Private school "effects" on student achievement in Australian schools*

Chris Ryan

June 2014

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (613) 90353794**
***Fax* (613) 8344 2111**
***Email* ryan.c@unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

* The initial work that this paper draws on was supported by a research grant provided by the Australian Research Council (LX0883152). The paper has benefited from comments of participants at seminars at the Melbourne Institute and the University of Wollongong. All errors are responsibility of the author.

Abstract

This paper examines the impact of the type of school (public or private) an individual attends on two dimensions Australian parents indicate are important in school choice: student attitudes and achievement. It exploits longitudinal data that captures individuals who change high schools to estimate how much of the apparent gaps in attitudes and achievement between students who attend different types of schools reflect unobserved differences between students and how much is the school sector effect. The apparent average gaps in attitudes and achievement between students in public and private schools largely disappear, suggesting that differences in unobserved characteristics contribute substantially to observed differences in student attitudes and achievement between Australian school sectors.

Keywords: school choice, private school effects, achievement, student attitudes

JEL Classification Codes: I210, I280.

1. **Introduction**

Students at different types of schools, say public versus private schools, are often observed to have different levels of school achievement on average or experience different outcomes in other dimensions of interest to themselves, their parents and the public. These other outcomes might be desirable attitudes and behaviours while at school, desirable patterns of school graduation or post-school activities, such as participation in university and, possibly, desirable adult outcomes, such as employment and earnings patterns.

Researchers often characterise these differences in average outcomes as having three possible sources: differences in the average characteristics of the two groups that they (the researchers) observe (such as parental education and occupation, language background and so on); differences in the average characteristics of the two groups that are typically not observed by researchers (such as student ability, motivation and ambition, and parental attitudes to education and their investments in their child's development); and an average school sector effect, reflecting the differences in the average effects of the two sectors' schools on outcomes.

While we can typically take account of the role of factors we observe, like parents' education, the process of school choice by parents and students in conjunction with the availability only of observational data means it is very difficult to distinguish between the last two factors. It is extremely difficult to disentangle the role of differences in average unobserved characteristics from the school sector effect. Essentially, the impact of differences in unobserved factors (motivation, ambition and so on) may bias estimated school sector effects through potential 'selection' or endogeneity effects.

Studies in the literature have addressed this problem in one of two ways. The first is by trying to study situations where there are no selection effects, such as where the allocation of students to schools has an explicit experimental or randomised design (for example, Hsieh & Urquiola, 2006, Wolf, Gutmann, Puma, Kisida, Rizzo & Eissa, 2009, Angrist, Dynarski, Kane, Pathak & Walters 2010). The second approach has been to try to remove the selection component from the estimated school effect by exploiting some phenomenon that influences the school choices people make or the allocation of students to schools, but that otherwise has no other impact on the outcomes of students. The phenomena used in these studies of school sector differences

include the religious affiliation of individuals or families (Evans & Schwab, 1995, Vella 1999, Le & Miller 2003) and the location or prevalence of particular types of schools (Cohen-Zada 2009, Cohen-Zada & Elder 2009, West & Woessman 2010), among others. Many of these studies are not compelling because the 'instruments' (the external phenomena) used can almost always be seen as having a potential effect on the outcome of interest via some other channel, especially the studies that use contemporary rather than historically-based instruments. Hence, a big growth area in the instrumental variables literature at present is in how to draw useful inferences when only potentially dubious instruments are available to researchers (for example, see Altonji, Elder & Taber 2005, Conley, Hansen & Rossi 2012 , Nevo & Rosen 2012).

This paper adopts a different approach, akin to that used by Weinhardt (2013) in looking at the impact on student achievement of living in public housing. Here we distinguish the contribution of unobservables and school sector effects to the average differences in student outcomes between sectors by identifying groups across the school sectors who reveal themselves to have similar unobserved characteristics. They do this by changing school sectors after their outcomes are observed. Specifically, we compare the mid-secondary school outcomes of private school students with those who attended government schools at the time the outcomes were measured, but who subsequently moved from their government school to a private school. By their actions, this group reveals themselves to have unobservables somewhat like those of private school students. Note, we do not assume that that the unobservables of those who change schools are identical on average to those in private schools, only that they lie somewhere between those of average private and public school students who do not change sectors. As we show below, the approach provides an upper bound estimate of the school sector effect and a lower bound estimate of the contribution of unobservables to the average differences in student outcomes between sectors.

The data used here are from a series of longitudinal studies where students are first surveyed in the middle years of high school and then followed beyond school to their mid-twenties. Many students change schools after they are first surveyed, and many change school sectors. In the first cohort we study, 18 per cent of the initial cohort of students changed school and 6 per cent changed school sector. This high mobility reflects both institutional and choice-related factors. In

two Australian jurisdictions the public high school system ends at Year 10 and students attend "college" for their last two years of school, so all public school students make a new choice of school. This institutional feature is mirrored in the private school sector in one of those jurisdictions and in general students move between sectors in large numbers at the end of Year 10 there. Further, many public and some private schools in regional areas of other jurisdictions mirror this feature, with schools serving small populations ending at Year 10, with students moving to consolidated, larger institutions for their last two years of school. Students also change schools for other reasons: because their family moves house; to improve their "match" with the school they attend, for negative reasons from the school they leave or positive ones from the school they move to; or because they are asked to leave.

The data also contain measures of student achievement as well as a large number of factors that reflect their behaviours and attitudes to their specific school and to school life in general. Surveys of parents relating to school choice in Australia tend to indicate that they have two sets of factors in mind in making the choices for their children that they do. Essentially, they indicate they make their choices with both student learning and behavioural outcomes in mind. On the first point, they tend to indicate that they are interested in schools with good academic programs and effective teachers. On behavioural outcomes, parents often say they choose schools with good disciplinary environments, or that are able to inculcate good values in students (for example, Beavis 2004, Department of Education, Science and Technology 2007). In this paper, we analyse both apparent differences in student learning outcomes between the sectors, as well as a range of student attitudes towards schools and their teachers, study behaviour and their plans for the future, to try to distinguish the impact of schools within sectors from the contribution of differences in students' unobserved characteristics.

The paper begins with a description of the Australian school system and school funding arrangements, to provide essential contextual information for the reader. We then review relevant literature on the effects of school choice, from Australia and other countries. The methodology section discusses the problems associated with estimation of school sector effects, particular issues with the data and our approach to this study. We present our analysis in the Findings section and a summary in the Conclusion.

2. The Australian school system

The public school system in Australia is administered at the state government level, so there are eight separate public systems, with slight variations in how they are structured. The public systems educate around two-thirds of Australian school students, with the balance educated in Catholic schools (20 per cent) and other non-government or Independent schools (13 per cent). These shares have changed substantially since the late 1970s when they were 79, 17 and 4 percent, respectively, in the three sectors. The growth in the private enrolment share and the reasons behind it are discussed in Ryan and Watson (2010). State public education authorities are responsible for determining educational policies in the areas of curriculum and state-wide student assessment, final year assessment and certification, as well as the registration of private schools.[1]

The Catholic schools are also organised via State-level Catholic authorities, while the other non-government are known as 'independent' because they have traditionally not belonged to school 'systems'. In institutional terms, Catholic schools in Australia are traditionally more similar to public schools than to Independent schools. The vast majority of Catholic schools are administered by state-wide Catholic Education agencies that allocate funding, determine staff salaries, and provide curriculum guidance (including a faith curriculum) to schools at all levels. At the high school level, Catholic schools cater to a more socially advantaged student population than public schools, but are less elite in terms of student population than Independent schools (Ryan and Watson 2010).

Independent schools are traditionally non-Catholic in religious affiliation (eg. Anglican and other Protestant denominations) and include many community-operated schools and schools based on a particular educational philosophy such as Montessorri or Steiner education. Traditionally, Independent schools have been concentrated in urban areas at the high-school level and focused on the preparation of students for university. However the Independent schools sector is now the

[1] While Australian schools share a common Year 1 to Year 12 grade structure, aspects of the structure of school education differ across Australian States and Territories in many areas: grade structures, commencement and age of compulsory attendance, qualification certification, curricula and the autonomy of decision-making at the school level (OECD 2009). Attendance is compulsory between the ages of 6 and 15, or up to 17 years in some States. The final two years of the secondary school are generally not compulsory.

fastest growing sector of private schooling in Australia and has gained an increased share of the student population over the past decade, in part through growth in low-fee schools.

Under the Australian constitution, power over education resides with state governments. Consequently, the operation of public schools is the responsibility of state governments, which provide most of their funding. Through its constitutional power to provide specific purpose payments to the states, the federal government provides some funding for public education, but provides more money directly for the operation of private schools. These payments effectively provide a weighted subsidy (voucher) for all students to attend the school of their choice in the private sector. Federal grants to private schools are supplemented by state government grants to the value of approximately half the federal grant. Schools in the Catholic system receive a combined (ie federal and state) grant per student that is worth approximately 70 per cent of school operating costs. Students attending Independent schools attract a federal voucher weighted according to the socio-economic status (SES) of their parents' home address ranging from 70 per cent to 14 per cent of school operating costs (plus the grant from the state governments). The weighted subsidies are paid in a lump sum to the school and all students attending a particular school are charged similar fees (these vary by grade).[2]

3. The literature on school sector effects

Many studies suggest that private school students outperform public school students and that the private school advantage appears particularly strong for students from minority groups or disadvantaged social backgrounds (eg. Coleman, Hoffer, & Kilgore, 1982, Hoffer 2009, Williams and Carpenter 1990, Evans & Schwab, 1995, Marks, McMillan, and Hillman, 2001, Neal 2009, Cardak and Ryan, 2009). However, as Berends *et al.* (2009) point out, these research outcomes are "difficult and controversial" due to confounding factors such as: the question of how and why parents choose schools; how chosen schools differ from those reporting lower levels of academic achievement; and the different research methods used to make comparisons between schools (Berends *et al.* 2009: xv).

[2] Funding to schools in the Catholic system also occurs on the basis of the SES of students. However, the money is paid to the Catholic education authorities who have their own mechanisms for allocating the funding between schools.

As in many other areas, the first generation of international studies of the impact of school sector effects did little more than control for the differences in the characteristics of students between the sectors. Studies tended to find large differences in student outcomes (for example, Coleman, Hoffer, & Kilgore, 1982). The second generation of studies attempted to take account of the selection into schools that arises because of the choices made by students and their parents via instrumental variables and sample selection approaches (for example, Evans & Schwab, 1995). These studies tended to find smaller differences between the sectors, but often relied on doubtful instruments (Altonji *et al*. 2005). The third generation of studies has used the randomized allocation of vouchers (for example, Wolf *et al.* 2009, Hsieh & Urquiola, 2006) and the historical patterns of religious group settlement as instruments for the current location of and access to particular types of schools (for example, Cohen-Zada 2009, Cohen-Zada & Elder 2009, West and Woessman 2010). Many, but not all, of these more recent studies show almost no effect from attending private schools, especially Catholic schools. These, and studies such as Vandenberghe and Robin 2004, Hoffer, 2009, Neal 2009 provide a mixed picture of the impact of private schools on student performance.

In Australia, it is clear that school students who attend Catholic and Independent schools experience better educational outcomes than those who attend Government schools. These better outcomes range from higher school achievement levels and Year 12 completion rates through to transfer rates from high school to studies at university (Marks, McMillan and Hillman, 2001, Fullarton, Walker, Ainley, and Hillman 2003, Le and Miller 2003 and Cardak and Ryan 2009). Using some of the same data as that used in this paper, Cardak and Ryan (2009) found that school sector has an impact on university participation through its impact on student ENTER scores, but no direct effect on university participation. Marks, McMillan and Hillman (2001) and Marks (2004) also found Catholic and Independent school effects of 3 to 5 and 5 to 6 points respectively on ENTER scores in the two cohorts of data used in this paper, once Year 9 school achievement and parental, occupation-based SES are taken into account. Interestingly, these observed gaps in student performance on ENTER scores between public and private school students in Australia are reversed at university. Studies of student university grades suggest that private school students with the same ENTER scores as public school students achieve lower grades at university (Dobson and Skuja 2005, Win and Miller 2005, Birch and Miller 2006).

Most of the Australian studies would be best viewed as first generation studies, however. Among the Australian studies that have tried to address selection issues associated with different sectors on student outcomes, Le and Miller (2003) estimate a first stage choice equation using wealth measures and the proportion Catholic in the students' parents' countries of birth as instruments for this equation. Le and Miller found significant school selection effects in the Year 12 completion outcome equation for one of the cohorts they studied and substantial remaining school sector effects of Year 12 completion at the beginning and end of the 1980s. Vella (1999) used a Catholic affiliation variable in the first stage choice equation and found no significant selection effects from attendance at a Catholic school on Year 12 completion rates. The use of such 'religious affiliation' variables, sometimes in conjunction with distance from schools, as instruments for the purposes of estimating Catholic school effects in the US was questioned in the work of Altonji, Elder and Taber (2005). Problems with this approach have led Altonji *et al.* to propose a method when good instruments are not available for assessing how substantial the role of selectivity bias would have to be to completely account for any apparent school sector effects. Their approach led them to conclude that there was a positive effect of attendance at a Catholic school on at least high school graduation.

Another strand of the international literature has examined the way schools operate in different sectors to identify factors that might generate differential student performance. A major US longitudinal study released in 1981 and 1983 *High School and Beyond,* provided a nationally representative database suitable for comparative studies of public and private schools (Marks 2009). Analyses of this database by Coleman and Hoffer found that Catholic students completed more maths, science and foreign language courses, completed more homework, had better attendance and saw fewer school-wide discipline problems that public school students with similar sophomore achievement and social backgrounds. When these school variables were entered into the achievement regressions, Coleman and Hoffer found the academic variables (track placement, homework and coursework) explained most of the Catholic school effect on verbal skills and all of the effects on Mathematics (Hoffer 2009: 442). Hoffer (2009) concludes that "neither the individual selection nor the aggregate-student composition explanations hold up for the positive effects of Catholic schooling on growth in verbal skills and mathematics over the last two years of high school" (Hoffer 2009: 443). Hoffer points to a substantial independent

effect of Catholic school attendance on the likelihood of academic program enrolment, with Catholic school students more likely to report being in an academic or college-preparatory program than public school students with comparable social backgrounds (Hoffer 2009: 442). This leads him to conclude that the main factor accounting for the Catholic High school effect on students' verbal skills and mathematics scores in 11th and 12th grade is the greater concentration of academic course taking among Catholic school students.

4. Methodology and data

We exploit a simple framework for describing school sector effects that informs the empirical analysis that follows. We now sketch this framework.

4.1 Approach to identification used in this paper

We are interested in the impact of the type of school attended by those in two school sectors (s_i = 0, 1) on some outcome y_i.[3] However, the outcomes of individuals who attend different types of schools will differ by more than just the impact of the school they attend. That is, individuals in different school types will differ in both their observed (by the researcher) characteristics and their unobserved characteristics. These unobserved factors might include unobserved ability, motivation, ambition, effort levels, attitudes to education, discipline and non-cognitive skills. Algebraically, the difference in average outcomes between school sectors can be written as reflecting the contribution of differences between the average observed characteristics of those in the two sectors, reflected in $f(\bar{x}_{s=1} - \bar{x}_{s=0})$ below, the school sector effect, denoted by γ below, and differences in the average effect of the unobserved characteristics of those in the two sectors, denoted by δ below. Hence, we write:

$$\bar{y}_{s=1} - \bar{y}_{s=0} = f(\bar{x}_{s=1} - \bar{x}_{s=0}) + \gamma + \delta \qquad (1)$$

If we estimate this difference, conditional on some specific set of *X*s, then we can characterise the average estimated difference in some outcome of the students of different school sectors as

$$E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

[3] The extension to a second private sector is straightforward.

where E is the expectations operator and $\bar{u}_1$ and $\bar{u}_0$ are the average effect of unobservables in school sectors 1 and 0 respectively. This equation can be alternatively decomposed as

$$= E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_1]$$

$$+ E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

$$= \gamma^1 + \delta^0 \qquad (2)$$

or

$$= E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_0]$$

$$+ E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_0] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

$$= \delta^1 + \gamma^0 \qquad (3)$$

where, as before, γ is the school sector effect and δ is the impact of the differing unobserved factors between the groups on the outcome of interest. In the first decomposition, the school effect is estimated between students with the average unobservable characteristics of those in type 1 schools but who attend different types of schools, with the unobservables effect calculated from students within type 0 schools, as indicated by the superscripts in the last line. In the second approach, the school effect is estimated between students with the average unobservable characteristics of those in type 0 schools, with the unobservables effect calculated from students within type 1 schools. If the school sector effect is homogeneous, that is, it is the same for students with unobservables of $\bar{u}_1$ as it is for those of $\bar{u}_0$ then the parameters estimated by each approach should be similar. If the school sector effect is heterogeneous and varies for different types of students, the parameters estimated by one approach will be only approximately equal to those estimated via the alternative approach.

Since the average difference in outcomes between students of the two school types are observed, the school sector effect (the parameter γ), can be identified if we can account for the differences in observed student characteristics across the sectors and if there are identifiable students across the two school systems with likely identical unobserved factors. But since these factors are unobserved, clearly this is literally impossible to verify. Instead, the aim here is to identify

individuals whose unobserved characteristics are likely similar to those in the alternative school sector. Imagine that there are two readily identifiable groups, whose average unobserved characteristics can be characterized as $\varphi\delta$ and $\theta\delta$, respectively, with $0 < \varphi \leq 1,\ 0 < \theta \leq 1$. Depending on the values of these parameters, the unobserved characteristics of these groups might approach the average of those of students in school sector 1.

Substituting for φ and the associated level of unobservables, $\bar{u}_{\varphi}$, in the first decomposition we get

$$E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

$$= E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E\big[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_{\varphi}\big]$$

$$+ E\big[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_{\varphi}\big] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

$$= [(1-\varphi)\delta^0 + \gamma^1] + [\varphi\delta^0] \tag{4}$$

And substituting for θ in the second decomposition gives

$$= E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_1] \quad - E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_{\theta}]$$

$$+ E[y_i|X_i = \bar{x},\ s_i = 1, u_i = \bar{u}_{\theta}] \quad - E[y_i|X_i = \bar{x},\ s_i = 0, u_i = \bar{u}_0]$$

$$= [\theta\delta^1] + [(1-\theta)\delta^1 + \gamma^0] \tag{5}$$

In the first approach, where we can estimate the contribution from unobservables from $\varphi\delta^0$, we can obtain an estimate of $\hat{\gamma}^1 = (1-\varphi)\delta^0 + \gamma^1$, which will overestimate the magnitude of the school effect. The second approach provides similar terms, so both approaches provide lower bound estimates of the effect of the differences in the unobservables, and upper bound estimates of the school effect. It may be that these bounded effects provide useful information. For example, lower bound unobservables effects that encompass the whole gap in average outcomes and upper bound school sector effects that are not significantly different from zero provide real information about the source of differences in outcomes between the sectors.

The question is, can such groups with unobserved characteristics sufficiently like those of the alternative school sectors be readily identified? In this paper, we use students who move from school sector 0 to 1 after their outcomes are measured as those with unobservables approaching those of the sector 1 students in the first decomposition, and students who move from school sector 1 to 0 as those with unobservables approaching those of the sector 0 students in the second decomposition. We assess empirically whether this seems reasonable below.

4.2 Regression methodology used in the paper

The regression analogue to the framework set out above is to estimate a regression equation of the form

$$y_i = \alpha_0 + \beta_{GP} I_{GP} + \beta_{PG} I_{PG} + \beta_{PP} I_{PP} + X_i' \pi + \varepsilon_i \qquad (6)$$

where y_i is an outcome observed for individual *i* in the middle of high school, I_{AB} indicates the individual attended an *A*-type school in the middle of high school and a *B*-type school by the time they completed their schooling, the *X*s reflect a set of observed characteristics, ε_i is a random error term and α_0, π and the β_{AB} are parameters or parameter vectors. In terms of the schools attended indicators, the subscript *G* indicates the individual attended a government school and *P* a private school.

Estimation of the parameters identified in the last subsection in this regression framework is straightforward. With the group who attend a Government school in the middle of high school and at the end of high school, the parameter $\hat{\beta}_{PP}$ provides an estimate of the total difference in average outcomes, once observable characteristics have been controlled for (via $X_i' \hat{\pi}$). The table below shows how the school effect and unobservables effects can be recovered from the regression parameters using each of the two groups of school sector movers.

Table 1: School sector effect parameters

		Year 9 estimates	
	Total difference	School effect	Unobservables

Using private to public movers	$\hat{\beta}_{PP} - \hat{\beta}_{GG} = \hat{\beta}_{PP}$ [(a)] $\delta^1 + \gamma^0$	$\hat{\beta}_{PG} - \hat{\beta}_{GG} = \hat{\beta}_{PG}$ $[(1-\theta)\delta^1 + \gamma^0]$	$\hat{\beta}_{PP} - \hat{\beta}_{PG}$ $[\theta\delta^1]$
Using public to private movers	$\hat{\beta}_{PP}$ $\delta^0 + \gamma^1$	$\hat{\beta}_{PP} - \hat{\beta}_{GP}$ $[(1-\varphi)\delta^0 + \gamma^1]$	$\hat{\beta}_{GP} - \hat{\beta}_{GG} = \hat{\beta}_{GP}$ $[\varphi\delta^0]$

(a) Since the *GG* category is the omitted group in the regression equation, $\hat{\beta}_{GG} = 0$.

We also estimate two further types of regression equations. The first reflects the nature of the data available to us. For the first two cohorts, there are restrictions in our use of the achievement variables, described below. Further, we have access to an additional, end of school achievement measure that is used to determine access to university, known at the time as an ENTER score. These ENTER scores were obtained by only a subset of the original grade cohort, yet purport to reflect the individual's achievement rank within the entire cohort. We use the achievement variable from the middle of high school to obtain an analogue rank from that time for individuals who eventually obtained an ENTER score. We use this estimate, combined with their eventual ENTER score to construct a variable that can be used as a longitudinal rank dependent variable to estimate an individual fixed effects estimate of the impact on the achievement rank of individuals of changing school. That is, we estimate an equation of the form

$$y_{it} = \alpha_0 + \beta_P I_P + X'_{it}\pi + \tau_i + \varepsilon_{it} \qquad (7)$$

where τ_i is the fixed effect for individual i. The parameter of interest is β_P, identified by those individuals who change school from *G* in the first period to *P* in the second.

The other type of equation we estimate is also a fixed effects regression. This time, though, the effects are school effects, subscripted by *k*. We estimate an equation of the form

$$y_{ik} = \alpha_0 + X'_i\pi_{FE} + \mu_k + \epsilon_{ik} \qquad (8)$$

where μ_k is the fixed effect for school k and ϵ_{ik} is the random error for individual i within school *k*. This equation is estimated over the same set of middle of high school outcomes as equation (6). The interest in this equation is that it allows us to say something about the types of

schools the movers come from and also something about where in the distribution at their original school these students were. For example, were movers the most or least hardworking, in terms of homework hours, in the schools they originally attended? Were they different from others in their schools in their attitudes to their teachers or their plans for the future? Estimation of statistics like those below allow us to say something about these phenomena

$$\bar{\mu}_{GP} = \frac{\sum_{i,GP} \mu_k}{n_{GP}}, \qquad \bar{\epsilon}_{i,GP} = \frac{\sum_{i,GP} \epsilon_i}{n_{GP}}$$

where the first is just the average school effect estimated from the schools of those who change from school type *G* to *P*, estimated over the n_{GP} who change, while the second statistic is an estimate of the average individual effect of those who change school from *G* to *P*.

4.3 Data

The data used in this study are drawn from the Longitudinal Surveys of Australian Youth (LSAY). This is a national government-funded data collection that follows cohorts of students from the middle of high school through to their mid-twenties. It contains extensive information on students' academic performance, social background, future study plans, occupational ambitions and their attitudes to schooling, as well as the type of school they attend.

Data from three cohorts of students in the middle years of high school are used in our analysis: cohorts of ninth graders in 1995 and 1998 and of fifteen year olds in 2009. These cohorts were all drawn as two-stage cluster samples of Australian school children. In the first stage, schools were randomly selected. In the second stage, intact classes of Year 9 students in the first two cohorts and of all fifteen year olds in the third cohort from those schools were randomly selected. The samples were stratified by school sector (Government, Catholic or Independent private schools). Around 14,000 individuals in just over 300 schools were surveyed initially in each cohort. This represents close to 6 per cent of students in Year 9 (and of fifteen year olds) in Australian schools and 12 per cent of schools with secondary school students. The number of students per school varies between 4 and 156, but averages just over 50. Population means in this paper are estimated with weighted data to account for this stratification.[4] In the first survey year,

[4] The weights also attempt to take account of survey attrition for waves after the initial contact.

when students were in Year 9 (or aged fifteen years), they completed literacy and numeracy tests at their schools, along with a questionnaire to elicit background information.

The Y09 cohort was an age-based cohort, slightly more advanced in terms of their schooling than the two earlier cohorts. Some 17 per cent were in Year 11 or higher when surveyed, with a further 71 per cent in Year 10. In light of our need to identify those changing school and given that Year 10 is a critical transition point, we restrict our analysis of the third cohort to students in Year 10 or below when first surveyed.

There was a significant overlap of items in the literacy and numeracy tests administered to the first two cohorts, so it was possible to develop common scales for these dimensions of school achievement. Rothman (2002) contains details of the development of these scales.[5] The achievement scale for those cohorts used in this paper is the average of students' literacy and numeracy scores.[6] The individual scales were constructed to have a mean of 50 and standard deviation of 10 and the average scale has a standard deviation of 8.5. The same sets of questions were used to elicit background information from the first two cohorts, which were collected by the same market research company and administered by the same institutions. For the third cohort, the achievement scales are based on the PISA reading, mathematical and scientific literacy scales, which have international means and standard deviations of 500 and 100 in all scales. Similar background information was collected from the PISA 2009 subjects as in the earlier cohorts.

Participants were surveyed in subsequent years by mail and/or telephone questionnaires. In subsequent contact years, subjects were asked whether they had received the relevant certificate from their jurisdiction to indicate they had completed Year 12, whether they had obtained an ENTER/ATAR score and whether they were studying at university. A student is awarded an ENTER/ATAR score if they complete a pre-university entrance program in their final (twelfth) year of schooling. The ENTER/ATAR score is based on their achievement in statewide

[5] In fact, the scales developed by Rothman (2002) linked school achievement for a series of cohorts over a much longer time frame, because the earlier instruments also included overlapping items.

[6] Where only one of the literacy and numeracy scales is available, it was used as the achievement score. This constituted about 3 per cent of the pooled data from both cohorts.

examinations and other assessment tasks and reflects the percentile rank of the student's performance within their cohort.[7]

Key background characteristics and some outcome indicators for the three cohorts are shown in Table 2. It indicates that the important features of the first two cohorts are broadly comparable, which is useful for the analysis presented below. The private school enrolment share is much higher in the third cohort, which reflects a long term trend increase in the enrolment share. Other features of the first two cohorts are almost identical– average achievement levels, parental socio-economic status and student occupational ambitions. The gender and regional distributions in the data differ a little and the outcomes show small increases between cohorts in school completion and ENTER scores, but no change in university participation rates. In general, the data confirm that little changed in Australian education and the characteristics and ambitions of young people between the 1995 and 1998 cohorts of Year 9 students. By contrast, the Y09 cohort looks quite different, with a big change in the private sector enrolment share and the use of a new set of measures for the metropolitan region and occupational SES scale that affects both parents' SES and the measure of the students expectations about future occupations. Consequently, this cohort is studied separately from the other two.

4.5 Students who change schools

Students change schools for a variety of reasons. For some, the school they attended when first surveyed did not have a senior school program, so they were required to change if they wanted to complete Year 12. Others change for reasons somewhat outside their own or their schools control, for example where their family moves house. Others change because they are drawn to new school or pushed out of their old ones. We use data on all such movers, but distinguish them in different places to ensure that the results are not driven by any particular group of movers.

As previously indicated, some individuals attended schools that did not have a Year 11 and 12 program. This is one of the design features of the public school systems in the Australian Capital

[7] The name given to the university entrance rank score differed between Australian jurisdictions at the time of the first two cohorts, as did their scales, the requirements for obtaining them and the proportion who undertook Year 12 studies who obtain an entrance rank. An ENTER score is a generic name for these entrance ranks that is calibrated to a common, Australian-wide scale that ranges from 30 to 99.95. A common scale, known as an Australian Tertiary Admissions Rank (ATAR) score, also ranging from 30 to 99.95, was in place by the time of the third cohort.

Territory (ACT) and the state Tasmania. Such schools also occur in the private sector. There are Catholic schools in the ACT that also end after Year 10, as well as in other jurisdictions. It is much less common for Independent schools not to have a senior (Year 11 and 12) program. Unfortunately, the ACT and Tasmania are relatively less populous jurisdictions within Australia and while they are over-sampled in the data, the relatively small number of observations means that we must pool the data for the two years for our analysis.

In the 1995 and 1998 cohorts of 9th graders, 787 and 829 respondents respectively reported when they were in Year 11 that they had changed schools because their Year 9 school did not offer 11th and 12th grade. At that time, they provided the sector of their new school.

Another set of students leave school because they either move house or for another reason. In the 1995 and 1998 cohorts of 9th graders, a total of 1503 respondents reported that they had changed schools despite the fact their Year 9 school offered 11th and 12th grade. Around 20 per cent moved house, just over 40 per cent indicated they wanted to move to a new school or one with a better choice of subjects, while just over 20 per cent gave negative reasons about their initial school, with most of them indicating they did not like the other students or the school.

The transition matrix between school sectors from Years 9 to 12 for all students (and who had not left school) in the first two cohorts is shown in Table 3. Almost 90 per cent of students who attended a Government school in Year 9 were at a new Government school in year 12, if they were still in school. The proportion remaining in the Catholic school system was similar. Few students whose original school was an Independent one went to a new Independent school, which suggests the actual schools observed to have no program must have been quite unusual. In fact, they were all non-metropolitan schools, which makes them unrepresentative, since almost two-thirds of non-government school students attend metropolitan schools. To a considerable extent, this limits what we can say about the students in those schools and their experiences as being representative of other students in the Independent schools system. The other point of note about the table is that it almost a symmetric matrix – that is, about the same number of students left Government schools for Catholic ones as went in the opposite direction, with similar patterns for all other sector pair flows.

The third cohort differs from the first two in a number of important respects. First the students were in a higher grade when initially surveyed, and in some jurisdictions were already in at least Year 11. In the analysis of this cohort, we focus solely on students in Year 10 or lower, to at least observe individuals who crossed this threshold. Second the data collected from the cohort is different. Students were not asked the reason they changed schools, only whether they had done so and the type of school they now attended. Third, many fewer students appear to change school sectors in the third cohort than the earlier ones. It is not clear if this is a real phenomenon or a peculiarity of this sample.

4.4 Characteristics of the students who changed schools

We now assess how similar the background characteristics of students from the differing school systems are. In Tables 4 and 5 we present the mean values for a key set of demographic variables by school sector for four groups – the group who did not change school; the group who changed school, but stayed in the same sector and the groups moved out of and into the sectors respectively. Table 4 contains the data on the Y95 and Y98 cohorts, while Table 5 presents it for the Y09 cohort.

The tables show a number of well-known features about the characteristics of students from the sectors – students from private schools come from higher socio-economic status (SES) backgrounds – they live in wealthier neighbourhoods, their parents are more educated and work in higher status jobs. More of them are university educated than are the parents of government school students. Students in Independent schools are from higher SES backgrounds than are students in Catholic schools. Previous studies using comparable earlier data have suggested that, in part because their SES is higher, students in private schools also have higher levels of school achievement (Williams and Carpenter 1990).

The movers into and out of the school sectors are different from those who do not move. Those who move in or out of the Government sector are from higher SES backgrounds than those always in that sector, while the reverse is true for movers into or out of the Independent sector - they are from lower SES backgrounds than those always in Independent schools. These phenomena were evident in both the Y95 andY98 cohorts, as well as the Y09 cohort. By

contrast, the movers into or out of the Catholic sector look little different in terms of observable characteristics to those always there.

5. Findings

In discussing the results we focus first on what we can learn about the apparent unobservables of students who changed school. We do this by looking at the results from estimation of the fixed school effects regression of outcomes based on equation (8). We then use these same regression results to try to say something about the types of schools students tend to leave. Third, we review the results that tell us about the magnitude of school sector effects on student plans, behaviours and attitudes, before considering the results on the impact of school sectors on student achievement.

5.1 The unobservables of those who change school

Tables 6 and 7 allow us to look further at the issue of who changes school, beyond the differences in the observable characteristics of individuals described in the last section. These tables contain the average individual effect, $\hat{\epsilon}_{ik}$, from the fixed effects regression of equation (8). The averages are calculated from each individual in each group of mid- and late high school sector groups. That is, the average is calculated based on each individual value $\hat{\epsilon}_{ik}$ over all individuals in any specific group, such as those who moved from Government to Independent schools - the *GI* group. Table 6 contains the estimate for each school sector combination for each outcome variable for the Y95 and Y98 cohorts. Table 7 contains the estimate for each school sector combination for the outcome variables for the Y09 cohort.

For each individual, their estimated residual shows how far away from the average or expected value for the specific outcome they were within their school, given their set of individual characteristics. Those with positive values, were above the expected value, given their characteristics, within their school, while those with negative values were below their expected value. Since most students do not change school sectors, the values in the *GG*, *CC* and *II* columns of the tables, which show the average values for those groups, are approximately zero. The patterns in the other columns are quite different.

In Table 6, the *GI* column typically contains 'positive' values, in that they show that students who moved from Government schools to Independent schools in Y95 and Y98 had above average rates of indicating they planned to complete Year 12, attend university, had high occupational ambitions and better attitudes towards homework, even when they attended public schools. They had positive views of their teachers, but not of their school in general or the other students. By contrast, the averages in the *IG* column show a uniformly negative pattern, so the students who moved from Independent to Government schools were below average in their views and attitudes in the school they left. The group who moved from Catholic to Government schools were similar. The patterns for other moves are less consistent.[8]

The averages in Table 7 for Y09 show some different patterns to those of Table 6 for Y95 and Y98. The *CI* group remain ambitious in terms of their future plans, but appear far less satisfied with their current schools, with many negative values on the life at school variables. They appear to be higher achievers than their peers. The *IC* group and *CG* groups again show negative patterns, so those students who moved from Independent and Catholic to Government schools were below average or expected in their views, attitudes and achievement in the school they left. Further, in this case the *GC*, *CI* and *IC* groups also tended to have relatively negative views of their schools and were lower achievers, relative to their peers. Unlike the picture from the Y95 and Y98 cohorts, leavers appear to have more negative views about their current schools, and most movers were below average achievers. In general, this suggests that the two earlier cohorts might provide a better case for considering the unobservables of movers to approach those of the sectors they move into than the last cohort, since many of the movers seem to have negative reasons for leaving the schools they leave.

5.2 What types of schools did the movers leave?

We turn now to the types of schools movers left and ask whether they were above or below average for their sector in terms of the various outcome variables. Tables 8 and 9 present the average school fixed effects from the same regressions as the individual effects presented in the preceding tables. These are not centred on zero, but on the average for the sector as a whole for

[8] While not shown, the patterns in terms of achievement were similar to those for other characteristics – the *GI* movers were high achievers relative to their peers, the *IG* and *CG* movers were low achievers relative to their peers.

each outcome measure. The value for each group in the tables, such as the *GI* group, is the average across all individuals in that group of the estimated fixed effects, $\hat{\mu}_k$, for the schools they attended. The estimated averages allow us to say whether movers came from above or below average schools for their sector. Table 8 contains the estimate for each school sector combination for each outcome variable for the Y95 and Y98 cohorts and Table 9 those for the Y09 cohort.

Once more, the patterns seem somewhat different between the two earlier cohorts and the last one. For the Y95 and Y98 cohorts, the *GI* group for example, tended to come from above average schools for their sector in terms of Year 12 completion, plans to attend university, student occupational ambitions, homework attitudes and hours, among other outcomes. *GC* movers also tended to come from above average schools on many measures. Movers from schools in the other sectors tended to come from slightly below average schools, compared to others in their sectors.

In contrast, *GI* movers in the Y09 cohort tended to come from below average government schools on most outcomes, including on disciplinary climate and student achievement. *GC* group movers came from slightly above average schools on most outcome measures. Once more, movers from schools in the other sectors tended to come from slightly below average schools, compared to others in their sectors, most notably in terms of achievement.

5.3 Estimated school sector effects on student plans, behaviours and attitudes

Table 10 and 11 contain the estimated school sector parameters from regression equations of the Year 9 outcomes for the Y95 and Y98 cohorts combined and for the Y03 cohort, respectively. The estimates are based on equations where only the mid-high school sectors are included in the equation and are presented with and without additional regressors. The reason for including the estimates without additional regressors is just to show the difference in means and to provide a simple test of the difference of the averages of those in Catholic and Independent schools from those in Government schools. In almost all cases, the parameters in both the with- and without regressors indicate the significant differences for the Catholic and Independent school averages from the Government school averages. The differences are generally larger in Independent

schools, while taking account of observed differences in the student body typically results in estimated differences that are around two-thirds those of the raw differences.

As a way of introducing the results and summarising key features of the, Tables 12, 13 and 14 contain some indicative results for two outcome variables for the three cohorts. Tables 12 and 13 contain the estimates on whether individuals indicated during the middle of high school that they planned to attend university for the three cohorts. The results for Y95 and Y98 are presented together in Table 12, while those for Y09 are shown separately in Table 13. The first panel shows the proportion of individuals in each mid- and later high school sector combination who indicated they planned to attend university. For example, the first item in Table 12 indicates that 53.9 per cent of the group who attended Government schools in both Years 9 and 12 (the *GG* group) in the Y95 and Y98 cohorts indicated they planned to go to university. By way of contrast, 72.4 per cent of those attended an Independent school in both Years 9 and 12 (the *II* group) indicated they planned to go to university. The middle panel shows the differences in standard deviation units from the group who attended Government schools in both Years 9 and 12. Hence, the gap between the *II* and *GG* groups was in excess of half of a standard deviation. But note that even without taking account of differences in the observed characteristics of those who attended different school sectors, the gap between the group who moved from Government to Independent schools (the *GI* group) was also almost half a standard deviation. The lower panel shows the estimated parameters on the group indicator variables once the characteristics of individuals have been taken into account. Now, the parameter on the *GI* group exceeds that of the *II* group, though the difference in the two parameters is not statistically significant. These results are consistent with the estimated gap between the Government and Independent sector on this measure being entirely due to the differences in the unobservables between the two groups in the Y95 and Y98 cohorts. From Table 13, the pattern between the *GG*, *GI* and *II* groups is broadly similar. It appears that much of the estimated gap between the Government and Independent sector plans in Y09 was also due to the differences in the unobservables between the two groups. Table 14 shows the same pattern of results for reading literacy in the Y09 cohort. Specifically, the parameter on the *GI* indicator was 0.241, compared to the *II* estimate of 0.308, so much of the estimated gap between the Government and Independent sectors in reading

literacy in Y09 could again be accounted for by differences in the unobservables between the two groups.

This pattern is repeated consistently across the other outcome variables for the Y95 and Y98 cohorts, but perhaps a bit less so for the Y09 cohort, where as we have already discussed, the group of GI movers seem somewhat different from the earlier cohorts in terms of their unobservables and the types of schools they came from.

Tables 15 and 16 present the estimated parameters on the mid- and late high school sector group indicators from the regressions specified in equation (6). Table 15 contains the estimates for each school sector combination for each outcome variable for the Y95 and Y98 cohorts and Table 16 those for the Y09 cohort. The results in Table 15 are only for the student plans, attitudes and behaviours, not their achievement. The achievement estimates for the Y09 cohort are discussed in more detail in the next subsection.

Looking down the *GI* and *II* columns in Table 15, it is clear that the estimated parameters in the *GI* column lie in the same direction as the *II* column parameters, and often are not much different in terms of magnitude. Sometimes, they are slightly larger than the *II* parameters (such as the plan to attend university variable and SES of occupation at 30). In general, the results support the earlier statements that much of the estimated gap between the Government and Independent sector outcomes for the Y95 and Y98 cohorts could be accounted for by differences in the unobservables between the two groups. It is much less straightforward to make the same statement for other groups of movers, since the estimated parameters often lie in a different direction from the *GG* group than the *II* and *CC* parameters (for example, the *CG* and *IG* homework attitudes parameters).

In Table 16, the *GI* group results are more mixed than was the case for the Y95 and Y98 cohorts. Some lie in the same direction as the *II* parameters, but many do not, including those on the disciplinary climate, student teacher relations in the school and general attitudes to school. As already noted previously, it seems the movers in the last cohort were different in important respects compared to the earlier ones, being more negative about their schools than other students at the same schools, for example, leading us to prefer the results for the Y95 and Y98 cohorts.

Tables 17 and 18 present the outcomes of tests of significance of the differences between the parameters on the various mid- and late high school sector group indicators estimated from equation (6). Essentially, these are tests of whether the parameters from the various mover groups can explain the estimated gaps in outcomes between those who never changed sector. In the first two columns, the *GC* group of movers is used to see if it can explain the gap between the *GG* and *CC* groups. The next two columns use the *CG* group to explain this gap. The next two columns use the *GI* group of movers to explain the gap between the *GG* and *II* groups, while the last two columns use the *IG* group. Two tests are undertaken: that the unobservabes effect is equal to zero; and that the school sector effect is zero. The p-values of those tests are shown in the tables. Where the estimated parameter for a specific mover group was not in the same direction as that of the relevant *II* or *CC* parameter in the earlier tables, the test results are suppressed since tests of whether all or none of the gap are explained by the parameter for the mover group are irrelevant. Table 17 contains the estimates for each school sector combination for each outcome variable for the Y95 and Y98 cohorts and Table 18 those for the Y09 cohort.

Four things are evident from the tables. First, the hypothesis that the unobservables effect is zero is rejected more often than that the school sector effect is zero – so unobservables do contribute considerably to the gap in outcomes between the sectors. Second, the *GI* group tends to be the one with the effects heading in the same direction as the main sector effect most often. Third, neither the *CG* nor *GC* groups tend to be very useful in explaining the gap in outcomes between the *CC* and *GG* groups. Finally, in the Y09 results, the parameters of the groups of movers less often lie between the sector effects of the stayers, so there are more blank cells in Table 18 than Table 17.

5.4 Estimated school sector effects on student achievement

The results for student achievement in the middle of high school appear in tables already discussed. The regression parameters for Y09 appear in Table 16 and the *p-values* for the tests that unobservables or the school effects explain none of the gap in Table 18. The results either have been largely discussed already or are like those already discussed. Only the achievement parameters of the *GI* group lie between *GG* and *II* groups. The tests do not particularly support unobservables or school effects as largely making up the observed differences between the two

groups, instead suggesting that both phenomena contribute to the observed differences for the Y09 cohort. While the results for the Y95 and Y98 cohorts are not presented, the *GI* mover group parameters for literacy, numeracy and their average were commonly quite close to those of the *II* group, indicating unobservables made a major contribution to the gap in achievement in that case.

The final regression equation discussed provides somewhat stronger evidence of school sector effects. It is the fixed effects regression of university rank ENTER scores from equation (7) for the Y95 and Y98 cohorts. In that equation, the private school effects are identified by those individuals who change school sector, so including the groups *GI* and *IG* for the Independent school effect, and so on. If the unobserved characteristics of high school students are unchanging over time, the parameter on the school effect measures a reliable sector effect. In this case, only the parameter on Independent schools was significantly different from zero. Its magnitude was around 0.2 of a standard deviation, indicative of a sector effect of around 3 ENTER points. That private schools influence ENTER scores is consistent with Australian evidence that ex public school students outperform ex private school students, conditional on their ENTER scores, in Australian universities (Dobson and Skuja 2005, Win and Miller 2005, Birch and Miller 2006).

6. Conclusions

This paper aims to distinguish the contributions of differences in the unobserved characteristics of students who attend different types of schools and school sector effects to the gaps observed in student outcomes between public and private school sectors in Australia. It uses longitudinal data and an identification strategy that assumes movers have similar average unobservables to those already in the sector they join to estimate the contribution of unobservables to the gaps in outcomes. From the data, it is evident that the assumption works better for the group who moved from Government to Independent schools in the first two data cohorts studied than for other groups, or for the *GI* group in the last cohort. The results are consistent with unobservables making a considerable contribution to the gaps in average outcomes in the middle of secondary school between students in Independent and Government to schools. These outcomes include student achievement and a range of student plans, behaviours and attitudes. School sector effects,

then seem much smaller than they would appear to be, given the differences in average outcomes between the sectors.

In one important dimension, however, there is evidence of school sector effects. These lie in the end of school ENTER rank scores used to allocate university places between students in Australia. Since these ENTER ranks determine which university students attend and how desirable or prestigious the course they get into is, along with the factors that flow from university study such as increased lifetime incomes, this is a very important effect. Even if the sector effects on other outcomes are negligible, a positive ENTER score effect may well be enough for parents to view the money they pay in school fees to be well spent.

References

Altonji, J. G., Elder, T. E., & Taber, C. R., (2005) "Selection on Observed & Unobserved Variables: Assessing the Effectiveness of Catholic Schools", *Journal of Political Economy*, 113(1): 151-184.

Angrist, J. D., Dynarski, S. M., Kane, T. J., Pathak, P. A., and Walters, C. R. (2010), 'Inputs and Impacts in Charter Schools: KIPP Lynn' *American Economic Review,* 100 (2), 239-243

Beavis, A. (2004), 'Why parents choose Private or Public schools', *Australian Council for Education Research Research Developments*, 12 , 2 – 4.

Berends, M., Springer, M. G., Ballou, D., and Walberg, H. J. (2009) *Handbook of Research on school choice*, Taylor and Francis.

Berry Cullen, J., Jacob, B., & Levitt, S. (2003). The effect of school choice on student outcomes: evidence from randomized lotteries. *National Bureau of Economic Research Working Paper No. 10113.*Cambridge, MA: National Bureau of Economic Research.

Birch, E. and Miller, P. (2006), 'Student Outcomes at University in Australia: A Quantile Regression Approach', Australian Economic Papers, 45: 1–17.

Bifulco, R., Ladd, H.F. and Ross, S. (2008) *Public School Choice and Integration: Evidence from Durham, North Carolina.* Center for Policy Research Working Paper 109. Fall.

Cardak, B. and Ryan, C. (2009), "Participation in Higher Education in Australia: Equity and Access: Are Equity-based Scholarships an Answer?' *Economic Record*, 85(271) 433- 448.

Cohen-Zada, D. (2009). An alternative instrument for private school competition. Economics of Education Review, 28 (1), 29–37.

Cohen-Zada, D., & Elder, T. (2009). Historical religious concentrations and the effects of Catholic schooling. Journal of Urban Economics, 66 (1), 65–74.

Coleman, J.S., Hoffer, T., & Kilgore, S. (1982). *High School Achievement.* New York: Basic Books.

Conley, T.G., Hansen, C.B. and Rossi, P.E. (2012), 'Plausibly exogenous', *Review of Economics and Statistics*, 94(1), 260-272

Department of Education Science and Technology, (2007), *Parents' attitudes to schooling*, Canberra: Department of Education Science and Technology.

Dobson, I. and Skuja, E. (2005) Secondary Schooling, Tertiary Entrance Ranks and University Performance. People and Place, 13: 53–62.

Evans, W.N. & Schwab, R.M. (1995). Finishing high school and starting college: do Catholic schools make a difference? *Quarterly Journal of Economics, 110(4)*: 941-974.

Figlio, D. (2009) "Voucher Outcomes" in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 19: 321-337

Fiske, E. & Ladd, H. (2000). *When Schools compete: a cautionary tale.* Washington D.C: Brookings Institution.

Fullarton, S., Walker, M., Ainley, J. and Hillman, K. (2003), *Patterns of participation in Year 12*, LSAY Research Report No.33, Australian Council for Educational Research, Melbourne

Goldhaber, D. (2009) "Voucher Finance" in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 18: 309-319

Godwin, R. K. and Kemer, F. R. (2002) *School choice tradeoffs: liberty, equity and diversity*. Austin: university of Texas Press.

Hanushek, E. A., Kain, J. F., Markman, J.M., & Rivkin, S. G. (2001). Does Peer Ability Affect Student Achievement? *National Bureau of Economic Research Working Paper No. 8502.* Cambridge, MA: National Bureau of Economic Research.

Heyneman, S. P. (2009) "International Perspectives on School Choice" in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 5: 79-95.

Hoffer, T. B. (2009) "Perspectives on Private Schools", in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 25: 429-446

Hsieh, C & Urquiola, M, (2006). "The effects of generalized school choice on achievement and stratification: Evidence from Chile's voucher program," *Journal of Public Economics*, vol. 90(8-9): 1477-1503, September.

Jones, F.L. (1989), "Occupational prestige in Australia: a new scale", Australian and New Zealand *Journal of Sociology*, 25 (August): 187-199.

Kreuger, A.B. & Zhu, P. (2002). Another look at the New York City School Voucher Experiment. *National Bureau of Economic Research Working Paper No. 9418.* Cambridge, MA: National Bureau of Economic Research.

Ladd, H. F. (2002). School Vouchers: a Critical View. *Journal of Economic Perspectives 16(4)*, 3–24.

Le, A.T. and Miller, P. (2003), 'Choice of school in Australia: Determinants and consequences', *Australian Economic Review*, 36: 55 – 78.

Levin, H. M. (1998). Educational Vouchers: Effectiveness, Choice and Costs. *Journal of Policy Analysis and Management 17(3)*: 373–392.

Marks, G.N. (1998), Attitudes to School Life: Their Influences and their Effects on Achievement and Leaving School, LSAY Research Report No. 5, ACER, Melbourne

Marks, G.N. (2004) 'School sector differences in tertiary entrance: Improving the educational outcomes of Government school students', *Australian Social Monitor*, 7, 43-47.

Marks, G.N., McMillan, J. and Hillman, K. (2001), Tertiary Entrance Performance: The Role of Student Background and School Factors, LSAY Research Report No. 22, ACER, Melbourne

Marks H. M. (2009) “Perspectives on Catholic Schools” in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 28, pp. 479-499

McMillan, J. and Jones, F.L. (2000), "The ANU3_2 scale: a revised occupational status scale for Australia", *Journal of Sociology*, 36 (March): 64-80.

Neal, D. (2009) “Private Schools in Education Markets”, in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 26, pp. 447-460

Nevo, A. and Rosen, A.M. (2012), ‘Identification with imperfect instruments’, *Review of Economics and Statistics*, 94(3), 659-671

Nechyba, T. J. (2009) “The Social Context of Vouchers” in Berends, Mark, Springer, Matthew G., Ballou, Dale, and Walberg, Herbert J. (2009) *Handbook of Research on school choice*, Taylor and Francis. Chapter 17: 289-308

Ritzen, J.M.M. (1997), “School finance and school choice in the Netherlands”, *Economics of Education Review*, 16, (3) 329 – 335

Rothman, S. 2002. “Achievement in Literacy and Numeracy by Australian 14-Year-Olds, 1975-1998” Research Report Number 29, ACER: Melbourne.

Ryan, C. and Watson, L. (2010), ‘Choosers and losers: the impact of government subsidies on Australian secondary schools’, *Australian Journal of Education* vol. 54, No. 1, pp. 86–107.

Schneeweis, N. and Winter-Ebmer, R. (2005), *Peer Effects in Austrian Schools*, Discussion Paper 5018, Centre for Economic Policy Research, London. April

Vandenberghe, V. and Robin, S. (2004) Evaluating the effectiveness of private education across countries: a comparison of methods, *Labour Economics*, 11, 487– 506

Vella, F. (1999), Do Catholic Schools Make a Difference? Evidence from Australia, *Journal of Human Resources*, 38, 208 – 224.

Weinhardt, F. (2013) *Neighborhood Quality and Student Performance*, IZA Discussion Paper No. 7139, Bonn.

West, M.R. and Woessman, L. (2010), “Every Catholic child in a Catholic school’: Historical resistance to state schooling, contemporary private competition and student achievement across countries”, *Economic Journal*, 120 (546), F229–F255

Williams, T. and Carpenter, P. (1990), ‘Private schooling and public achievement’ *Australian Journal of Education*, 34, 3 – 24.

Win, R. and Miller, P. (2005), ‘The Effects of Individual and School Factors on University Students’ Academic Performance’, *Australian Economic Review*, 38, 1–18.

Wolf, P., Gutmann, B., Puma, M., Kisida, B., Rizzo, L. and Eissa, N. (2009) *Evaluation of the DC Opportunity Scholarship Program: Impacts after three years.* NCEE 2009-4050. US Department of Education

Table 2 Key descriptive features of the two cohorts

	1995	1998	2009
Government School in Year 9 (%)	67.2	66.4	59.7
Catholic school in Year 9 (%)	20.2	20.4	22.1
Independent School in Year 9 (%)	12.7	13.2	18.2
Male (%)	48.9	51.1	48.9
Parental SES (occupation based status scale, 0-100)	36.3	36.8	53.2[(a)]
Metropolitan school in Year 9 (%)	55.0	53.1	74.8[(a)]
Year 9 school achievement	50.1	50.2	N/A
SES of student's expected occupation (occupation based status scale, 0-100)	50.5	50.5	68.1[(a)]
Obtained a Year 12 certificate (%)	76.1	78.2	N/A
Has an ENTER score (%)	54.2	56.8	N/A
Attending university (%)	35.2	35.8	N/A
ENTER score	71.8	72.5	N/A

Source: Estimated from LSAY Y95 and Y98 cohort.

(a) Series break in 2009, with the variable estimated differently. N/A indicates the variable is not available for this cohort, mostly because many in the cohort are too young for the variable to have been determined completely yet.

Table 3 Transitions across school sectors between Years 9 and 12 (unweighted data)

(a) 1995 & 1998 Cohorts	Year 12 school: Government Schools	Catholic schools	Independent Schools	Total	% of distribution
Year 9 school					
Government Schools	1,119	170	225	1,513	64.4
Catholic schools	193	348	62	604	25.7
Independent Schools	140	30	63	232	9.9
Total	1,452	548	349	2,350	
% of distribution	61.8	23.3	14.9		
Number who did not change school	6,817	2,284	1,593	10,694	
% of distribution	63.7	21.4	14.9		

(b) 2009 Cohort					
Initial school					
Government Schools	439	43	55	537	54.2
Catholic schools	132	146	34	311	31.4
Independent Schools	77	18	48	143	14.4
Total	647	207	136	991	
% of distribution	65.4	20.9	13.7		
Number who did not change school	4,061	1,759	1,523	7,343	
% of distribution	55.3	23.9	20.7		

Source: Estimated from LSAY Y95, Y98 and Y09 cohorts.

Table 4 Comparison of 'observable' characteristics across groups, Y95 & Y98

	Same school	Same sector	Moved out	Moved in
Government Schools				
Male (%)	45.7	44.6	46.4	47.3
Parental SES (occupation based scale, 0-100)	32.2	32.5	39.6	38.4
Metropolitan school in Year 9 (%)	53.3	46.9	41.5	51.6
Indigenous background (%)	1.8	2.1	1.6	3.2
Father had degree (%)	16.4	17.9	25.1	26.0
Mother has degree (%)	15.4	18.6	25.5	23.3
Siblings (#)	2.1	2.1	2.0	2.2
Student born in non-English-speaking country (%)	8.8	7.1	9.0	8.2
Wealth rank of region where student lives (0-100)	45.7	37.5	46.5	47.7
Catholic schools				
Male (%)	49.5	45.7	43.7	50.5
Parental SES (occupation based scale, 0-100)	40.3	40.5	38.1	39.0
Metropolitan school in Year 9 (%)	72.0	48.0	61.9	39.7
Indigenous background (%)	0.7	0.2	3.9	1.5
Father had degree (%)	27.7	20.4	27.7	26.5
Mother has degree (%)	23.3	20.7	29.8	24.9
Siblings (#)	2.1	2.1	2.1	2.0
Student born in non-English-speaking country (%)	7.8	5.1	12.4	10.3
Wealth rank of region where student lives (0-100)	50.7	48.3	47.4	45.4
Independent Schools				
Male (%)	54.1	40.7	44.8	39.1
Parental SES (occupation based scale, 0-100)	49.7	47.3	43.6	42.5
Metropolitan school in Year 9 (%)	69.9	74.7	40.4	48.6
Indigenous background (%)	1.1	0.0	2.0	2.1
Father had degree (%)	42.1	45.2	27.7	26.9
Mother has degree (%)	36.0	40.1	19.3	28.6
Siblings (#)	1.9	2.6	2.2	2.0
Student born in non-English-speaking country (%)	6.1	4.3	4.5	9.3
Wealth rank of region where student lives (0-100)	62.3	71.3	51.2	49.5

Source: Estimated from LSAY Y95 and Y98 cohort.

Table 5 Comparison of 'observable' characteristics across groups, Y09

	Same school	Same sector	Moved out	Moved in
Government Schools				
Male (%)	45.2	43.7	42.6	40.0
Parental SES (occupation based scale, 0-100)	51.4	52.3	53.8	56.1
Metropolitan school in Year 9 (%)	72.0	57.8	60.0	63.3
Indigenous background (%)	2.9	4.1	4.7	0.9
Father had degree (%)	37.3	33.1	37.9	49.0
Mother has degree (%)	39.7	40.2	51.8	59.9
Siblings (#)	85.8	80.2	84.4	85.3
Student born in non-English-speaking country (%)	8.8	6.8	15.7	6.4
Wealth rank of region where student lives (0-100)	42.9	40.2	42.1	50.3
Catholic schools				
Male (%)	43.3	40.8	44.5	48.9
Parental SES (occupation based scale, 0-100)	56.7	55.1	55.5	54.1
Metropolitan school in Year 9 (%)	81.3	69.8	67.9	67.8
Indigenous background (%)	1.0	2.3	1.6	4.0
Father had degree (%)	45.9	52.4	49.3	40.4
Mother has degree (%)	44.5	54.8	58.2	59.6
Siblings (#)	89.6	87.9	82.3	87.4
Student born in non-English-speaking country (%)	5.3	2.3	4.8	15.3
Wealth rank of region where student lives (0-100)	51.4	52.5	50.4	46.4
Independent Schools				
Male (%)	41.8	42.0	30.7	35.2
Parental SES (occupation based scale, 0-100)	61.4	63.6	55.6	53.5
Metropolitan school in Year 9 (%)	88.0	80.1	67.3	69.5
Indigenous background (%)	0.6	0.0	0.5	3.8
Father had degree (%)	63.3	65.4	46.5	40.7
Mother has degree (%)	61.4	61.5	59.6	47.7
Siblings (#)	84.3	91.6	85.7	77.8
Student born in non-English-speaking country (%)	9.0	6.6	7.5	8.8
Wealth rank of region where student lives (0-100)	58.1	66.4	50.6	44.4

Source: Estimated from LSAY Y09 cohort.

Table 6 Unobservables contribution to outcomes by school choice variables – based on "within" school estimates – Y95 & Y98

	$\bar{\epsilon}_{GG}$	$\bar{\epsilon}_{GC}$	$\bar{\epsilon}_{GI}$	$\bar{\epsilon}_{CG}$	$\bar{\epsilon}_{CC}$	$\bar{\epsilon}_{CI}$	$\bar{\epsilon}_{IG}$	$\bar{\epsilon}_{IC}$	$\bar{\epsilon}_{II}$
Complete Year 12	0.002	0.061	-0.006	-0.196	0.012	0.025	-0.083	-0.218	0.002
Attend university	-0.009	0.148	0.253	-0.259	0.011	0.101	-0.088	0.181	0.008
Undertake apprenticeship	0.005	-0.035	-0.099	0.096	-0.007	-0.107	-0.071	-0.099	0.003
Attend VET	0.005	-0.140	-0.189	0.100	0.002	-0.128	0.047	0.006	-0.002
SES of Job at 30 years	-0.006	-0.044	0.306	-0.140	0.010	0.052	-0.241	-0.093	0.016
School satisfaction	0.003	0.061	0.055	-0.310	0.016	-0.006	-0.331	0.092	0.010
Student motivation	0.001	0.097	0.111	-0.306	0.019	-0.076	-0.311	-0.096	0.007
Teachers	0.011	-0.197	0.015	-0.365	0.018	-0.309	-0.260	-0.157	0.020
Sense of opportunity	0.005	-0.034	-0.022	-0.249	0.016	-0.249	-0.289	0.071	0.018
Sense of achievement	0.007	-0.004	0.001	-0.227	0.003	0.157	-0.220	-0.110	0.005
Other students	0.002	-0.076	0.078	-0.070	-0.003	-0.144	-0.284	-0.007	0.024
Participation in extracurricular activities	0.000	-0.051	0.125	-0.112	0.009	-0.139	-0.271	0.177	0.008
School overall	0.002	-0.118	0.135	-0.227	0.011	-0.274	-0.390	0.104	0.030
Homework attitudes	0.007	-0.215	0.038	-0.287	0.015	0.041	-0.362	0.279	0.012
Homework hours	-0.007	0.018	0.258	-0.254	0.020	-0.014	-0.341	-0.013	0.019

Source: Estimated from LSAY Y95 and Y98 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lived and state indicators.

Table 7 Unobservables contribution to outcomes by school choice variables – based on "within" school estimates – Y09

	$\bar{\epsilon}_{GG}$	$\bar{\epsilon}_{GC}$	$\bar{\epsilon}_{GI}$	$\bar{\epsilon}_{CG}$	$\bar{\epsilon}_{CC}$	$\bar{\epsilon}_{CI}$	$\bar{\epsilon}_{IG}$	$\bar{\epsilon}_{IC}$	$\bar{\epsilon}_{II}$
Complete Year 12	0.039	-0.160	0.047	-0.308	-0.015	-0.017	-0.293	-0.469	-0.037
Attend university	0.014	0.037	0.105	-0.145	0.022	-0.172	-0.285	-0.320	-0.036
Undertake apprenticeship	-0.007	0.177	0.003	0.139	-0.027	0.052	0.043	-0.318	0.035
Attend VET	0.008	0.086	-0.330	-0.139	-0.010	0.242	0.361	0.273	-0.016
SES of Job at 30 years	0.028	0.206	0.020	-0.215	-0.024	-0.288	-0.306	-0.494	-0.003
School satisfaction	0.003	-0.152	-0.116	-0.577	0.053	-0.436	-0.835	-0.300	0.027
Student motivation	0.012	-0.135	-0.114	-0.381	0.030	-0.272	-0.768	-0.313	0.012
Teachers	0.025	-0.515	-0.165	-0.486	0.025	-0.556	-0.513	-0.054	-0.005
Sense of opportunity	0.010	0.028	-0.328	-0.478	0.041	-0.442	-0.605	-0.235	0.008
Sense of achievement	0.016	-0.067	0.026	-0.532	0.030	-0.041	-0.812	-0.418	0.007
Attitudes to school	0.005	0.157	-0.200	-0.310	0.017	-0.369	-0.268	-0.266	0.015
Disciplinary climate	0.013	-0.333	-0.096	-0.272	0.018	-0.011	-0.260	-0.197	-0.009
Student/teacher relations	0.022	-0.070	-0.366	-0.445	0.007	-0.332	-0.379	-0.185	0.007
Reading Literacy	0.031	-0.229	0.249	-0.155	-0.006	-0.207	-0.226	-0.500	-0.043
Mathematical Literacy	0.028	-0.189	0.141	-0.143	-0.007	-0.038	-0.153	-0.370	-0.041
Scientific Literacy	0.029	-0.238	0.154	-0.189	-0.004	-0.282	-0.250	-0.433	-0.035

Source: Estimated from LSAY Y09 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 8 School fixed effects contribution to outcomes by school choice variables – based on "within" school estimates – Y95 & Y98

	$\bar{\mu}_{GG}$	$\bar{\mu}_{GC}$	$\bar{\mu}_{GI}$	$\bar{\bar{\mu}}_{CG}$	$\bar{\bar{\mu}}_{CC}$	$\bar{\mu}_{CI}$	$\bar{\mu}_{IG}$	$\bar{\bar{\mu}}_{IC}$	$\bar{\bar{\mu}}_{II}$
Complete Year 12	-0.051	-0.024	0.013	0.028	0.068	0.076	-0.018	0.062	0.131
Attend university	-0.080	-0.079	-0.048	0.004	0.119	0.157	0.233	0.195	0.180
Undertake apprenticeship	0.045	0.032	0.016	-0.032	-0.074	-0.038	-0.094	-0.061	-0.091
Attend VET	0.046	0.099	0.050	0.004	-0.060	-0.124	-0.173	-0.194	-0.119
SES of Job at 30 years	-0.077	-0.003	0.007	0.006	0.130	0.035	0.058	0.110	0.162
School satisfaction	-0.059	-0.038	-0.033	0.026	0.084	0.093	0.154	0.294	0.131
Student motivation	-0.045	0.013	-0.016	0.055	0.061	0.058	0.116	0.241	0.092
Teachers	-0.066	-0.046	-0.074	0.115	0.086	0.064	0.260	0.412	0.145
Sense of opportunity	-0.045	-0.086	-0.007	0.060	0.077	0.015	0.055	0.197	0.083
Sense of achievement	-0.001	0.041	0.007	0.023	0.029	-0.004	-0.014	0.046	-0.053
Other students	-0.081	-0.058	-0.109	-0.057	0.100	0.057	0.131	0.333	0.232
Participation in extracurricular activities	-0.075	0.036	0.036	0.155	0.061	0.042	0.347	0.496	0.198
School overall	-0.164	-0.130	-0.180	0.054	0.212	0.203	0.329	0.425	0.434
Homework attitudes	-0.022	0.055	0.046	-0.016	-0.009	-0.035	0.014	0.036	0.107
Homework hours	-0.154	-0.076	-0.078	0.111	0.250	0.296	0.161	0.148	0.325

Source: Estimated from LSAY Y95 and Y98 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lived and state indicators.

Table 9 School fixed effects contribution to outcomes by school choice variables – based on "within" school estimates – Y09

	$\bar{\mu}_{GG}$	$\bar{\mu}_{GC}$	$\bar{\mu}_{GI}$	$\bar{\bar{\mu}}_{CG}$	$\bar{\bar{\mu}}_{CC}$	$\bar{\mu}_{CI}$	$\bar{\mu}_{IG}$	$\bar{\bar{\mu}}_{IC}$	$\bar{\bar{\mu}}_{II}$
Complete Year 12	-0.065	-0.019	-0.097	0.039	0.081	0.080	-0.073	-0.155	0.077
Attend university	-0.097	-0.033	-0.105	-0.019	0.086	0.053	-0.036	-0.138	0.158
Undertake apprenticeship	0.069	0.132	0.084	0.072	-0.050	0.002	-0.023	0.147	-0.134
Attend VET	0.046	-0.024	0.062	0.020	-0.029	-0.027	-0.098	0.204	-0.085
SES of Job at 30 years	-0.100	-0.082	-0.076	0.001	0.076	0.026	-0.012	-0.313	0.171
School satisfaction	-0.067	-0.095	-0.023	0.112	0.027	0.058	0.002	-0.123	0.137
Student motivation	-0.044	-0.037	-0.040	0.074	0.017	-0.009	-0.026	-0.103	0.094
Teachers	-0.087	-0.132	-0.159	0.137	0.031	-0.022	-0.007	0.040	0.184
Sense of opportunity	-0.057	-0.113	-0.050	0.077	0.037	0.044	-0.037	-0.032	0.103
Sense of achievement	-0.036	-0.049	-0.008	0.037	0.013	-0.017	-0.086	-0.052	0.081
Attitudes to school	-0.070	-0.081	-0.067	0.172	0.084	0.075	-0.016	0.077	0.069
Disciplinary climate	-0.112	-0.188	-0.232	0.070	0.041	0.064	0.151	0.365	0.238
Student/teacher relations	-0.076	-0.115	-0.136	0.052	-0.002	-0.018	0.076	0.201	0.198
Reading Literacy	-0.132	-0.150	-0.170	0.002	0.066	0.034	0.069	0.189	0.270
Mathematical Literacy	-0.096	-0.039	-0.133	-0.085	0.018	-0.044	-0.018	0.114	0.244
Scientific Literacy	-0.097	-0.067	-0.138	-0.015	0.005	-0.012	0.082	0.138	0.251

Source: Estimated from LSAY Y09 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 10 Sector differences in outcome variables, Y95 & Y98

	Catholic schools				Independent schools			
	Without controls		With controls*		Without controls		With controls*	
	Beta	Std Err.	Beta	Std Err.	Beta	Std Err.	Beta	Std Err.
Complete Year 12	0.140***	(0.021)	0.099***	(0.023)	0.233***	(0.025)	0.102***	(0.028)
Attend university	0.246***	(0.020)	0.153***	(0.025)	0.375***	(0.024)	0.174***	(0.032)
Undertake apprenticeship	-0.129***	(0.021)	-0.109***	(0.019)	-0.156***	(0.025)	-0.122***	(0.025)
Attend VET	-0.131***	(0.021)	-0.071***	(0.024)	-0.237***	(0.025)	-0.081***	(0.028)
SES of Job at 30 years	0.246***	(0.026)	0.159***	(0.028)	0.332***	(0.031)	0.167***	(0.035)
School satisfaction	0.139***	(0.021)	0.120***	(0.030)	0.209***	(0.025)	0.127***	(0.041)
Student motivation	0.099***	(0.021)	0.089***	(0.030)	0.151***	(0.025)	0.088**	(0.040)
Teachers	0.163***	(0.021)	0.136***	(0.031)	0.249***	(0.026)	0.189***	(0.043)
Sense of opportunity	0.103***	(0.021)	0.098***	(0.028)	0.122***	(0.025)	0.050	(0.034)
Sense of achievement	0.061***	(0.021)	0.032	(0.029)	0.022	(0.025)	-0.050	(0.039)
Other students	0.182***	(0.023)	0.135***	(0.033)	0.319***	(0.026)	0.271***	(0.044)
Participation in extracurricular activities	0.155***	(0.023)	0.118***	(0.034)	0.339***	(0.027)	0.237***	(0.041)
School overall	0.345***	(0.022)	0.312***	(0.034)	0.565***	(0.026)	0.535***	(0.044)
Homework attitudes	0.006	(0.022)	-0.013	(0.028)	0.118***	(0.026)	0.071**	(0.032)
Homework hours	0.373***	(0.022)	0.356***	(0.034)	0.418***	(0.026)	0.388***	(0.040)

Source: Estimated from LSAY Y95 and Y98 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lived and state indicators.

Table 11 Sector differences in outcome variables, Y09

	Catholic schools				Independent schools			
	Without controls		With controls*		Without controls		With controls*	
	Beta	Std Err.	Beta	Std Err.	Beta	Std Err.	Beta	Std Err.
Complete Year 12	0.120***	(0.025)	0.077**	(0.036)	0.156***	(0.027)	0.059	(0.043)
Attend university	0.259***	(0.026)	0.169***	(0.035)	0.353***	(0.028)	0.174***	(0.042)
Undertake apprenticeship	-0.146***	(0.026)	-0.112***	(0.025)	-0.226***	(0.028)	-0.115***	(0.034)
Attend VET	-0.104***	(0.027)	-0.101***	(0.028)	-0.177***	(0.029)	-0.114***	(0.035)
SES of Job at 30 years	0.169***	(0.030)	0.100***	(0.036)	0.379***	(0.033)	0.208***	(0.050)
School satisfaction	0.121***	(0.028)	0.095***	(0.032)	0.246***	(0.030)	0.136***	(0.043)
Student motivation	0.074***	(0.028)	0.050	(0.031)	0.165***	(0.030)	0.073*	(0.044)
Teachers	0.122***	(0.028)	0.076**	(0.030)	0.284***	(0.030)	0.153***	(0.042)
Sense of opportunity	0.110***	(0.028)	0.093***	(0.032)	0.194***	(0.031)	0.110***	(0.040)
Sense of achievement	0.079***	(0.028)	0.032	(0.031)	0.168***	(0.030)	0.028	(0.040)
Attitudes to school	0.185***	(0.027)	0.131***	(0.032)	0.207***	(0.029)	0.101***	(0.038)
Disciplinary climate	0.155***	(0.027)	0.125***	(0.045)	0.341***	(0.029)	0.305***	(0.051)
Student/teacher relations	0.056**	(0.027)	0.032	(0.031)	0.299***	(0.029)	0.196***	(0.037)
Reading Literacy	0.255***	(0.026)	0.163***	(0.038)	0.490***	(0.028)	0.283***	(0.048)
Mathematical Literacy	0.180***	(0.026)	0.071*	(0.043)	0.428***	(0.028)	0.253***	(0.053)
Scientific Literacy	0.170***	(0.026)	0.089**	(0.040)	0.441***	(0.028)	0.297***	(0.050)

Source: Estimated from LSAY Y09. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 12 Proportion who in Year 9 indicated they planned to attend university after leaving school by Year 9 and Year 12 school sectors, Y95 & Y98

	Year 12 school		
	Government Schools	**Catholic schools**	**Independent Schools**
Year 9 school		Percent	
Government Schools	53.9	63.1	70.1
Catholic schools	50.4	67.0	80.2
Independent Schools	66.5	79.3	72.4
		Difference Government in standard deviation units	
Government Schools	0.000	0.257	0.454
Catholic schools	-0.096	0.368	0.736
Independent Schools	0.354	0.711	0.517
		Parameter estimates in standard deviation units (regression with controls[(a)])	
Government Schools	0.00	0.139*	0.269***
Catholic schools	-0.098	0.180***	0.300***
Independent Schools	0.121	0.367**	0.191***

Source: Estimated from LSAY Y95 and Y98 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lives and state indicators.

Table 13 Proportion who in Year 9 indicated they planned to attend university after leaving school by initial and subsequent school sectors, Y09

		Subsequent school	
	Government Schools	**Catholic schools**	**Independent Schools**
Initial school		Percent	
Government Schools	57.0	61.2	63.8
Catholic schools	57.3	70.9	52.0
Independent Schools	52.9	47.9	75.7
		Difference Government in standard deviation units	
Government Schools	0.000	0.085	0.136
Catholic schools	0.006	0.281	-0.102
Independent Schools	-0.083	-0.184	0.377
		Parameter estimates in standard deviation units (regression with controls)	
Government Schools	0.000	0.146	0.130
Catholic schools	0.001	0.190***	0.037
Independent Schools	-0.158	-0.214	0.208***

Source: Source: Estimated from LSAY Y09 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 14 Reading literacy by initial and subsequent school sectors, Y09

		Subsequent school	
	Government Schools	**Catholic schools**	**Independent Schools**
Initial school		Literacy score	
Government Schools	527	495	547
Catholic schools	527	552	512
Independent Schools	533	531	573
		Difference Government in standard deviation units	
Government Schools	0.000	-0.357	0.218
Catholic schools	-0.001	0.271	-0.166
Independent Schools	0.061	0.043	0.500
		Parameter estimates in standard deviation units (regression with controls)	
Government Schools	0.000	-0.193	0.241*
Catholic schools	0.028	0.176***	0.163
Independent Schools	-0.006	0.034	0.308***

Source: Estimated from LSAY Y09 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 15 Regression parameters by school choice variables –Y95 & Y98

	$\hat{\beta}_{GG}$	$\hat{\beta}_{GC}$	$\hat{\beta}_{GI}$	$\hat{\beta}_{CG}$	$\hat{\beta}_{CC}$	$\hat{\beta}_{CI}$	$\hat{\beta}_{IG}$	$\hat{\beta}_{IC}$	$\hat{\beta}_{II}$
Complete Year 12		0.028	0.025	-0.048	0.113***	0.064	-0.059	-0.037	0.123***
Attend university		0.139*	0.269***	-0.098	0.180***	0.300***	0.121	0.367**	0.191***
Undertake apprenticeship		-0.072	-0.130**	-0.049	-0.118***	-0.139**	-0.129*	-0.155	-0.128***
Attend VET		-0.095	-0.137**	0.059	-0.084***	-0.240***	-0.022	-0.153	-0.095***
SES of Job at 30 years		0.011	0.337***	-0.071	0.187***	0.196	0.024	0.066	0.197***
School satisfaction		0.037	0.070	-0.196***	0.148***	0.145	-0.138	0.266	0.156***
Student motivation		0.117	0.134*	-0.186**	0.119***	0.022	-0.186**	0.088	0.125***
Teachers		-0.158	-0.005	-0.199**	0.163***	-0.011	-0.039	0.096	0.211***
Sense of opportunity		-0.075	0.050	-0.128*	0.121***	-0.170	-0.221***	0.148	0.077**
Sense of achievement		0.027	0.005	-0.210***	0.052*	0.042	-0.338***	-0.225	-0.015
Other students		-0.032	0.093	-0.021	0.153***	-0.070	0.018	0.318	0.297***
Participation in extracurricular activities		0.076	0.128*	0.084	0.128***	0.015	0.085	0.577***	0.251***
School overall		0.015	0.118	-0.029	0.350***	-0.034	0.143	0.531*	0.578***
Homework attitudes		-0.086	0.040	-0.318***	0.011	-0.042	-0.352***	0.211	0.109***
Homework hours		0.268***	0.301***	0.134*	0.390***	0.259*	0.058	0.201	0.441***

Source: Estimated from LSAY Y95 and Y98 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lived and state indicators.

Table 16 Regression parameters by school choice variables – Y09

	$\hat{\beta}_{GG}$	$\hat{\beta}_{GC}$	$\hat{\beta}_{GI}$	$\hat{\beta}_{CG}$	$\hat{\beta}_{CC}$	$\hat{\beta}_{CI}$	$\hat{\beta}_{IG}$	$\hat{\beta}_{IC}$	$\hat{\beta}_{II}$
Complete Year 12		0.042	0.118	-0.137	0.099***	0.090	-0.233	-0.327	0.087**
Attend university		0.146	0.130	0.001	0.190***	0.037	-0.158	-0.214	0.208***
Undertake apprenticeship		0.120	-0.049	0.055	-0.125***	-0.135	0.001	-0.261***	-0.120***
Attend VET		0.027	-0.273***	-0.179***	-0.104***	0.133	0.223	0.119	-0.145***
SES of Job at 30 years		0.184	0.046	-0.083	0.122***	-0.009	-0.178	-0.495**	0.247***
School satisfaction		-0.149	-0.073	-0.296***	0.132***	-0.297	-0.631***	-0.162	0.188***
Student motivation		-0.169	-0.087	-0.214**	0.076**	-0.284*	-0.635***	-0.283	0.120***
Teachers		-0.433**	-0.103	-0.157	0.095***	-0.301	-0.386***	0.158	0.180***
Sense of opportunity		-0.033	-0.215	-0.225**	0.121***	-0.174	-0.385**	-0.063	0.140***
Sense of achievement		-0.165	0.075	-0.330***	0.064**	-0.014	-0.768***	-0.393**	0.087**
Attitudes to school		0.085	-0.160	-0.072	0.152***	-0.114	-0.121	-0.009	0.116***
Disciplinary climate		-0.380***	-0.079	-0.139	0.143***	0.077	0.001	0.280**	0.320***
Student/teacher relations		-0.104	-0.323***	-0.207**	0.049	-0.111	-0.150	0.128	0.214***
Reading Literacy		-0.193	0.241*	0.028	0.176***	0.163	-0.006	0.034	0.308***
Mathematical Literacy		-0.090	0.101	-0.128	0.088**	0.145	-0.123	-0.016	0.283***
Scientific Literacy		-0.119	0.151	-0.065	0.106**	-0.029	0.023	-0.030	0.322***

Source: Estimated from LSAY Y09 cohort. "***", "**" and "*" denote significance at the 1, 5 and 10 per cent level, respectively. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Table 17 P-values of tests of parameters that school and unobservables effects are zero, Y95 & Y98

	Catholic schools				Independent schools			
	β_{GC}-β_{GG}=0	B_{CC}-β_{GC}=0	B_{CC}-β_{CG}=0	B_{CG}–β_{GG}=0	B_{GI}-β_{GG}=0	B_{II}-β_{GI}=0	B_{II}–β_{IG}=0	B_{IG}–β_{GG}=0
	Unobserv=0	Sch eff=0	Unobserv=0	Sch eff=0	Unobserv=0	Sch eff=0	Unobserv=0	Sch eff=0
Complete Year 12	0.721	0.769			0.697	0.151		
Attend university	0.063	0.196			0.000	0.248	0.358	0.105
Undertake apprenticeship	0.474	0.576	0.335	0.492	0.017	0.964	0.985	0.078
Attend VET	0.175	0.134			0.013	0.471	0.370	0.773
SES of Job at 30 years	0.922	0.319			0.000	0.126	0.034	0.765
School satisfaction	0.696	0.423			0.341	0.307		
Student motivation					0.059	0.913		
Teachers								
Sense of opportunity	0.390	0.504			0.523	0.743		
Sense of achievement	0.739	0.913						
Other students					0.246	0.023	0.004	0.852
Participation in extracurricular activities	0.385	0.671	0.640	0.321	0.091	0.138	0.115	0.426
School overall	0.893	0.787			0.183	0.000	0.000	0.169
Homework attitudes					0.591	0.392		
Homework hours	0.002	0.955	0.415	0.093	0.000	0.108	0.000	0.425

Source: Estimated from LSAY Y95 & Y98 cohorts. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, number of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the suburb/town in which the student lived and state indicators.

Table 18 P-values of tests of parameters that school and unobservable effects are zero, Y09

	Catholic schools				Independent schools			
	β_{GC}-β_{GG}=0 Unobserv=0	B_{CC}-β_{GC}=0 Sch eff=0	B_{CC}-β_{CG}=0 Unobserv=0	B_{CG}–β_{GG}=0 Sch eff=0	B_{GI}-β_{GG}=0 Unobserv=0	B_{II}-β_{GI}=0 Sch eff=0	B_{II}–β_{IG}=0 Unobserv=0	B_{IG}–β_{GG}=0 Sch eff=0
Complete Year 12	0.365	0.823			0.788	0.833		
Attend university	0.309	0.561	0.004	0.197	0.326	0.627		
Undertake apprenticeship					0.529	0.305		
Attend VET			0.008	0.109	0.862	0.691		
SES of Job at 30 years	0.730	0.147	0.001	0.145	0.293	0.455		
School satisfaction								
Student motivation								
Teachers								
Sense of opportunity								
Sense of achievement					0.325	0.559		
Attitudes to school	0.186	0.027						
Disciplinary climate								
Student/teacher relations								
Reading Literacy			0.004	0.960	0.106	0.099		
Mathematical Literacy					0.480	0.205		
Scientific Literacy					0.332	0.648	0.833	0.363

Source: Estimated from LSAY Y09 cohort. (a) Controls include gender, parental occupation-based socio-economic status, living in a metropolitan region, Indigenous background, father is employed, father has a university degree, mother has a university degree, presence of siblings, born overseas in an English-speaking country, born overseas in a predominantly non-English-speaking country, rank of the wealth of the household and state indicators.

Appendix Table A.1: Data and variable description

Background characteristics	Variable Description	Mean	Std dev
Male	A dummy variable taking the value 1 if the individual was Male	0.50	0.50
Achievement	The average of literacy and numeracy tests undertaken by subjects in Year 9 (or the sole result if one was missing). The original scales developed in Rothman (2002) had means of 50 and SDs of 10, and were equated between surveys using overlapping test items. The average scale has a mean of around 50 and an SD of 8.5.	50.0	8.5
Parents occupational status	Based on the father's reported current or past occupation, or the mother's occupation where the father's was missing. This was then placed on the ANU 3 occupational status scale, which lies between 0 (farm labourers) and 100 (medical specialists). See Jones (1989) and McMillan and Jones (2000).	36.6	23.2
Metropolitan	Student attended a school in a major metropolitan city (=1).	0.54	0.50
Indigenous	Student indicated they were from an Aboriginal or Torres Strait Island background, in which case the variable takes the value 1.	0.03	0.17
Father worked	Father worked when the student was in Year 11 (=1)	0.76	0.43
Father degree	Father completed a university degree (=1)	0.19	0.40
Mother degree	Mother completed a university degree (=1)	0.18	0.39
Number of siblings	Number of siblings reported by the individual	2.1	1.4
Born overseas in English-speaking country	Student born overseas from Australia in a predominantly English-speaking country - specifically the British Isles, New Zealand, Canada and USA (=1).	0.03	0.18
Born overseas in non-English-speaking country	Student born overseas in a predominantly non-English-speaking country - specifically born overseas in a country other than those identified above (=1)	0.07	0.25
Wealth rank of region	Ranking from 0 to 1 of postcode-based regions (zipcodes) of average reported asset income in the region from Australian Taxation Office data. Data were averaged for 2001 - 2003 for the ranking of regions.	0.47	0.28

(continued . . .)

Appendix Table A.1: Data and variable description (continued)

Background characteristics	Variable Description	Mean	Std dev
Self-confidence scale	Based on students' Year 9 assessment of their overall school performance relative to others at their school (very well; better than average; about average; not very well; very poorly). The mean response, conditional on their actual achievement, whether they were in high or low performing schools and their gender, was removed from this assessment, with the residual reflecting levels of self-confidence. The response was placed on a scale with a mean of 50 and SD of 10.	50.1	3.2
Student plans and expectations	In Year 9 when first surveyed, students were asked when they intended to leave school and about any study plans they had for the future, at any time after they left school.		
Planned to complete Year 12	Student planned to leave school after Year 12 (=1)	0.72	0.45
Planned to attend university	Student planned to attend university sometime after leaving school (=1)	0.48	0.50
Planned to do apprenticeship	Student planned to undertake an apprenticeship sometime after leaving school (=1)	0.10	0.29
Student planned study at TAFE	Student planned to attend a TAFE (vocational education) college sometime after leaving school (=1)	0.15	0.36
Future occupation status score	In wave 2, students were asked about the job or occupation they intend to work in when they completed their studies (school or further study), which was also placed on the ANU 3 occupational status scale	50.5	20.8
School satisfaction scales.	In Year 9 when first surveyed, students were asked 30 questions about the 'quality' of school life at their current school. Research (Marks 1998) has shown these responses support the four scales used here, which pick up differing aspects of the school climate.		
Overall school satisfaction	Overall school satisfaction, which reflects student's favourable feelings about school as whole (range 11-44).	27.4	5.6
Teaching satisfaction scale	Assessment of teachers, which refers to students views about the adequacy of the interaction between teachers and students (range 6-24).	16.1	3.2
Opportunities	The Opportunities or Relevance scale which represents the belief in the relevance of schooling for the future (range 5-20).	15.4	2.8

Appendix Table A.1: Data and variable description (continued)

Background characteristics	Variable Description	Mean	Std dev
Sense of achievement scale	Sense of achievement, which reflects the student's sense of confidence in their ability to be successful in school work (range 7-28).	21.1	3.2
Homework variables	In wave 2, students were asked 2 questions about their approach towards homework: whether they completed all set and undertook additional homework (always, sometimes, most, rarely or never). Responses to these questions (score 1 to 5 for low through to more positive responses) were summed to generate an attitudes toward homework scale. Students were also asked about the average weekly hours of homework they undertook.		
Homework attitudes	Homework attitudes, on a scale ranging from 2 through 10.	6.6	1.5
Weekly homework hours	Weekly homework hours	6.0	5.1