Morgan Street, UH 716, Chicago, IL 60607.

who is performing well at the expense of allocations for the younger child[2]. If the improved performance of the older child leads to parents increasing investments that are public goods, the younger child would also benefit from these. Given the multiple channels through which the older sibling's learning can impact younger siblings, the net impact is unclear and must be empirically determined.

Since many siblings share the same set of parents, have a similar type of upbringing and attend the same schools, their outcomes are strongly correlated due to these factors. In order to credibly estimate the causal spillover effects of older sibling human capital on younger sibling outcomes that is free of these confounding influences, I need a plausibly exogenous source of variation in the older siblings' learning. This paper utilizes the quality of the teacher the older sibling is assigned as an instrument for the older sibling's learning in that year and uses this source of variation to identify the spillover effects on younger siblings. I will use administrative public school records on North Carolina students between grades 3 and 8 to estimate teacher value-added (VA) estimates to measure variation in teacher quality. Previous estimates of teacher value-added have shown that being assigned a relatively effective teacher raises a student's test scores considerably – a 1 standard deviation (SD) improvement in teacher VA raises normalized test scores by approximately 0.14 SD in math and 0.1 SD in English[3].

This study will use the value-added of the teacher assigned to the older sibling in a year as an exogenous shock to the older sibling's human capital or test score in that year. I will then use that to analyze spillover effects on younger siblings' test scores. Sorting of students into classrooms represents a potential threat to this identification strategy. To account for student sorting into classrooms and teacher effectiveness, I will compare the outcomes of students whose older siblings were assigned to teachers with different VA, controlling for a rich set of student characteristics such as prior test scores and demographic variables. This approach follows that used by Chetty, Friedman, and Rockoff (2014) to estimate the effect of teacher value-added on students' long term outcomes of college attendance and labor market earnings. My preliminary results show that an improvement of older sibling's test scores leads to a statistically significant, positive effect on younger siblings' math and reading scores. The spillover effects for reading are larger than the spillover effects for math. I will also test whether the results are heterogeneous by age, sibling age gap, family size and by gender as discussed earlier.

If this project finds beneficial spillovers from the older sibling's learning on younger sibling outcomes, these findings would suggest a significant role of schools in reinforcing social inequalities. If poor, disadvantaged children are taught by relatively ineffective teachers, not only does that adversely affect their life outcomes but it may also depress the human capital accumulation of their younger siblings. This may contribute to a poverty trap where investments in poor children are low because they have low human capital parents and low human capital older siblings. This also suggests that the potential for remediation through public schools, if effectively tapped, is immense because we can positively impact students directly and have important beneficial externalities on the students' younger siblings. This study attempts to improve our

[2] This is similar to the parental investment response that favors the more able child in the Becker and Tomes framework.

[3] Chetty, Friedman, and Rockoff (2014)

understanding of the inputs into human capital production and how family context interacts with schooling to create learning.

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