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The effect of school entrance age on educational outcomes: Evidence using multiple cutoff dates and exact date of birth

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ABSTRACT

Using Israeli data, we estimate the effect of school entrance age (SEA) on student outcomes. Unlike much of the recent literature, our unique identification strategy separates the SEA effect from date of birth effects. We find that delaying school entry by one year increases fifth grade test scores in Hebrew by 0.29 standard deviations and in math by 0.16. Interestingly, while the advantage in Hebrew decreases in eighth grade, in math it almost doubles. We show that although the bias induced by failing to control for date of birth effects is generally rather small, in some cases it is quite notable. This bias could have mistakenly led us to conclude that the SEA effect on math test scores slightly decreases from fifth to eighth grade while it actually substantially increases.

1. Introduction

At what age should children start school? This is a question that has long perplexed not only parents but policymakers and researchers as well. Indeed, child development researchers have argued that children's social, emotional, intellectual and physical maturity levels are important factors of school success. This view has led several states in the US to move their entry cutoff date to earlier in the school year, thereby raising the kindergarten entrance age (Bedard and Dhuey 2006; Elder and Lubotsky 2009; Stipek 2002). It has also induced more and more parents to voluntarily postpone their child's entry into school to the following year (McEwan and Shapiro 2008; Stipek 2002; Graue and DiPerna 2000; Paul 2010). However, as the decision to postpone school entrance involves large economic costs of childcare, delaying entry to the labor market, and lower educational attainment, it is justified only if it leads to better educational outcomes. Therefore, a vast literature has investigated the causal effect of entrance age on educational and economic outcomes.[1]

Previous studies that examined the effects of school entrance age (SEA) generally acknowledged that this variable is endogenous due to three main reasons. First, parents do not strictly follow the school entry rule and their choice of whether

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[1] Overall, the results have been quite mixed. On the one hand, Angrist and Krueger (1991) show that a higher school entrance age leads to lower educational attainment and Black et al. (2011) provide evidence that starting school older leads to lower earnings. On the other hand, many studies find that children who enter school at an older age outperform their younger peers, at least in the lower grades (Bedard and Dhuey 2006, Datar 2006, McEwan and Shapiro 2008, Elder and Lubotsky 2009, Dhuey et al. 2017). Another related issue concerns the persistence of the SEA effect. While Bedard and Dhuey (2006) and Fredriksson and Öckert (2014) show that the school entrance age effect is long-lasting and significant, Elder and Lubotsky (2009) demonstrate that it dissipates as early as the first grades of elementary school. For a more comprehensive review of this literature see Pena (2017).

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to delay or expedite school entry is determined based on the characteristics of the child. For example, if the child is talented and emotionally and intellectually mature, a parent will tend to expedite his entrance to school although his date of birth is after the entrance cutoff. On the other hand, if there are developmental problems school entry might be postponed, although his date of birth is before the cutoff. Second, in some countries, grade retention of underperforming students is quite common. Third, variation in entrance age stems also from variation in dates of birth throughout the calendar year, and the choice of date of birth is commonly correlated with unobserved characteristics of the parents.[2]

To control for the endogenous parental choice regarding the timing of school entry, most studies used a quasi-experimental approach that instruments actual entrance age with the "assigned" age at which the child could first legally enter school (Bedard and Dhuey 2006; Black et al., 2011; Datar 2006; Elder and Lubotsky 2009, among many others).[3,4] However, this approach has been criticized because the instrument violates the monotonicity assumption required for interpreting the estimates as the local average treatment effect (Aliprantis 2012; Barua and Lang 2016; Fiorini and Stevens 2014).[5] In addition, it does not address the concern that dates of birth are non-random and are likely to be correlated with student outcomes. In fact, Cascio and Lewis (2006) show that the season of birth has a direct effect on test scores and thus argue that controlling for detailed date of birth in a model of test scores might be not only appropriate but also important for drawing conclusions.

In order to address these issues, some studies exploited a regression discontinuity approach that concentrates on children born around school entrance cutoff dates (McEwan and Shapiro 2008; Black et al., 2011; Crawford et al., 2014; Pena 2017). However, this too may be problematic. First, it has been shown that birthdates may be nonrandom even within a narrow interval around entrance cutoff points because parents may purposely shift their child's date of birth from one side of the entrance cutoff date to the other in order to influence their children's school entrance age (Shigeoka 2015; Kim 2018; Pena 2017).[6] Importantly, such shifts may invalidate the regression discontinuity approach even if they are made for any other institutional motivation and without any intention of influencing their children's school entrance age. For example, Dickert-Conlin and Chandra (1999) show that the probability that a child is born in the last week of December rather than the first week of January is positively correlated with tax benefits, as parents giving birth to children in December receive tax credit points for the full calendar year. This causes the timing of births not to be uniformly distributed over the two-week period surrounding the end of the year, which may invalidate the regression discontinuity approach if the school entrance cutoff coincidentally falls at the end of the year. Second, only if the functional form of the trend in date of birth is correctly specified would this strategy capture the effect of entrance age at the discontinuity. Third, due to data limitations, several of these studies were not able to include any trend in date of birth (Black et al., 2011; Elder and Lubotsky 2009) and in this case, as shown by Fiorini and Stevens (2014), monotonicity significantly fails to hold even in a regression discontinuity framework.

The previous school entrance rule in Israel (which was in effect until 2015) provides a rare opportunity to estimate the effect of entrance age on outcomes while separating it from date of birth effects. This rule determines that the school entry cutoff date is always on the same Jewish calendar date – the first day of the fourth Jewish month of "Tevet." Thus, since the Jewish lunar year is about eleven days shorter than the solar cycle, in different years this same Jewish cutoff date is mechanically converted into different Gregorian cutoff dates, that are spread throughout December. As a result, children born on the same date of the year and who are also educated in the same country have a different school entrance age for a reason unrelated to their educational strength: They simply face a different entrance cutoff date, which implies that some of them are situated before the relevant cutoff and are allowed to enter school in the current year, while others are situated after it and have to wait until the following year.

This unique setting allows us to exploit a novel identification strategy that relies on variation in cutoff dates across years while holding the date of birth constant.[7] Accordingly, to examine whether school entrance age affects student outcomes,

[2] Bound and Jaeger (2000) provide extensive evidence that the season of birth is correlated with family background, education and earnings, and Buckles and Hungerman (2013) document that women who give birth in the winter are younger, less educated, and less likely to be married. McEwan and Shapiro (2008) show that scheduled births cause the frequency of birthdate distribution to decline during weekends and that mothers of Sunday births have 0.18 less years of schooling relative to Monday births. Using our dataset, Appendix A provides similar evidence from Israel on the non-randomness of dates of birth.

[3] Alternatively, one can instrument actual entrance age with a dummy variable indicating whether the child's date of birth is before or after the school entrance cutoff.

[4] Another interesting approach was to concentrate on educational systems where delaying school entry and repeating grades are not permitted and thus school entry age is likely to be exogenous (Kawaguchi, 2011).

[5] This violation derives from the fact that for compliers (counterfactually) shifting a child's date of birth after the cutoff increases the school entrance age, while for non-compliers it reduces it. Consequently, the instrumental variable indicating whether the child's date of birth is before or after the entrance cutoff is not monotonically related to the actual school entrance age.

[6] To illustrate, in a recent article in the New Yorker (http://www.newyorker.com/tech/elements/youngest-kid-smartest-kid - last accessed 22.5.16) a Harvard sociologist who when expecting her first child was concerned that her due date was too close to January 1st, an age cutoff for school entrance, argued that she was determined "to keep him in" until after January first in order that he be the oldest in his class and not the youngest.

[7] Since our identification strategy keeps the date of birth constant, it also has the advantage that it strictly satisfies monotonicity. To show this, if we counterfactually shift the location of a child from before the cutoff point to after it while holding the date of birth constant, for compliers such a shift would increase the child's school entrance age by exactly one year while for never-takers and always-takers it would not have any effect on the school entrance age. Thus, under the reasonable assumption that there are no defiers, the instrumental variable indicating whether a child's date of birth is before or after the entrance cutoff is monotonically related to the actual school entrance age.