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Impact of Year-Round Education on Travel

Authored by Elton Mykerezi and Xinyi Qian, Ph.D.

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EXECUTIVE SUMMARY

Using data from the American Time Use Survey (ATUS), this study examines the relationship between year-round education (YRE) and travel among U.S. households with children. Several aspects of YRE were evaluated, including the implications of YRE policy at the state level, the interaction of YRE policy with other state regulations regarding school scheduling, and the reported use of YRE by several states and districts. Normal linear regression analysis was used to identify the effects of YRE policy and practice on travel. Data was collected through an email survey to state departments of education. Administrative data was provided by several states, as well as various secondary sources on school schedules. For the purposes of this study, it was assumed that households with children, as well as those without, would be affected differently by YRE. Households with teachers were also expected to be effected by YRE. Chicago Public Schools was used as a case study, as several schools experienced a dramatic increase in YRE during the study period. Their experiences provided valuable data in which to examine the effects of YRE.

Main study findings include the following: (1) Travel patterns among households with children differ from those without in a way that is heavily shaped by the traditional school schedule; (2) The presence of YRE policy at the state level, and interaction with other state policy on school scheduling, did not appear to influence the travel patterns of households with children; (3) Use of YRE at the state level does not appear to be correlated with travel patterns among households with children; (4) The large increase in YRE in Chicago between 2007 and 2010 did not result in a disproportionate change in travel patterns among households with children, when compared with similar households in other Midwest urban areas.

There are two primary caveats to the study. First, while the use of longitudinal, household-level micro-data linked with school-level policy provides a close view, such data is difficult to obtain. Second, states and districts that have implemented YRE to a substantial extent do not have strong school year start regulations, thus the lack of interaction between YRE and other policies found in this study may not generalize to widespread adoption of YRE in states with late school start dates (e.g. Minnesota, Wisconsin, Virginia, and Michigan).

INTRODUCTION

The year-round educational (YRE) calendar is designed to redistribute the traditional three-month summer school break more evenly during the year. The merits and costs of this alternative attract lively debate, while its effect on household time use has elicited less formal research.

Year-round calendars can be organized in many ways, but two common types are single- and multi-track schools. Singe-track year-round schools redistribute school days throughout the year, eliminating the traditional summer break. This is done to reduce a potential loss of knowledge that might accrue during long breaks, especially among children in lower-income households. Multi-track year-round schools also redistribute school days more evenly during the year, but students are split into cohorts and attend school on a rotating schedule. This is done to utilize space more effectively and deal with possible overcrowding in schools while eliminating long breaks.

There is reason to believe that school schedules are an important factor in household travel. For instance, Mykerezi and Kostandini (2014) found that households with children travel about 30 percent fewer times during the summer when school starts before Labor Day. Mykerezi and Nash (2012) found that, when schools operate on a four-day week schedule, households take more day trips that do not require stay away from home but fewer trips that exceed four nights away from home.

A substantial body of research has examined possible impacts of year-round schools on student academic outcomes, as well as principal, teacher and parental attitudes. A comprehensive meta-analysis of studies on year round schools found that student outcomes are mixed and that no consensus had emerged about whether the modified schedule has been successful in reducing knowledge loss or in closing achievement gaps along socio-economic lines (Cooper, Valentine, Charlton, & Melson, 2003). Recent high-quality studies, on the other hand, find that there are no educational benefits to YRE (McMullen & Rouse, 2012).

Parental attitudes toward year-round schools are also split, with nearly half of those interviewed having a positive attitude. However, on average, parents have more positive attitudes after *implementation* of year-round schooling than before (Cooper et al., 2003). This finding may indicate that parents are able to adjust better than they had expected, or it could simply reflect self-selection—parents who are in favor of year-round schooling are more likely to self-select into such schools, or not oppose their school system's decision to switch.

No empirical study has addressed the impact of YRE on household travel explicitly; however, theoretical postulations and small scale qualitative studies have proposed two possibilities: YRE might effectively relax or tighten family time constraints as they plan travel. YRE could relax time constraints since it provides multiple breaks of two or more weeks in non-traditional months, possibly resulting in more travel. The frequent breaks may provide households with more travel flexibility, as not all households prefer to travel at the same time. It may also allow travel in off-peak times, which could be more affordable. On the other hand, YRE may prohibit travel with friends and relatives who are on a different schedule, particularly in multi-track schools.

YRE may also restrict a longer summer vacation, since it eliminates the three-month traditional summer. The two most popular year-round school calendars are the "60-20" and "45-15" (referring to the number of days in school and on vacation). Both calendars allow for at least 15 days of vacation during the summer. Depending on the precise alignment, they may also allow for multiple 15 day periods during which travel is possible in the summer. While YRE may be prohibitive of trips longer than 15 days, it would allow trips of two weeks or shorter on multiple occasions throughout the year.

In general, there is no theoretical reason to expect YRE to either prohibit or encourage the overall amount of yearly travel. However, there is reason to expect YRE will make travel *patterns* of household with children and those without more similar. For a family to go on vacation, households with children must generate free time from work and school. Summer travel is less costly time-wise for households with children, since school is out. For households composed only of adults, there is no reason to expect that they would face lower opportunity costs (time-wise) to travel in summer than they would in other parts of the year. One would thus expect two phenomena:

> 1) Travel among adult-only households is more evenly distributed throughout the year than that of households with children (expected to peak in summer).
>
> 2) YRE, which provides multiple equal opportunities to travel during the year, should reduce the "summer advantage" that households with children face. Thus, it is expected that the travel patterns of households with children more closely resemble those of households without children.

This study collected data on policies and practices related to YRE in states and districts around the nation. The data include state policies governing YRE, as well as specific lists of schools/districts implementing YRE on any given year between 2005 and 2012. The state and district YRE policy and implementation data is then linked to time-use data from the American Time Use Survey to examine

how YRE affects household travel quantity and timing. First, the hypotheses regarding travel distribution of households with and without children are tested. Then the differential patterns of travel for the different household types are exploited, in conjunction with state and district YRE policy from several areas around the nation to test the impact of YRE on travel patterns for households with children.

DATA

Travel Data

This study used data from the 2005-2010 American Time Use Survey (ATUS). The ATUS is the most substantial effort to collect time diary data on U.S. households, with more than 125,000 interviews conducted between 2001 and 2010. ATUS interviewers collect data via telephone calls on a randomly chosen day. The questionnaire collects information on how and with whom respondents spent the 24 hours preceding the phone call. In 2005, a "trips" supplement was added to the ATUS that asked respondents whether they had been away from home for two nights or more during the month preceding the ATUS interview. This supplement (ATUS-Trips) has become an important source of information on the nation's leisure travel for several reasons. First, it represents a large national sample. Second, monthly data are available, making it possible to examine travel behavior, and its distribution throughout the year. Third, the purpose for the reported trip(s) was recorded, making it possible to isolate leisure trips, as well as trip longevity in days. Lastly, ATUS is administered to individuals already sampled in the Current Population Survey (CPS). The CPS is sponsored by the U.S. Census Bureau and the Bureau of Labor Statistics, and it is one of the primary sources of labor force statistics, family characteristics, well-being and other population information in the United States. With CPS data available for ATUS respondents, this study used data on family size and composition, demographic information, location of residence (state and Metropolitan Statistical Area), economic circumstances, and human capital to control for other influences on travel that might confound the analysis.

State Policy Data

This project collected data on the history of policies and practices related to YRE from each US state, via an email survey, followed by a telephone call. Project personnel identified the contact person responsible for "alternative scheduling," or scheduling in general, in each state's department of education (or equivalent state agency responsible for K-12 education administration). These individuals were then contacted via email. The email survey asked respondents to identify any current legislation pertaining to school schedules in their state, as well as past versions of such legislation. They were also asked to supply information on whether districts in their particular state were required to obtain permission from the department of education in order to run alternative schedules. In states where districts were required to file petitions for modifying school schedules, officials were asked to provide administrative data identifying such districts, or any statistics on the use of YRE that the state collects. These data were then complemented with secondary information from the National Center for Education Statistics (NCES) and other secondary sources to build a more comprehensive YRE policy and use database.

Most states do not have explicit policies that regulate YRE, but nearly all have policies that regulate the minimum amount of time school must be in session (in days or hours). In states with no explicit policy, the status quo is that districts are free to schedule as they see fit, provided they do not reduce the number of instructional days to violate state regulations. Many states also regulate the earliest date schools can start in the fall (Mykerezi & Kostandini, 2014). In such cases, the state

generally requires districts to obtain permission to run YRE, since it must be exempt from school start regulations. Thus, the absence or presence of state legislation regarding YRE does not necessarily coincide with its actual use. Table 1 (Appendix A) presents the number of states legislating YRE and those with at least one district that has implemented YRE.

In this study, we examine the impact of having a YRE policy only, as well as that of having a YRE policy *and* a school start date policy. Since mandated school start dates may affect travel, the use of YRE to circumvent this policy may have a significant effect, while having an YRE policy alone may not. We then use data on the share of students who attend schools on a year-round schedule each year, as implied by state or district level data, to examine the impact of YRE on travel patterns.

Data Analysis

The data is analyzed both graphically and through normal linear regression techniques. The overall strategy uses the fact that different states/districts show different patterns of YRE policy and implementation, as well as the fact that households with children are the group that is primarily expected to be affected by school schedules while households without children are not. Households without children are used as a "placebo" test when comparing travel patterns across states/districts with different YRE policy and practice. Thus, to conclude that YRE policy/practice in a state/district has an effect on travel, one would have to observe changes in travel patterns that are present only in YRE states/districts, AND that are unique only among households with children.

A third group of interest is also examined: households in which at least one adult is a teacher and children may or may not present. We examined this third group, as a teacher's schedule is tied to the school, and it may affect the household's travel behavior. Graphs plot the share of households reporting leisure travel in any given month for the various groups of interest (e.g., households with children, adult-only households, and households with at least one adult working as a teacher). These distinctions allow a preliminary assessment of differences in travel patterns.

Regression analysis is then used to formally test for differences in travel attributable to YRE policy or practice. Linear probability models that use data for the entire calendar year test if there is an effect on the total quantity of travel, regardless of its distribution during the year. Models estimated with only data that cover the summer months are used to estimate differences in summer travel alone, testing for distributional effects of YRE. Regression analysis holds constant several factors, including metropolitan status of residence, race and ethnicity, household size, number of children younger than 18 years of age, age of youngest child, age of respondent, family income, years of education of respondent, ownership of a family business, and home ownership status.

YRE policy or practice is captured via indicators of policy presence (or actual use of YRE) in the household's relevant jurisdiction (district or state, depending on the model) and year of interview.

RESULTS

Identifying the Effects of YRE

To identify the effects of YRE on travel, this study leverages the difference between households with and without children across areas that use YRE and those that don't. For instance, Figure 1 represents the distribution of reported trips across all months for households with children, those without children, and teachers.

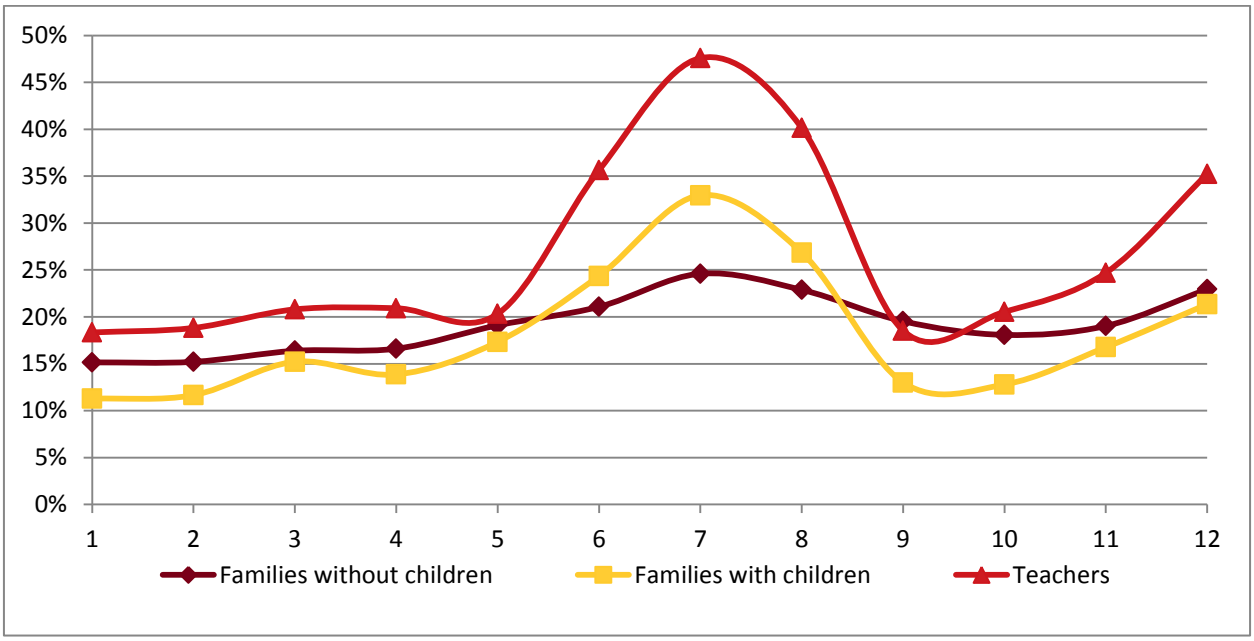

FIGURE 1: Distribution of travel for families with children, families without children, and teachers.
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

Figure 1 shows that families with children tend to travel less when school is in session (months 2-5 and 9-11) than those without children, but they travel more during the summer. If these patterns emerge due to school schedules alone, they can be leveraged to identify the effect of YRE on the travel patterns of households with children. Presumably, in order to take a trip, all household members need to arrange for time off school/work. Households with children may find it advantageous to travel more in the summer, since the children are already off school. Households without children may not find a distinct advantage in scheduling their vacation during the summer. Since YRE shortens the amount of time off school during the summer and redistributes throughout the year, it is likely the opportunity costs of vacationing for families with children with YRE schedules will more closely resemble those of families without children.

The travel patterns observed above, however, may not arise due to school schedules alone, but may be due to other factors, such as preferences. Perhaps households with children prefer summer activities more than those without, regardless of scheduling issues. This would be plausible, for example, if adult-only households had a relative affinity for winter activities.

To increase confidence that the differences in travel patterns are due to school schedules rather than other factors that affect households with/without children, the distribution of travel for

teachers (regardless of presence of children) is included in the analysis. Since teachers show travel patterns similar to households with children, it is likely that gaps in travel patterns between the two types of households are due to school schedules.

In Figure 2, two more observed factors are added to further test correlations between school schedules and travel:

- 1) ATUS collects data on what the respondent did during the 24-hour period prior to their ATUS interview; activities related to "helping children with homework or other school related activities" were coded and their distribution plotted over 12 months.
- 2) During 2006-2009, ATUS collected a health and well-being supplement that asked parents if their children ate any meals in school during the week of the interview; affirmative answers were also plotted over the 12 months.

If the travel gap between households with and without children is due to school schedules, one would expect the exact opposite patterns in behavior related to being in school (as we do in Figure 2).

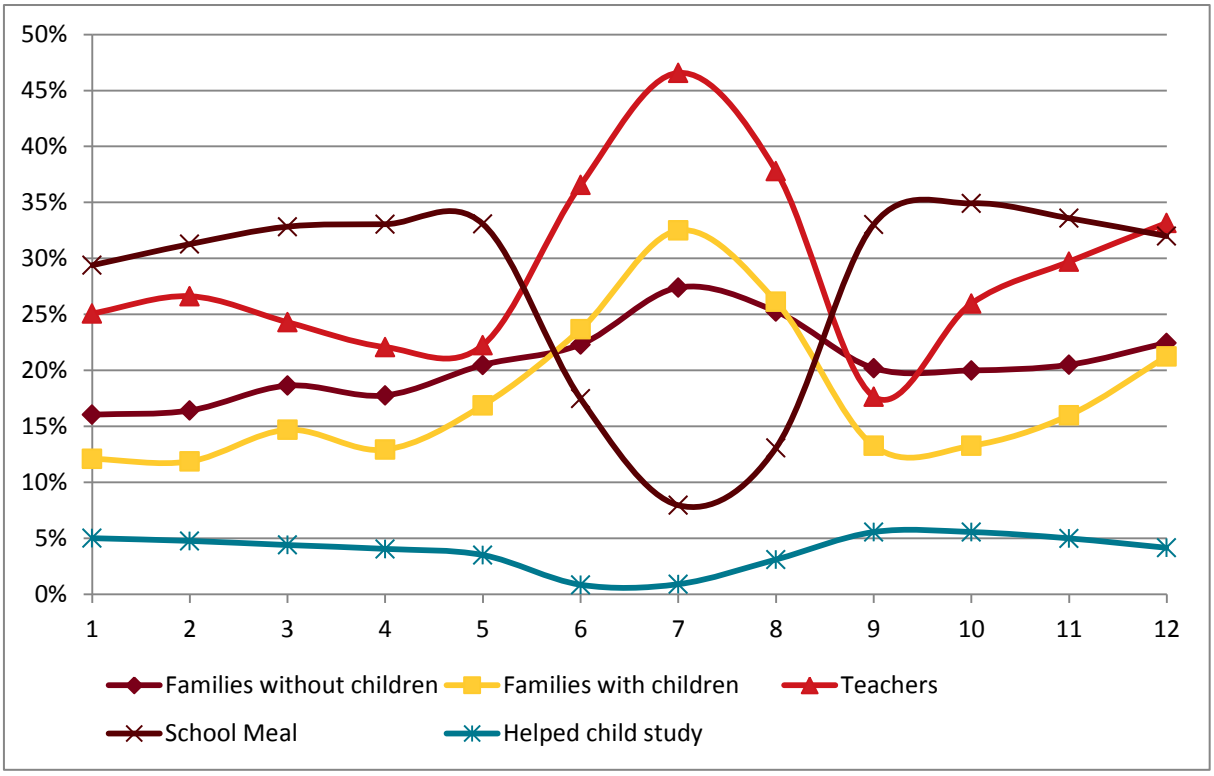

FIGURE 2: Distribution of travel and various school-related activities.
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

Finally, the duration of leisure trips is plotted to see whether two-to-three week breaks on YRE calendars prevent a large share of trips. As seen in Figure 3, average trip length for households without children does not vary significantly during the year, while households with children take their longest trips during the summer months. However, the average summer trip is still about eight

days long. In fact, as seen in Table 2 (Appendix B), nearly 95% of all trips for both household types are 15 days or shorter. This implies that YRE may not necessarily present a substantial barrier to summer travel for the majority of households.

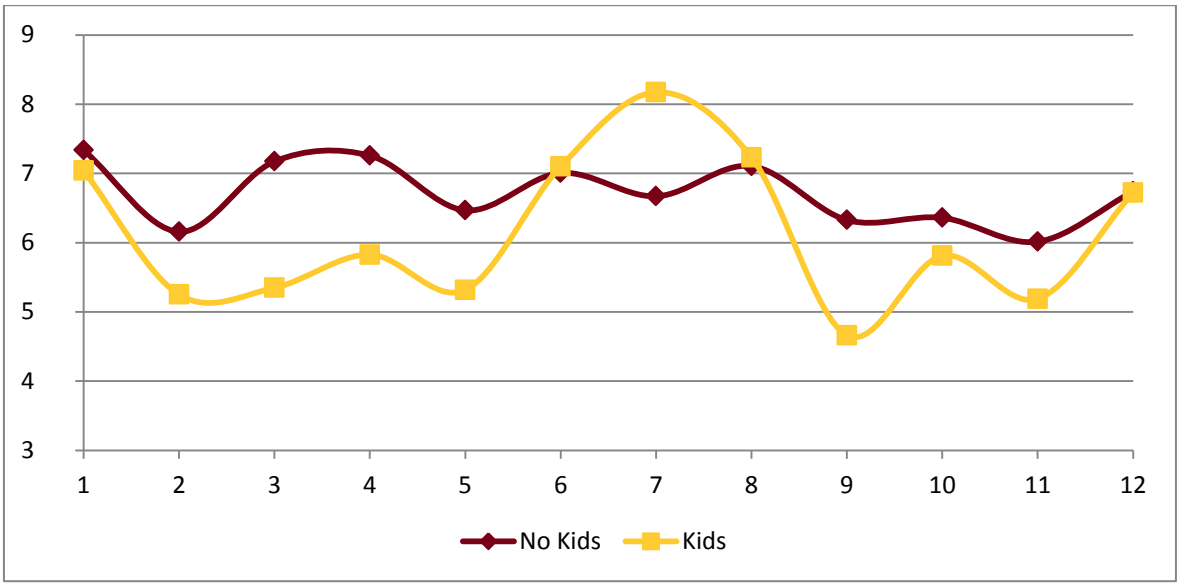

FIGURE 3: Length of average trip by month.
*Note: Length of leisure trip presented on vertical axis; month of travel presented on horizontal axis.

The patterns captured in Figures 1-3 collectively provide a strategy for identifying the impacts of YRE-related policy and the occurrence of YRE in states or school districts. YRE provides multiple two-to-three week periods during the year when travel is possible, but a very small share of trips by any type of household is longer than two-to-three weeks. Differences in monthly patterns between households with and without children can be reliably attributed to school schedules, generating a theoretical expectation for the effect of YRE. It provides more opportunities to travel during off-summer months, while still allowing at least one trip of two weeks or less during the summer. This would lead to travel patterns of households with children in YRE districts to more closely resemble those of households without children. The rest of this study conducts tests of this hypothesis by using policy variation in YRE, as well as reported practices in various states and metropolitan areas.

Does Having a YRE Policy Affect Travel?

As noted, not all states have an explicit policy that regulates YRE. When interviewed by our staff, officials in most states with no policy stated the absence of an explicit policy means that districts are free to schedule in the manner of their choosing, provided they comply with other state regulations regarding school calendars. For instance, most states regulate the total number of days or hours that students are required to be in school. If no other policies exist, districts in states with no explicit policy regulating YRE are effectively free to use a year-round calendar, provided they schedule the minimal number of days/hours required. Additionally, districts or schools in these states most likely do not have to report weather they use YRE to the state's education authority. In states without an explicit YRE policy but that also regulate a school-year start or end date—in addition to total days in school—YRE is effectively not possible. Complying with both policies rules out the possibility of a year-round schedule. As a result, many states with legislation that mandates

school start dates also implement rules or legislation that allows year-round schools to be exempt from this policy. These states are also likely to have administrative data on the use of YRE generated by district applications for exemptions.

Monthly travel patterns for households with and without children in states with a YRE policy and those without are shown in Figure 4. If YRE policy were to have an impact on travel, one would expect very similar travel patterns for households without children across policy regimes but a more uniform dispersion of travel for households with children in policy states. It is apparent, however, that this is not the case; patterns for each type of household are no different across policy regimes.

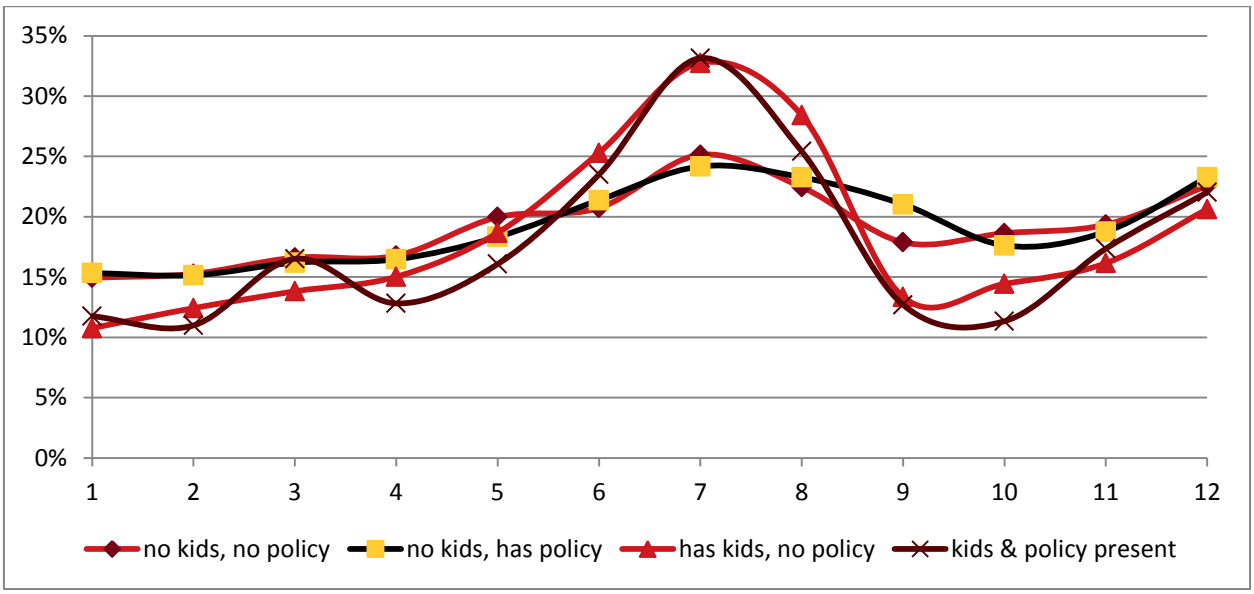

FIGURE 4: Travel patterns in states with and without YRE policy.

Figure 5 presents travel patterns for teachers in states with and without a policy. Teachers in states with a policy tend to have travel patterns that are slightly more concentrated in the summer months, which is the opposite one would expect if state legislation on year-round schooling impacted travel patterns.

A lack of differences in travel patterns across policy regimes for households with children and teachers suggests that having YRE legislation alone does not affect travel.

The next step is using regression analysis to compare travel patterns across states with no policy whatsoever, YRE policy only, and YRE + School-Start policy, while controlling for the effects of demographic and socioeconomic factors. If districts were using YRE to get around school start policies, one would expect no differences in travel patterns for households without children but less summer travel for households with children and for teachers. It is also possible there would be less overall travel in states that have both policies. Results in Table 3 (Appendix C) indicate, however, that this is not the case. In Table 3, the first two columns present regression results for travel among households with children during both the entire year (column1) and the summer only (column 2). The results also reflect state policy and household characteristics. The same results are then reported for households with children (columns 3 and 4) and teachers (columns 5 and 6). The first row shows the estimated effect of living in a state with a YRE policy on travel behavior. The second

row indicates the effect of having a school-start policy, and the third row shows estimates of being subject to both a school-start and a YRE policy.

The expectation is that school-related policies have no effect on the travel of households without children and that having a school-start *and* YRE policy has a negative effect on summer travel for households with children and teachers. There is no particular expectation, however, of the effect of YRE on total travel throughout the year. None of the estimated effects are statistically significant, indicating there is no effect of having a YRE policy (alone or in conjunction with a school-start policy) on either the total quantity or distribution of leisure travel.

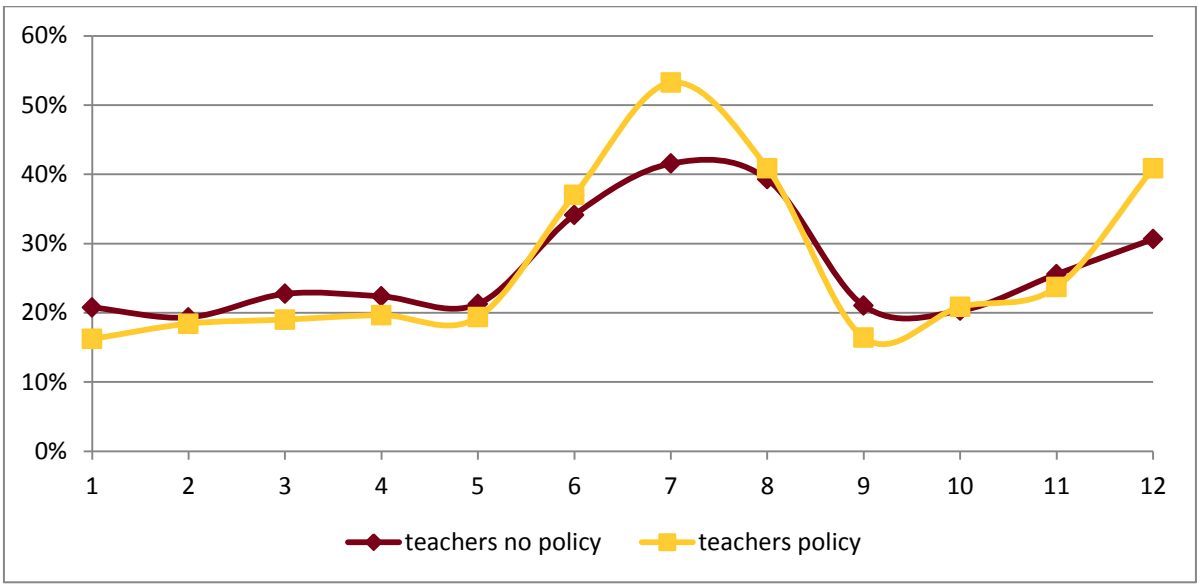

FIGURE 5: Travel patterns of teachers across YRE policy regimes.
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

Do States That Have Higher Shares of YRE Students Show Different Travel Patterns?

The absence or presence of a YRE policy, however, does not imply that many districts would use year-round schooling. Data collected from administrative records of several states and from the National Association for Year-Round Schooling (NAYRE) were used to classify states into "low-use" (<2% of students), "high use" (>10% of students) and everything in-between as "medium use" states. The three states with the highest use of YRE are California, Arizona, and Nevada. Each has student shares well above 10 percent.

Figure 6 shows travel patterns for households with children across low, medium, and high-use states. The patterns appear to overlap to a great extent, indicating that the presence or absence of YRE is unlikely to affect travel. This may be caused by YRE having no impact on travel or because proportions of students enrolled in YRE are relatively low even in "high-use" states.

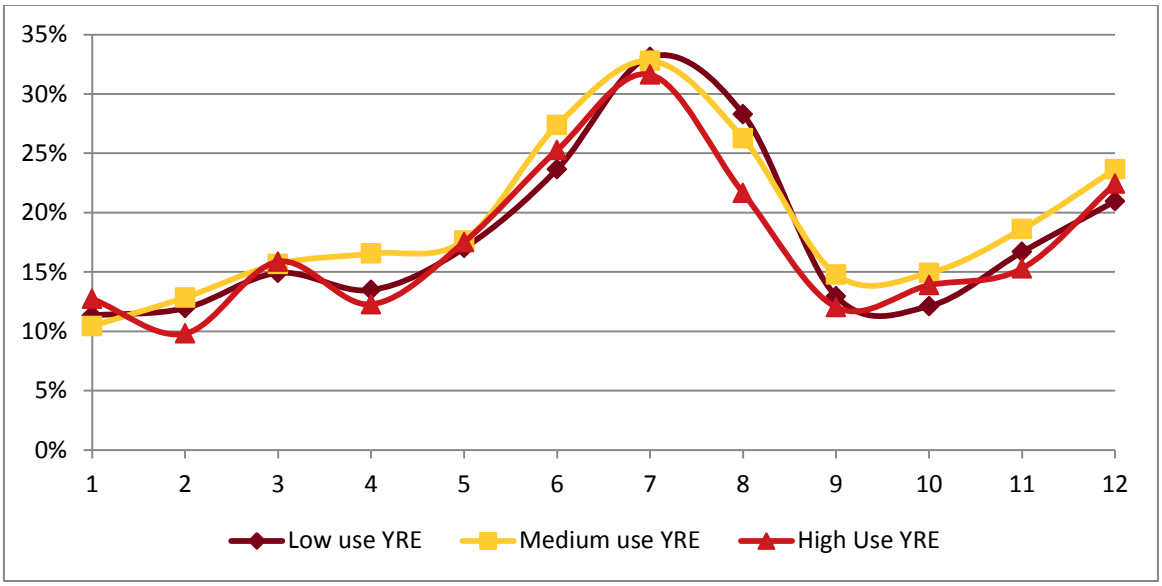

FIGURE 6: Distribution of travel among households with children in states with low, medium, and high share of students in YRE calendars.
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

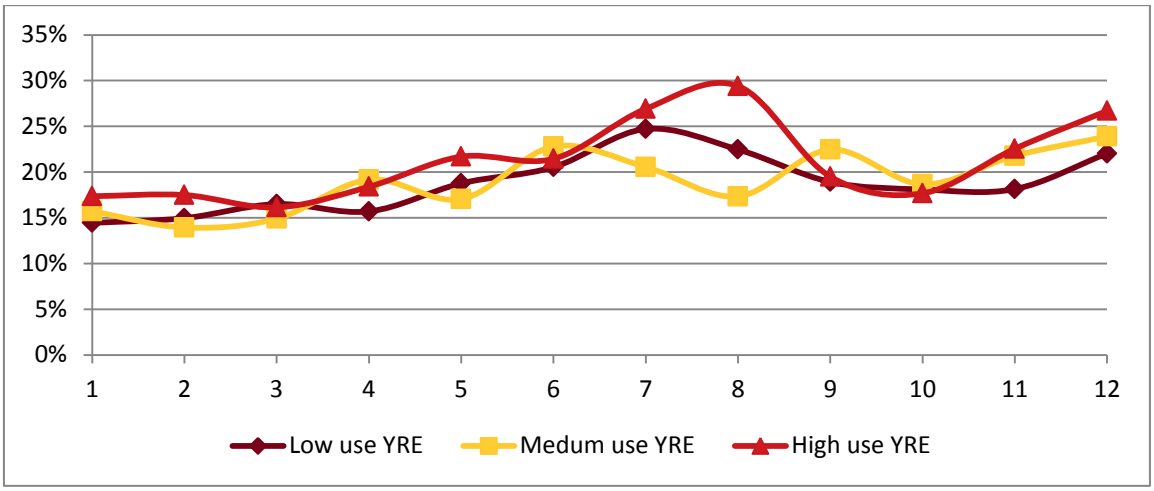

FIGURE 7: Distribution of travel among households without children in states with low, medium, and high share of students in YRE calendars.
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

Figure 7 shows that travel patterns of households without children are also rather similar across states, regardless of the use of YRE. They are also, as expected, far more evenly distributed across months.

The Case of Chicago Public Schools

The linked CPS-ATUS data also identifies the general metropolitan area (in the form of a Metropolitan Statistical Area) where households reside, as well as an indicator of whether the household resides within the city or in the surrounding areas. This makes it possible to identify, with some confidence, households that reside in major cities.

Households in Chicago are of particular interest, since the city has had large changes in its use of YRE during the timespan of the ATUS data. Chicago Public Schools had minimal to no use of YRE until 2006. In 2007, they started to implement YRE for several of their schools. The number of schools using the alternative calendar grew from 18 in 2007 to 195 (comprising almost one-third of all students) in 2010. This report uses this rapid growth in YRE to see if travel patterns of households with children classified as "in city" in the Chicago Metropolitan Statistical Area changed in ways that were unmatched by households with children in similar Midwest urban areas. Figure 8 presents travel patterns of households with children for the Chicago Metro Area before and after the introduction of YRE (pre/post 2007), while figure 9 does the same for households with children throughout the Urban Midwest (UMW).

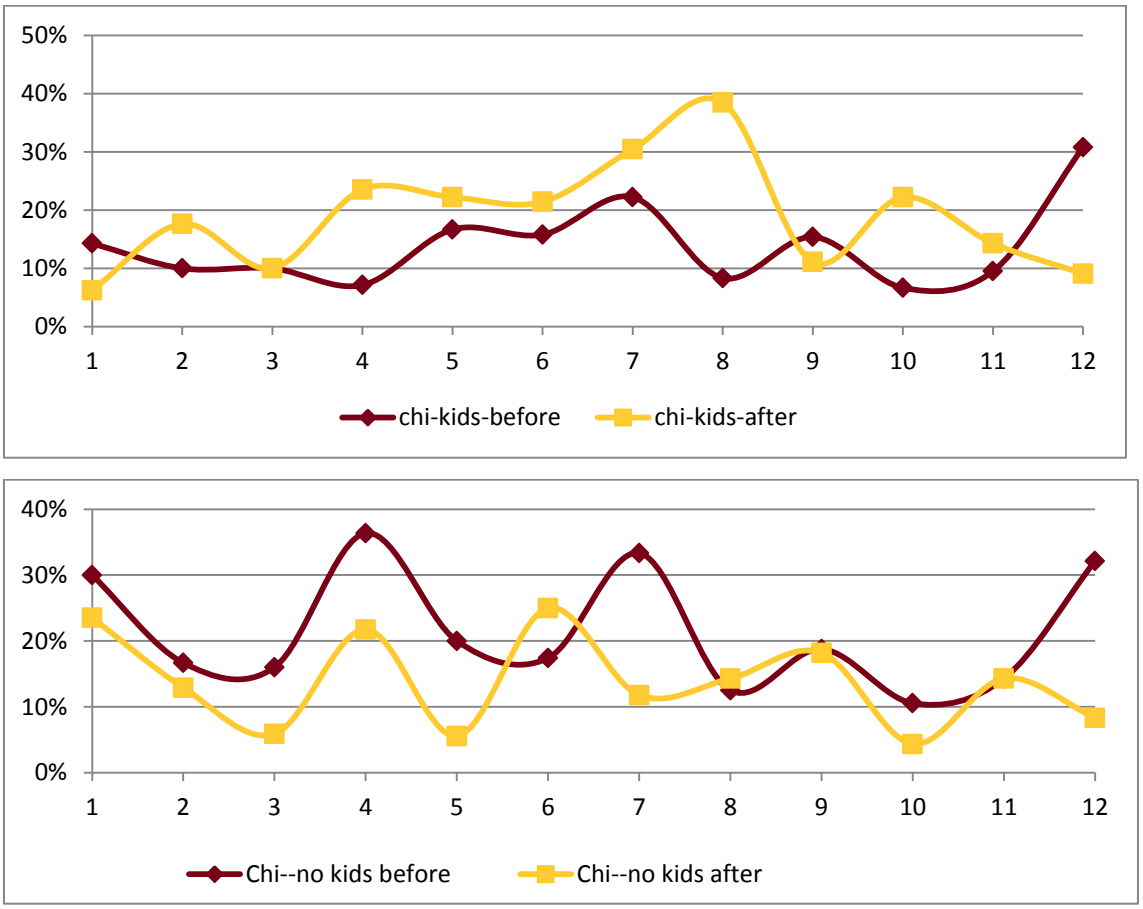

FIGURE 8: Travel patterns of households with and without children in Chicago, before and after introduction of YRE (2007).

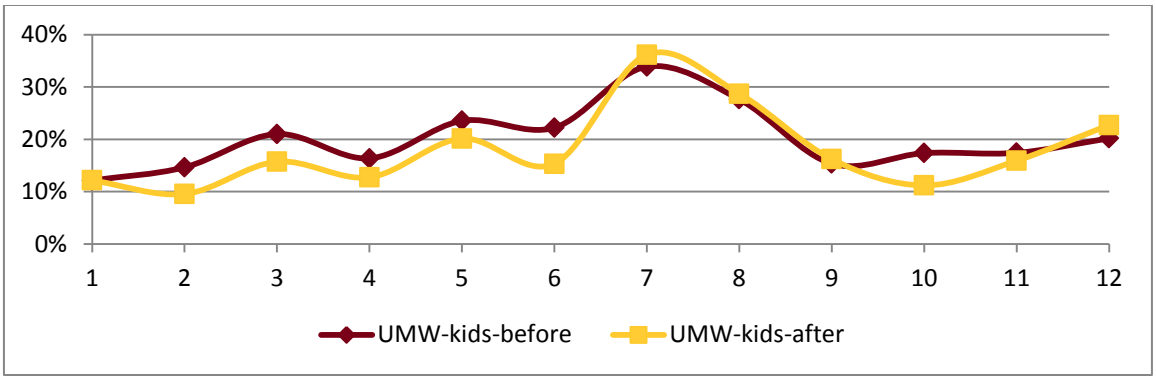

FIGURE 9: Travel patterns of households with children in all Midwest cities, except Chicago, before and after introduction of YRE in Chicago (2007).
*Note: Share of households reporting leisure travel presented on vertical axis; month of travel presented on horizontal axis.

Given the smaller samples of households in urban Chicago, the variance of travel is higher, making it more difficult to interpret the graphs and distinguish between random and systematic differences without formal statistical analysis. It appears, however, that travel patterns for households with children throughout the urban Midwest did not change before and after 2007, and neither did patterns for households without children in Chicago (with the exception of a small, general decline in overall travel). Households with children in Chicago appear to have shifted their peak summer travel to August, rather than July. Yet this seems implausible, since the Chicago Public School YRE schedule started school *after* the first week of August and provided additional 15-day breaks in the middle of the fall and spring, with a three week break over the winter holiday season. The schools also had nearly two months off during the summer, covering June and August partially and all of July.

Regression analysis tested whether the shift in travel patterns post-2007 in Chicago households with children is statistically different than changes in patterns of travel among households with kids throughout the Urban Midwest. The results are presented in Table 4. The coefficient of interest, denoted as "Chicago x Post 2007," measures the change in travel for households with kids in Chicago (pre-to-post 2007) that is unmatched by households with kids throughout other urban areas in the Midwest. This coefficient is virtually zero for summer trips and those taken year-round. These results indicates that the jump from no YRE in 2007, to nearly one-third of all Chicago public school students being in an YRE school in 2010, caused no notable shift in travel patterns.

DISCUSSION

This study shows that, nationwide, there is a spike in summer (predominantly July) travel among households with children that is not matched by those without. During the fall and spring months there is a disproportionate dip in travel among households with children. These patterns are similar among teachers, regardless of the presence of children in the household and exactly opposite to time spent in other school-related activities (e.g., helping kids with homework and having a meal in school). This analysis, thus, implies that school schedules in general seem to shape the timing of travel among households with children.

Given that travel patterns among households with children seem to be shaped largely by the traditional school calendar, it is reasonable to expect that YRE would also impact travel in the opposite direction. One could expect the introduction of YRE to cause travel to become more even over the year (as in households without children). Several aspects of YRE were examined. First, models that examined travel patterns by the presence of a YRE policy found no impact of a policy. This is not surprising, since having a policy and actually *using* YRE do not necessarily overlap. In fact, not having an explicit YRE policy, and not having any rules on when school must start and end, implies districts are free to use YRE as they see fit. In states with a school start and/or end date legislation (e.g., Minnesota, Michigan, Wisconsin), a YRE policy is required to make YRE possible; otherwise, it would violate school start policy. Tests of whether states with a school start policy *and* a YRE policy show different travel patterns also revealed no significant differences in travel.

The next set of tests examined if states with a high share of students in YRE schools (e.g., California, Nevada, Arizona) display different travel patterns from those with medium use (e.g., Utah, Colorado, Kentucky, Texas, North Carolina) and negligible use of YRE (most states). No particular patterns emerged.

Another exercise exploited a natural experiment involving the rapid growth of YRE in Chicago Public Schools between 2007 and 2010. This analysis showed no patterns of change in travel among households with children.

While the overall year-long distribution of travel among households with children is shaped by the traditional school schedule, it appears to cause no shift in behavior when the schedule is relaxed. This is somewhat puzzling. We propose several alternative explanations but do not have a way to discriminate among them. As such, we propose them as future areas of study, and they are detailed below:

1) Even in high-use states/districts, we only observed as many as 20-50% of students in YRE schools. This implies that parents whose travel plans would be affected by YRE may have chosen to enroll their children at a different school and maintained their original travel schedules. Essentially, parents who would be affected could avoid the policy by switching schools.

2) YRE is not that big of a change in people's lives and their opportunity costs of travel. With 95% of trips shorter than 15 days, there is sufficient flexibility in travel that households just do not adjust their travel plans significantly in response to YRE (albeit this seems inconsistent with the sharp differences in travel between households with and without children).

3) It could be that the "summer spike" in travel for households with children is driven by the traditional school calendar but has been institutionalized through the scheduling of summer activities for kids, such as summer camps, etc. Some schools in states switching to YRE are not able to generate a whole 'vacationing infrastructure' that caters to the YRE school calendar. If this were the case, and most of the nation switched to YRE, it is likely that households with children would

start to act much more like those without, and the travel infrastructure would follow. This explanation, however, is not consistent with the finding that adult-only teacher households behave more like households with children than adult-only households. To make this explanation more plausible, one would expect adult-only teacher households to behave more like adult-only households rather than households with children.

4) YRE was traditionally viewed as a means to close the summer knowledge gap between more affluent households and those that were not, since the former are more likely to be able to send their children to more productive activities during the summer. So as applied, YRE has been more prevalent in schools and districts with disproportionate shares of lower income households. These households tend to travel less regardless of YRE. We correct for this, in part by controlling for income and other socioeconomic variables in regressions, but there may still be too little variation in travel among those truly exposed to YRE.

5) Could low statistical power be an issue? Even in high-use states/districts, only 10% to 30% of children are exposed to YRE, so the methods used in this study might not be able detect a YRE effect of modest magnitude. To assess the likelihood of low power being the reason that this report does not find an effect we did some sensitivity analysis for Chicago Public Schools, since it represents our best natural experiment. If YRE *were* to cause a reduction in summer travel in about one in three exposed households (e.g., as school start legislation was found to do in Mykerezi & Kostandini, 2014), in Chicago, there would be about a 10% reduction in summer travel. The model employed in our analysis does have sufficient power to detect a 10% change, and even a 5% change in population behavior. Thus, any changes in summer travel caused by YRE that may remain uncaptured due to low statistical power must affect, *at most*, one in six exposed households.

There are a few caveats worth mentioning. First, in relation to number five above, the discussion of an "effect" refers to the change in behavior that YRE causes on households, should they be exposed to the policy. This study did not test for that effect directly, since we were unable to establish data links between individuals and their schools. This is still a theoretically relevant test, however, that future research should pursue. The effect examined might be more policy-relevant; in the case of Chicago, for example, we examined what happens to travel patterns when a large urban district switches about one-third of their students to YRE over a three-to-four year period.

Second, we must note there is no significant overlap between states with a school start policy (e.g., post Labor Day) and significant use of YRE. This means our assertion that the combination of YRE *and* a school start policy does not affect travel is based on the experiences of a few states. Even though these states have some restrictions on when school starts, the rule only mandates that schools start no earlier than the second or third week in August. A meaningful interaction between states with more aggressive school start policies and the use of YRE (e.g., Minnesota, Virginia, Wisconsin, Michigan) could produce different findings.

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Appendix A

TABLE 1: State school start and YRE policy.

States	YRE policy start	School Start Policy	Districts with YRE
Alabama			Yes
Arizona	2004		Yes
Arkansas	2004	Yes	Yes
California	2004		Yes
Colorado			Yes
Connecticut			
Delaware			Yes
DC			Yes
Florida	2004	Yes	Yes
Georgia	2009		Yes
Idaho			Yes
Illinois	2004		Yes
Indiana			Yes
Iowa	2004	Yes	Yes
Kansas			
Kentucky	2009		Yes
Louisiana			Yes
Maine			Yes
Maryland	2004		Yes
Massachusetts			
Michigan	2004	Yes	Yes
Minnesota	2004	Yes	Yes
Mississippi			
Missouri			Yes
Montana			
Nebraska			Yes
Nevada	2004		Yes
New Hampshire			
New Jersey			
New Mexico	2004		Yes
New York			Yes
North Carolina	2004	Yes	Yes
North Dakota			Yes
Ohio	2005		Yes
Oklahoma	2006		Yes
Oregon			Yes
Pennsylvania	2004		Yes
Rhode Island			
South Carolina		Yes	Yes
South Dakota	2004		Yes
Tennessee	2004	Yes	Yes
Texas	2004	Yes	Yes
Utah			Yes
Vermont			
Virginia	2008	Yes	Yes
Washington			Yes
West Virginia	2004	Yes	Yes
Wisconsin		Yes	Yes
Wyoming	2004		Yes

Appendix B

TABLE 2: Distribution of trips by length and presence of children.

	Households without children			Households with children	
Number of Days	% of trips	Cumulative %		% of trips	Cumulative %
2	19.02	19.02		20.95	20.95
3	11.15	30.17		12.42	33.38
4	14.51	44.68		14.67	48.05
5	8.01	52.69		8.29	56.34
6	8.45	61.14		9.27	65.6
7	7.26	68.4		7.78	73.38
8	7.2	75.6		5.4	78.78
9	4.06	79.66		4.17	82.95
10	3.64	83.3		3.73	86.68
11	1.75	85.05		1.74	88.42
12	2.81	87.86		2.32	90.73
13	1.42	89.29		1.21	91.95
14	2.29	91.58		1.77	93.72
15	1.1	92.68		0.9	94.62
16	1.25	93.93		0.95	95.57
17	0.68	94.62		0.6	96.16
18	0.9	95.51		0.3	96.46
19	0.23	95.74		0.46	96.92
20	0.68	96.43		0.49	97.41
21	0.59	97.02		0.39	97.8
22	0.28	97.3		0.55	98.35
23	0.2	97.5		0.29	98.64
24	0.39	97.89		0.16	98.8
25	0.19	98.08		0.12	98.92
26	0.12	98.2		0.22	99.14
27	0.08	98.28		0.03	99.17
28	0.26	98.54		0.23	99.4
29	0.19	98.72		0.04	99.45
30	0.76	99.48		0.22	99.67
31	0.52	100		0.33	100

Appendix C

TABLE 3: Impact of YRE Policy on travel patterns.

	(1)	(2)	(3)	(4)	(5)	(6)
Family Type:	Children	Children	No Children	No Children	Teachers	Teachers
Time–Frame	All year	Summer	All year	Summer	All year	Summer
State Has:						
YRE policy	-0.001	0.001	0.003	0.016*	0.002	0.026
	(0.008)	(0.012)	(0.007)	(0.009)	(0.013)	(0.036)
School–start policy	0.007	-0.004	0.009	0.005	0.011	-0.001
	(0.007)	(0.013)	(0.006)	(0.011)	(0.012)	(0.038)
School–start & YRE	0.002	0.001	0.010	0.027	0.011	-0.001
	(0.013)	(0.026)	(0.012)	(0.029)	(0.014)	(0.054)
Metro not central	-0.006	-0.001	-0.011	-0.009	-0.014	-0.053
	(0.005)	(0.010)	(0.007)	(0.008)	(0.017)	(0.032)
Metro other	-0.012*	0.002	-0.009	-0.007	-0.004	-0.022
	(0.007)	(0.015)	(0.007)	(0.013)	(0.025)	(0.052)
Non Metro	-0.045***	-0.063***	-0.029***	-0.032***	-0.047*	-0.073
	(0.005)	(0.010)	(0.009)	(0.010)	(0.027)	(0.051)
Hispanic	-0.056***	-0.078***	-0.028***	-0.051***	-0.079***	-0.015
	(0.006)	(0.011)	(0.008)	(0.016)	(0.021)	(0.047)
African American	-0.044***	-0.061***	-0.066***	-0.073***	-0.116***	-0.093**
	(0.008)	(0.012)	(0.007)	(0.010)	(0.023)	(0.040)
Other Non-White	-0.034***	-0.065***	-0.038***	-0.028	-0.089***	-0.108**
	(0.012)	(0.022)	(0.013)	(0.024)	(0.027)	(0.050)
Household Size	-0.005**	-0.007*	-0.005*	0.006	-0.006	0.008
	(0.002)	(0.004)	(0.003)	(0.005)	(0.010)	(0.023)
Number children <18	-0.000	0.008			-0.007	0.017
	(0.003)	(0.006)			(0.016)	(0.035)
Age Youngest Kid	0.004***	0.006***			0.000**	0.000***
	(0.000)	(0.001)			(0.000)	(0.000)
Age (Respondent)	-0.003***	-0.004***	-0.002***	-0.002***	-0.003***	-0.003**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Family Income	0.001	0.006***	0.000	0.002	-0.008*	-0.018**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.005)	(0.009)
Years of education	0.008***	0.013***	0.017***	0.018***	0.009***	0.016**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.007)
Family Business	0.031***	0.024**	0.004	-0.007	-0.018	-0.043
	(0.007)	(0.011)	(0.007)	(0.011)	(0.022)	(0.038)
Owns Home	0.046***	0.083***	0.030***	0.049***	0.006	0.038
	(0.005)	(0.008)	(0.005)	(0.007)	(0.021)	(0.046)
Constant	0.181***	0.156***	0.144***	0.059	0.413***	0.218
	(0.020)	(0.031)	(0.029)	(0.038)	(0.078)	(0.139)
Observations	37,382	12,245	39,734	13,161	3,531	1,166

R-squared	0.028	0.046	0.038	0.044	0.027	0.028
Robust standard errors in parentheses * $p<0.1$, ** $p<0.05$, *** $p<0.01$						

Appendix D

TABLE 4: Changes in travel patterns for households with children post YRE implementation (relative to urban Midwest).

Variables	Summer travel	All year travel
Post 2007	-0.004	-0.028**
	(0.016)	(0.011)
Chicago	-0.016	0.008
	(0.046)	(0.031)
Chicago x Post 2007	0.009	-0.001
	(0.054)	(0.037)
Metro not central	0.004	-0.013
	(0.018)	(0.013)
Hispanic	-0.089***	-0.072***
	(0.031)	(0.021)
African American	-0.063***	-0.046***
	(0.021)	(0.015)
Other Non-White	-0.020	0.031
	(0.035)	(0.026)
Household Size	0.020**	-0.002
	(0.009)	(0.007)
Number children under 18	-0.032**	-0.015
	(0.014)	(0.010)
Age Youngest Kid	0.000	0.000**
	(0.000)	(0.000)
Age (Respondent)	-0.003***	-0.003***
	(0.001)	(0.000)
Family Income	0.010**	0.000
	(0.005)	(0.003)
Years of education	0.010***	0.005***
	(0.003)	(0.002)
Family Business	0.021	0.045***
	(0.022)	(0.016)
Owns Home	0.057***	0.028**
	(0.019)	(0.014)
Constant	0.107*	0.224***
	(0.056)	(0.039)
Observations	3,370	5,052
R-squared	0.032	0.026
Robust standard errors in parentheses * $p<0.1$, ** $p<0.05$, *** $p<0.01$		