FRBSF ECONOMIC LETTER

Number 2008-24, August 8, 2008

How and Why Does Age at Kindergarten Entry Matter?

Those who have spent time in a kindergarten classroom know that there are remarkable differences in children's skills. Research has shown that these skill differences are strongly tied to age, with students who enter kindergarten later in life doing better than younger entrants. Moreover, an "entry-age achievement gap" (hereafter, the EAAG) has been found to persist until as late as the eighth or ninth grade (see, for example, Bedard and Dhuey 2006).

Does this finding imply that parents or policymakers should push children to start kindergarten at a later age? The answer depends in part on what is driving the EAAG. In this *Economic Letter*, I describe possible interpretations of the EAAG, along with their implications, and discuss new empirical research attempting to establish their relative importance.

Three interpretations of the entry-age achievement gap

There are three broad, and not mutually exclusive, interpretations of the EAAG. The first is "relative age"—that is, older kindergartners stand to gain over the long term because they are temporarily bigger and smarter *in relation* to their classmates. This can matter for school achievement because elementary school children are sorted into reading and other curricular groups on the basis of achievement, which, as mentioned above, is strongly correlated with age at this point in the life cycle. Placement in the top group can be self-reinforcing, since top groups may tackle more advanced material and move more quickly through a given curriculum. At the same time, older school entrants might become relatively more motivated for school or self-confident because of their relative standing in the class. Anecdotally, this concern has created an unsustainable race in some communities to secure one's own child the position at the top of the class, with "kindergartners pushing [age] seven" (Gootman 2006).

Importantly, in each case, the result is "zero-sum": when older students gain, younger students lose, becoming less engaged with school, being placed in lower reading groups, etc. Therefore, a policy intervention that moves the date by which starting kindergartners should be aged five from December 2 (as is currently the regulation in California) to September 1 would affect who is at the top of the class and who is at the bottom, but not academic outcomes on average.

The second interpretation, "age at entry," is that older school entrants outperform younger school entrants because they are better equipped to succeed in school. While this interpretation of the EAAG might seem quite similar to the relative age interpretation, it differs in a very important way: Here, it is no longer the case that older students gain at the expense of younger students; rather, older students gain without affecting younger students at all. This suggests that increasing the minimum age at school entry may indeed raise academic outcomes of a cohort on average by promoting the achievement of students who would have otherwise started one year younger. Parents might also be able to improve a child's achievement by holding him back, giving him an extra year of preparation for kindergarten through more preschool and other enriching activities. However, any given child's achievement will not be compromised by other parents making the same choice.

The third interpretation, "age at test," is that age at school entry has no impact on achievement per se, but is correlated with cognitive development and the stock of skills that a child has accumulated outside of school. At any point after kindergarten entry, older children have lived longer and experienced more—had more books read to them by parents, taken more trips to the museum or the zoo, and potentially spent more time in preschool—than younger children who started kindergarten with them. The additional life experience of older students will eventually be minuscule compared to the stock of skills accumulated by their younger counterparts. If "age at test" is driving the EAAG, concern over age at school entry must rest on different grounds.

A new generation of research

Most empirical research on the EAAG has estimated the net effect of being older at school entry and has thus failed to separate out the individual contributions of relative age, age at school entry, and age at test to achievement. The difficulty has arisen because of a lack of data as well as a lack of independent variation in the three variables. For example, it is only possible to estimate the effect of age at school entry separately from that of age at test (holding time spent in school constant) if children who entered school at the same age were tested at different ages in the same grade, or vice versa, which is generally not the case. The survey data that form the backbone of this literature also generally lack information on respondents' peer groups, making it impossible to establish a child's age relative to his peers.

In recent research, Cascio and Schanzenbach (2007) (hereafter CS) attempt to address the second of these challenges using data from a social experiment called Project STAR (Student-Teacher Achievement Ratio), the original purpose of which was to estimate the effects of class size on achievement (Schanzenbach 2007). In the fall of 1985, approximately 6,000 kindergartners and 330 teachers in 79 Tennessee schools were assigned by lottery to one of three types of classes—small (with target enrollment of 13–17 students), regular (with target enrollment of 22–25 students), and regular with a full-time teacher's aide. Data from the study are available on the classrooms to which each child was assigned and on test scores through the eighth grade.

The design of Project STAR thus allows CS to observe children who entered school at the same biological age but were different ages relative to their kindergarten classmates. Moreover, classmates were in general not chosen by principals or by parents, but rather were assigned to each child randomly. As a result, relative age should not be related to other correlates of achievement the researchers cannot observe or control for. To confront the additional challenge that parents exercised some choice over when their children started kindergarten, so that individuals who were older at kindergarten entry might have differed in other important ways from individuals who were younger, CS follow the common practice of predicting a child's age at the start of school with the age he *should* have been, given his birthday, if his parents had complied with local school-entry regulations. School entry ages of a child's peers, and hence his relative age, are predicted in the same way.

Their findings suggest that relative age does not explain the EAAG. In fact, CS find that children assigned to classrooms where the gap between their own age and the age of their peers on average—one possible measure of relative maturity—is positive and large perform *worse* on tests than children of the same age assigned to classrooms where this age gap is smaller. Holding constant both own age and peer average age, the authors do uncover some evidence that being relatively young by several different measures increases the likelihood of being retained in (forced to repeat a) grade, which is generally thought of as a signal of inadequate performance. One possible interpretation is that teachers assess a child's school readiness in relation to other children in a classroom, not by some absolute standard. However, their estimates suggest that moving a child from a classroom where he would be the oldest to one where he would be the youngest would still lower the likelihood of being retained on net.

CS surmise that their findings are driven by positive spillovers from having older classmates regardless of one's own age. For example, older classmates may be better behaved classmates, making time in the classroom more productive. If anything, these spillovers are likely to be especially large in this context because formal learning expectations of students were likely unchanging. Consistent with this idea, Elder and Lubotsky (2008) show that, holding constant own age, having older peers in one's cohort because of a higher minimum age at school entry—which might also be associated with higher expectations of students—*increases* the likelihood of being retained or diagnosed with a learning disability, and while it raises test scores, does so by less than found by CS.

While CS make some headway toward estimating the contribution of relative age to the EAAG, they do not directly address the question of whether the EAAG might be driven by age at school entry or age at test. Elder and Lubotsky (2008) present suggestive evidence of the importance of age at test, showing that there is an "effect" of age at school entry on test scores at the start of the kindergarten year, before students have had much exposure to formal schooling. They also show that this age gradient is steeper for children from families with more resources, supporting the notion that age reflects the accumulation of investments in a child.

To date, however, no research presents separate estimates of age at test and age at entry effects for the United States. However, Black, Devereux, and Salvanes (2008) take advantage of a situation in Norway, where time in school is roughly fixed, and age at school entry and age at test do not vary one-for-one. The authors find that age at test—not age at school entry—is largely responsible for the EAAG.

Implications

On balance, this new research suggests that the EAAG is largely an artifact of natural differences in skill between older and younger students. Does this mean that policymakers and parents should not be concerned about age at kindergarten entry? Not necessarily. There are possibly positive spillovers from having older peers, but these need to be weighed against the negative effects of starting school later. First, a lost year of schooling may lower test scores by more than is gained by an additional year of school preparation. Among minorities, high schoolers expected to be youngest in their school cohorts score significantly higher on tests than individuals expected to be eldest in the cohort behind them (Cascio and Lewis 2006). Americans who are older when they start kindergarten also on average end up with less schooling as adults, since the oldest children in a class reach the age at which they can legally leave school in a lower grade (Angrist and Krueger 1991). Further, under the assumption of an unchanging retirement age, the loss of labor market experience among older school entrants might not only negatively impact lifetime earnings, but also lower lifetime contributions to Social Security (Deming and Dynarski 2008). Thus, knowing what drives the EAAG is only a first step toward learning the optimal age at kindergarten entry.

Elizabeth Cascio
Dartmouth College and
Visiting Scholar, FRBSF

References

Angrist, Joshua D., and Alan B. Krueger. 1991. "Does Compulsory School Attendance Affect Education and Earnings?" *The Quarterly Journal of Economics* 106(4) (November) pp. 979–1,014.

Bedard, Kelly, and Elizabeth Dhuey. 2006. "The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects." *The Quarterly Journal of Economics* 121 (4) pp. 1,437–1,472.

Black, Sandra, Paul Devereux, and Kjell Salvanes. 2008. "Too Young to Leave the Nest? The Effects of School Starting Age." NBER Working Paper 13969. Cambridge, MA: National Bureau of Economic Research.

Cascio, Elizabeth U., and Ethan G. Lewis. 2006. "Schooling and the Armed Forces Qualifying Test: Evidence from School-Entry Laws." *The Journal of Human Resources* 41(2), pp. 294–318.

Cascio, Elizabeth U., and Diane Whitmore Schanzenbach. 2007. "First in the Class? Age and the Education Production Function." NBER Working Paper 13663. Cambridge, MA: National Bureau of Economic Research.

Deming, David, and Susan Dynarski. 2008. "The Lengthening of Childhood." Forthcoming, *Journal of Economic Perspectives*.

Elder, Todd E., and Darren H. Lubotsky. 2008. "Kindergarten Entrance Age and Children's Achievement: Impacts of State Policies, Family Background, and Peers." Forthcoming, *The Journal of Human Resources.*

Gootman, Elissa. 2006. "Preschoolers Grow Older as Parents Seek an Edge." *The New York Times* (October 19).

Schanzenbach, Diane Whitmore. 2007. "What Have Researchers Learned from Project STAR?" In *Brookings Papers on Education Policy 2006–2007*, eds. T. Loveless and F. Hess. Washington, DC: Brookings Institution Press, pp. 205–228.

ECONOMIC RESEARCH
FEDERAL RESERVE BANK
OF SAN FRANCISCO

P.O. Box 7702
San Francisco, CA 94120

Address Service Requested

Index to Recent Issues of *FRBSF Economic Letter*

DATE	NUMBER	TITLE	AUTHOR
1/25	08-02	Publishing Central Bank Interest Rate Forecasts	Rudebusch
2/1	08-03	2007 Annual Pacific Basin Conference: Summary	Glick
2/8	08-04-05	Prospects for the Economy in 2008	Yellen
2/15	08-06	Recent Trends in Economic Volatility: Conference Summary	Notzon/Wilson
2/22	08-07	Economic Conditions in Singapore and Vietnam: A Monetary...	Yellen
2/29	08-08	The Economics of Private Equity Investments: Symposium Summary	Lopez
3/7	08-09	Assessing Employment Growth in 2007	Regev
3/14	08-10	The Corporate Bond Credit Spread Puzzle	Christensen
3/21	08-11	Falling House Prices and Rising Time on the Market	Krainer
4/11	08-12	Are Global Imbalances Due to Financial Underdevelopment...?	Valderrama
4/18	08-13-14	The Financial Markets, Housing, and the Economy	Yellen
5/9	08-15	Small Business Lending and Bank Competition	Laderman
6/6	08-16	Retirement Savings and Decision Errors: Lessons from Behavioral...	Armour/Daly
6/13	08-17	Did Large Recalls of Chinese Consumer Goods Lower U.S. Imports...?	Candelaria/Hale
6/20	08-18	Speculative Bubbles and Overreaction to Technological Innovation	Lansing
6/27	08-19	Consumer Sentiment and Consumer Spending	Wilcox
7/3	08-20	Research on the Effects of Fiscal Stimulus: Symposium Summary	Wilson
7/11	08-21	Monetary Policy and Asset Markets: Conference Summary	Dennis
7/18	08-22	Can Young Americans Compete in a Global Economy?	Cascio
7/25	08-23	Unanchored Expectations? Interpreting the Evidence from Inflation...	Huang/Trehan

Opinions expressed in the *Economic Letter* do not necessarily reflect the views of the management of the Federal Reserve Bank of San Francisco or of the Board of Governors of the Federal Reserve System. This publication is edited by Judith Goff, with the assistance of Anita Todd. Permission to reprint portions of articles or whole articles must be obtained in writing. Permission to photocopy is unrestricted. Please send editorial comments and requests for subscriptions, back copies, address changes, and reprint permission to: Public Information Department, Federal Reserve Bank of San Francisco, P.O. Box 7702, San Francisco, CA 94120, phone (415) 974-2163, fax (415) 974-3341, e-mail sf.pubs@sf.frb.org. **The *Economic Letter* and other publications and information are available on our website, http://www.frbsf.org.**