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The Demand for Private Schooling in England: the Impact of Price and Quality

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Abstract

In this paper we use English school level data from 1993 to 2008 aggregated up to small neighbourhood areas to look at the determinants of the demand for private education in England from the ages of 7 until 15 (the last year of compulsory schooling). We focus on the relative importance of price and quality of schooling. However, there are likely to be unobservable factors that are correlated with private school prices and/or the quality of state schools that also impact on the demand for private schooling which could bias our estimates. Our long regional and local authority panel data allows us to employ a number of strategies to deal with this potential endogeneity. Because of the likely presence of incidental trends in our unobservables, we employ a double difference system GMM approach to remove both fixed effects and incidental trends. We find that the demand for private schooling is inversely related to private school fees as well as the quality of state schooling in the local area at the time families were making key schooling choice decisions at the ages of 7, 11 and 13. We estimate that a one standard deviation increase in the private school day fee when parents/students are making these key decisions reduces the proportion attending private schools by around 0.33 percentage points which equates to an elasticity of around -0.26. This estimate is only significant for choices at age 7 (but the point estimates are very similar at the ages of 11 and 13). At age 11 and age 13, an increase in the quality of local state secondary reduces the probability of attending private schools. At age 11, a one standard deviation increase in state school quality reduces participation in private schools by 0.31 percentage points which equates to an elasticity of -0.21. The effect at age 13 is slightly smaller, but still significant. Demand for private schooling at the ages of 8, 9, 10 and 12, 14 and 15 are almost entirely determined by private school demand in the previous year for the same cohort, and price and quality do not impact significantly on this decision other than through their initial influence on the key participation decisions at the ages of 7, 11 and 13.

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1. Introduction

This paper looks at the impact of private school fees and school quality on the demand for private secondary schooling in the UK. This topic has not been examined before in the UK and almost all research on this issue has used US data.

There are some papers looking at the demand for private schooling in the UK. A recent paper by Blow, Blundell and Machin (2010) using UK Family Expenditure Data shows that household demand for private schooling is positively related to income, but also positively to regional inequality. Recent work by Dearden and Sibieta (2010) using the British Household Panel Survey shows that that the probability of attending a private schooling is related to household income and parental education but is also more likely if one of the child's parents went to a private school when they were young. Neither of these papers, however, explicitly consider the impact of private school fees or school quality on the demand for education. A number of papers have looked at how parental preferences for state schools are related to school quality (recent examples include Hansen and Machin (2010) and Burgess and Vignoles (2009)) but they do not consider choices between the state and private sector, only choices within the state sector. In a series of papers, Gibbons and Machin (2003, 2006, 2008) examine the relationship between local state school quality (at primary level) and local house prices, and attempt to recover the implicit price of attending high-performing state schools. However, they also are unable to consider the private sector in such analysis.

The key problem with trying to estimate the causal impact of price and quality is that there are likely to be unobservable factors that are correlated with private school prices and/or the quality of private and state schooling as well as the demand for private schooling which would bias any estimates. Moreover, it is highly likely that these unobservable factors are changing over time. Coming up with a credible way of controlling for this potential endogeneity is therefore a key issue.

One paper which does this in a convincing way is Dynarski et. al. (2009). They only have cross-sectional data but use variation in private school tuition that arises through sibling discounts and use

this within-neighbourhood variation in tuition price to identify the price elasticity of demand (as this within neighbourhood variation means that unobserved determinants of demand can be controlled with a neighbourhood fixed effect). They estimate the price elasticity of demand for private schooling in the US and find that a standard deviation decrease in tuition prices increases the probability of a family sending their child to private schools by 0.5 of a percentage point which translates into an elasticity of -0.19.

In this paper we use rich English schools data which records the number of children in every state and private school by age and gender from 1996 to 2008 from the age of 7 until 15. We use this data to calculate the proportion of children in private schooling at a fine neighbourhood level over a 13 year period from 1996 to 2008. In the paper, we consider private school participation from the age of 7 through to 15. At age 7, most children have the option of attending a private primary school whereas before that time private schooling is not always an option. Age 15 is the last year of compulsory schooling in the UK. As might be expected, we find that private school attendance is a dynamic process, and understanding what drives the initial decision to enter private schooling is a crucial part of understanding what determines the demand for private schooling at subsequent ages. It turns out that private school decisions at age 7, 11 and 13 are the key points at which fees and state school quality can impact on demand for private schooling. For other years, attendance in the previous year is the key determinant of the demand for private schooling.

Our neighbourhood measure is at the local authority. There are 150 local authorities in England, each of which is responsible for state school in their area. Unlike in the US, schools within each local authority are not funded through local taxation. Instead, they are largely funded via grants from central government, raised through centrally collected taxes. Around 90 per cent of children attend state secondary schools in their own local authority and local authorities decide on admissions policies for most state schools in their authority. This allows us to identify how variation in prices and school quality over time impact on the demand for private schooling at each age.

In the UK, the overall demand for private schooling has remained very flat at around just over 7 per cent for the period under examination (and as Blundell et. al. (2010) show this is also true for the last 30 years). However over this period there has been changes in the regional patterns of private school attendance with some areas seeing large increases, other large decreases and yet others not much change at all.

This means we need to come up with a methodological approach which can account for these differing trends in the observed and unobserved changes in regional demand for private education. In Dynarski et. al. (2009) the unobserved determinants of demand can be controlled with a local authority fixed effect. However they are dealing with just one cross-section. In our reasonably long panel this may not be a credible strategy. In this paper we develop a system GMM panel data estimation method that allows for incidental trends in the unobserved determinants of demand for private schooling and this turns out to be important for the question we are looking at.

We find that the demand for private schooling at age of 7 (the first year when the majority of students enter private schools for primary education) is inversely related to private school fees. We estimate that a one standard deviation increase in fees reduces the demand for private schooling at age 7 by 0.33 percentage points which equates to an elasticity of -0.26. Between the ages of 8 and 10, private school attendance in the previous year is the key determinant of private schooling and controlling for incidental trends is crucial in deriving consistent estimates.

At age 11, the demand for private schooling is related to private school attendance in the previous year, as well as being inversely related to state school quality and private school fees (though the fee effect is not significant at conventional levels). An increase in the quality of local state secondary schools of one standard deviation when the child is 10 reduces the probability of 11 year olds attending private schools by 0.31 percentage points, which equates to an elasticity of -0.21. The price elasticity at this age is similar to that found at age 7 but is not statistically significant. Demand for private schooling at the age of 13 is also inversely related to price and state school quality,

however the price effect is not significant and the impact of quality is significant but lower than at age 11. Demand for private schooling at the ages of 12, 14 and 15 is almost entirely determined by demand in the previous year for the same cohort and price and quality to not impact on this decision other than through their initial influence on the participation decision at ages 7 and/or 11 and/or 13.

Our paper proceeds as follows. In section 2 we describe the data we use in the paper and our empirical approach. In section 3 we discuss the results of our modelling. In section 4 we conclude.

2. Data and Estimation Strategy

2.1 Introduction

In this paper we make use of detailed English schools administrative data from 1993 to 2008 to look at the determinants of the demand for private education.

We use two sources of school administrative data. The first is the school census data (LEASIS data) which from 1996 records the number of pupils in every school in England for every age group in the private and state sector. It also records information on the number of children receiving and eligible for free school meals in all of the state schools (a measure of socio-economic status) as well as information on the proportion of children in the school with special educational needs and items like authorised and unauthorised absences. It also has information on pupil teacher ratios at the school (for schools in the state and independent sector).

From 1993 to 2008 we know the results of GCSE exams taken by 15/16 year olds in England for every secondary school in the country (the last exam before children can leave school).

In this paper we use as our quality measure the proportion of children achieving the expected level at age 15/16 (which is 5 or more GCSEs with a mark of A*,A, B or C).

In this paper we concentrate on looking at the demand for private schooling between the ages of 7 and 15 in England. We start at age 7 (Year 3 of primary school) as a significant proportion of private schooling begins at this age. In most local authorities secondary school starts in year 7 when all children are aged 11 at the beginning of the school year. However, in some local authorities they have middle schools, and children do not start at secondary school until Year 9 (age 13 at the beginning of the school year). Also, a significant proportion of boys' private secondary schools, have large intakes at Year 9 or indeed only start at Year 9 (Eton perhaps being the most famous example). However, students also attend private schools for primary education, so demand for secondary private schooling will also depend on earlier primary school choices. Hence our modelling takes a dynamic approach and looks at the demand at each age, beginning at age 7. It turns out that these dynamics are very important in explaining private school demand.

The second data source we use is the annual census of the Independent Schools Council. This goes back to 1983 and contains the average private school fee for boarding and day schools across broad regions in the UK. We focus on the fee level of day schools within these broad regions, as boarding schools are much more likely to be attended by pupils from all over the country rather than just those in the region or local authority. We have fee information dating back to the mid 1980s.[2]

2.2 Estimation Strategy

[2] At this stage we only have historical private school information at 7 broad regional levels. For 2008 we have individual school data and we are in the process of obtaining this information back to the early 1990s.

We begin by modelling the demand for private schooling at age 7[3] (measured as the proportion of children in private schools) as a function of the known fees and school quality when the child was aged 5 or 6 (when parents were making the decision). This is generally the first time parents will consider private schooling (although some children will attend private preparatory schools before this age).

The next major decision point is when the child is aged 10 (generally in October when the child has just commenced in Year 6) when parents must decide whether they want their child to be educated up to age 15 in a state or private secondary school. However, a significant proportion of children choosing private education at 11 will already be in the private sector so we need to account for this within a dynamic framework. In some areas and for some private schools, secondary schooling starts at age 13, so this is an important age for some parents if they are going to switch sectors.

Our modelling set-up is very general and models the demand for private schooling from all ages from 7 to 15. However, as mentioned earlier, we need to account for the fact that school quality and fees are potentially endogenous or pre-determined. It is also highly likely that unobserved determinants of demand have changed over this long time period and if we do not take this into account our estimates could be biased. So we begin with a general model of the form:

$$\boldsymbol{P_{rt}^{a} = \rho^{a} * P_{rt-1}^{a} + \beta_1^{a} X_{rt} + \beta_2^{a} Z_{rt-1} + v_r^{a} + f_r^{a} t + \varepsilon_{rt}^{a}} \quad (1)$$

where $\boldsymbol{X_{rt}}$ is a vector of strictly exogenous variables (such as time dummies and other exogenous determinants of demand), $\boldsymbol{Z_{rt}}$ is a vector of pre-determined covariates as well as

[3] At age 7 we mean children who are 7 at the beginning of the beginning of the school year and who will turn 8 sometime during the year. These children are in Year 3 of primary school.

potentially endogenous covariates such as school quality measures in the state and private sector and private school fees (with some lag). This is the model developed by Blundell and Bond (1998) and others, the exception is that we allow the unobserved group level effect $\boldsymbol{f_r^a}$ to vary incidentally with time *t*. First differencing removes the unobserved fixed effect $\boldsymbol{v_r^a}$ however it does not remove the incidental trend (if it is present). If, however, we double difference the incidental trend is removed.

Double differencing equation (1) gives:

$$\Delta^2 \boldsymbol{P_{rt}} = \boldsymbol{\rho}^{*a} * \Delta^2 \boldsymbol{P}_{\boldsymbol{rt-1}}^{\boldsymbol{a}} + \boldsymbol{\beta}_{\boldsymbol{1}}^{*a} \Delta^2 \boldsymbol{X}_{\boldsymbol{rt-1}} + \boldsymbol{\beta}_{\boldsymbol{2}}^{*a} \Delta^2 \boldsymbol{Z}_{\boldsymbol{rt-1}} + \Delta^2 \boldsymbol{\varepsilon}_{\boldsymbol{rt}}^{\boldsymbol{a}} \quad (2)$$

Clearly in this model $\Delta^2 P_{rt-1}$ and $\Delta^2 \boldsymbol{Z_{rt-1}}$ are correlated with $\Delta^2 \varepsilon_{rt}$, violating one of the moment conditions and meaning OLS estimation of (2) is severely biased (see Han and Phillips (2010)). But, $\Delta^2 P_{rt-3}$ and $\Delta^2 \mathbf{Z}_{rt-3}$ are not correlated with $\Delta^2 \varepsilon_{rt}$ so can be used to instrument $\Delta^2 P_{rt-1}$ and $\Delta^2 Z_{rt-1}$. Clearly in this the error term is likely to be subject to second order autocorrelation but if our model is correctly specified it should not have third order autocorrelation. We test for this in our estimation procedure.

Of course, if there is no incidental trend, we need only first difference and use standard system GMM estimation. However if there is an incidental trend, then the first difference moment conditions are violated and we would expect our traditional system GMM estimates to be upward biased if the unobserved incidental trend is positively related to our variable of interest (which is what we would expect for lagged participation and fees as it is highly likely that unobserved trend increases in private school demand are positively correlated with increases lagged participation, and increases in private school fees) and downward bias coefficients if negatively correlated to this incidental trend (which is what we might expect with state school quality as it is highly likely that unobserved trend increases in private school demand are inversely related to changes in state school quality).

We estimate (2) using a modified version of the Blundell and Bond (1998) Generalised Method of Moments (GMM) system estimator where the levels equation is now a first difference equation and the difference equation is a double difference equation, and where we now add the first difference

equation to the system together with our double difference equation. This is related to the double difference estimators suggested by Han and Phillips (2010) where there is an incidental trend.

2.2 Data Description

For our identification strategy to work we need variation within region in private school fees and school quality over time. This is because we need to control for differences across regions in factors such as average income, parental education and taste for private education using regional fixed effects with an incidental trend. We have just under 150 local authorities in our data but we aggregate it up to 9 broader regions to demonstrate the variability we have (we demonstrate it empirically in the next section).

Broadly speaking, private school attendance in England has remained largely unchanged at just over 7 per cent for the last 30 years. Over the period we consider, private school attendance at secondary schools reduced slightly from 7.3% in 1996 to 6.9% in 2001 and 2002, before increasing to 7.4% in 2008. However the patterns differ by age group as can be seen in the Table 2.1 below (where we show the proportion attending at age 7, age 11 (first year of secondary school), age 13 and age 15 (last year of compulsory school). Over the same time period real private schools fees have increased fairly rapidly with average real growth of 3.8% per year. However this increase has been far from smooth. In 2004 real day fees went up by 6.8 per cent whereas in 1998 the comparable figure was 1.8 per cent. The proportion of pupils achieving 5 GCSEs at A*-C (the expected level at age 15) has risen steadily in the state sector and much faster than in the independent sector, but from a much lower base. We do not use independent school quality in our analysis as a number of independent schools have started taking exams at 16 which are not included in the standard measures of school quality and hence from 2006 this data is not reliable. However over this period the proportion getting GCSEs at A*-C rose in independent schools rose from around 81 per cent to 91 per cent.

TABLE 2.1: Summary statistics (mean and [standard deviations]) for key variables

Year	Proportion Private at age 7	Proportion Private at age 11	Proportion Private at age 13	Day fee Private at age 15	Propn Private (£ pa)	Propn A*-C State	Propn Eligible FSM
1996	0.048	0.069	0.073	0.078	6399	0.427	0.184
	[0.042]	[0.053]	[0.054]	[0.059]	[662]	[0.078]	[0.107]
1997	0.049	0.07	0.071	0.077	6565	0.435	0.182
	[0.043]	[0.052]	[0.053]	[0.058]	[705]	[0.077]	[0.105]
1998	0.05	0.068	0.07	0.076	6680	0.449	0.176
	[0.044]	[0.052]	[0.054]	[0.058]	[770]	[0.082]	[0.105]
1999	0.051	0.066	0.07	0.073	6978	0.468	0.169
	[0.045]	[0.051]	[0.054]	[0.056]	[714]	[0.080]	[0.100]
2000	0.051	0.066	0.069	0.073	7227	0.479	0.166
	[0.045]	[0.052]	[0.053]	[0.057]	[812]	[0.080]	[0.102]
2001	0.052	0.067	0.068	0.072	7589	0.49	0.16
	[0.046]	[0.054]	[0.053]	[0.056]	[875]	[0.077]	[0.099]
2002	0.054	0.069	0.069	0.072	8025	0.506	0.151
	[0.047]	[0.054]	[0.053]	[0.056]	[924]	[0.075]	[0.094]
2003	0.054	0.069	0.07	0.071	8378	0.522	0.148
	[0.046]	[0.054]	[0.054]	[0.055]	[1016]	[0.069]	[0.093]
2004	0.054	0.07	0.072	0.072	8943	0.531	0.147
	[0.047]	[0.054]	[0.055]	[0.056]	[1103]	[0.066]	[0.093]
2005	0.054	0.07	0.071	0.073	9261	0.561	0.144
	[0.046]	[0.054]	[0.054]	[0.056]	[1114]	[0.060]	[0.093]
2006	0.054	0.072	0.071	0.074	9470	0.585	0.139
	[0.047]	[0.056]	[0.054]	[0.057]	[1177]	[0.055]	[0.089]
2007	0.055	0.073	0.071	0.073	9667	0.614	0.137
	[0.048]	[0.055]	[0.055]	[0.056]	[1212]	[0.051]	[0.088]
2008	0.055	0.075	0.074	0.075	9926	0.656	0.136
	[0.049]	[0.059]	[0.056]	[0.057]	[1293]	[0.048]	[0.085]
All years	0.052	0.07	0.071	0.074	8134	0.52	0.156
	[0.046]	[0.054]	[0.054]	[0.056]	[1566]	[0.097]	[0.097]

Note: fees are measured in 2007-08 prices , and are measured yearly as three time the termly fee.

This summary masks significant variation in the level of private school attendance, fee levels and average state school quality across regions. In Appendix 1 we show the variation in private school attendance (at age 15) for each of our 149 local authorities but in Figure 1 below we show differences in private school participation (at age 15), private school real day fees and state school quality across nine English regions between 1996 and 2008. As can be seen, even at these broad regional levels there is significant variation across region. This is even more true at the local authority level (as seen in Appendix 1) and it is this variation across local authority that we exploit in this paper.

Figure 1: Proportion of 15 year olds in private schools 1996-2008

Figure 2: Private school day fees, 1990-2008 (2007/08 prices)

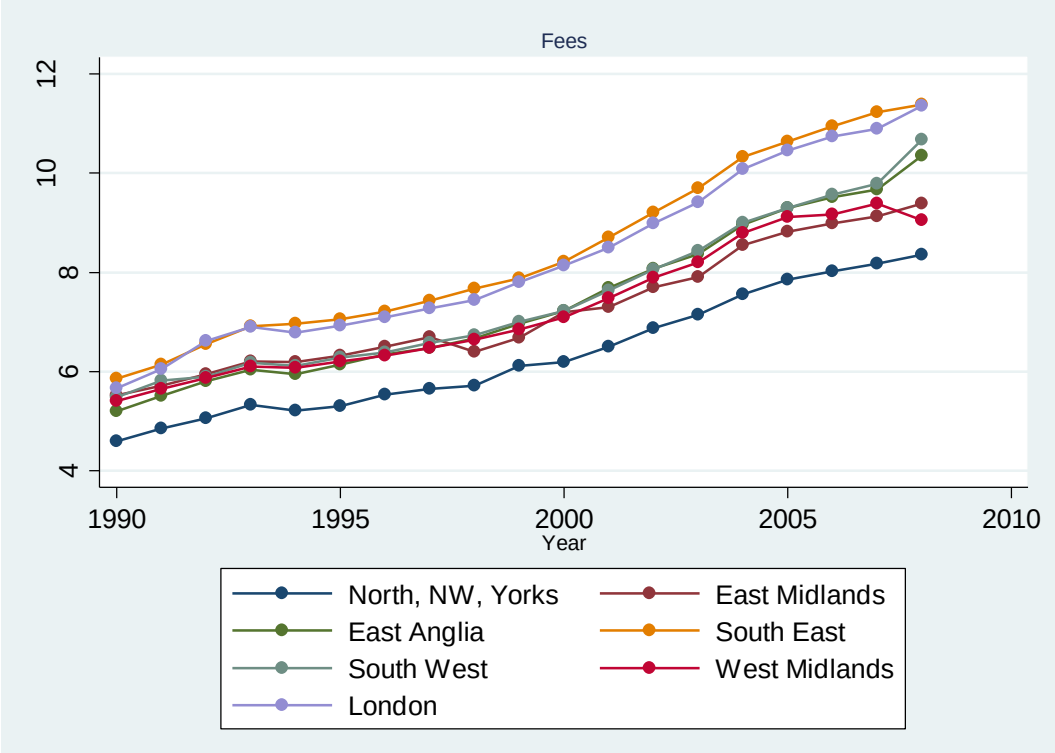
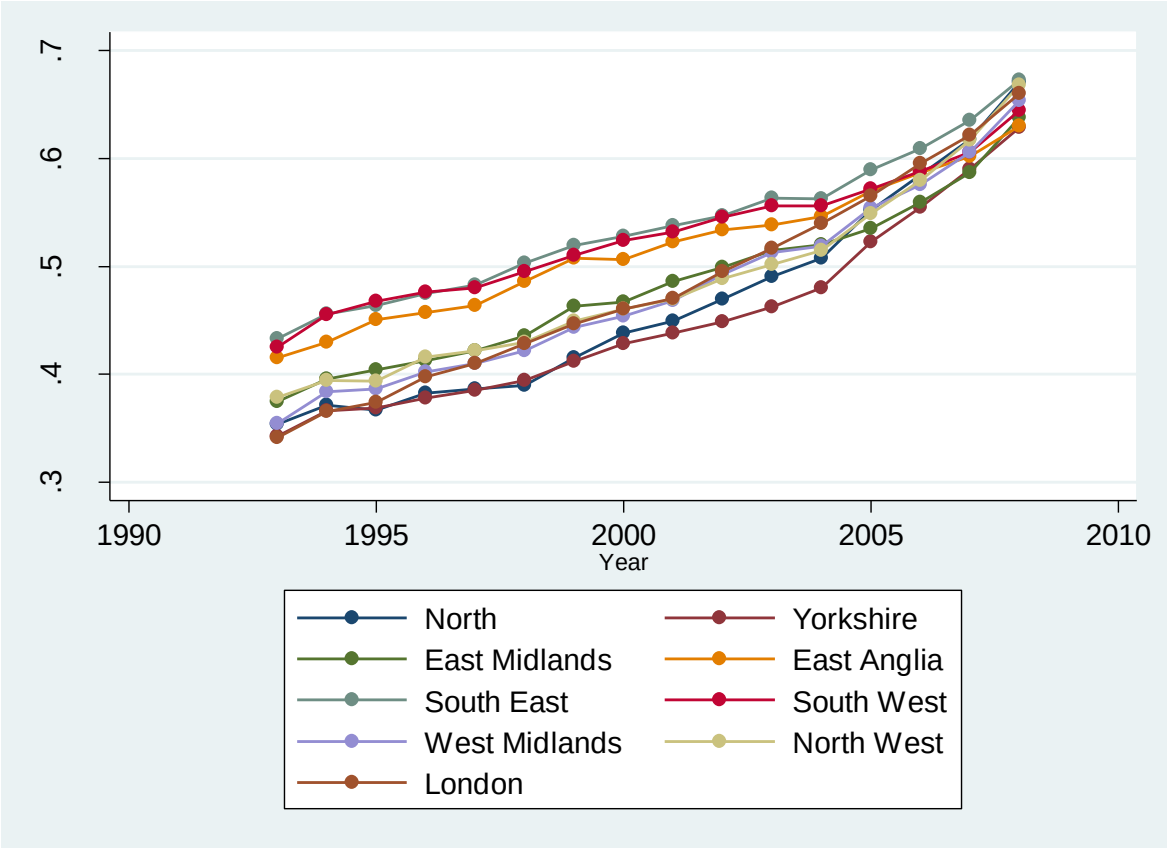


Figure 3: Proportion of 15 year olds reaching expected level in state schools, 1993-2008



3. Results

The results of our preferred double difference GMM system estimation procedure is shown in Table 3.1. It turns out that using a double difference model is important in this context as the system GMM estimates of the lagged dependent variable for a number of ages is close to a unit root and in some cases unstable. This is probably due to there being an incidental trend in our unobserved fixed effect which renders the traditional system GMM invalid (because of the violation of the required moment conditions). The results of doing the traditional system GMM estimation procedure is shown in Table A2 in Appendix 2.

TABLE 3.1: System GMM Double Difference Estimates of the Demand for Private Schooling for 7, 11, 13 and 15 year olds.

Variable	$\Delta^2 P_{rt}^{7}$			$\Delta^2 P_{rt}^{11}$			$\Delta^2 P_{rt}^{13}$			$\Delta^2 P_{rt}^{15}$		
	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase
$\Delta^2 P_{rt-1}^{a}$				0.591			0.747			0.945		
				[0.067]			[0.082]			[0.035]		
$\Delta^2 lnF_{rt-1}$	0.004	0.075	0.093	-0.006	-0.081	-0.132	0.009	0.118	0.198	0.004	0.048	0.083
	[0.012]	[0.210]	[0.262]	[0.014]	[0.180]	[0.294]	[0.012]	[0.155]	[0.260]	[0.010]	[0.124]	[0.214]
$\Delta^2 lnF_{rt-2}$	-0.015	-0.263	-0.328	-0.017	-0.224	-0.366	-0.014	-0.181	-0.303			
	[0.007]	[0.123]	[0.153]	[0.015]	[0.204]	[0.333]	[0.013]	[0.164]	[0.274]			
$\Delta^2 Q_{rt-1}$	0.002	0.014	0.016	-0.032	-0.211	-0.304	0.003	0.019	0.029	-0.009	-0.054	-0.082
	[0.008]	[0.069]	[0.076]	[0.012]	[0.081]	[0.117]	[0.007]	[0.046]	[0.067]	[0.010]	[0.064]	[0.098]
$\Delta^2 Q_{rt-2}$	0.013	0.117	0.129	-0.015	-0.098	-0.141	-0.019	-0.125	-0.185			
	[0.012]	[0.105]	[0.116]	[0.018]	[0.121]	[0.173]	[0.010]	[0.065]	[0.095]			
$\Delta^2 FSM_{rt-1}$	0.005	0.015	0.052	-0.067	-0.169	-0.751	0.007	0.018	0.083	-0.045	-0.106	-0.5
	[0.016]	[0.052]	[0.177]	[0.027]	[0.068]	[0.302]	[0.019]	[0.046]	[0.211]	[0.035]	[0.083]	[0.390]
$\Delta^2 FMS_{rt-2}$	-0.007	-0.022	-0.076	-0.11	-0.276	-1.228	-0.015	-0.036	-0.163			
	[0.033]	[0.109]	[0.369]	[0.044]	[0.110]	[0.490]	[0.028]	[0.069]	[0.314]			
No. Of observations		1788			1639			1639			1639	
AR(1) p-value		0.000			0.000			0.000			0.000	
AR(2) p-value		0.001			0.015			0.028			0.019	
AR(3) p-value		0.290			0.596			0.838			0.983	
GMM Lags		3 to 5			3 to 6			4 to 7			4 to 7	
Hansen test p-value		0.142			0.170			0.054			0.114	

Note: All regressions include time dummies and use robust two stage system GMM estimation (see Windmeijer (2005)). There are 149 groups in our panel. F_{rt} refers to day fees in region *r* at time *t,* Q_{rt} to proportion of children obtaining the expected level in state secondary schools at time *t* in region *r* and FSM_{rt} refers to the proportion of children eligible for free school meals in state secondary schools in region *r* at time *t*.

If we start by focusing on the results at age 7 we see that fees at age 5 (when parents were making their primary school choice) have a negative impact on private school attendance at age 7. A one standard deviation increase in fees reduces the demand for private schooling at age 7 by 0.33 percentage points which equates to an elasticity of -0.26. This is very close to the elasticity found by Dynarski et. al. (2009). Secondary state school quality has no effect on the primary school decision but impacts on demand at ages 11 and 13. We have not included primary state school quality in our regressions as this information is not available for the time period under consideration. No other factors impact on demand (after we have done our double differencing).

At ages 8, 9 and 10, the demand for private schooling is determined by participation in the previous year. No other factors influence demand[4].

If we move to participation at age 11, we see that fees in the previous two years have a negative impact on participation, but this effect is not significant at conventional levels. In particular, fees at age 9, when parents are making their secondary school decision, have a similar elasticity to that found at age 7 (-0.22), but this estimate is not significant at conventional levels. However, now the quality of state secondary schools impacts on demand for private schooling with an increase of one standard deviation in state school quality at age 10 reducing private school demand at age 11 by 0.31 percentage points which equates to an elasticity of -0.21.

If we move on to look at demand at age 13, another key moving point in the English education system, we similar negative but slightly smaller effects of price and quality on demand, although once again the fees effect is not significant at conventional levels. A one standard deviation increase in state school quality at age 11 decreases participation in private schooling at age 13 by 0.19 percentage points which equates to an elasticity of -0.13.

At age 15, the final year of secondary school, it is only participation in the previous year that explains demand for private schooling. Similar findings are found for participation at age 12 and age 14.

Hence price and quality impact on the demand for private education in the expected way. However, private school demand in England is a dynamic process and prices and quality only have direct impacts at key moving points in the education cycle at the ages of 7, 11 and 13. For other ages, fees and quality only impact on the demand for private schooling via their effect on lagged demand.

[4] These results are available from the authors.

4. Conclusions

In this paper we use English school level data from 1993 to 2008 aggregated up to small neighbourhood areas to look at the determinants of the demand for private education in England from the ages of 7 until 15 (the last year of compulsory schooling). We focus on the relative importance of price and quality of schooling. However, there are likely to be unobservable factors that are correlated with private school prices and/or the quality of state schools that also impact on the demand for private schooling which could bias our estimates. Our long regional and local authority panel data allows us to employ a number of strategies to deal with this potential endogeneity. Because of the likely presence of incidental trends in our unobservables, we employ a double difference system GMM approach to remove both fixed effects and incidental trends. We find that the demand for private schooling is inversely related to private school fees as well as the quality of state schooling in the local area at the time families were making key schooling choice decisions at the ages of 7, 11 and 13. We estimate that a one standard deviation increase in the private school day fee when parents/students are making these key decisions reduces the proportion attending private schools by around 0.33 percentage points which equates to an elasticity of around -0.26. This estimate is only significant for choices at age 7 (but the point estimates are very similar at the ages of 11 and 13). At age 11 and age 13, an increase in the quality of local state secondary reduces the probability of attending private schools. At age 11, a one standard deviation increase in state school quality reduces participation in private schools by 0.31 percentage points which equates to an elasticity of -0.21. The effect at age 13 is slightly smaller, but still significant. Demand for private schooling at the ages of 8, 9, 10 and 12, 14 and 15 are almost entirely determined by private school demand in the previous year for the same cohort, and price and quality to not impact significantly on this decision other than through their initial influence on the key participation decisions at the ages of 7, 11 and 13.

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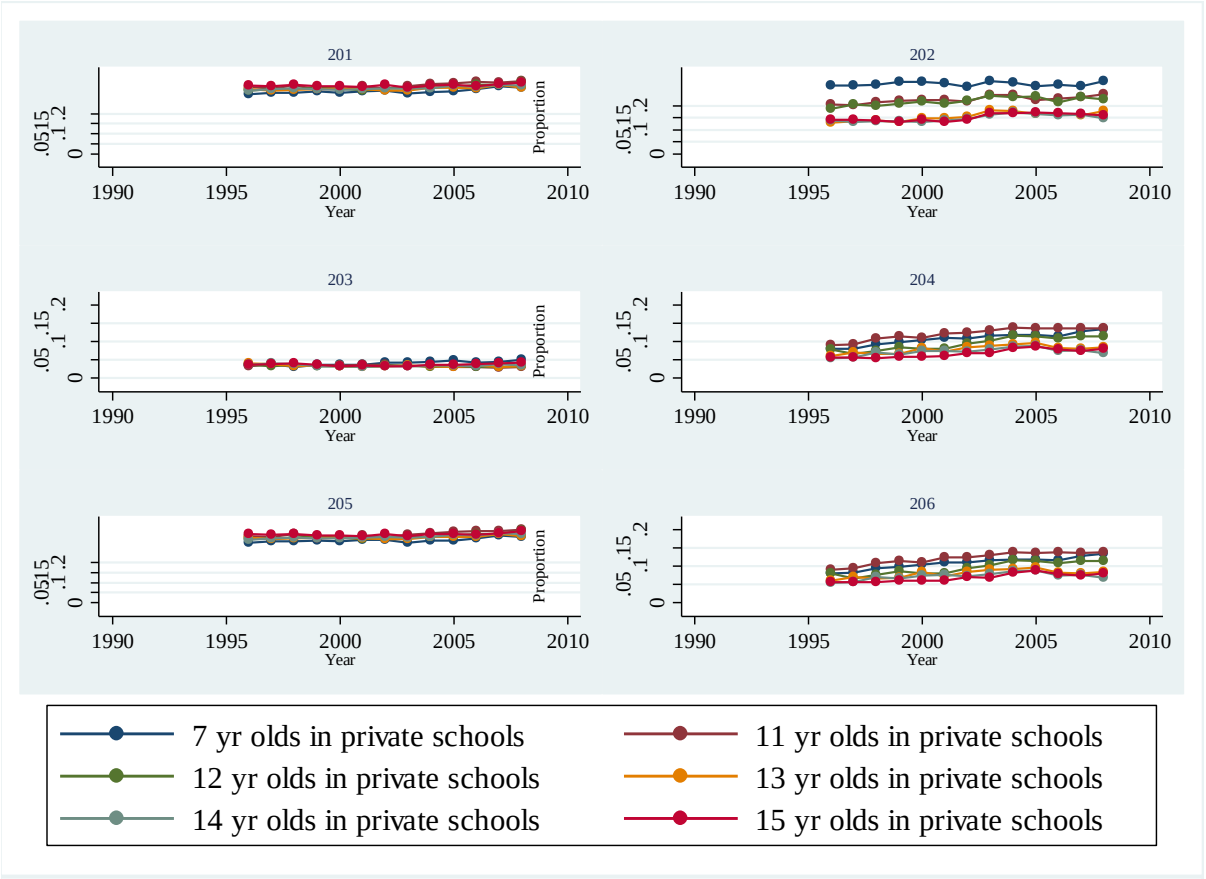
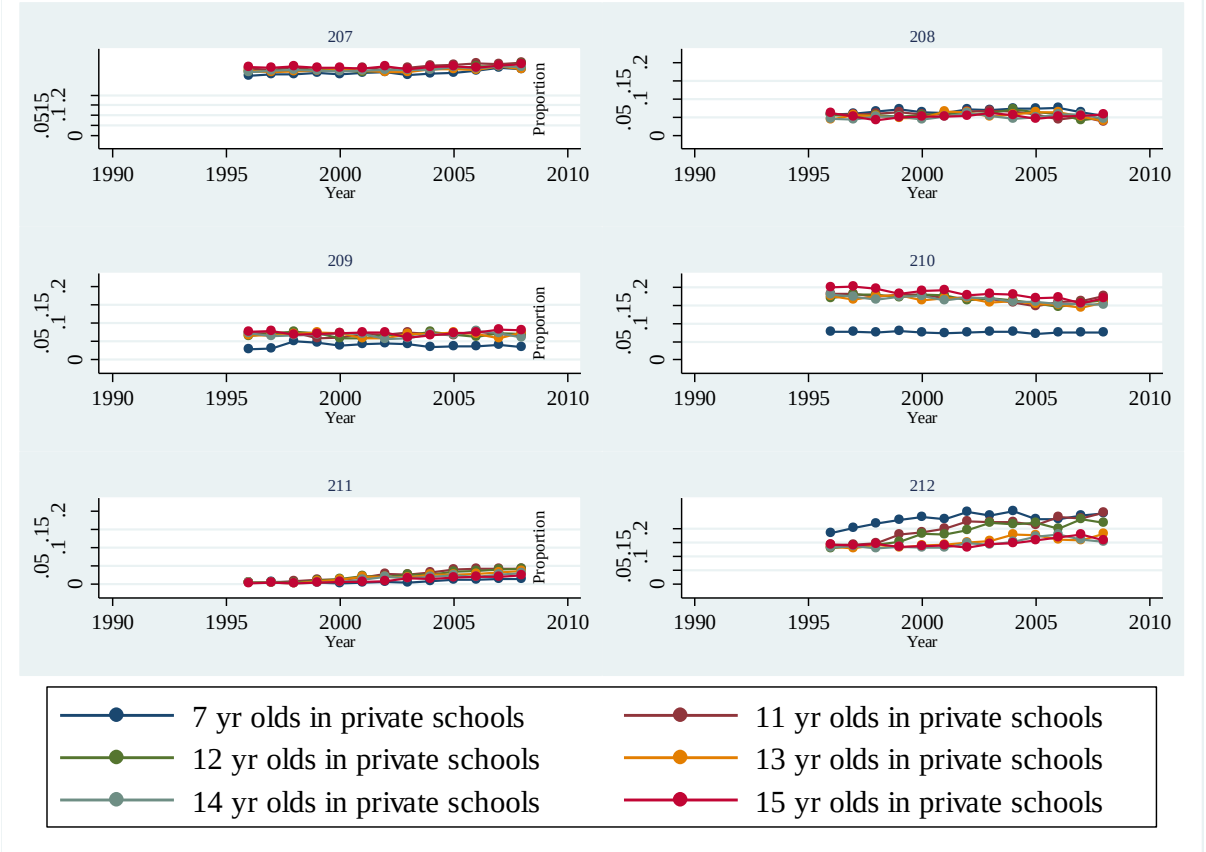
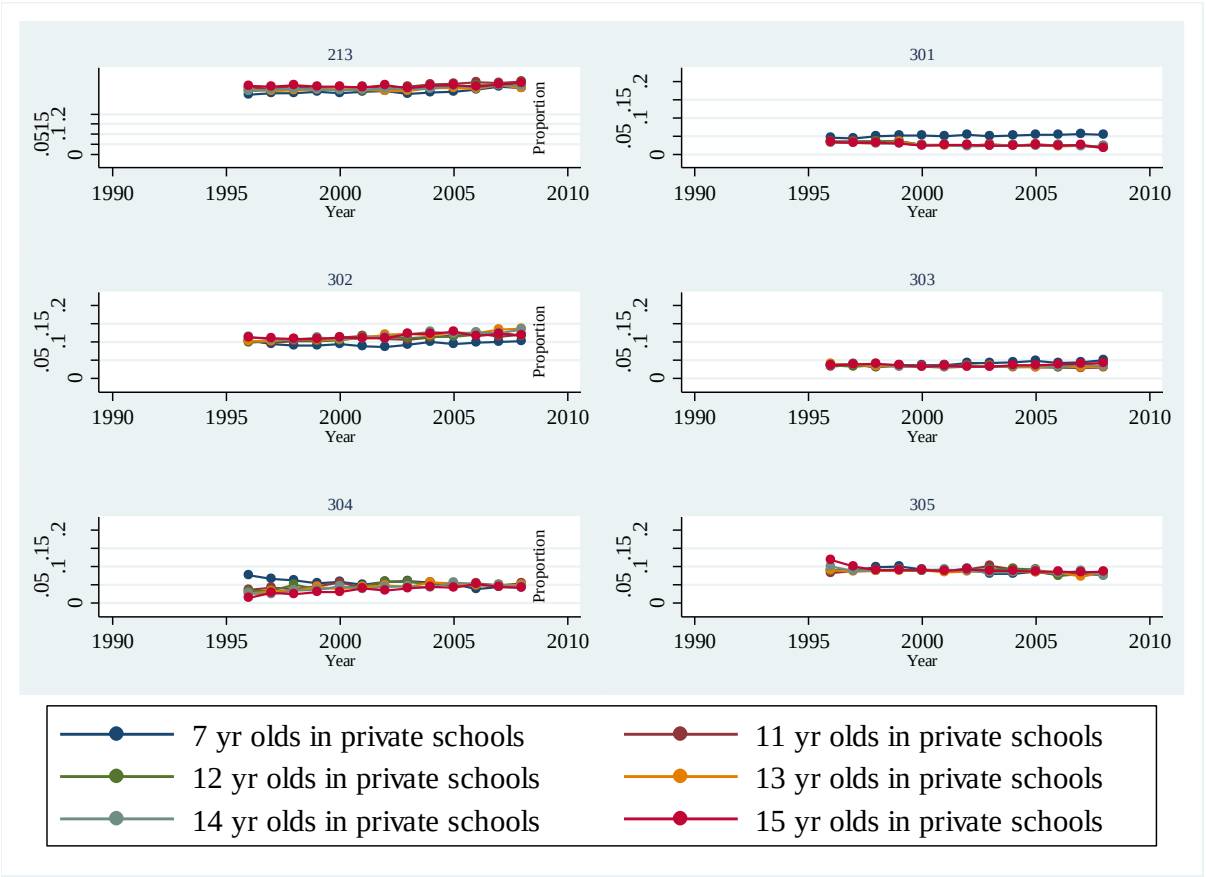
Appendix 1 – Private school attendance by local authority 1996-2008



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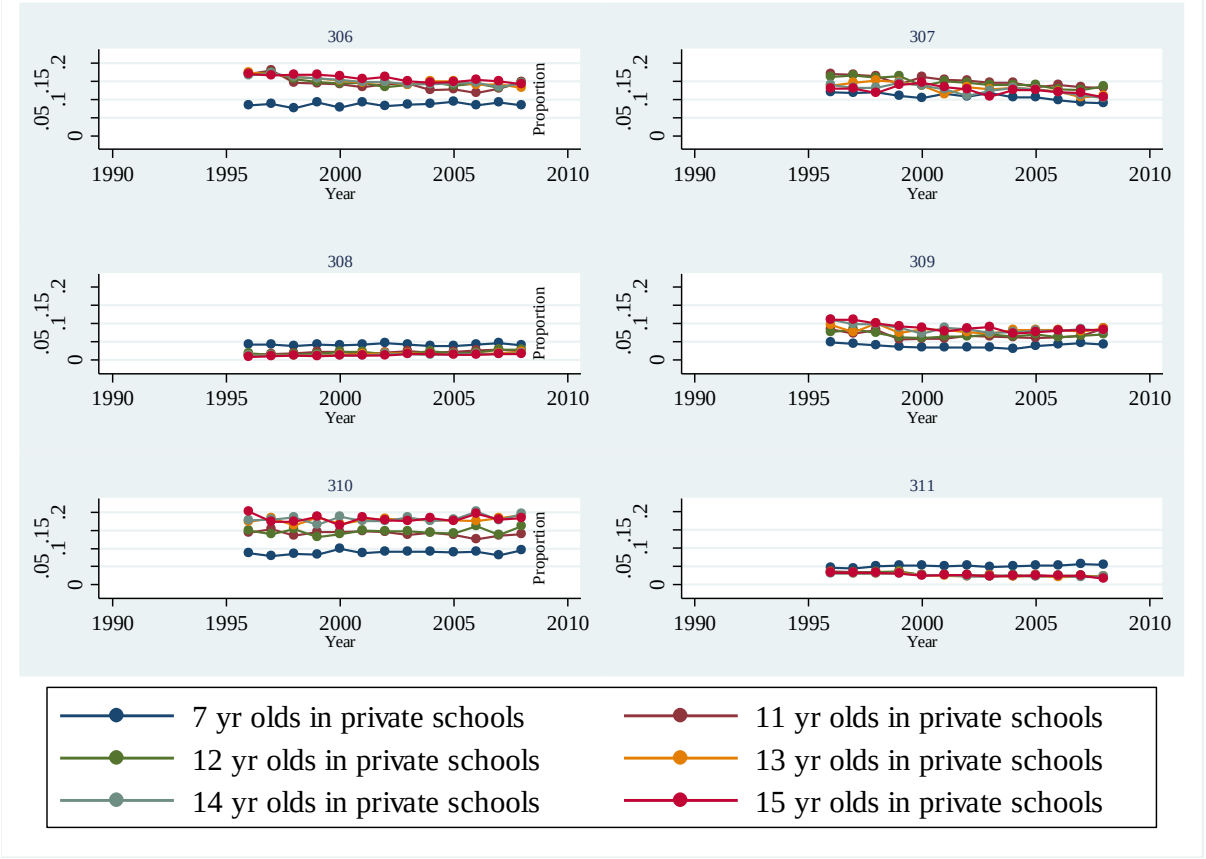
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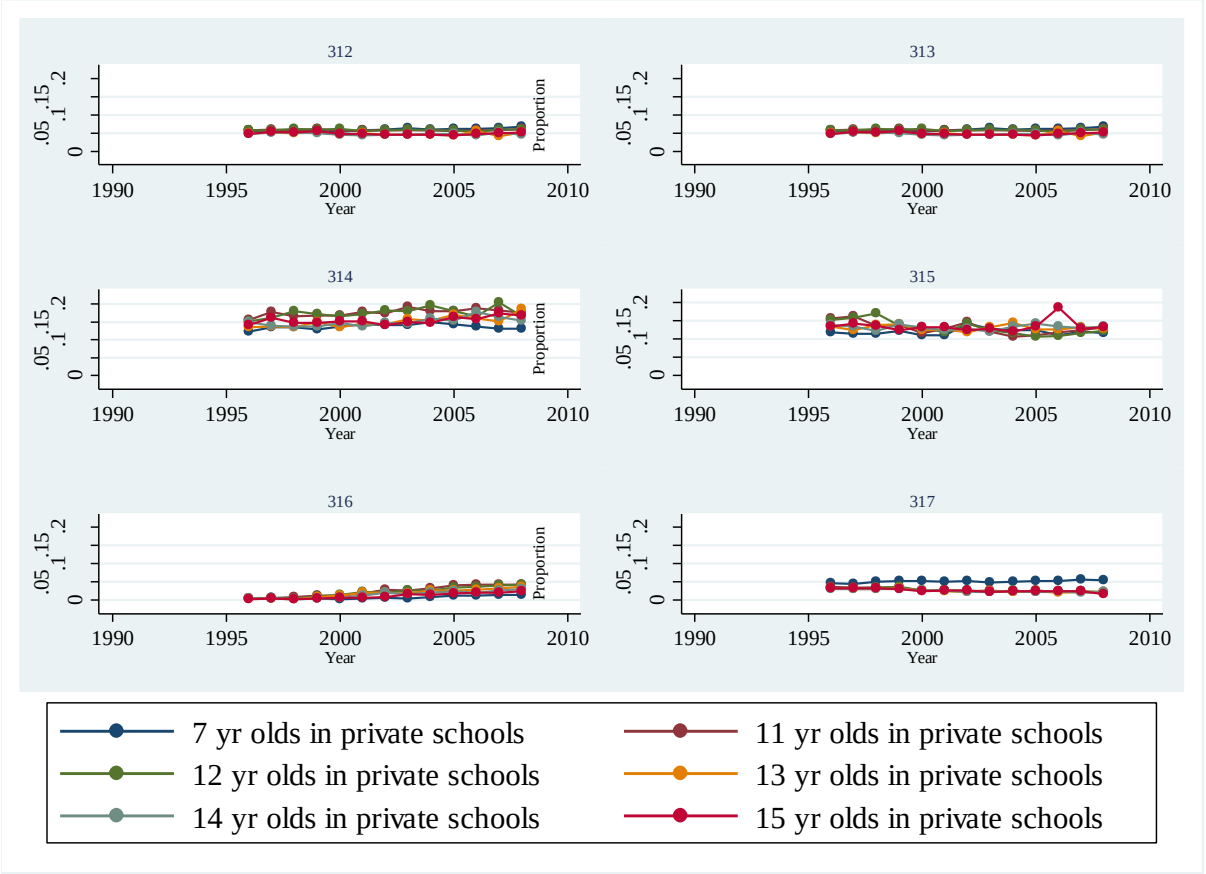
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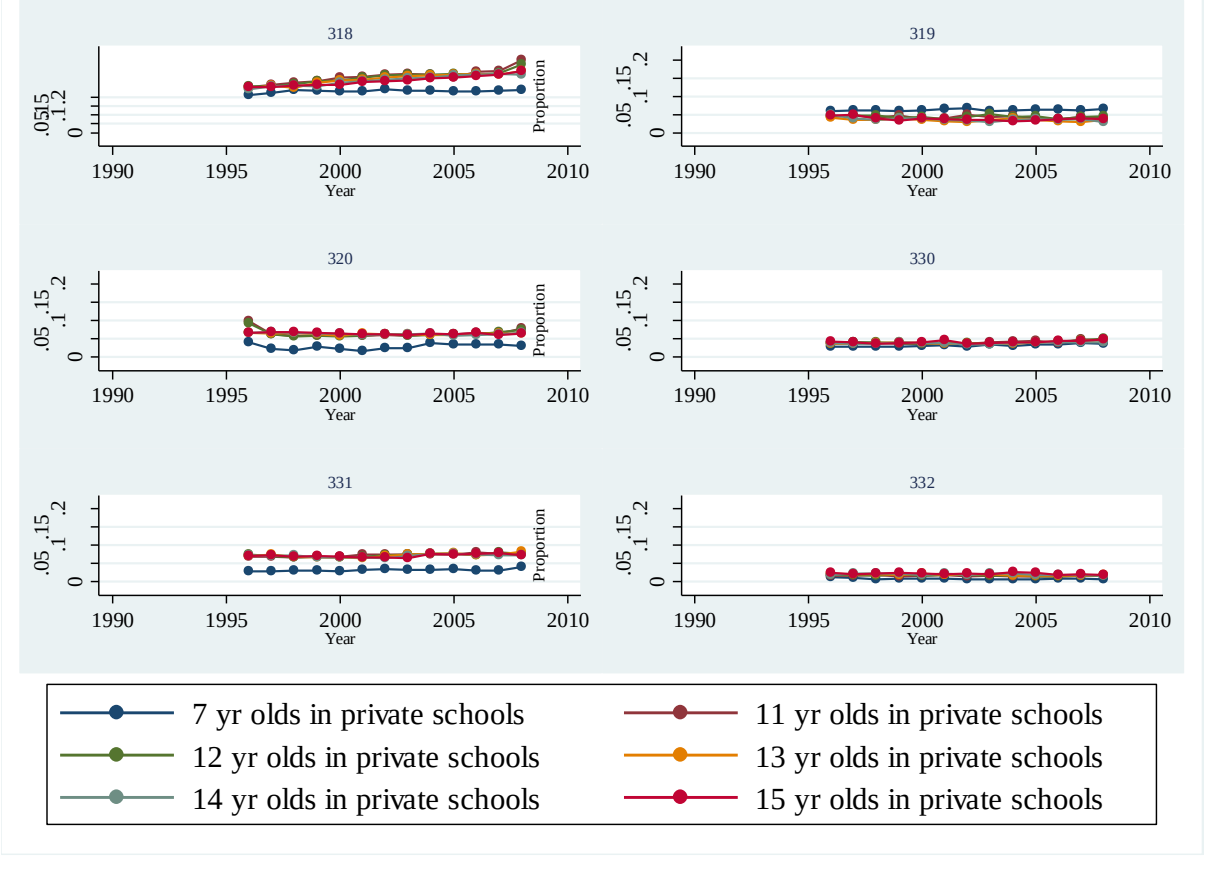
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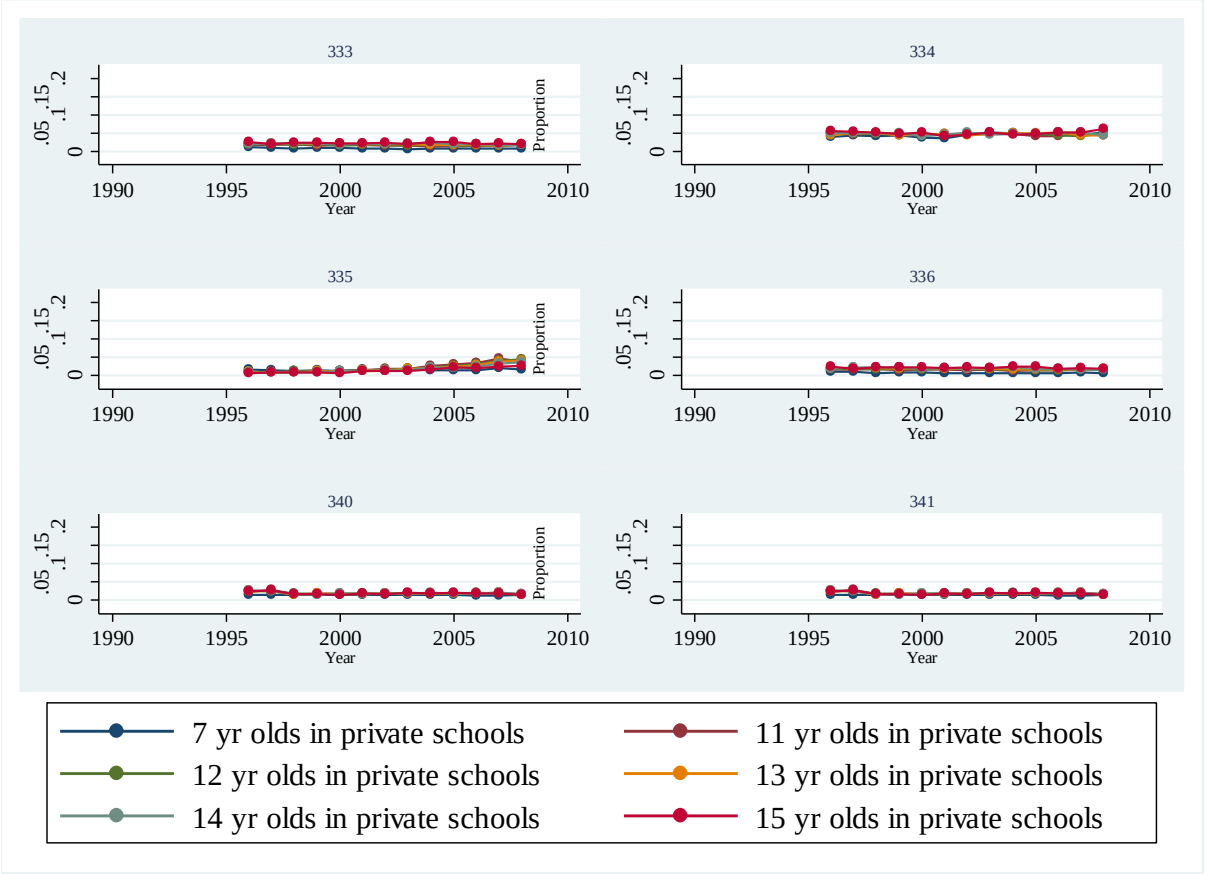
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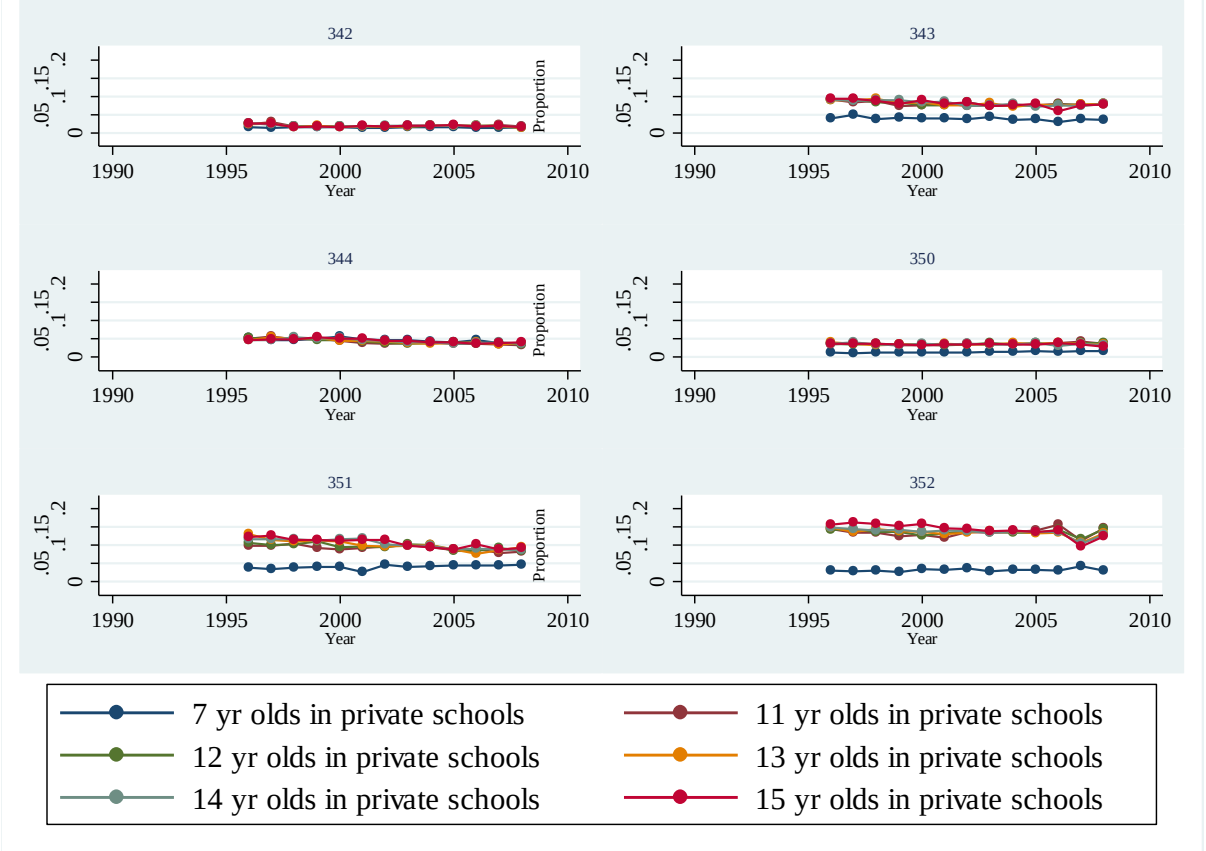
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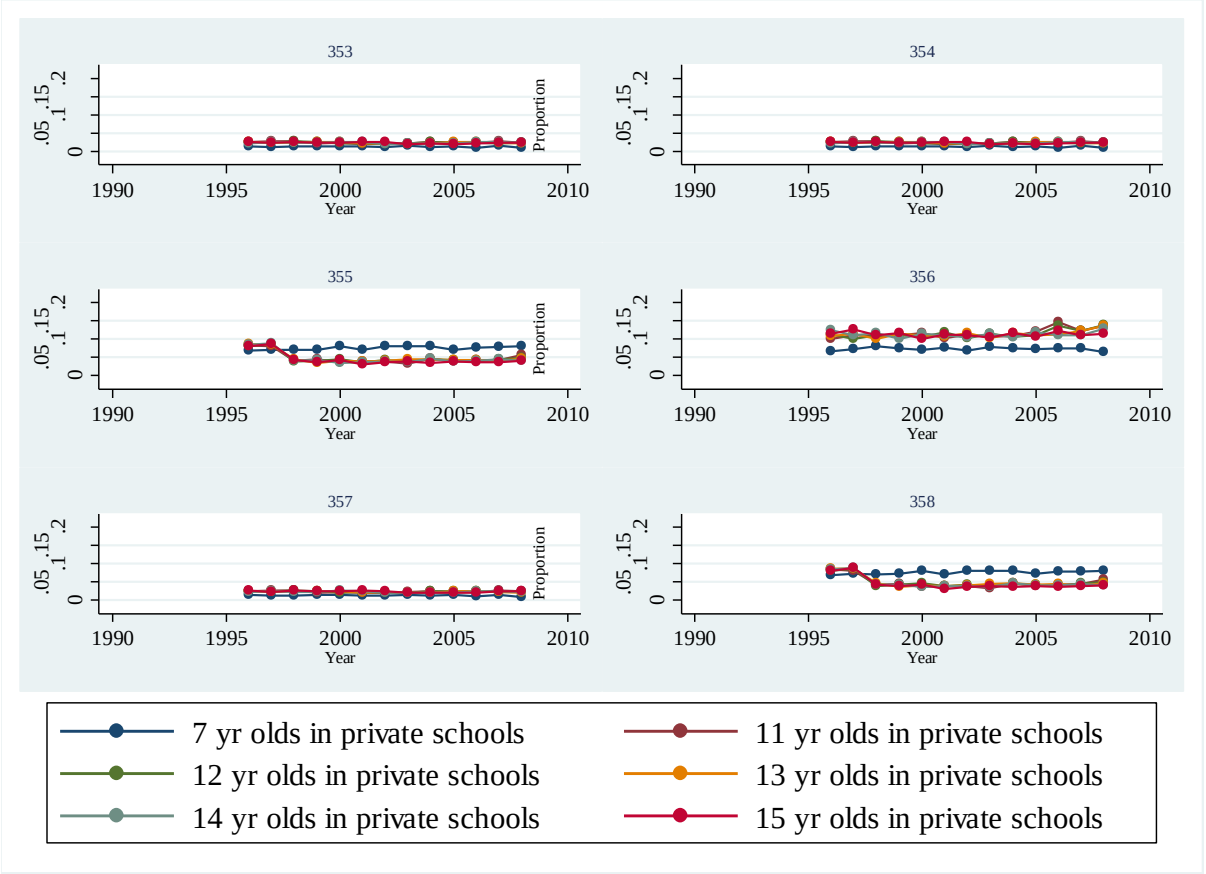
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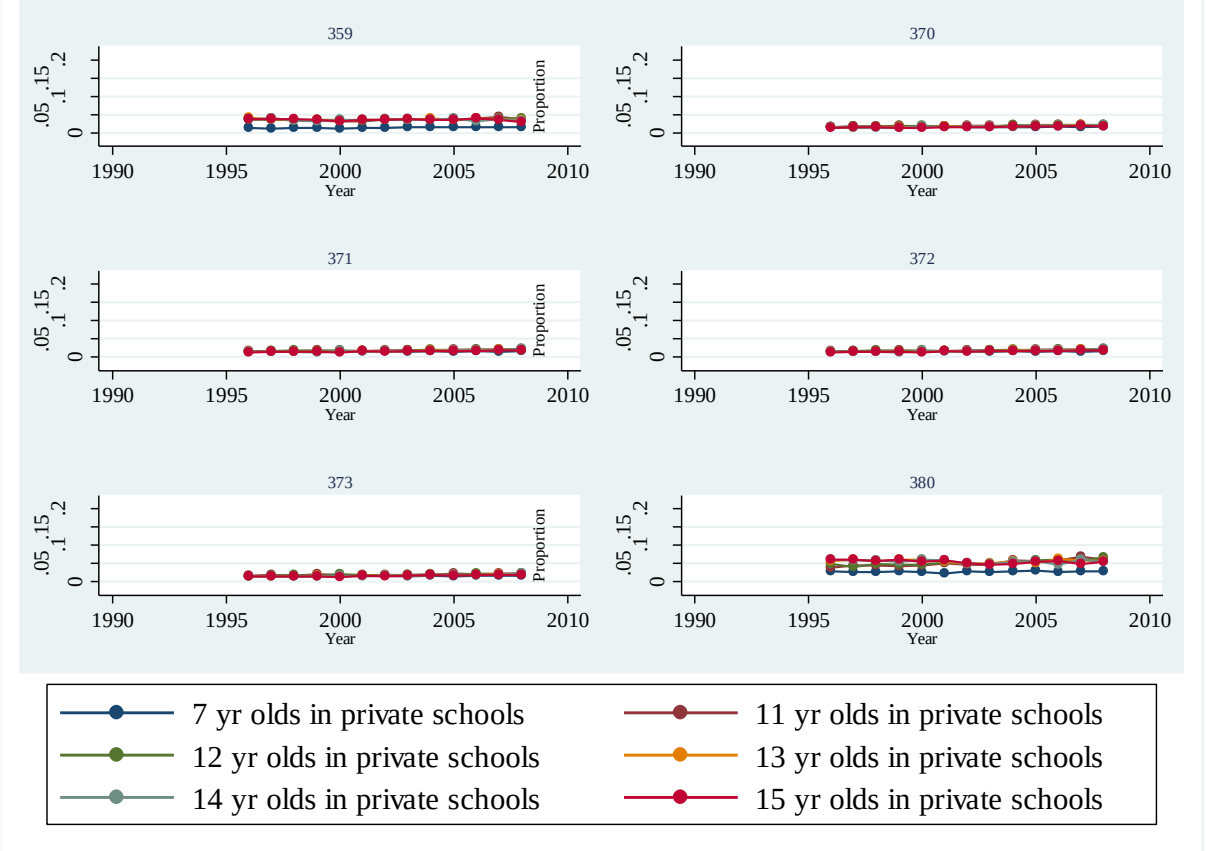
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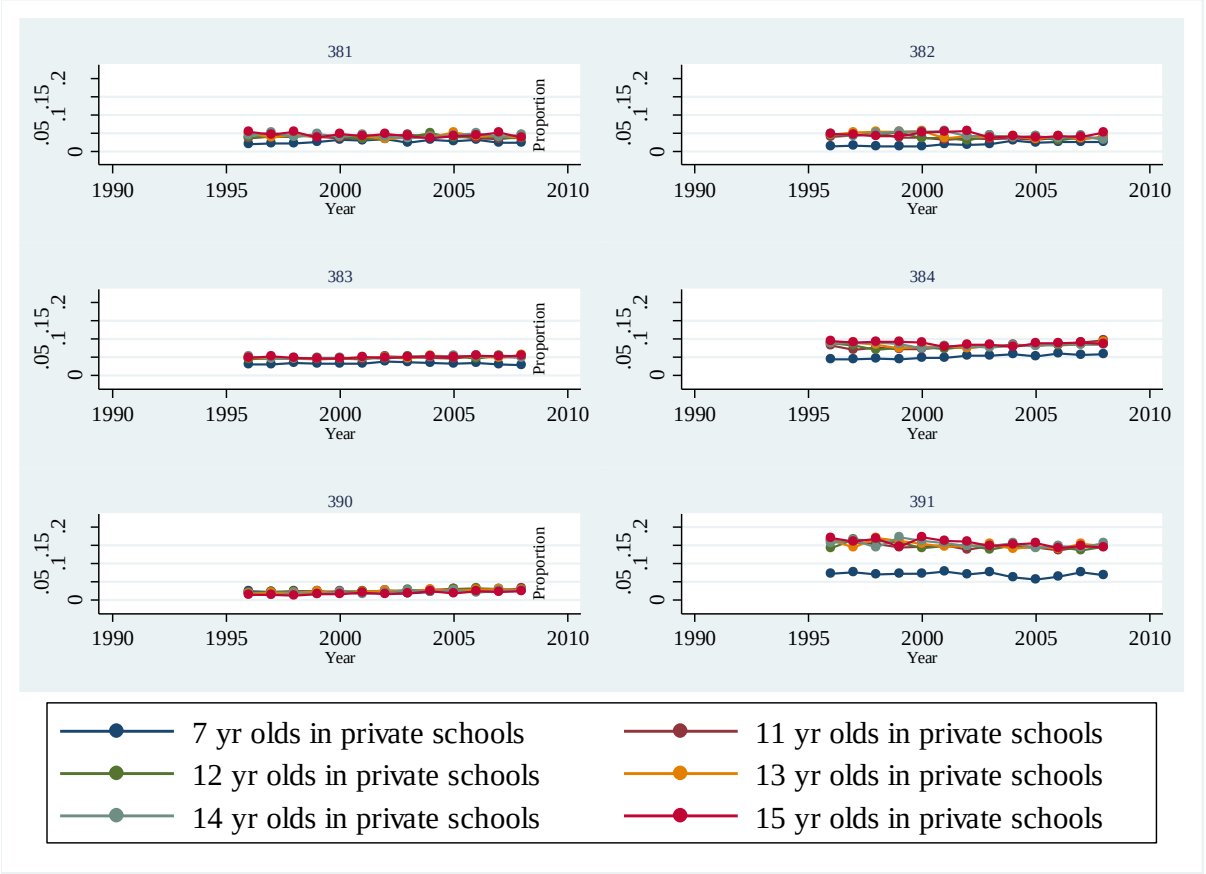
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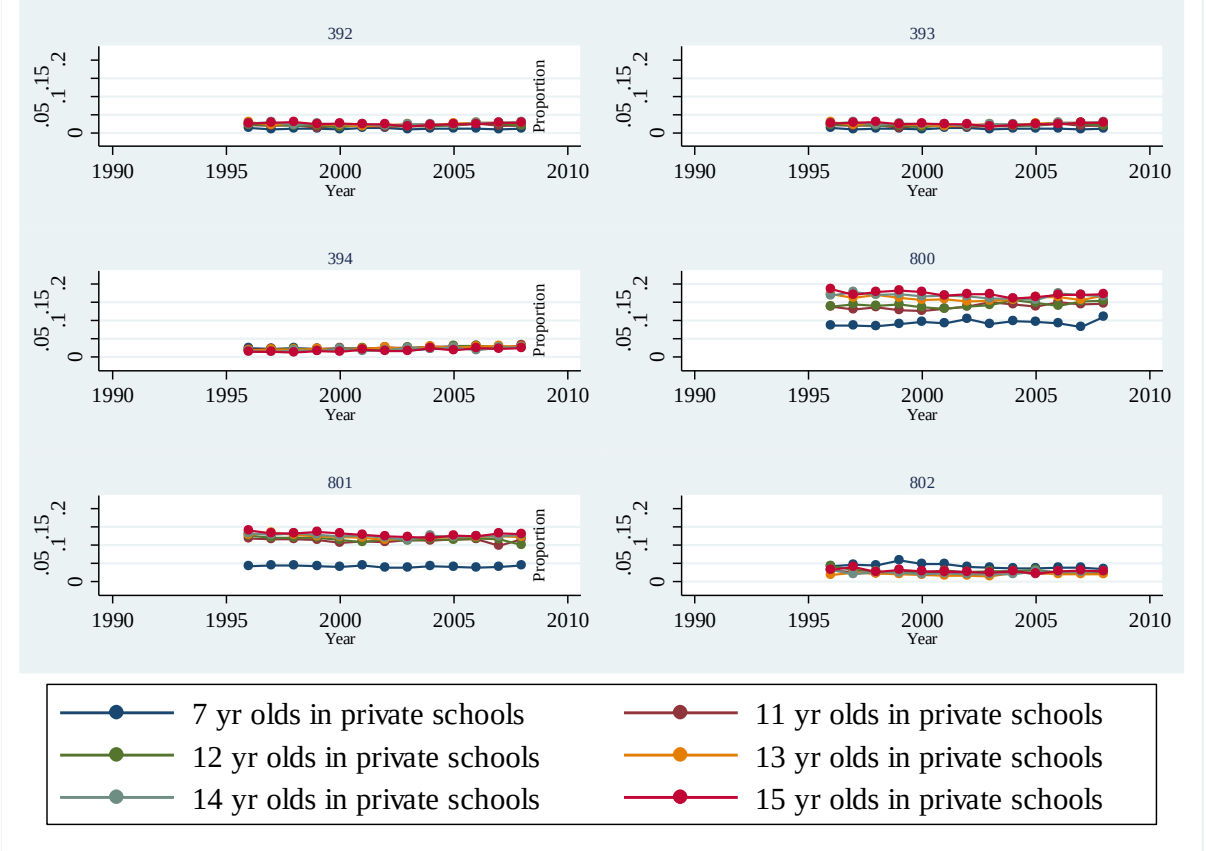
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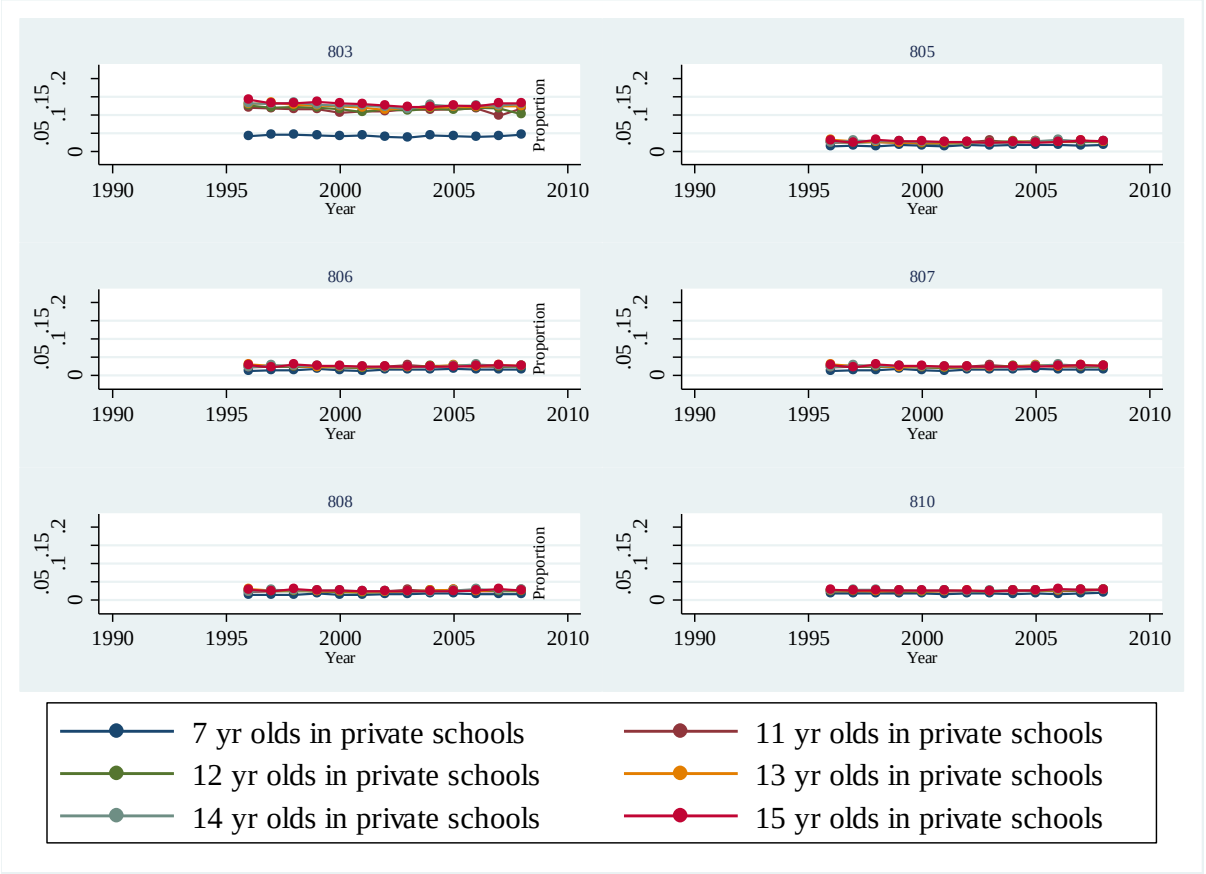
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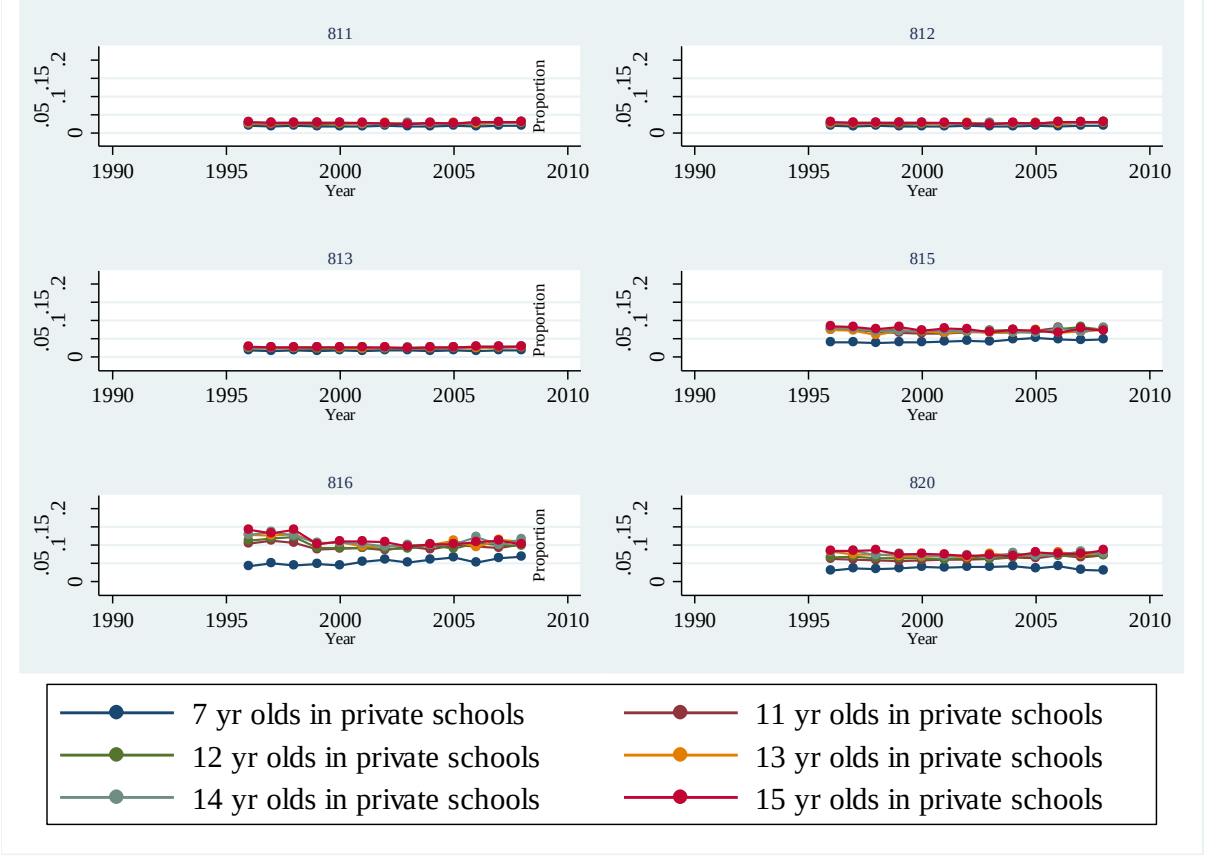
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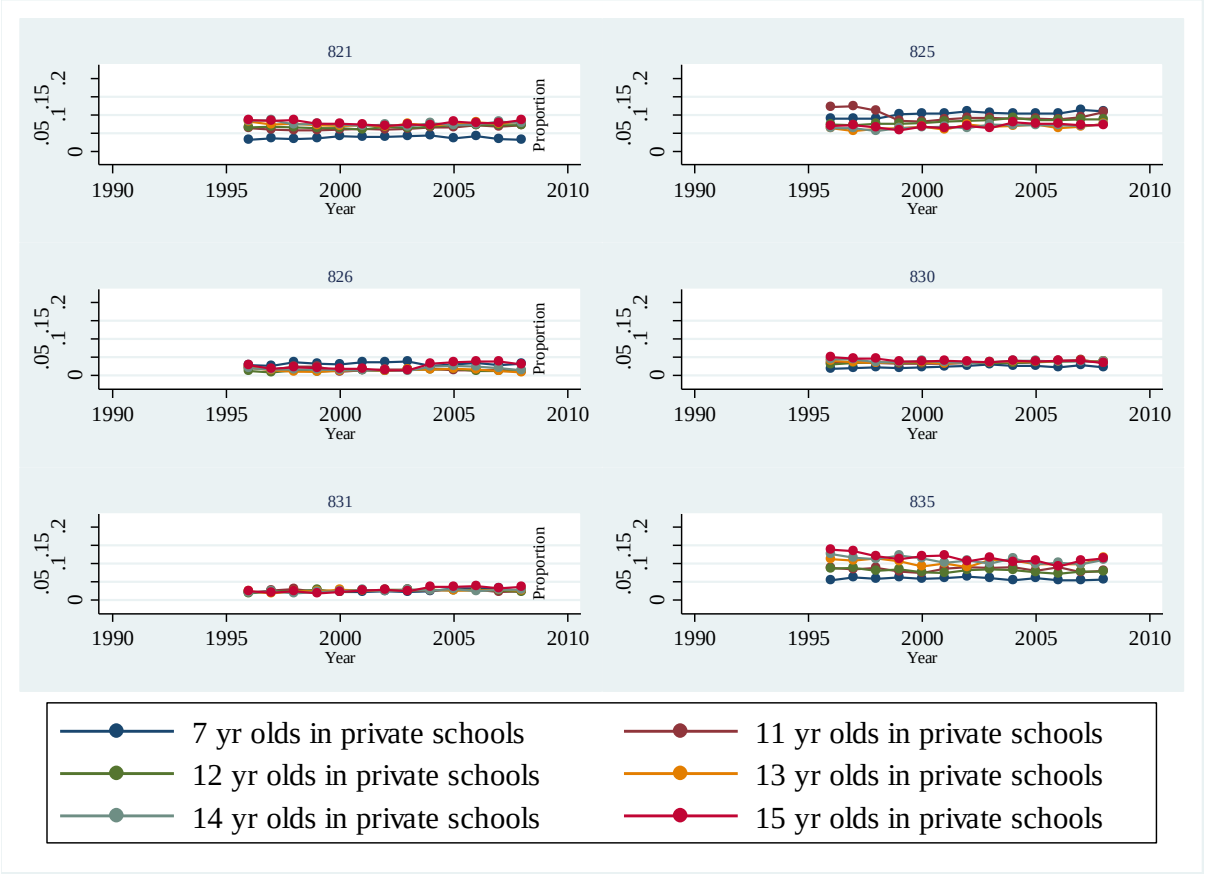
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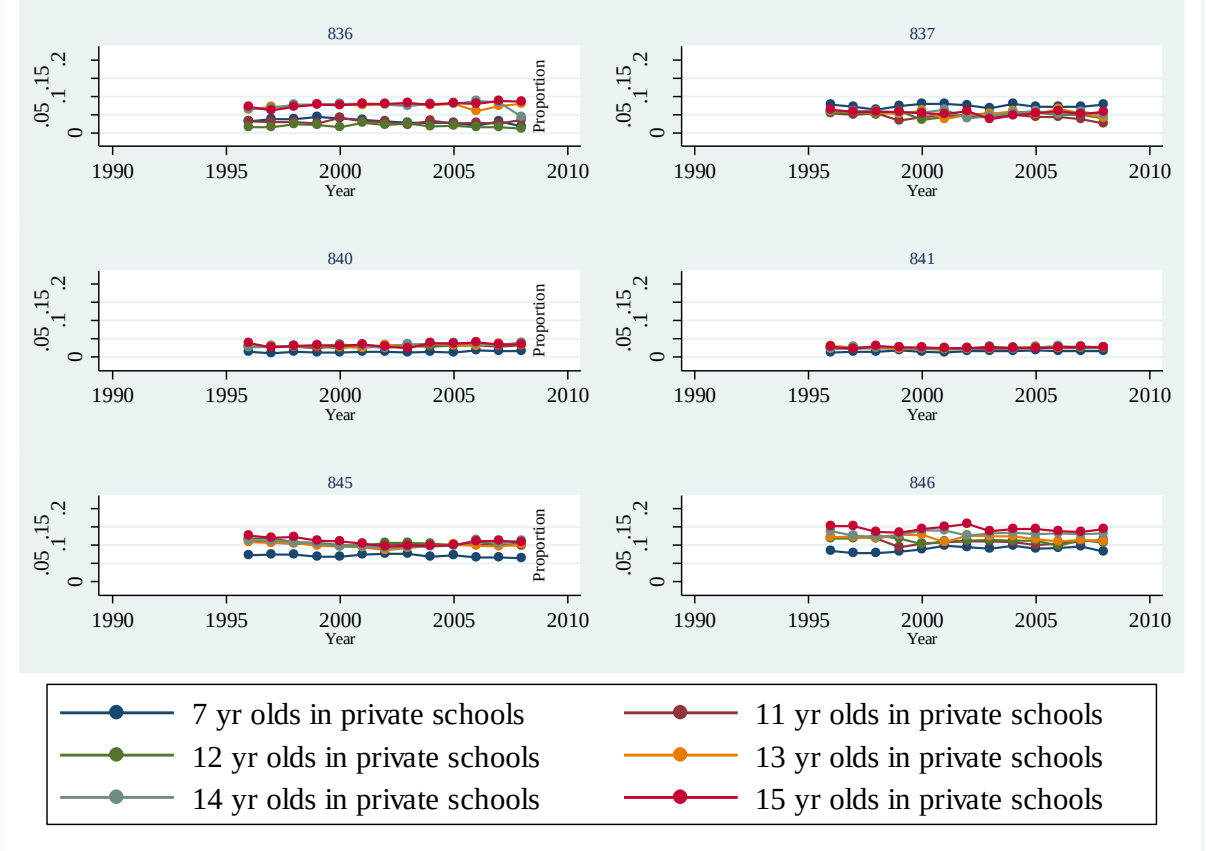
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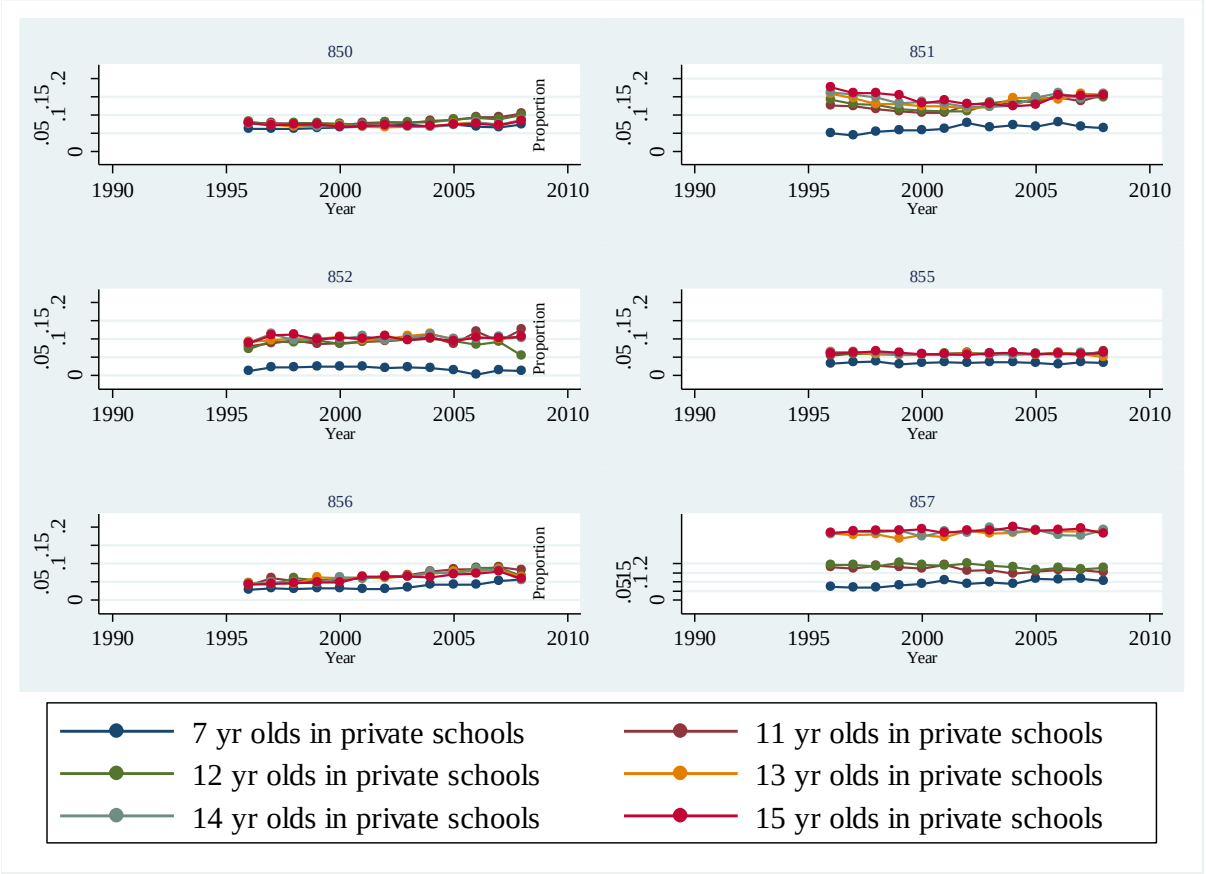
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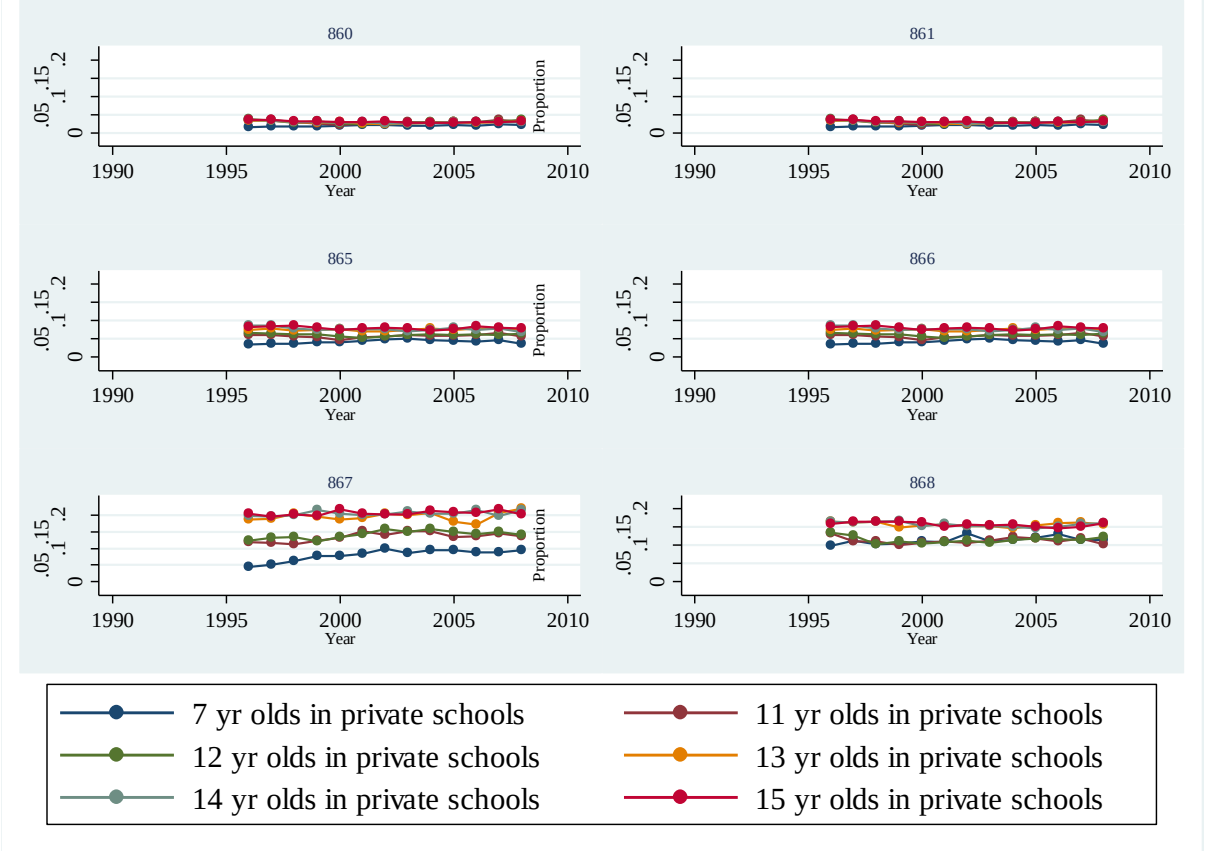
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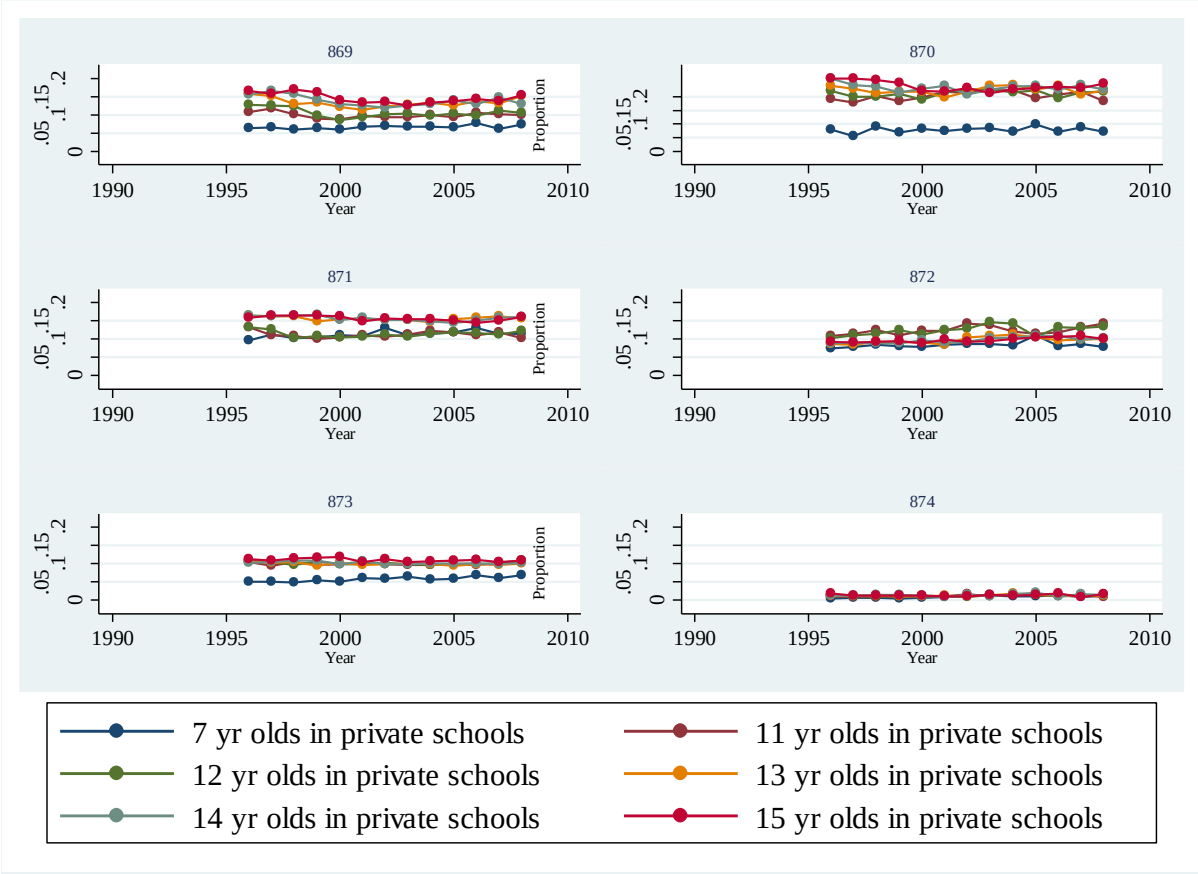
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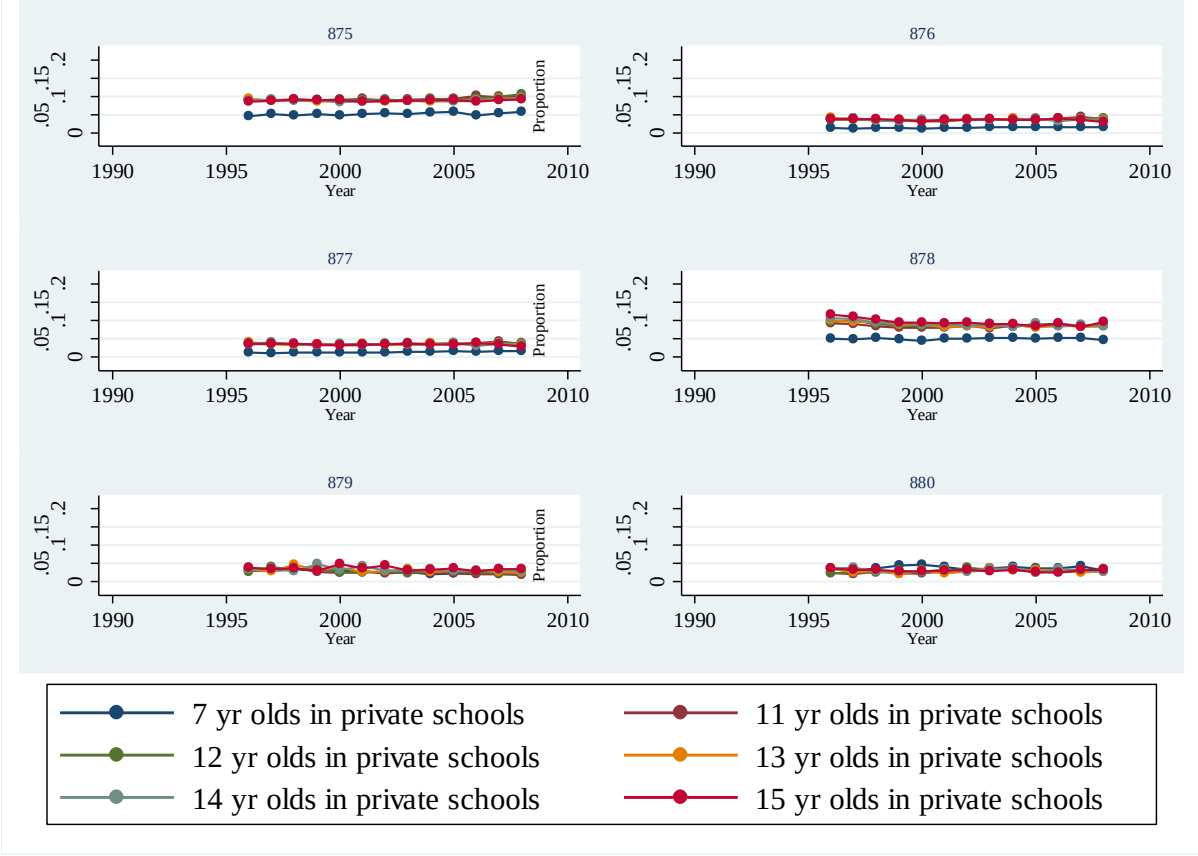
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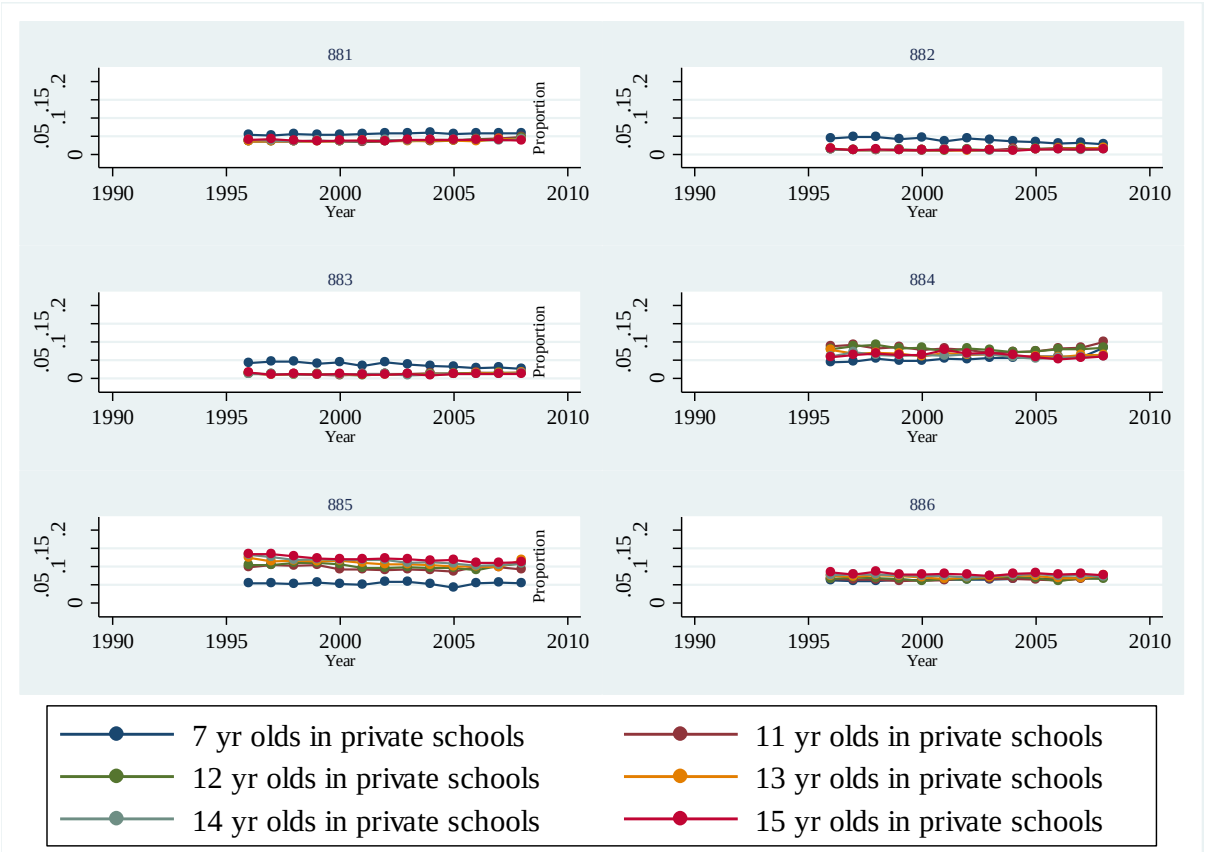
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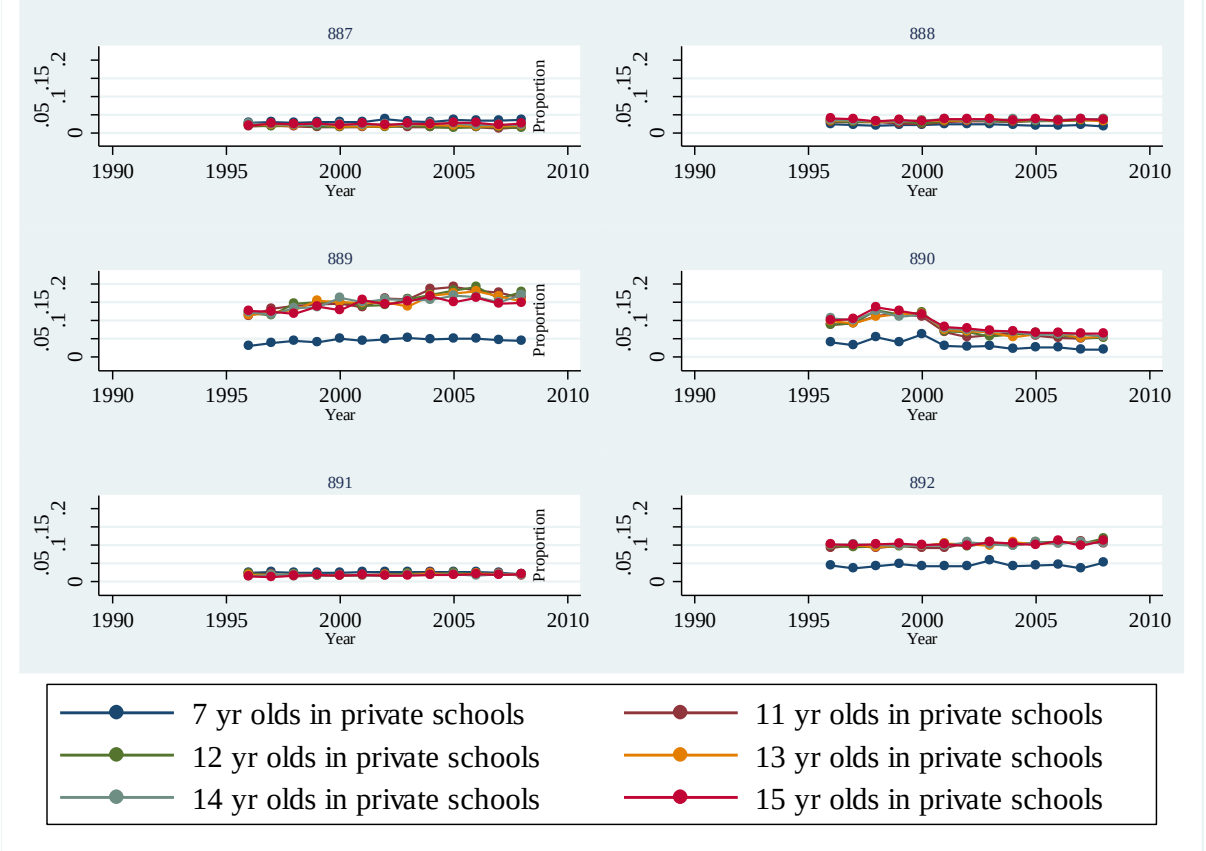
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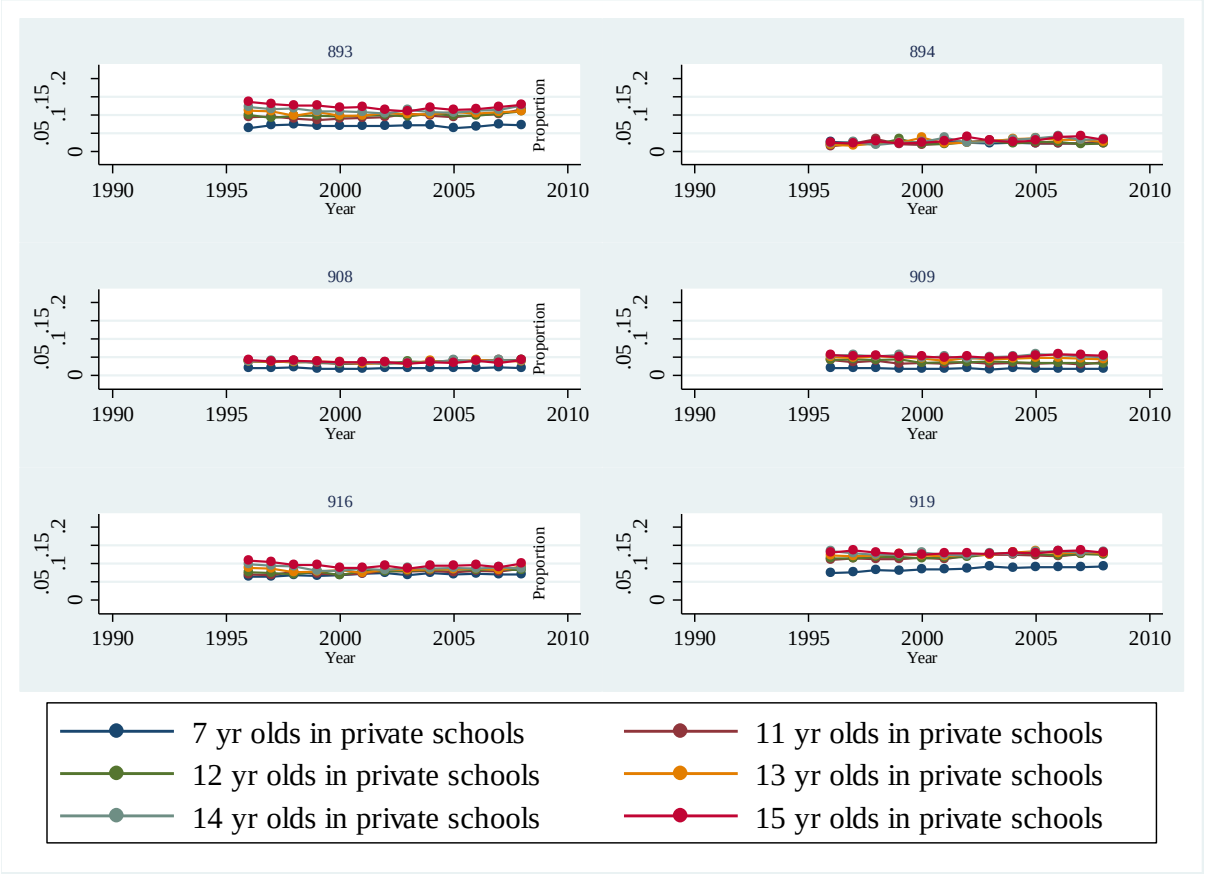
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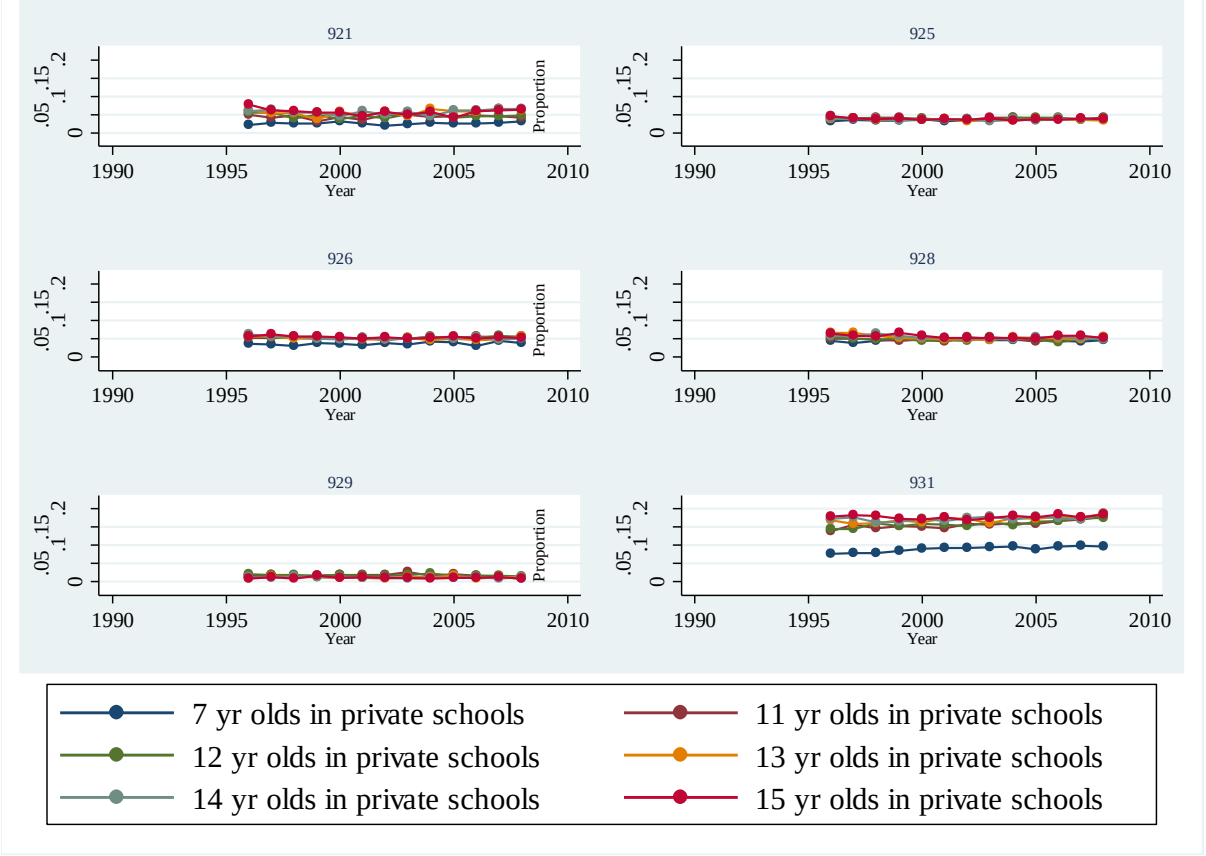
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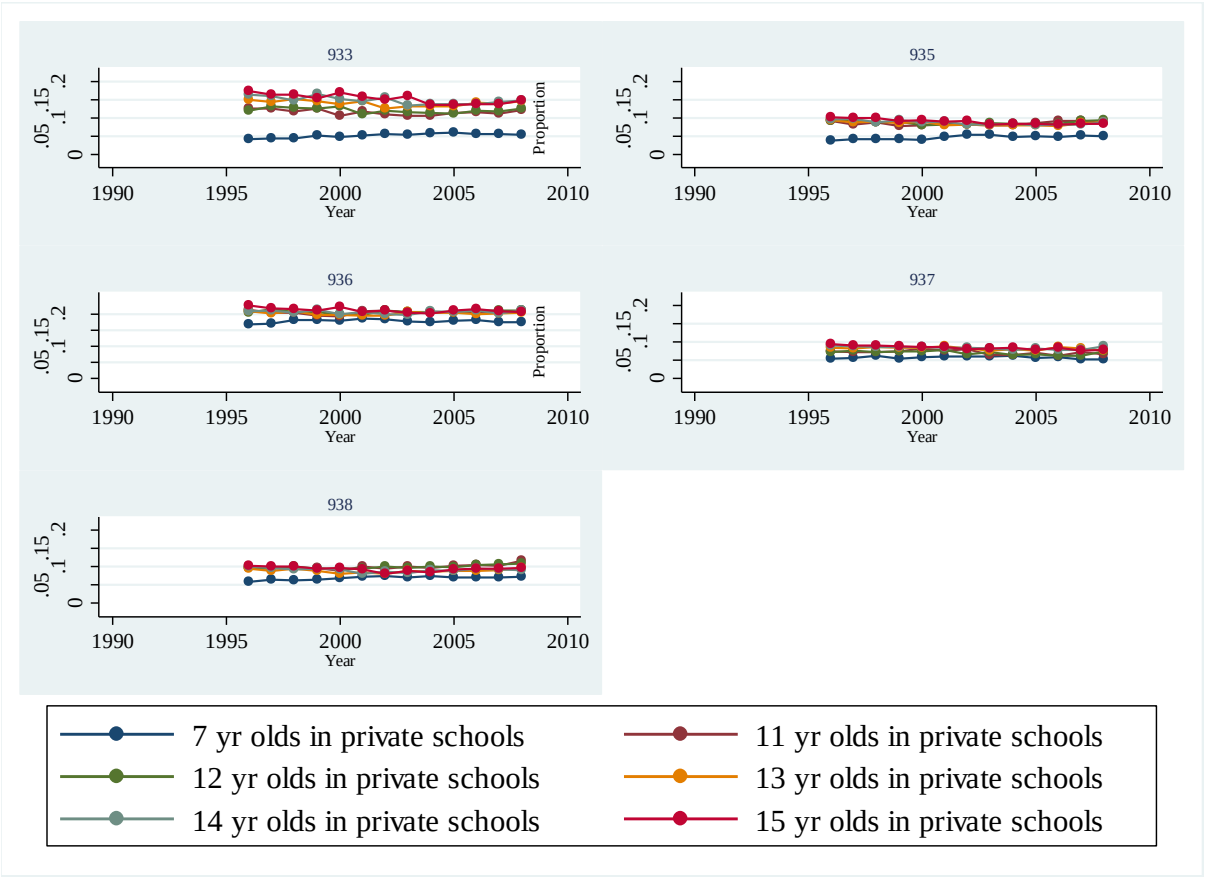
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Appendix 2 – Traditional System GMM estimates

TABLE A.2: Traditional System GMM Estimates of the Demand for Private Schooling for 7, 11, 13 and 15 year olds.

Variable	$\Delta\ P_{rt}^{7}$			$\Delta\ P_{rt}^{11}$			$\Delta\ P_{rt}^{13}$			$\Delta\ P_{rt}^{15}$		
	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase	Estimate	Elasticity	SD Increase
$\Delta\ P_{rt-1}^{a}$				0.918 [0.093]			0.942 [0.035]			1.009 [0.011]		
$\Delta\ lnF_{rt-1}$	0.105 [0.031]	1.823 [0.548]	2.273 [0.683]	-0.004 [0.031]	-0.055 [0.412]	-0.09 [0.672]	0.031 [0.013]	0.395 [0.168]	0.661 [0.281]	0.006 [0.002]	0.074 [0.028]	0.128 [0.048]
$\Delta\ lnF_{rt-2}$	-0.004 [0.027]	-0.069 [0.475]	-0.086 [0.592]	0.011 [0.031]	0.143 [0.415]	0.234 [0.678]	-0.02 [0.011]	-0.254 [0.145]	-0.426 [0.243]			
$\Delta\ Q_{rt-1}$	0.078 [0.024]	0.681 [0.209]	0.748 [0.230]	-0.038 [0.020]	-0.255 [0.131]	-0.367 [0.188]	-0.004 [0.007]	-0.028 [0.045]	-0.041 [0.066]	0 [0.003]	0.003 [0.022]	0.004 [0.033]
$\Delta\ Q_{rt-2}$	0.109 [0.027]	0.951 [0.087]	1.045 [0.297]	0.013 [0.020]	0.086 [0.050]	0.123 [0.225]	-0.008 [0.011]	-0.052 [0.026]	-0.076 [0.121]			
$\Delta\ FSM_{rt-1}$	0.004 [0.039]	0.013 [0.129]	0.045 [0.440]	-0.007 [0.025]	-0.019 [0.062]	-0.084 [0.278]	-0.013 [0.010]	-0.033 [0.024]	-0.15 [0.108]	-0.001 [0.003]	-0.002 [0.008]	-0.007 [0.037]
$\Delta\ FMS_{rt-2}$	0.053 [0.038]	0.173 [0.126]	0.588 [0.429]	0.037 [0.024]	0.094 [0.061]	0.418 [0.272]	-0.007 [0.008]	-0.018 [0.020]	-0.081 [0.093]			
No. Of observations		1937			1788			1788			1788	
AR(1) p-value		0			0			0			0	
AR(2) p-value		0.074			0.205			0.933			0.505	
AR(3) p-value		0.443			0.533			0.532			0.896	
GMM Lags		3 to 5			3 to 6			3 to 6			2 to 5	
Hansen test p-value		0.01			0.107			0.272			0.126	

Note: see notes to Table 3