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Year-Round School Calendars: Effects on Summer Learning, Achievement, Parents, Teachers, and Property Values

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Year-round school calendars take the usual 175-180 instruction days of the school year and redistribute them, replacing the usual schedule – nine months on, three months off – with a more "balanced" schedule of short instruction periods alternating with shorter breaks across all four seasons of the year. Over the past three decades, the number of schools using year-round calendars has increased ninefold, from 410 in 1985 to 3,700 in 2011-12 (Skinner, 2014). Over 2 million children now attend year-round schools – as many as attend charter schools – yet year-round schools have attracted relatively little attention from researchers and the public.

In this chapter, I review the evidence for the effects of year-round calendars on test scores. Once thought to be positive, these effects now appear to be neutral at best. Although year-round calendars do increase summer learning, they reduce learning at other times of year, so that the total amount learned over a 12-month period is no greater under a year-round calendar than under a nine-month calendar. I also review evidence that year-round calendars make it harder to recruit and retain experienced teachers, make it harder for mothers to work outside the home, and reduce property values. When students' schedules are staggered, year-round calendars do offer a way to reduce school crowding – an alternative to busing or portable classrooms, and a low-cost alternative to new school construction.

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Over the past three decades, the number of schools using year-round calendars has increased ninefold, from 410 in 1985 to 3,700 in 2011-12 (Skinner, 2014). Over 2 million children now attend year-round schools -- as many as attend charter schools – yet year-round schools have attracted relatively little attention from researchers and the public.

In this chapter, I define year-round schools, describe their characteristics, and discuss the educational, political, and financial reasons why schools do or do not adopt year-round calendars. I then review the evidence for the effects of year-round calendars on test scores. Once thought to be positive, these effects now appear to be neutral at best. Although year-round calendars do increase summer learning, they reduce learning at other times of year, so that the total amount learned over a 12-month period is no greater under a year-round calendar than under a nine-month calendar. I also review evidence that year-round calendars make it harder to recruit and retain experienced teachers, make it harder for mothers to work outside the home, and reduce property values. I conclude by discussing the remaining uses for year-round calendars and posing questions for future policy and research.

What is a year-round calendar?

Unlike the much rarer "extended-year" calendar, which can have more than 200 days of instruction, a year-round calendar does not increase instruction time. Instead, a year-round calendar takes the usual 175-180 instruction days and redistributes them, replacing the usual schedule -- nine months on, three months off -- with a more "balanced" schedule of short instruction periods alternating with shorter breaks across all four seasons of the year. There are several year-round calendars in use; the most popular alternate 9 or 12-week instruction periods with 3- or 4-

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week breaks. Year-round calendars include a summer break that is longer than other breaks during the year, but still shorter than the summer break on a traditional nine-month calendar.

Table 1a compares the calendars of 30 year-round and 595 nine-month public elementary schools in the nationally representative Early Childhood Longitudinal Study, Kindergarten cohort of 1998-99 (ECLS-K).[1] On average, the year-round schools offer 2-3 fewer instruction days, but start more than a month earlier and end 2-3 weeks later than the nine-month schools, so that on average 11 months elapse between the first and last day of the year-round school year. Because the year-round calendar spreads the same amount of instruction over 11 months rather than 9, the pace of instruction is more leisurely in year-round schools than in nine-month schools. Between the first and last days of the school year, year-round students attend school 1 day out of 2, while nine-month students attend school 3 days out of 5 (Table 1a). Later we will see that the leisurely pace of the year-round calendar may have implications for the pace of learning.

Why do schools adopt year-round calendars?

Crowding

Schools adopt year-round calendars for two different reasons. One is to reduce crowding. About 40 percent of year-round schools are so crowded that they would find it hard to serve all of their students simultaneously on a nine-month calendar (Cooper, Valentine, Charlton, & Melson, 2003). These schools handle crowding with a "multi-track" year-round calendar that splits students into 3-5 groups who that attend school on a staggered schedule. When one group is on break, the other groups are in session, so that only a fraction of students (2/3, 3/4, or 4/5) is in the building on any given day.

Multi-track year-round calendars are especially popular when the demand for classrooms increases quickly or unexpectedly. For example, between 1995 and 2007, school enrollments increased by two-thirds in Wake County, North Carolina (greater Raleigh), and nearly doubled in Clark County, Nevada (greater Las Vegas). By 2007, one-third of Wake County and one-half of Clark County

[1] The ECLS-K began with 21,260 kindergarteners attending 1,018 schools. Table 1 uses a smaller subsample that excludes private schools because none of the year-round schools in the ECLS-K, and only 2 percent of year-round schools nationally, are private (National Association for Year Round Education, 2007). Table 1 also excludes schools with missing or contradictory calendar information. For example, it excludes 2 schools that were flagged as year-round but had fewer than 300 days between the first and last day of kindergarten or first grade.

elementary schools had adopted a multi-track year-round calendar, which saved Clark County half a billion dollars in new school construction (Year Round Calendar Study Group, 2007). Clark County dropped the year-round calendar when Las Vegas's population fell after the 2007-09 recession, but now that Las Vegas is growing again, 24 Clark County elementary schools have switched back to multi-track year-round calendars (McCabe, 2015).

A multi-track calendar is not just suited to handle an surge in enrollment; it can also handle a surge in teachers. The leading example is California, where a 1996 class-size reduction law forced elementary schools to hire 25,000 new K-3 teachers in two years (Jepsen & Rivkin, 2009). Lacking classrooms for the new teachers, one quarter of California elementary schools used multi-track calendars (Graves, 2010). Later, as new buildings and portable classrooms became available, some of California's multi-track schools switched back to single-track year-round or nine-month calendars. Yet even a decade after class-size reduction, California still had half of the nation's year-round schools, enrolling more than 1 million students (Graves, 2010; National Association for Year Round Education, 2007).

Table 1b confirms, using ECLS-K data, that year-round schools are often crowded. Average kindergarten enrollment is twice as high in year-round schools as in nine-month schools. On a subjective 1-to-5 scale of crowding, year-round principals rate their schools as significantly more crowded than do nine-month principals. Eighty percent of year-round schools are in the western census region, which has long been the fastest-growing part of the US; most of the rest are in the south, which is also growing faster than other regions. In fact, the four states with the most year-round schools are all in the west (California, Hawaii, Arizona, and Nevada), and several southern states (Georgia, North Carolina, Texas) are close behind (National Association for Year Round Education, 2007), although Texas' use of year-round calendar declined after a 2006 law forbade schools from starting before the last Monday in August (Texas Association of School Boards, 2012). Only 11 percent of year-round schools are in small town and rural areas, where crowding is less common.

Table 1c shows that, despite high enrollments, average class sizes are no larger in year-round schools than they are in nine-month schools. Evidently the year-round calendar helps to control class size by increasing capacity for extra classes -- just as it was intended to do in California.

Table 1. Characteristics of year-round and nine-month schools

a. Calendars

	Year-round	Nine-month	Difference: National			Difference: Within strata		
Kindergarten, first day	Jul 18, 1998	Aug 25, 1998	-38	***	(3)	-40	***	(3)
last day	Jun 25, 1999	Jun 5, 1999	21	***	(3)	19	***	(3)
First grade, first day	Jul 19, 1999	Aug 24, 1999	-36	***	(3)	-38	***	(3)
last day	Jun 20, 2000	Jun 3, 2000	17	***	(3)	15	***	(3)
Calendar days (first to last), kindergarten	343	284	59	***	(3)	59	***	(3)
first grade	337	284	54	***	(3)	54	***	(3)
Instruction days, kindergarten	175	178	-3	***	(0.8)	-3	***	(.8)
first grade	177	179	-2	**	(0.6)	-2	***	(.6)
Instruction days/calendar day, kindergarten	.51	.63	-.12	***	(.005)	-.12	***	(.006)
first grade	.53	.63	-.10	***	(.005)	-.11	***	(.005)

b. School characteristics

	Year-round	Nine-month	Difference: National			Difference: Within strata		
Kindergarten enrollment	124	68	56	***	(8)	45	***	(9)
Crowded (principal's 5-point scale)	3.2	2.6	0.6	*	(.3)	0.5	†	(.3)
Central city	43%	34%	9%		(10%)	-7%		(10%)
Urban fringe and large town	46%	35%	11%		(10%)	-2%		(10%)
Small town and rural	11%	31%	-20%	**	(7%)	9%		(7%)
West	80%	19%	61%	***	(9%)	0%		
South	13%	33%	-20%	*	(8%)	0%		
Northeast	0%	20%	-20%	***	(2%)	0%		
Midwest	6%	28%	-21%	***	(6%)	0%		

c. Teacher and classroom characteristics

	Year-round	Nine-month	Difference: National			Difference: Within strata		
Class size, kindergarten	21	20	1		(0.9)	0		(0.7)
first grade	20	20	0		(0.5)	1	†	(0.3)
Half-day kindergarten	78%	38%	41%	***	(9%)	5%	†	(3%)
Teacher experience, kindergarten	11	14	-3	**	(1)	-4	***	(1)
first grade	11	14	-2	*	(1)	-4	***	(1)

d. Student characteristics

	Year-round	Nine-month	Difference: National			Difference: Within strata		
Hispanic	50%	17%	33%	***	(7%)	13%		(8%)
White	34%	59%	-25%	***	(6%)	-6%		(7%)
Black	8%	17%	-9%	**	(3%)	-5%		(4%)
Asian	5%	3%	2%		(1%)	0%		(2%)
Hawaiian/Pacific islander	1%	0%	1%		(1%)	-1%		(1%)
Native American	0%	2%	-2%	***	(.5%)	-2%	**	(.5%)
Multiracial	-31%	-56%	25%	***	(6%)	6%		(7%)
Qualifies for free lunch, kindergarten	58%	38%	21%	**	(6%)	12%	†	(7%)
first grade	54%	37%	17%	**	(6%)	8%		(7%)
Qualifies for reduced lunch, kindergarten	7%	11%	-3%		(2%)	-3%		(2%)
first grade	8%	10%	-3%		(2%)	-3%		(2%)
Household income (thousands)	$39	$46	-$6		($5)	-$2		($6)
Siblings in household	1.5	1.5	.06		(.07)	-.01		(.08)
Parents in household	1.8	1.7	.05		(.03)	.04		(.04)
Mother has no high school diploma/GED	28%	15%	13%	**	(4%)	7%		(5%)
has no bachelor's degree	87%	80%	7%		(4%)	3%		(5%)
Mother employed, kindergarten	49%	56%	-7%	*	(3%)	-2%		(4%)
first grade	50%	59%	-9%	**	(3%)	-5%		(3%)
Birth date	Mar 13, 1993	Feb 7, 1993	34	**	(11)	14		(12)

*p<.05, **p<.01, ***p<.001. Standard errors in parentheses. *Note*. Means and percentages use survey weights, and standard errors account for the clustering of students and teachers in schools. Missing values were multiply imputed at the school, classroom, and student level.

Table 1c also shows that year-round schools tend to favor half-day kindergarten, which is twice as common in year-round schools as in nine-month schools. Half-day kindergarten may be another way to handle crowding. Like the year-round calendar, half-day kindergarten staggers children's schedules -- half attend in the morning, half in the afternoon -- so that twice as many kindergarteners can be served by the same number of teachers and classrooms.

Some characteristics of year-round schools are truly associated with the year-round calendar, while other characteristics are merely associated with the geographic areas where year-round calendars are used. To clarify the geographic issue, it is helpful to compare year-round schools with nine-month schools that are in the same area. The last two columns of Table 1 do this by comparing year-round schools to nine-month schools that are in the same survey stratum of the ECLS-K. The ECLS-K defines a survey stratum as a single large county or a group of similar and contiguous small counties (Tourangeau, Le, Nord, Sorongon, & Chapman, 2009). Because year-round schools are geographically concentrated, all of the year-round schools in the ECLS-K are in just 15 strata which contain only one-fifth of the nine-month schools. The last two columns of Table 1 are limited to these 15 strata, and use stratum fixed effects to compare each year-round school to the nine-month schools that are in the same stratum.

Within the same strata, some but not all of the differences between year-round and nine-month schools become much smaller. For example, within strata year-round schools are only 5 percentage points more likely than nine-month schools to offer half-day kindergarten. Yet within strata kindergarten enrollments remain more than 50% higher in year-round schools than in nine-month schools.

Achievement

Another goal of the year-round calendar is to raise achievement. Achievement gains may or may not be expected when schools use a multi-track calendar for crowding, but gains are invariably promised when a district adopts a single-track year-round calendar as an educational reform. In 2010, when the Indianapolis and Oklahoma City Public Schools started using single-track year-round calendars in some schools, the Oklahoma City superintendent predicted that the new calendar would have "a positive effect on student growth and achievement" (Adcock, 2010), and the Indianapolis Public Schools announced that the calendar would "provide additional opportunities for our children to be academically successful" (Indianapolis Public Schools, 2010).

It is debatable whether a year-round calendar, by itself, can increase achievement. For skeptics, the bottom line is clear: since year-round calendars do not increase instruction time or change instruction practices, they cannot be expected to increase achievement.

Advocates, on the other hand, make several arguments for the year-round calendar's potential to raise achievement. One argument -- especially salient to readers of this volume -- is that shortening the summer vacation should increase summer learning, especially for the socioeconomically disadvantaged students who are most vulnerable to summer learning loss (Ballinger, 2000; Stenvall, 1999). The argument is not just that the year-round calendar increases summer learning, but that year-round teachers can spend less of the fall reviewing what students have forgotten over the summer.

A weakness of this argument is that, in many year-round schools, the summer vacation remains surprisingly long. In Oklahoma City and Indianapolis, conversion to a year-round calendar has only shortened the summer vacation from three months to two, and even on the "balanced" calendar recommended by the National Association for Year-Round Education, the summer vacation is still six weeks long. Over a two-month or even six-week summer vacation, it seems likely that a fair amount of summer stagnation or setback will occur. Further stagnation and setback may take place in the three- to- four-week breaks that year-round calendars intersperse through the fall, winter, and spring.

Another argument in favor of year-round calendars is that learning is more effective if it is broken into short periods with frequent breaks. This argument relies on the psychological evidence for "spaced" rather than "massed" practice (Dempster, 1988). Unfortunately, the evidence for spaced practice is inconsistent -- "now you see it, now you don't," according to one review (Donovan & Radosevich, 1999) -- and experiments on spaced practice have used breaks of a few minutes, hours, or days (Donovan & Radosevich, 1999), which are far shorter than the 3-6 week breaks in year-round school calendars.

The achievement argument for year-round calendars is most compelling when a year-round calendar includes supplemental instruction in the "intersessions" between instruction periods. For example, when Indianapolis adopted a year-round calendar in some schools, it announced that students who were below grade level would be required to attend 20 days of remedial instruction during intersessions (Indianapolis Public Schools, 2010). Unfortunately, due to tight budgets, the district was never able to fund more than 10 days of intersession instruction, and today the decision to offer intersession instruction is left to individual schools, according to a district administrator (Deborah Leser, personal communication, October 22, 2015).

Of course, the possibility of supplemental instruction is not limited to the year-round calendar. On a nine-month calendar, children can also receive supplemental instruction outside of regular school hours -- after school, on weekends, or during the summer. While many types of out-of-school-time instruction can be effective (Lauer et al., 2006), it is unclear whether out-of-school-time instruction would be more convenient or effective on a year-round calendar. The proper comparison for a year-round school with intersession instruction is a nine-month school with a summer learning program.

Effects of year-round calendars

Effects on test scores

Over the past 5 years, the weight of evidence has shifted against the idea that year-round calendars increase test scores. A 2003 meta-analysis estimated that year-round calendars improved student test scores by an amount that, though small on average (0.05 standard deviations [SD]), was larger for socioeconomically disadvantaged children (0.2 SD) (Cooper et al., 2003). Yet more recent research estimates that year-round calendars have not improved test scores on average, and that any effects on disadvantaged children are small (0.05 SD) and as likely to be negative as positive (Graves, 2010, 2011; McMullen & Rouse, 2012b).

Why are recent studies of year-round schools more negative than older studies? One reason is that recent studies use more rigorous research designs. Before 2003, most year-round studies did not control for confounding differences between year-round and nine-month schools (Cooper et al., 2003). These differences are considerable, as Tables 1c-d show. Although the differences between year-round and nine-month students vary from place to place, on a national level year-round students are much more likely than nine-month students to be Hispanic and to qualify for free lunch. The mothers of year-round students are less likely to have a high-school diploma and less likely to work outside the home. Year-round students are on average a month younger than nine-month students. Most student-level differences become insignificant when we limit comparisons to the same strata, but even within strata there are some significant differences. For example, year-round teachers are on average 4 years less experienced than nine-month teachers in the same stratum.

Most studies before 2003 failed to control for observed differences between year-round and nine-month schools (Cooper et al., 2003), and hardly any studies were designed to control for unobserved differences that might have biased the results after observed differences were taken into account.

Not all studies before 2003 were poorly designed. The best was a study that compared the 67 year-round and 1,364 nine-month elementary and middle schools in North Carolina (McMillen, 2001). Two features made this study more compelling than earlier work. First, in addition to controlling for student demographics, the North Carolina study controlled for prior test scores. Controlling for prior test scores is a simple but effective technique which can remove 80-100 percent of the bias from estimated effects. As a result, studies that control for prior test scores sometimes predict the results of randomized experiments with remarkable accuracy (Cook, Shadish, & Wong, 2008; Kane & Staiger, 2008; Steiner, Cook, Shadish, & Clark, 2010).

Another strength of the North Carolina study was that, in addition to comparing schools that used the same calendar schoolwide, the study also examined 39 “schools-within-a-school” where some children followed a year-round calendar and others followed a nine-month calendar. It is revealing to compare year-round students to nine-month students at the same school, because the comparison holds constant all school-level variables, such as the neighborhood, the administrative staff, the library, and the computers. In addition, year-round and nine-month students who attended the same school were more demographically similar than students who attended different schools (McMillen, 2001).

The North Carolina study concluded that year-round calendars did not improve test scores on average, and more recent rigorous studies have reached similar conclusions. The most impressive studies follow schools over time as they convert between nine-month and year-round calendars. Like a study of schools-within-a-school, a study of calendar conversion is compelling because it makes comparisons within the same school, holding many student and school characteristics constant, while little but the calendar changes from year to year.

Calendar conversion studies have focused on Wake County, North Carolina, which converted 22 elementary schools to a multi-track year-round calendar in 2007 (McMullen & Rouse, 2012b), and California where, between 1998 and 2005, 936 elementary schools switched between multi-track year-round, single-track year-round, and nine-month calendars (Graves, 2010).

The Wake County study found that year-round calendars had no significant effect on average test scores (McMullen & Rouse, 2012b), while the California studies found that year-round calendars, especially the multi-track variety, reduced average test scores by 1-2 percentile points, or 0.05-0.11 SD (Graves, 2010).

Year-round schools may be one of the reasons that class-size reduction did so little to raise achievement in California. To reduce class sizes, California hired to 25,000 novice teachers, and it has been shown that the low effectiveness of these teachers offset the benefits of reduced class sizes in the early years of the class size reform (Jepsen & Rivkin, 2009). But that may not be the whole story. To accommodate the new teachers, many California schools switched to multi-track year-round calendars (Graves, 2010), and these may have offset the class-size effect even more.

Though year-round calendars have not raised achievement on average, we might hope that they raised achievement among disadvantaged or underachieving children. After all, these are the children who are most vulnerable to summer learning loss (Alexander, Entwisle, & Olson, 2001; Downey, von Hippel, & Broh, 2004). Unfortunately, the effects of year-round calendars on disadvantaged children have been disappointing as well. In Wake County and the rest of North Carolina, year-round calendars have not raised the achievement of nonwhite, black, or Hispanic students (McMillen, 2001; McMullen & Rouse, 2012b). In California year-round calendars have actually reduced the achievement of black, Hispanic, and socioeconomically disadvantaged students more than they have reduced the achievement of white students (Graves, 2011).

The effects on low-achieving students have been more mixed. In California year-round calendars have had a more negative effect on the bottom of the achievement distribution than on the top (Graves, 2011). But in North Carolina, year-round calendars appear to have raised the scores of students who are, or were previously, near the bottom of the achievement distribution (McMillen, 2001; McMullen, Rouse, & Haan, 2015). One suggested reason for this effect is that more than half of North Carolina's year-round schools require intersession instruction for low-achieving students (McMillen, 2001). But the lowest-achieving students also appear to benefit from the year-round calendar in Wake County (McMullen et al., 2015), where intersession instruction is not required (Katy Rouse, personal communication, November 2015). Whatever the cause, the effect of year-round calendars on North Carolina's low achieving students is quite small (0.05 SD) (McMillen, 2001; McMullen et al., 2015), and no effect is evident in the state's schools-within-a-school (McMillen, 2001).

Effects on summer and school-year learning

The disappointing effects of year-round calendars on achievement may puzzle some readers. Don't year-round calendars increase summer learning? And if they do, why don't they increase achievement overall? Past studies could not address these questions because they used data that only tested students once a year.

To address the question of summer learning in year-round schools, we use data from the ECLS-K. The ECLS-K tested students twice a year for the first two years of elementary school, giving math and reading tests in the fall and spring of kindergarten and first grade, which were scored using an ability scale (or theta scale) that was estimated using item response theory (IRT).[2]. The ECLS-K's twice-yearly tests permit us to estimate learning rates during summer and during the nine months of the traditional school years. We can also estimate learning rates over the months before kindergarten, by estimating the association between test scores and age at the start of kindergarten.

Given the number of potentially confounding differences between the year-round and nine-month schools in Table 1, it may seem daunting to try and estimate the effects of the year-round calendar. Using the ECLS-K we cannot observe the same schools under both a year-round and a nine-month calendar, as we could if there were calendar conversions or schools-within-a-school. Fortunately, there are several steps we can take to increase the comparability of year-round and nine-month schools.

First, we do not have to compare year-round and nine-month schools nationwide. Instead, we limit our analysis to public schools in the 15 ECLS-K survey strata that contain year-round schools. Within those strata, year-round and nine-month schools are much more similar, as the last two columns of Table 1 show. Results from these 15 strata are limited in generality, but this limitation is unavoidable because year-round schools are so geographically concentrated. No analysis of the ECLS-K could tell us anything about the effects of year-round calendar in, say, the northeast, because there aren't any year-round schools in the northeastern strata of the ECLS-K (Table 1b).

In addition to limiting our analysis to strata with year-round schools, we use stratum fixed effects to control for unobserved differences between strata. Stratum fixed effects ensure that each year-round school is compared to nine-month schools that are in the same stratum. To control for differences between schools in the same stratum, we include as covariates all of the potentially confounding variables in Table 1. Estimates are obtained using a multilevel growth model that we describe in the Appendix (Singer & Willett, 2002).

Are these steps adequate to control for preexisting differences between year-round and nine-month student? We can check, because children in the ECLS-K are tested nearly the beginning of kindergarten. If our covariates and fixed effects are adequate, we should find that, net of those controls, the test

[2] IRT ability scales may seem strange to some readers because they can take negative values, and annual gains can be less than 1 point per year. In fact, IRT ability scales are used routinely by all modern test vendors, which typically rescale ability scores to be positive and show annual progress in tens or hundreds of points. The Northwest Evaluation Association, for example, multiplies ability scores by 10 and adds 200.

scores of year-round and nine-month children do not differ significantly when kindergarten starts. That is, we should find that the children are conditionally equivalent at baseline.

Fortunately, baseline equivalence is exactly what we find. In Table 2 we estimate children's average reading and math ability on July 18, 1998, which is the average start date for year-round kindergarten. Within strata, holding all of the variables in Table 1 constant, we find no significant differences between the reading and math scores of children who are about to enter year-round or nine-month schools.

Table 2. Learning rates in year-round and nine-month schools

a. Reading

		Reading		
	Dates	Year-round schools	Nine-month schools	Difference
Ability at baseline	Jul 18, 1998	-1.603***	-1.637***	0.034
		(0.035)	(0.022)	(0.036)
Monthly learning rates	Jul 18-Aug 25, 1998	0.086***	0.017***	0.069***
		(0.003)	(0.002)	(0.004)
	Aug 25, 1998-Jun 5, 1999	0.086***	0.105***	-0.019***
		(0.003)	(0.001)	(0.003)
	Jun 6-Aug 23, 1999	0.089***	0.018*	0.070***
		(0.014)	(0.009)	(0.015)
	Aug 24, 1999-Jun 3, 2000	0.061***	0.085***	-0.023***
		(0.005)	(0.003)	(0.005)
12-month gains	Aug 25, 1998-Aug 23, 1999	1.038***	1.030***	0.009
		(0.041)	(0.027)	(0.046)
	Jun 5, 1999-Jun 3, 2000	0.810***	0.841***	-0.031
		(0.025)	(0.013)	(0.027)

b. Math

	Dates	Year-round schools	Nine-month schools	Difference
Ability at baseline	Jul 18, 1998	-1.468***	-1.438***	-0.030
		(0.027)	(0.017)	(0.028)
Monthly learning rates	Jul 18-Aug 25, 1998	0.075***	0.018***	0.056***
		(0.002)	(0.002)	(0.003)
	Aug 25, 1998-Jun 5, 1999	0.075***	0.086***	-0.011***
		(0.002)	(0.001)	(0.002)
	Jun 6-Aug 23, 1999	0.079***	0.041***	0.038**
		(0.012)	(0.008)	(0.012)
	Aug 24, 1999-Jun 3, 2000	0.052***	0.063***	-0.011**
		(0.004)	(0.003)	(0.004)
12-month gains	Aug 25, 1998-Aug 23, 1999	0.908***	0.914***	-0.005
		(0.036)	(0.023)	(0.036)
	Jun 5, 1999-Jun 3, 2000	0.700***	0.702***	-0.003
		(0.021)	(0.011)	(0.022)

Note. These estimates come from a multilevel growth model (Singer & Willett, 2002) fit to multiply imputed data from which imputed test scores were deleted (von Hippel, 2007).

According to Table 2, year-round students do learn significantly faster than nine-month students during the summer (June 6-August 23), but nine-month students learn significantly faster than year-round students during nine-month kindergarten (August 25-June 5) and during nine-month first grade (August 24-June 3). This pattern is consistent with the idea that learning increases with school exposure. During the summer, year-round students are in school, while nine-month students are not. During the nine-month school year, all students are in school, but nine-month students are in school more often. During the school year, nine-month students are in school 3 days out of 5, but year-round students are in school just 1 day out of 2 (Table 1a).

In effect, the year-round calendar redistributes learning, just as it redistributes days of instruction. As a result, the year-round calendar does not produce a net increase in average learning. The increase in summer learning on a year-round calendar is almost perfectly offset by the decrease in learning during the rest of the year. Over a 12-month period -- e.g., August to August, or June to June -- the total amount learned on a year-round calendar is not significantly different from the total amount learned on a nine-month calendar, according to Table 2.

Figure 1 summarizes the results graphically, showing that year-round students pull ahead during the summer but nine-month students catch up and pull ahead during the rest of the year. Year-round students make slow, steady progress all year long, while nine-month students surge during their school year but slow down or stall out during the summer. It is a bit like the race between tortoise and hare, except that, in this case, the race ends in a tie.

Effects on teachers, mothers, and property values

Research has evaluated the effects of year-round calendars not just on students, but also on teachers and parents. Here, too, the weight of evidence has recently shifted against year-round calendars. Research reviewed in 2003 suggested that parent and staff attitudes toward year-round calendars were "overwhelmingly" positive (Cooper et al., 2003). Yet research since 2012 finds that both parents and teachers are more likely to respond negatively than positively to year-round calendars.

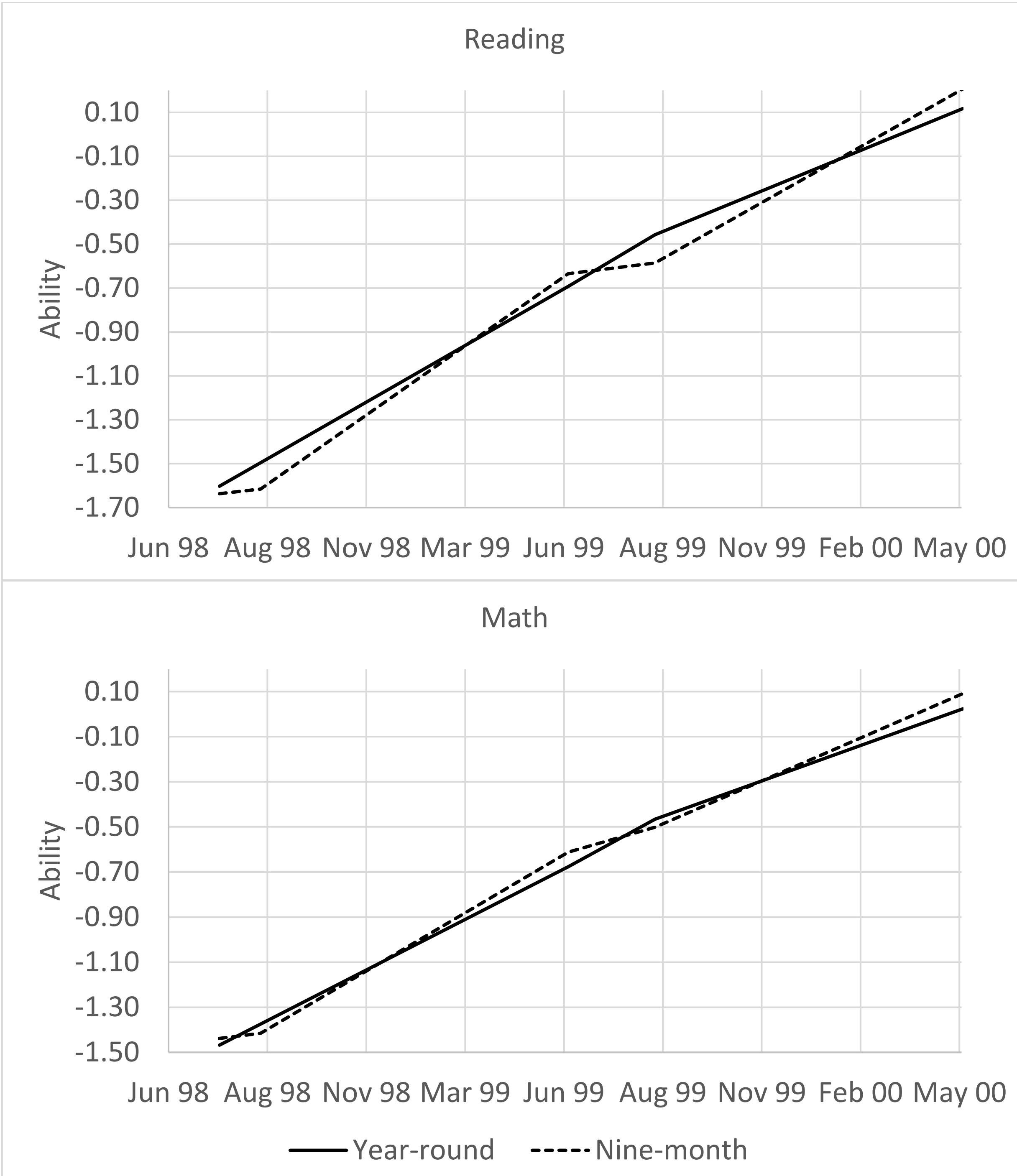

Figure 1. Learning in year-round and nine-month schools from the start of kindergarten to the end of first grade.

Year-round calendars reduce mothers' employment rates by about 4 percentage points, especially in predominantly white communities where mothers are more likely to rely on formal childcare arrangements rather than informal kin networks (Graves, 2013). The finding that year-round calendars reduce maternal employment is consistent with news reports that year-round calendars complicate family schedules, especially in families where different siblings attend schools using different calendars (e.g., CBS News Chicago, 2013; Haug, 2010).

Families are willing to pay a premium to avoid year-round schools, and as a result living in the attendance area of a year-round school reduces property values by 1-2 percent (Depro & Rouse, 2015).

Schools using year-round calendars find it harder to recruit and retain effective and experienced teachers, at least in California schools serving predominantly poor and minority populations (Graves, McMullen, & Rouse, 2015). The effects of the year-round calendar on teacher turnover, experience, and quality may be part of the reason why year-round calendars have reduced test scores in California, especially in high-poverty, high-minority schools where teachers are already hard to attract and retain (Graves et al., 2015). Teachers' distaste for the year-round calendar was also evident when the Chicago Teachers Union, as one of the conditions for ending its 2012 strike, demanded that Chicago public schools discontinue use of the year-round calendar (CBS News Chicago, 2013). Perhaps teachers, like parents, experience scheduling conflicts when working under a year-round calendar, for example if the calendar at the school where they work does not line up with the calendar at the schools their children attend.

Why weren't the negative externalities of the year-round calendar evident at the time of the 2003 meta-analysis? Again, many studies conducted before 2003 were poorly designed. When older studies measured attitudes, they used surveys, and they did not employ a control group. That is, they asked whether attitudes at year-round schools were positive on average (Cooper et al., 2003), not whether attitudes were more positive at year-round schools than at nine-month schools.

Recent studies are better designed, using longitudinal designs to track changes in outcomes when schools convert to or from a year-round calendar (Depro & Rouse, 2015; Graves, 2013; Graves et al., 2015). In addition, recent studies do not measure attitudes using surveys, but instead use concrete behaviors such as teachers' decisions to take or leave jobs at year-round or nine-month schools (Graves et al., 2015); mothers' decisions to work or stay home while their children are enrolled in year-round or nine-month schools (Graves, 2013); and the prices that families are willing to pay for homes near year-round or nine-month schools (Depro & Rouse, 2015). Although surveys can be informative, behaviors show teachers and parents voting with their feet. Actions speak louder than words.

Politics of year-round calendars

It would be comforting to imagine that policy regarding year-round calendars is determined by an impartial review of evidence regarding what is best for parents and children. Unfortunately, this is not always the case. Both proponents and opponents of year-round calendars often have ulterior motives.

As discussed earlier, the year-round calendar is often adopted for financial reasons. The multi-track year-round calendar saves money when schools face a shortage of classrooms. The single-track year-round calendar does not save money, but it costs very little, and that increases its appeal when little funding is available but districts are under pressure to do *something* about chronically low achievement. The low cost of the year-round calendar may explain why two large, high-poverty districts -- Indianapolis and Oklahoma City -- adopted it during the recent recession.

In some districts the year-round calendar can also be a way to game high-stakes state tests by increasing the amount of instruction that children receive before the test date. In Indianapolis, for example, a district administrator told me that the year-round calendar became attractive when state-required "testing was in the fall, because [the year-round calendar] allowed the district more time with students before they took high stakes tests. This has since changed when Indiana moved testing back to the spring" (Deborah Leser, personal communication, October 22, 2015). When used to cram pre-test instruction, the year-round calendar, along with other calendars that have early start dates, can be one of the "nonacademic strategies" (Koretz, 2009) that districts adopt to improve test scores without actually increasing educational effectiveness. States should adjust their testing schedules to discourage calendar games, as both California and North Carolina do already (Graves, 2010; Katy Rouse, personal communication, November 2015).

Opponents of the year-round calendar often have nonacademic motivations as well. Trade groups representing summer camps, amusement parks, and tourist destinations oppose year-round calendars because they reduce summer visits from families with children and make it harder to hire students as summer employees (Peercy & McCleary, 2011). I found it hard to believe that tourism interests could shape education policy -- until an Ohio legislator contacted me about year-round calendars, explaining that he got my name from an executive at Cedar Point, the state's largest amusement park. The legislator wanted me to testify in favor of a bill forbidding schools to open before Labor Day (Ohio 129th General Assembly, 2011). I declined, but similar calendar laws have passed in 11 states (Education Commission of the States, 2011), although the laws in North Carolina and Texas exempt year-round districts (North Carolina State Legislature, 2013; Texas Association of School Boards, 2012).

In various states, groups opposed to year-round calendars have formed under names such as Save Tennessee Summers, Save Alabama Summers, Save Pennsylvania Summers, etc.; a current list of state groups is available on the website of the San Antonio-based Coalition for a Traditional School Calendar. In newspaper interviews, opposition leaders often appear to be middle-class parents; the leader of a Florida group, for example, is described as "a nonpracticing lawyer and mother of two" (Janofsky, 2005). Given the effects of year-round calendars on vacation plans, property values, and maternal employment, it is plausible that these groups do represent concerned families. However, in newspaper stories several state and national groups have acknowledged receiving funding from trade groups representing summer camps and amusement parks (Chaker, 2005; Cumming, 1993; MacFarquhar, 1995), and a contribution to the Coalition for a Traditional School Calendar is disclosed on the tax return of one summer camp group (Association of Independent Camps, Inc., 2008). This does not mean that parent opposition groups are mere puppets of business interests. They could simply be allies, bedfellows brought together by shared goals. Future research should seek to better understand the connections and motivations of groups opposed to year-round calendars.

Conclusion

Given the current state of evidence, it is hard to argue for year-round calendars as a way to increase achievement. On average, year-round calendars have not improved achievement, and in California they have slightly reduced achievement, especially in disadvantaged populations, in part by making it harder to attract and retain experienced teachers. In addition, year-round calendars are somewhat unpopular with parents and teachers, and very unpopular with business interests that depend on summer vacation to bring them customers and employees.

Although year-round calendars do not increase average achievement by themselves, they might have benefits, at least for low-achieving students, if combined with substantial amounts of remedial instruction during intersessions. Some results from North

Carolina suggest that year-round calendars help the lowest achievers (McMillen, 2001; McMullen et al., 2015), and it is plausible that this is in part due to intersession remediation (McMillen, 2001). Yet results from California suggest that year-round calendars are worst for low achievers (Graves, 2011). It is hard to sort out these discrepant results because data on year-round schools rarely indicate which schools offer intersession instruction. This gap in data needs to be filled so that we can fully understand the potential of intersession instruction under a year-round calendar. Districts that are using or considering a year-round calendar should offer intersession instruction, at least for students who are behind, and the effects of the district's intersession program should be rigorously evaluated.

Whatever their effects on achievement, year-round calendars are likely to persist because they offer an inexpensive way to handle crowding. Crowded schools have to find some way to serve all students, and the achievement effects of year-round calendars are no worse than the effects of other approaches to crowding, such as portable classrooms (McMullen & Rouse, 2012a). Another way to handle crowding is to bus children from more crowded to less crowded schools.

Crowding can negatively affect achievement however it is handled (McMullen & Rouse, 2012a), so portable classrooms and year-round calendars should be treated as temporary measures to be used only until new buildings are completed. If a district chooses to save money by using year-round calendars instead of building new schools, the district should invest some of its savings in other programs with greater potential to raise achievement and help working parents to manage the complexities of the year-round calendar.

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Methodological appendix

This Appendix describes the statistical model that Chapter 13 used to estimate the learning rates of year-round and nine-month students in the Early Childhood Longitudinal Study, Kindergarten class of 1998-99 (ECLS-K). Estimates from this model are displayed in Table 2 and Figure 1.

Statistical model

The ECLS-K tested children's reading and math skills on four occasions in the first two years of elementary school: the fall and spring of kindergarten and the fall and spring of first grade. The tests in the fall of first grade were limited to a random 30 percent subsample of schools. Test dates varied both between and within schools; on each occasion, the test date had a between-school SD of 15-16 days and a within-school SD of 4-6 days.

Average test dates are given in Table A1. The dates are similar for year-round and nine-month schools, except in the fall of kindergarten, when year-round students took the tests 22 days before nine-month students (or 20 days earlier, if we restrict the comparison to schools in the same strata). Our model controls for the fact that different students have different amounts of school exposure on each test occasion.

Table A1. Average test dates in year-round and nine-month schools

	Test date		Difference, in days					
Test occasion	Year-round	Nine-month	National			Within strata		
Kindergarten, fall	Oct 8, 1998	Oct 31, 1998	-22	***	(3)	-20	***	(3)
spring	May 6, 1999	May 2, 1999	4		(3)	2		(4)
First grade, fall	Oct 8, 1999	Oct 10, 1999	-2		(7)	-2		(7)
spring	May 4, 2000	Apr 29, 2000	5	†	(3)	1		(4)

Estimates (SEs). *p<.05, **p<.01, ***p<.001

On each test occasion, we calculate the number of months that each child has been exposed to periods that we define as *nine-month kindergarten* (Aug 25, 1998-Jun 5, 1999), *nine-month summer* (Jun 6-Aug 23, 1999), and *nine-month first grade* (Aug 24, 1999-Jun 3, 2000). We define these periods using the average dates for the start and end of the nine-month school year. Note that year-round students start school before the beginning of nine-month kindergarten, and that year-round students have school during part of the nine-month summer.

Our model of test score growth is

$$Y_{msct} = \alpha_0 + \alpha_1 AgeStartKind9_c + \alpha_2 Kind9_{ct} + \alpha_3 Summer9_{ct} + \alpha_4 First9_{ct} + YR_s(\beta_0 + \beta_1 AgeStartKind9_c + \beta_2 Kind9_{ct} + \beta_3 Summer9_{ct} + \beta_4 First9_{ct}) + \cdots + f_m + r_s + u_{sct}$$

where Y_{sct} is the reading or math score of child *c* in school *s* and stratum *m* on test occasion t. On that occasion, $Kind9_{ct}$, $Summer9_{ct}$I, and $First9_{ct}$ are the number of months that the student has been exposed to nine-month kindergarten, nine-month dummer, and nine-month first grade. The coefficients $\alpha_2, \alpha_3, \alpha_4$ of these exposures are the average monthly learning rates during each period for children in nine-month schools. YR_s is a dummy for year-round schools, and the coefficients $\beta_2, \beta_3, \beta_4$ are the differences between the average learning rates of year-round and nine-month learning students during each period.

The model includes several terms to adjust for confounders and autocorrelation. The ellipsis (…) indicates inclusion of all of the school, teacher, classroom, and child covariates in Table 1, which are mean-centered and interacted with YR_s. In addition, the model includes a stratum fixed effect f_m which controls for unobserved stratum-level variables and limits the comparison to schools in the same stratum. The model also includes a school random effect r_s which accounts for the correlation among students from the same school, as well as a residual u_{sct} with a spatial power structure that accounts for the correlation between tests taken by the same student on different occasions.[3]

Many quantities of interest can be calculated as linear combinations of the model parameters. For example, the average learning rates for children in year-round schools are $\alpha_2 + \beta_2$ during nine-month kindergarten, $\alpha_3 + \beta_3$ during nine-month summer, and $\alpha_4 + \beta_4$ during nine-month first grade. These learning rates are estimated in Table 2.

Table 2 also estimates average monthly learning rates for the 1.2 months between the start of year-round kindergarten (on July 18, 1998) and the start of nine-month kindergarten (on August 25, 1998). Nine-month students are not in school during this period, so to estimate their learning rate, we exploit the fact that children vary in age at kindergarten entry. $AgeStartKind9_c$ is the child's age in months (mean-centered) at the

[3] Under a spatial power structure, the residual correlation between two tests taken by the same student is ρ^d, where $\rho<1$ is a parameter estimated from the data, and *d* is the number of months elapsed between the tests (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006). We also tried an AR(1) structure, which yielded very similar estimates but ran more slowly.

start of nine-month kindergarten, so we interpret its coefficient α_1 as the monthly rate at which nine-month students learn just before the start of nine-month kindergarten.[4] For year-round students, the situation is different; they are in kindergarten for 1.2 months before the start of nine-month kindergarten, so during that period we assume that they learn at their kindergarten rate $\alpha_2 + \beta_2$.

We can now estimate students' ability levels at baseline. The coefficients β_0 and α_0 represent the average ability of year-round and nine-month students on the first day of nine-month kindergarten, but that is not the baseline date for year-round students. To calculate a common baseline before anyone has started school, we have to extrapolate back an additional 1.2 months to the first day of year-round kindergarten. During those 1.2 months, year-round children learn at a rate of $\alpha_2 + \beta_2$ and nine-month children learn at a rate of α_1, so on the first day of year-round kindergarten, year-round students have an average ability of $\beta_0 - 1.2(\alpha_2 + \beta_2)$ and nine-month students have an average ability of $\alpha_0 - 1.2\alpha_1$. Estimates of these baseline abilities appear in Table 2.

The final quantities in Table 2 are estimates of 12-month gains. Since nine-month kindergarten lasts 9.34 months and nine-month summer lasts 2.66 months, average gains over the 12 months after the start of nine-month kindergarten are $9.34\alpha_2 + 2.66\alpha_3$ for nine-month students and $9.34(\alpha_2 + \beta_2) + 2.66(\alpha_3 + \beta_3)$ for year-round students. Likewise, for the 12 months after the start of nine-month summer, average gains are $2.66\alpha_3 + 9.34\alpha_4$ for nine-month students and $2.66(\alpha_3 + \beta_3) + 9.34(\alpha_4 + \beta_4)$ for year-round students.

Alternatives

We considered two alternative ways to estimate the effects of the year-round calendar. These are not reported in our chapter, but we describe them here for readers who are thinking about other ways to approach these data.

One alternative is to match year-round to nine-month schools using propensity scores estimated from the variables in Table 1 – both the school-level variables and school-level averages of student and teacher/classroom variables. The results o are similar to those reported in Table 2 and Figure 1,

[4] This interpretation depends on the assumption that age at kindergarten entry is exogenous to ability. But for some students age at entry is endogenous; low-ability students are more likely to delay or repeat kindergarten, while high-ability students are more likely to enter kindergarten early. Endogenous entry may bias the estimated effect of age on ability, but the bias is not large in the ECLS-K (Elder & Lubotsky, 2009).

suggesting that year-round students learn faster in the summer but do not learn more over periods of 12 months.

Propensity score matching works best when the matched units are in the same local area, so we also tried matching year-round schools to nine-month schools in the same survey stratum. When we tried this, though, we found we could not achieve good matches because, within strata, year-round and nine-month schools differed too much in enrollment.

Because the decision to adopt a year-round calendar is often driven by crowding, we also considered a regression discontinuity design where the forcing variable was a measure of crowding – either enrollment or the subjective crowding scale in Table 1. This approach also ran into difficulties, since although the probability of using a year-round calendar increases with both crowding and enrollment, there is no threshold where the probability increases discontinuously. Looking for such a discontinuity, we also considered using the ratio of enrollment to the number of rooms in the school. But this ratio was not strongly related to use of the year-round school, probably because the number of rooms was not measured well in the ECLS-K.

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