Effects of age at entry to Year 1 on later schooling outcomes: Evidence from Australia

Hielke Buddelmeyer
(hielkeb@unimelb.edu.au)
Trinh Le*
(tvtle@unimelb.edu.au)

Melbourne Institute of Applied Economic and Social Research
Faculty of Business and Economics
The University of Melbourne VIC 3010
Phone: +61 3 9035 4919
Fax: +61 3 8344 2111

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Abstract

This paper uses data from the Longitudinal Surveys of Australian Youth (cohorts 1998 and 2003) to examine the effect of age at entry to Year 1 on schooling outcomes at around ages 15-20. The OLS/ probit estimates usually indicate a significant association between entry age and three outcomes, including test scores in reading and mathematics at around age 15-16 and probability of grade repetition by that age. However, most of the IV estimates, which account for the endogeneity of entry age, are insignificant. The only significant result is that a one-year delay in Year 1 entry reduces the likelihood of grade repetition by 27-66%. Under neither estimator does entry age show an effect on the probability of university attendance. Our results contrast with most of the existing international evidence which shows that late school entry has a significant, positive effect on students' schooling outcomes. Given that delayed school entry necessitates child care costs and reduces working lives, our findings suggest that it is not sensible for governments or schools to raise school entry ages or for parents to delay their children's school enrolment.

Keywords: school starting age, schooling outcomes

JEL: I20, I28

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1. Introduction

The past few decades has seen a trend towards increasing the minimum entry age for kindergarten in the US. Many parents also voluntarily delay their child's school enrolment, believing that by being older in the class, their child would be more confident and thus more likely to get ahead.[1] A similar willingness to postpone school entry has also been observed in other developed countries.

A vast empirical literature has examined the impact of school entry age on schooling outcomes, with the balance of the evidence showing a positive link between the two. However, Australian evidence on the subject is rare. Taylor et al (2009) examine the relation between school enrolment age and (short-term) child outcomes like behavioural traits and Peabody Picture Vocabulary Test scores. This paper will complement the existing Australian literature by drawing on data from the Longitudinal Surveys of Australian Youth to study the effect of age of entry to Year 1 on longer-term schooling outcomes including test scores in reading and mathematics, grade repetition and university enrolment. Unlike Taylor et al. (2009) who looked at age at entry to primary school, we are specifically interested in Year 1 enrolment. This is because Year 1 is not compulsory in some states (eg. Queensland). Besides, our focus avoids treating as early entrants those who started pre-Year 1 at an 'early' age but were retained in that grade for an extra year, effectively a disguised form of delayed enrolment.

The paper proceeds as follows. Section 2 reviews the empirical literature on the effect of school entry age on educational and labour market outcomes. A data description follows in Section 3 and the conceptual framework is presented in Section 4. Section 5 reports the modelling results and Section 6 concludes.

2. Literature review

This section reviews the most recent studies in a long and rich empirical literature on the effects of school entry age.[2] Schooling outcomes are the main focus of this literature, as the recent upward trend in school entry ages has been driven by the belief that younger children are not ready for school. Various schooling outcomes have been examined, including educational attainment, college attendance and school completion rates, and most commonly test scores.

Three methods have typically been used to examine the impact of entry age on schooling outcomes. The first method compares outcomes for children who have delayed entry with same-age children who entered school when they were eligible. The second method compares children in the same grade who are of different ages. The last method compares same-age children who enter school a year apart because their dates of birth fall on opposite sides of enrolment cut-off, or compares same-

[1] According to Deming and Dynarski (2008), 96% of six-year-old American children were enrolled in first grade or above in 1968 but this proportion decreased to 84% in 2005.
[2] See Stipek (2002) for a comprehensive review of earlier studies.

grade children who are a year apart because their dates of birth are at the two ends of an enrolment cut-off.

Given that a student's current grade is correlated with his/her current age and age at school entry, the above methods can show the effects of different factors. Children can, by choice or by compulsion, enter school at different ages, hence children of the same age can be in different grades. When grade, repetition and skipping are known, comparing same-age children will show the effect of entry age. Similarly, children in the same grade can have different dates of birth and thus different ages. By comparing these children, the second method can deduce the effects of age: absolute age (or "age at test") and relative age (how old a child is relative to his/her classmates).

Entry age can affect schooling outcomes as a child's physical and mental maturity can affect how quickly he/she learns. The absolute age effect captures how much he/she has learned over time while the relative age effect shows how much he/she has learned relative to his/her peers.

Endogeneity is the single biggest issue in this literature, as the factors that determine when a child starts school may also affect his/her schooling performance. For example, if parents choose to delay entry of low-ability children, and since these children tend to perform worse than other children, OLS estimates of delayed entry on schooling outcomes will be negatively biased. Delay is also more likely with families who can afford child-care costs or who have a non-working parent. If delay is caused by family resources, the OLS estimate will be upwardly biased. The direction of the bias is ambiguous if delay is due to having a non-working parent. On the one hand, having a stay-at-home parent may mean that family is well off enough not to need another income (upward bias). On the other hand, it may indicate that the parent is not employable (downward bias). When school entry legislation does not allow parents to choose when to enrol their children, it is still possible that parents time births. Parents who have the resources to time births tend to be richer and if family background has a significant effect on children's schooling outcomes, then ignoring this will bias results. The net effect of the biases is unknown. Instrumental variables (IV) are needed to eliminate endogeneity biases. However, as will be discussed in Section 4, no valid instruments have been identified.

Most of the existing evidence is based on US data, and therefore examines kindergarten entrance. Even though kindergarten is not compulsory in most states, most children start school from kindergarten and most states have state-regulated cut-off dates for enrolment. Comparing same-age children (with birthdays surrounding enrolment cut-off dates), Cascio and Lewis (2006) estimate that an additional year of high school raises the Armed Forces Qualifying Test scores of minorities by 0.31 to 0.32 standard deviations. Comparing same-grade children, Datar (2006) finds that entering kindergarten a year older boosts test scores at kindergarten entry and has a steeper test score trajectory during the first two years in school in the US. The IV estimates tend to exceed the OLS estimates by up to 18 percent, suggesting that endogeneity is a significant attenuation bias.

Elder and Lubotsky (2009) also observe an advantage associated with entry age in test scores during the first months of kindergarten, especially among children from upper income families, but the advantage fades away in subsequent years. These findings seem to suggest that achievement gaps reflect skill accumulation prior to kindergarten rather than an ability to learn faster in school among older children. Similarly, Dong (2010) observes that repeating kindergarten has positive but diminishing effects on the retained children's test scores up to third grade, that is, the retained children would perform worse were they to start school when eligible.

By contrast, Lincove and Painter (2006) find that delayed kindergarten entrants have no longer-term advantages in terms of high school achievement, graduation rates and college enrolment. Using data from an experiment where children of the same biological age were randomly assigned to different classroom at the start of school, Casio and Schanzenbach (2007) find no evidence that relative age matters for test scores or the likelihood of taking a college-entrance exam in the general population. However, when a disadvantaged child is among the youngest in a classroom, he/she is less likely to take the ACT or SAT, holding absolute age constant. Interestingly, it was also found that disadvantaged school entrants who are biologically older are less likely to take the ACT or SAT than their biologically younger counterparts of the same relative age.

Similar to the US, parents in Germany have some freedom in deciding when to enrol their child. Fertig and Kluve (2005) find at worst a negative relationship between entry age and schooling outcomes (school qualifications obtained and probability of grade repetition) and at best, no relationships. Another study, however, documents robust and significant positive effects on schooling outcomes for students who enter school at seven instead of six, with test scores at the end of primary school being 0.42 standard deviations higher and years of secondary schooling increasing by almost half a year (Puhani and Weber, 2005).

In the Netherlands, children are allowed to start school immediately after their four birthday instead of at the beginning of the school year and children having their birthday before, during and after the summer holiday are placed in the same class. Exploiting those two features, Leuven et al (2009) estimate that one additional month of time in school increases language scores of disadvantaged students by 6 percent of a standard deviation and their math scores by 5 percent of a standard deviation but no effect is found for non-disadvantaged students. This suggests that at age four school and home environment are close substitutes for non-disadvantaged children, whereas for disadvantaged children school provides better learning opportunities.

In many countries, enrolment is dictated by administrative rules, hence school entry age is purely determined by date of birth. Accordingly, children born around enrolment cut-off dates are essentially of the same age but enter school a year apart. Treating as the 'control' group children with birthdays just preceding the cut-off, and as the 'treatment' group children whose birthdays fall just after the cut-off, regression discontinuity can be used to study the 'treatment effect' of delayed entry. This method assumes that the timing of births around enrolment is purely random.

Using regression discontinuity, Fredriksson and Ockert (2005) estimate that in Sweden, increasing school starting age by one year increases grade point average at the age of 16 by 0.2 standard deviations. The authors show that the effect of absolute age is more important than relative age. In England, where enrolment cut-off date is 31 August, Crawford et al (2010) find evidence of significant August birth penalty in standardised average scores, the proportion of children achieving the expected level at every age and college participation. The penalty is greatest when a child first enters school and declines over time but is still significant at ages 16, when students make choices about employment and/or future study. Their analysis shows that the absolute age effect is more important than the effects of entry age and relative age. For Japan, where the length of compulsory schooling does not depend on school entry age and where grade retention or skipping are rare, Kawaguchi (2009) finds that older children of both sexes in a school cohort obtain higher test scores and more education years than their younger counterparts. The persistent effect of entry age suggests that the relative age effect is more important than the absolute age effect. McEwan and Shapiro (2008), using a large data set from Chile, show that a one-year delay of entry into primary school decreases the probability of repeating first grade by two percentage points, and increases 4th- and 8th-grade test scores by more than 0.3 standard deviations, with larger effects for boys. On the contrary, based on Norwegian data, Black et al (2008) find that starting school *younger* has a significant positive effect on IQ scores at age 18 and the probability of teenage pregnancy, but little effect on educational attainment.

While the effects of entry age on schooling outcomes have been widely studied, evidence on its impact on labour market outcomes is scant. Dobkin and Ferreira (2010) find no evidence that the age at which children enter school affects wages or the probability of employment for a large cohort of California and Texas natives. Also using US data, Bedard and Dhuey (2009) show that a one-month increase in the minimum school entry age increases wages by about 0.5 percent. Fredriksson and Ockert (2005) report that starting school later has a small positive effect on earnings in Sweden, but the impact on lifetime earnings is negative, as delayed school entry entails delayed labour market participation. By contrast, Black et al (2008) document a small positive earnings effect of starting school at a *younger* age in Norway, which largely disappears by age 30. This pattern is consistent with the idea that starting school early increases potential labour market experience at a particular age for a given level of education, but this advantage in experience diminishes as people age. Kawaguchi (2009) finds better academic performance translates into higher annual earnings among Japanese males.

Taken together, the recent evidence seems to suggest that on average, delayed school entry has favourable, yet diminishing, effects on schooling outcomes (test scores, repetition rates, completion rates, educational attainment, college enrolment and so on). The effects on annual earnings and employment probabilities are small, and the impact on lifetime earnings is likely to be negative, as delayed school entry necessitates delayed labour market entry and shorter working lives.

3. Data

3.1 Longitudinal Surveys of Australian Youth

This paper draws on data from the Longitudinal Surveys of Australian Youth (LSAY), which tracks young people from around ages 15 to 25 years as they move from school into further study, work and other destinations. It uses large, nationally representative samples of young people to collect information about education and training, work, and social outcomes.

Studies began in 1995, 1998, 2003, 2006 and most recently 2009, each starting out with over 10,000 students. Participants of each study are collectively known as a 'cohort' and are contacted once a year for up to 12 years. For Y95 (ie. study beginning in 1995) and Y98 cohorts, students entered the survey when they were in Year 9 – two classes from each selected school were chosen. Since 2003, the initial survey wave has been integrated with the OECD Programme for International Student Assessment (PISA). With this integration, initial survey targets became 15-year-old students (instead of Year 9) and students are no longer selected by class. Attrition from the sample was treated as a terminal condition (ie. once an individual fails to respond they will never be contacted again) in Y95 and Y98 but has not been so since Y03.

Our paper only uses Y98 and Y03 cohorts because Y95 and Y06 onwards cohorts do not contain sufficient information to determine early or late enrolment. We exclude from our analysis:

- Individuals with missing information on date of birth or grade repetition, as the timing of Year 1 enrolment can not be determined for those cases;
- Overseas-born individuals who arrived in Australia after entering Year 1, as we do not know entry age policies in their country of origin;
- Individuals in South Australia, where rolling admissions have been practised since 1990;
- Individuals in the Northern Territory, where rolling admissions were practised during 1983-2002.

Our analytical samples include 10,493 individuals for Y98 and 7,520 for Y03. Further details on sample selection are contained in Appendix Table 1.

3.2 Education in Australia

In Australia, school education consists of 13 grades. While the last 12 grades are known by the same names (Year 1-12) across states, the first grade has different names (Kindergarten, Pre-Primary, Preparatory, Preschool, Reception and Transition). For simplicity hereafter we will refer to that grade as Year 0. Children typically enter school at Year 0 even though that year is not compulsory in some states.

Public schools are free to attend for Australian citizens and permanent residents whereas private (Catholic and Independent) schools are not. The academic year usually starts in late January, around Australia Day holiday (26th) and runs for four terms until mid-December.

Over our analytical period, compulsory schooling started in the year in which the child turned six in most states. In Western Australia the relevant threshold was (the year in which the child reached) 6 years 6 months, whereas in South Australia and Northern Territory it started when the child turned six (rolling admissions).

Policies regarding school entry age vary across Australian states. Appendix Table 2 summarises the policies that were likely to affect LSAY Y98 and Y03 cohorts. Children usually start school at around age five, and most are around age six when first entering Year 1. Legislation generally gives parents some leeway to choose when to enrol their children. Parents can apply for early enrolling their child when he/she is under age, enrol when the child reaches the minimum required age, enrol when the child reaches the compulsory schooling age, or apply for delayed entry when the child reaches the compulsory schooling age. Accordingly, as summarised in Appendix Table 3, in each class there are up to four types of students:

- Delayed entrants: those who were required to have started school (usually Year 0), but have applied to delay entry

- Standard entrants: those who will become of compulsory schooling age in the current academic year

- Early entrants: those who are eligible, but not required, to start school this year

- Very early entrants: those who are below the legislated minimum age but have been granted entry this year. At the discretion of the school principal, early entry is available to gifted and talented children, children who may be disadvantaged by not commencing school early, or those in exceptional circumstances (Diezmann et al, 2001).

3.3 Entry age

Since LSAY does not record the state in which the respondent started school, we assume that students started school in the state in which they were observed in wave 1. This assumption is not ideal, but is forced on us due to data constraints.

We calculate the age at which a student first entered Year 0 and Year 1 based on their date of birth, his/her current grade and whether or not he/she has repeated a grade.[3] Y03 top codes repetition at two years for each schooling level (primary, lower secondary, upper secondary), thus up to six years of repetition is allowed for.[4] Since

[3] The Y03 cohort records the age at which the respondent started primary school. However, the values for this variable are whole numbers (eg. 5 or 6) so it is of limited use for us. Cross-checking with current age and grade also shows that most respondents understood “primary school” as Year 0.

[4] For Y03, 8.1% of the respondents have repeated at least a grade and 0.4% repeated multiple grades.

Y98 does not report how many times a respondent repeated a grade, we assume a year was repeated. However, for this cohort we found 8 cases with high ages of Year 0 entry (up to 8.75 years of age). We suspected that these cases reflect multiple repetitions rather than genuine late entry, so we adjusted them *down* so that the maximum entry ages are similar across the two cohorts.

Neither Y98 nor Y03 asked whether the respondent has skipped a grade. We assume there is no grade skipping. The lack of information on grade skipping is a limitation, as it necessitates treating a student who enrolled for Year 1 at the right age and skipped a grade the same as one who entered early and progressed normally.

3.4 Descriptive statistics

We consider three groups of schooling outcomes: repetition (whether or not the student has repeated a grade), standardised test scores on reading and maths at wave 1, and whether the student has ever attended university by around age 19-20.

Since the grading scale changed between Y98 and Y03, it is not possible to compare test scores between the two cohorts. Likewise for repetition and university attendance rates, as Y98 was grade-based sampled while Y03 was age-based. At the time of the first wave, a higher proportion of Y03 cohort had repeated a grade, mainly because they were older than Y98 (see Appendix Table 4). For university attendance, we consider the status at wave 6 for Y98 and wave 5 for Y03, when most students were around 19-20 years old. At those ages, most students who wanted to attend university have had sufficient time to try and while the remaining samples were still sufficiently large.

Our analyses use the standard variables that are often found in the economics of education literature: personal demographics (eg. age, gender, ethnicity, immigrant status), family resources (number of books at home), parental characteristics (education, occupation and immigrant status), other family characteristics (number of siblings, living with parents, language spoken at home) and school/class characteristics (school type, class size, share of girls in class).

As reported in Appendix Table 4, Y03 respondents were a year older than their Y98 counterparts when they entered the survey. Almost all Y98 respondents were in Year 9, while over 70% of Y03 respondents were in Year 10. Due to the PISA integration, some variables which were collected in Y98 were differently classified in Y03 (eg. number of books at home, variables on occupation and education) or dropped (eg. whether or not the respondent has a disability). However, this should not be a concern, as we analyse the two cohorts separately.

For variables that are consistently defined, their means are comparable between the two surveys. The average age at which students entered Year 1 was 5.96 for Y98, rising slightly to 6.08 for Y03, just above the age at which compulsory schooling starts in Australia.

Half of the samples are female, 2-3% come from an Australian indigenous background and for 93% English is the main language spoken at home. Only 4-7% were born overseas[5] but 35-38% have at least one parent who is a migrant and 15-17% have a mother coming from a non-English speaking country. The share of students born to university-qualified parents rose over time while the share born to unqualified parents declined. Around 22% were in a Catholic school while 13-15% attended an independent school. Over half of the students lived in urban centres with at least 100,000 residents.

For Y98, we computed several variables which capture peer effects, including the proportion of the class that were female, that aspired to study until Year 12, or whose mother was born in a non-English speaking country. These variables are not available for Y03, whose respondents were not surveyed by class. However, many interesting variables (eg. whether the respondent was living with a parent, number of siblings, number of books, parental employment status) which were collected right at wave 1 for Y03 were collected at wave 3 for Y98, and are of less use given the high attrition rate (only 70% of our Y98 sample remained in wave 3).

4. Models

Starting from Angrist and Krueger (1991), season (or quarter) of birth has been commonly used as an instrument for school entry age (or for educational attainment in wage equations). It is argued that a child's season of birth is strongly correlated to when a he/she is enrolled for school but not correlated to his/her schooling performance. However, several studies have shown that season of birth is strongly associated with later schooling, health and professional outcomes.[6] Most recently, Buckles and Hungerman (2008) show that children born at different times in the year are conceived by women with different socioeconomic characteristics, with children born in winter being disproportionally born to women who are more likely to be teenagers and less likely to be married or have a high school degree. School entry laws, another popular instrument, also attracts similar criticism. Dobkin and Ferreira (2010), for example, show that school entry laws increase educational attainment of students who enter school early, but lower their academic performance while in school. Such evidence casts doubt on the validity of season of birth and school entry laws as instruments for school entry age or educational attainment.

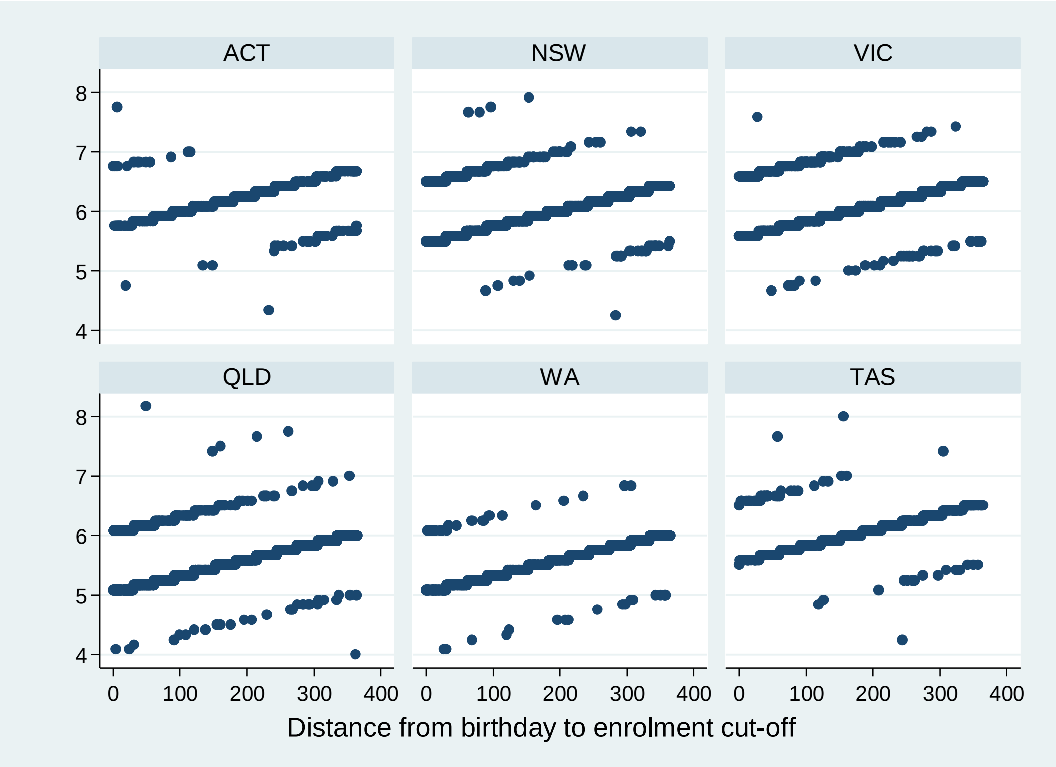
In this study, we follow Datar (2006) and use the number of days between a child's birthday and enrolment cut-off date as an instrument for age at Year 1 entry. For distance to enrolment cut-off to be a valid instrument, it needs to be (1) strongly correlated with entry age while (2) uncorrelated with any observable factors that affect schooling performance.

Children who have their fifth birthday just before the cut-off date are eligible to enter school in that school year, while those who have birthdays just after the cut-off date need to wait another year. Therefore, the number of days between a child's fifth

[5] Note that we have excluded students who arrived in Australia after entering Year 1.
[6] A comprehensive listing of related studies is provided by Buckles and Hungerman (2008).

birthday and the enrolment cut-off date would be strongly correlated to his/her entry age. As Figure 1 shows, the further is a child's birthday from the cut-off date, the older is he/she at entry to Year 1. The clustering of observations reflects the fact that while most children enter school when they reach the compulsory schooling age, many enter when they are eligible, some enter before even reaching the minimum age and a few enter late.

Figure 1: Age at entry and distance to cut-off date (Y98)



Notes: Value of 1 means the child's birthday is 1 day before the enrolment cut-off date. Value of 364 means the child's birthday is 1 day after the enrolment cut-off date.

The second condition is examined in Table 1, which shows that the observable characteristics (other than age at entry to Year 1) that can affect schooling achievement are very similar across categories of distance to enrolment cut-off. Thus, distance to enrolment cut-off is exogenous and has no direct effect on the child's schooling performance.

Table 1: Descriptive statistics by distance to enrolment cut-off (Y98)

	0-90 days	**91-181 days**	**182-272 days**	**273-364 days**
Age at Year 1 entry	5.87 (0.58)	5.81 (0.40)	5.98 (0.29)	6.19 (0.30)
Female	0.50 (0.50)	0.48 (0.50)	0.50 (0.50)	0.50 (0.50)
Indigenous background	0.03 (0.17)	0.03 (0.17)	0.03 (0.17)	0.03 (0.17)
Migrant	0.05 (0.21)	0.04 (0.19)	0.04 (0.19)	0.05 (0.22)
Speaks English at home	0.93 (0.26)	0.94 (0.25)	0.94 (0.24)	0.93 (0.26)
Has a disability	0.02 (0.14)	0.02 (0.14)	0.02 (0.13)	0.02 (0.13)
One parent born overseas	0.19 (0.39)	0.20 (0.40)	0.19 (0.39)	0.19 (0.40)

Both parents born overseas	0.17 (0.38)	0.16 (0.37)	0.14 (0.35)	0.17 (0.38)
Mother born in NESB country	0.16 (0.37)	0.16 (0.37)	0.14 (0.35)	0.16 (0.36)
Both parents have no qualifications	0.16 (0.37)	0.17 (0.38)	0.15 (0.36)	0.16 (0.37)
Both parents have a degree	0.13 (0.34)	0.12 (0.32)	0.12 (0.32)	0.11 (0.32)
Father white collar worker	0.41 (0.49)	0.41 (0.49)	0.41 (0.49)	0.41 (0.49)
Father blue collar high skilled worker	0.24 (0.43)	0.24 (0.43)	0.24 (0.43)	0.24 (0.42)
Father blue collar low skilled worker	0.19 (0.39)	0.19 (0.39)	0.21 (0.41)	0.18 (0.39)
Catholic school	0.21 (0.41)	0.22 (0.41)	0.21 (0.41)	0.21 (0.41)
Independent school	0.13 (0.33)	0.13 (0.34)	0.12 (0.33)	0.14 (0.34)
Metropolitan residence	0.54 (0.50)	0.52 (0.50)	0.52 (0.50)	0.54 (0.50)
Class size	20.3 (7.44)	20.6 (8.30)	20.4 (8.10)	20.7 (8.52)
Share of class female	0.50 (0.26)	0.49 (0.25)	0.50 (0.25)	0.49 (0.26)
Share of class intending to do Year 12	0.77 (0.16)	0.76 (0.17)	0.76 (0.17)	0.76 (0.17)
Share of class with mother born in NES countries	0.16 (0.19)	0.15 (0.18)	0.15 (0.18)	0.16 (0.20)
Note: Standard deviations are in parentheses.				

In Australia, schools in the same state have the same cut-off date, so there is little reason to believe that distance to enrolment cut-off is endogenous, as parents who want to choose cut-off dates would need to move to a different state.

5. Results

5.1 OLS vs. IV

Table 2 reports the effect of entry age on test scores for Y98 under various specifications. The OLS estimate suggests that a one-year delay in Year 1 entry raises reading test score at Year 9 by 0.06 standard deviations and that this effect is only significant at the 10% level. When distance to enrolment cut-off is used as an instrument, the effect of entry age increases slightly, but is not significant. When the instrument is quarter of birth or season of birth, the effect changes sign, but remains insignificant. [7] For math test score, the effect of entry age is positive but insignificant in all specifications.

It can be seen that when instrumented by quarter of birth or season of birth, the coefficient on entry age is more imprecisely estimated than when the instrument is distance to enrolment cut-off. This is because the latter variable contains more variation and is a better instrument than the former. For example, a child who is going to turn six in May is likely to be in Year 1 in New South Wales (NSW), where the enrolment cut-off date is 31 July, while a similar child is not likely to be in Year 1 in Australian Capital Territory (ACT), where the cut-off date is 30 April. For these children, the quarter of birth (quarter 3) and season of birth (autumn) are the same, but the number of days between each child's sixth birthday and their relevant enrolment cut-off date are very different. The NSW child is 2 months from enrolment cut-off while the ACT child is 11 months away and clearly that distance is a better predictor than quarter of birth or season of birth of when each child enters Year 1.

Table 2: Effect of Year 1 entry age on test scores for Y98

[7] All instruments pass the weak instrument test.

	Reading	Math
OLS	0.058+	0.051
	[0.031]	[0.034]
Distance to enrolment cut-off as IV	0.044	0.084
	[0.082]	[0.086]
Quarter of birth as IV	-0.016	0.090
	[0.177]	[0.184]
Season of birth as IV	-0.107	0.271
	[0.211]	[0.219]

Notes:

(1) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
(2) Cluster-corrected standard errors are in brackets.
(3) + significant at 10%
(4) Quarter of birth: quarter 1 is January to March. Season of birth: spring is September to November.
(5) Full regression results for Y98 Reading are presented in Appendix Table 5.

5.2 Baseline IV results

Table 3 summarises the OLS/ Probit and IV regression results on the four schooling outcomes for both cohorts. For the outcome at age 19-20 (university attendance), we only keep as explanatory variables those that are time-invariant (eg. sex, age at entry to Year 1, language and migrant background). The characteristics specific to wave 1 (metro residence, parental education, number of parents living with, and number of books at home) are dropped because we are focusing on the effect on later university attendance of age at Year 1 entry, not so much on the effect of the student's characteristics at Year 9 or 10 (wave 1).

Table 3: Effect of Year 1 entry age on schooling outcomes

	Y98		Y03	
	OLS/ Probit	IV	OLS/ Probit	IV
Reading test score at wave 1	0.058+	0.044	-0.179**	0.092
	[0.031]	[0.082]	[0.053]	[0.287]
Math test score at wave 1	0.051	0.084	-0.188**	0.171
	[0.034]	[0.086]	[.052]	[0.296]
Ever repeated a grade by wave 1	-1.049**	-1.915**	0.869**	-2.697**
	[0.065]	[0.123]	[0.114]	[0.375]
Marginal effect	-0.113**	-0.268**	0.087**	-0.661**
Attended university by ca. age 19-20	-0.028	0.218	-0.125	-0.621
	[0.058]	[0.172]	[0.095]	[0.507]
Marginal effect	-0.011	0.086	-0.047	-0.234

Notes:

(1) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
(2) Cluster-corrected standard errors are in brackets.
(3) ** significant at 1%
(4) All IV regressions use distance to enrolment cut-off as an instrument for age at entry to Year 1. Full IV regression results are presented in Appendix Tables 6-7.

For Y03[8] the OLS estimated effect of entry age on test score is significantly negative but the IV estimate switches sign and loses statistical significance. This result holds for both reading test score and math test score.

[8] Y03 does not collect the day value in date of birth.

It is interesting to note that for Y98 the effect of entry age on both test scores is positive under both OLS and IV estimators, whereas for Y03 the IV estimates are positive but the OLS estimates are significantly negative. This suggests that Y98 delayed entrants came from better-off families who could afford to pay child-care costs or to have a stay-at-home parent look after the child for another year.[9] By contrast, Y03 were likely to have been held back because their parents were concerned about their abilities.

In all but one specification for test scores, the IV estimate is larger than the OLS estimate, indicating that the latter is negatively biased. This in turn suggests that delayed children tend to have lower abilities than other children. It is notable that the IV estimate for the effect of entry age on both test scores for Y03 is twice as large that for Y98.[10]

Age at Year 1 entry shows no statistically significant effect on the probability of attending university by around age 19-20. However, delayed entry significantly decreases the likelihood of grade repetition in the IV specifications. Marginal effect calculations indicate that a one-year delay in Year 1 entry reduces the probability of repeating a grade by 27% for Y98 and 66% for Y03.

Of the four schooling outcomes examined in this paper, repetition is closest in time to Year 1 while university attendance is the furthest away. Our results suggest that the age at entry to Year 1 may have an effect on schooling outcomes initially. However, by Year 9-11 (ages 14-16), the effect is statistically insignificant once endogeneity bias is corrected for, and at the tertiary level (ages 19-20) it is small and insignificant under any specification. This is consistent with some international findings that the effect of school starting age, if any, diminishes over time.

5.3 Sensitivity analyses

Table 4 shows the IV estimates for Y98 by gender. Consistent with international evidence, age at Year 1 entry has stronger effects on schooling outcomes for boys than for girls. However, patterns of statistical significance remain the same, with the only significant effect being found for grade repetition. A one-year delay in Year 1 entry lowers the probability of grade repetition by 34% for boys and only by 20% for girls.

Estimates for the three largest states are displayed in Table 5.[11] The key results continue to hold for each state: age at entry to Year 1 is significantly negatively related to the probability of grade repetition while having no significant effect on the probability of university enrolment.

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[9] See discussion about causes of endogeneity bias in Section 2.

[10] Recall that Y98 is a same-grade sample while Y03 sample is same-age based.

[11] Results for the other states are likely to have a small sample bias. For example, the ACT sample has 243-444 observations from 13 clusters (schools).

Table 4: Effect of Year 1 entry age on schooling outcomes for Y98 by gender			
	Pooled	**Male**	**Female**
Reading test score	0.044	0.057	0.040
Math test score	0.084	0.041	0.128
Ever repeated a grade	-1.915**	-1.881**	-1.996**
Marginal effect	-0.268**	-0.335**	-0.196**
Attended university by ca. age 19-20	0.218	0.198	0.227
Marginal effect	0.086	0.074	0.091

Notes:
(1) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
(2) + significant at 10%, * significant at 1%, ** significant at 1%
(3) All regressions use distance to enrolment cut-off as an instrument for age at entry to Year 1.

Table 5: Effect of Year 1 entry age on schooling outcomes by state				
	NSW 98	**VIC 98**	**QLD 98**	**VIC 03**
Reading test score	0.062	-0.271	0.250*	-0.327**
Math test score	0.202	-0.233	0.121	-0.282**
Ever repeated a grade	-3.219**	-2.021**	-1.313**	1.939**
Marginal effect	-0.541**	-0.161**	-0.174**	0.085**
Attended university by ca. age 19-20	0.256	0.149	0.261	-0.377*
Marginal effect	0.101	0.059	0.103	-0.145*
Sample size	1,400-2,696	1,232-2,378	1,258-2,479	1,246-1,774
Number of clusters (schools)	64	68	62	62

Notes: See notes to Table 4.

For the two test scores for Y98, the only significant result is found for reading test score in Queensland (QLD). The estimated effects of entry age are positive but insignificant for NSW while negative and insignificant for Victoria (VIC). Note that differences in school entry age policies across states mean that at the time Year 1 entry, Y98 students were typically in the age range of 61-73 months in QLD, 66-78 months in NSW and 67-79 months in VIC (see Appendix Table 2). Our state-specific results suggest that delay in school enrolment is likely to have the most favourable effect when the legislated minimum entry age is low (QLD). When the legislated entry age is already high (VIC), such delay is more likely to induce an unfavourable impact.

In the early 1990s, VIC changed enrolment cut-off date from 30 June to 30 April (see Appendix Table 2). This change means that Y03 students were typically 2 months older than their Y98 students at entry to Year 1. For this state, the results for Y98 and Y03 are in stark contrast (see Table 4). While age at Year 1 entry has a negative but insignificant effect on test scores for Y98, the effect is highly significant for Y03 – a one-year delay lowers test scores at around age 15 by 0.33 standard deviations for reading and by 0.28 standard deviations for math. For Y98, delayed entry significantly reduces grade repetition and has a positive but insignificant effect on university attendance. These effects, however, switch sign and are both significant for Y03. That is, the effects of delayed entry, which were already unfavourable in a state with high legislated minimum entry age like VIC, worsened when the age was further lifted. These findings reinforce our earlier postulation that delayed entry is more likely to hurt than help when the legislated minimum entry age is already high.

6. Conclusion

This paper has examined the effect of age at entry to Year 1 on later schooling outcomes for two cohorts of Australian students. The OLS/ probit estimates usually indicate a significant association between entry age and three outcomes, including test scores in reading and mathematics at around age 15-16 and probability of grade repetition by that age. However, these estimates are biased as entry age is endogenous – parents choose when to enrol their child based on the child's observed and unobserved characteristics which are likely to affect his/her schooling outcomes. When we address this bias by using as an instrument the distance between the child's birthday and enrolment cut-off, the estimated effect of entry age becomes largely insignificant. The only significant result is that a one-year delay in Year 1 entry reduces the likelihood of grade repetition by 27-66%. Under neither estimator does entry age show an effect on the probability of university attendance.

These results are robust across the two cohorts, genders and three largest states. Our state-specific results suggest that delay in Year 1 enrolment is likely to have the most favourable effect when the legislated school entry age is low (QLD). When the legislated entry age is already high (VIC), such delay is more likely to induce an unfavourable impact.

On the one hand, our results are consistent with some international findings that the effect of school starting age, if any, diminishes over time. On the other hand, they contrast with most of the existing international evidence which shows that late school entry has a significant, positive effect on students' schooling outcomes. Given that delayed school entry necessitates child care costs and reduces working lives, our findings suggest that it is not sensible for governments or schools to raise school entry ages or for parents to delay their children's school enrolment.

References

1. Angrist, Joshua D and Alan B. Krueger (1991), "Does compulsory attendance affect schooling and earnings?" *Quarterly Journal of Economics,* 106(4): 979–1014.

2. Bedard, Kelly and Elizabeth Dhuey (2009), "School entry policies and skill accumulation across directly and indirectly affected men," Mimeo.

3. Black, Sandra E., Paul J. Devereux and Kjell G. Salvanes (2008), "Too young to leave the nest? The effects of school starting age," NBER working paper 13969, National Bureau of Economic Research, Inc.

4. Buckles, Kasey and Daniel M. Hungerman (2008), "Season of birth and later outcomes: Old questions, new answers," NBER Working Papers 14573, National Bureau of Economic Research, Inc.

5. Cascio, Elizabeth U. and Ethan G. Lewis (2006), "Schooling and the Armed Forces Qualifying Test: Evidence from school-entry laws," *Journal of Human Resources,* 41(2):294-318.

6. Cascio, Elizabeth and Diane W. Schanzenbach (2007), "First in the class? Age and the education production function," NBER Working paper 13663, National Bureau of Economic Research, Inc.

7. Crawford, Claire, Lorraine Dearden and Costas Meghir (2010), "When you are born matters: The impact of date of birth on educational outcomes in England," IFS Working paper W10/06, Institute for Fiscal Studies.

8. Datar, Ashlesha (2006), "Does delaying kindergarten entrance give children a head start?" *Economics of Education Review,* 25(1):43-62.

9. Deming, David and Susan Dynarski (2008), "The Lengthening of Childhood," *Journal of Economic Perspectives,* 22(3): pages 71-92.

10. Diezmann, Carmel M. James J. Watters and Kathryn Fox (2001), "Early entry to school in Australia: Rhetoric, research and reality," *Australasian Journal for Gifted Education,* 10(2):5-18.

11. Dobkin, Carlos and Fernando Ferreira (2010), "Do school entry laws affect educational attainment and labor market outcomes?" *Economics of Education Review,* 29(1): 40-54.

12. Dong, Yingying (2010), "Kept back to get ahead? Kindergarten retention and academic performance," *European Economic Review,* 54(2): 219-236.

13. Elder, Todd E. and Darren H. Lubotsky (2009), “Kindergarten entrance age and children’s achievement: Impacts of state policies, family background, and peers,” *Journal of Human Resources*, 44(3): 641-683.

14. Fertig, Michael and Jochen Kluve (2005), “The effect of age at school entry on educational attainment in Germany,” IZA Discussion Paper 1507, Institute for the Study of Labor.

15. Fredriksson, Peter and Bjorn Ockert (2006), “Is early learning really more productive? The effect of school starting age on school and labour market performance,” IFAU Working paper 2006:12, Institute for Labour Market Policy Evaluation.

16. Kawaguchi, Daiji (2009), “Actual age at school entry, educational outcomes, and earnings,” *Journal of The Japanese and International Economies,* doi:10.1016/j.jjie.2009.02.002.

17. Leuven, Edwin, Mikael Lindahl, Hessel Oosterbeek and Dinand Webbink (2010), “Expanding schooling opportunities for 4-year-olds,” *Economics of Education Review*, 29(3): 319-328.

18. Lincove, Jane A. and Gary Painter (2006), “Does the age that children start kindergarten matter? Evidence of long-term educational and social outcomes,” *Educational Evaluation and Policy Analysis*, 28(2): 153-179.

19. McEwan, Patrick J. and Joseph S. Shapiro (2008), “The benefits of delayed primary school enrollment: Discontinuity estimates using exact birth dates,” *Journal of Human Resources*, 43(1): 1-29.

20. Puhani, Patrick A. and Andrea M. Weber (2005), “Does the early bird catch the worm? Instrumental variable estimates of educational effects of age of school entry in Germany,” IZA Discussion Paper 1827, Institute for the Study of Labor.

21. Stipek, Deborah (2002), “At what age should children enter kindergarten? A question for policy makers and parents,” Social Policy Report: Giving Child and Youth Development Knowledge Away, 16(2).

22. Taylor, Mathew, Ben Edwards and Mario Fiorini (2009), “Does it matter at what age children start school in Australia? Investigating the effects of school starting age on six-year old children’s outcomes,” presented at Australian Social Policy Conference, University of New South Wales, July 8^{th}.

Appendices

Appendix Table 1: Sample selection		
	Y98	**Y03**
Original sample	14,117	10,370
Excludes:		
Missing date of birth	1,017	0
Arriving in Australia after entering Year 1	996	701
In South Australia	1,249	1,039
In Northern Territory	461	429
Missing grade repetition info	710	16
Analytical sample	10,400	8,267
Selection rate	73.7%	79.7%
Notes: Observations can have missing data for multiple variables. Regression samples may further be reduced due to missing variables.		

Appendix Table 2: School entry age policies that were likely to affect LSAY Y98 and Y03 cohorts

State	**Period**	**Typical grade when schooling begins**	**School admission rule**	**Typical age at Year 1 entry**(#)
Australian Capital Territory	1985-1999	Kindergarten	Turn 5 by 30 April	5y9m- 6y9m
New South Wales	1987-current	Kindergarten	Turn 5 by 31 July	5y6m- 6y6m
Victoria	1985-early 1990s	Preparatory	Turn 5 by 30 June	5y7m- 6y7m
	Early 1990s-current	Preparatory	Turn 5 by 30 April	5y9m- 6y9m
Queensland	1989-1999	Year 1	Turn 5 by 31 December in previous year Preschool: Turn 4 by 31 December in previous year	5y1m- 6y1m
South Australia	-1989	Reception	Continuous entry on or next school day after 5th birthday	5y7m- 6y4m (Year 1: single entry in January after 2-5 terms in Reception)
	1990-current	Reception	Continuous entry at beginning of each term after 5th birthday	5y7m- 6y4m (Year 1: single entry in January after 2-5 terms in Reception)
Western Australia	Pre-1989-2000	Pre-Primary	Turn 5 by 31 December	5y1m- 6y1m
Tasmania	1989-1994	Year 1/ Preparatory	-Year 1: Turn 5 by 1 July in previous year - Preparatory: Turn 5 by 1 January	5y7m- 6y7m Or 6y1m-7y1m (if entering via Preparatory)
Northern Territory	1983-2002	Transition	Continuous entry on or next school day after 5th birthday	6y1m- 6y4m

Notes: Most of Y98 entered Year 0 in 1989 while most Y03 entered Year 0 in 1993-1994.
(#)Extrapolated from typical age of school admission, assuming most students spend one year in Year 0 grade.

Appendix Table 3: An example of classifying school entrants by entry age in Victoria				
Type of entrants	**Date of birth**	**Age on 31 Jan 2011**	**Entry eligibility**	**Reason**
Delayed entrants	Dec-04 or earlier	At least 6 years 1 month	Overdue entry	Have previously applied for delayed entry
Standard entrants	Jan-05 to Dec-05	6 years to 5 years 1 month	Required to start school in Jan-11	Turn 6 in academic year 2011
Early entrants	Jan-06 to Apr-06	5 years to 4 years 9 months	Eligible to start school in Jan-11	Turn 5 by 30 April 2011
Very early entrants	May-06 or later	Up to 4 years 8 months	Can apply for early entry	Younger than the minimum age

Appendix Table 4: Descriptive statistics				
	Y98		**Y03**	
	N	**Mean**	**N**	**Mean**
Ever repeated a grade by wave 1	10,400	0.078	8,267	0.083
Maths test score [1]	10,240	10.31	8,267	524.9
Reading test score [1]	10,227	10.40	8,267	527.9
Ever attended university by age 19-20 [2]	5,296	0.432	5,386	0.377
Age at wave 1	10,400	14.71	8,267	15.77
Age at Year 1 entry	10,400	5.96	8,267	6.08
In Year 9 in wave 1	10,400	0.999	8,267	0.086
In Year 10 in wave 1	10,400	0.001	8,267	0.718
Female	10,397	0.494	8,267	0.502
Indigenous background	10,261	0.031	8,267	0.021
Migrant	10,400	0.043	8,267	0.068
Speaks English at home	10,381	0.931	8,221	0.938
Has a disability [3]	10,238	0.020		
One parent born overseas	10,400	0.195	8,267	0.198
Both parents born overseas	10,400	0.162	8,267	0.187
Mother born in non-English speaking country	10,400	0.154	8,267	0.176
Both parents have no qualifications [4]	10,399	0.162	8,267	0.134
Both parents have a degree [4]	10,399	0.119	8,267	0.154
Father is a white collar worker [4]	10,400	0.410	8,267	0.522
Father is a blue collar high skilled worker [4]	10,400	0.241	8,267	0.231
Father is a blue collar low skilled worker [4]	10,400	0.193	8,267	0.159
Catholic school	10,400	0.215	8,267	0.222
Independent school	10,400	0.131	8,267	0.154
Metropolitan residence (population>100,000)	10,244	0.529	8,267	0.570
Class size [5]	10,400	20.49		
Share of class female [5]	10,400	0.494		
Share of class intending to do Year 12 [5]	10,400	0.761		
Share of class with mother born in NES countries [5]	10,400	0.154		
Living with only one parent [6]	7,205	0.155	8,222	0.274
Not living with parents [6]	7,205	0.031	8,222	0.020
Has no siblings [6]	7,252	0.037	8,266	0.060
Eldest child [6]	7,251	0.353	8,254	0.394
Books at home: 0-50 [6, 7]	7,209	0.085	8,150	0.126
Books at home: 51-100 [6, 7]	7,209	0.264	8,150	0.288
Books at home: 101-500 [6]	7,209	0.434	8,150	0.449
Mother is working full time [6]	7,205	0.417	8,180	0.411
Mother is working part time [6]	7,205	0.270	8,180	0.253
Father is not working [6]	7,205	0.075	8,223	0.062

Notes: Statistics are weighted.
[1] The marking scale differs between the two surveys.
[2] Wave 6 for Y03 and wave 5 for Y03.
[3] Not collected in Y03.
[4] The two surveys use different classification systems for education and occupation, so the variables are not consistently defined between the two surveys.
[5] Derived based on count of respondents with same class-school IDs in Y98. Students were not surveyed by class in Y03.
[6] Collected in Wave 3 for Y98.
[7] The threshold for Y03 is 25 books.

Appendix Table 5: Full regression results on Reading test score for Y98				
	OLS	**Distance to enrolment cut-off as IV**	**Quarter of birth as IV**	**Season of birth as IV**
	(1)	(2)	(3)	(4)
Age at Year 1 entry	0.058+	0.044	-0.016	-0.107
	[0.031]	[0.082]	[0.177]	[0.211]
Female	0.145**	0.145**	0.143**	0.141**
	[0.024]	[0.024]	[0.024]	[0.025]
Indigenous background	-0.517**	-0.517**	-0.518**	-0.520**
	[0.063]	[0.063]	[0.063]	[0.063]
Migrant	0.105*	0.104*	0.103*	0.101*
	[0.050]	[0.050]	[0.050]	[0.050]
Speaks English at home	0.236**	0.236**	0.235**	0.233**
	[0.048]	[0.048]	[0.049]	[0.049]
Has a disability	-0.473**	-0.472**	-0.470**	-0.468**
	[0.075]	[0.074]	[0.074]	[0.075]
One parent born overseas	-0.006	-0.007	-0.01	-0.015
	[0.029]	[0.029]	[0.030]	[0.032]
Both parents born overseas	-0.034	-0.035	-0.041	-0.049
	[0.047]	[0.048]	[0.049]	[0.050]
Mother born in non-English speaking country	0.006	0.006	0.007	0.009
	[0.042]	[0.042]	[0.042]	[0.042]
Both parents have no qualifications	-0.170**	-0.171**	-0.172**	-0.175**
	[0.029]	[0.029]	[0.029]	[0.029]
Both parents have a degree	0.298**	0.298**	0.300**	0.302**
	[0.031]	[0.031]	[0.032]	[0.031]
Father white collar worker	0.354**	0.354**	0.357**	0.360**
	[0.033]	[0.033]	[0.034]	[0.035]
Father blue collar high skilled worker	0.199**	0.199**	0.200**	0.200**
	[0.034]	[0.034]	[0.035]	[0.035]
Father blue collar low skilled worker	0.093*	0.093*	0.093*	0.092*
	[0.037]	[0.037]	[0.037]	[0.037]
Catholic school	0.093+	0.094+	0.097+	0.103+
	[0.049]	[0.049]	[0.052]	[0.053]
Independent school	0.203**	0.203**	0.206**	0.210**
	[0.059]	[0.059]	[0.060]	[0.060]
Metropolitan residence	-0.01	-0.01	-0.01	-0.011
	[0.036]	[0.036]	[0.036]	[0.037]
Class size	0.006*	0.006*	0.006*	0.006+
	[0.003]	[0.003]	[0.003]	[0.003]
Share of class female	0.077	0.077	0.077	0.077
	[0.073]	[0.073]	[0.073]	[0.074]
Share of class intending to do Year 12	1.155**	1.151**	1.131**	1.102**
	[0.135]	[0.138]	[0.147]	[0.152]
Share of class with mother born in NES countries	-0.16	-0.157	-0.144	-0.125
	[0.125]	[0.125]	[0.131]	[0.134]
Constant	-1.906**	-1.819**	-1.444	-0.879
	[0.226]	[0.527]	[1.108]	[1.320]
Number of observations	9802	9802	9802	9802
R-squared	0.17			

Notes:

(1) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
(2) Cluster-corrected standard errors are in brackets.
(3) + significant at 10%; * significant at 5%; ** significant at 1%

Appendix Table 6: Full IV regression results on schooling outcomes for Y98				
	Reading test score	**Math test score**	**Ever repeated a grade**	**Attended university by ca. age 19-20**
	(1)	(2)	(3)	(4)
Age at Year 1 entry	0.044	0.084	-1.915**	0.218
	[0.082]	[0.086]	[0.123]	[0.172]
Female	0.145**	-0.238**	-0.286**	-0.039*
	[0.024]	[0.027]	[0.043]	[0.018]
Indigenous background	-0.517**	-0.377**	0.165+	0.054
	[0.063]	[0.063]	[0.098]	[0.197]
Migrant	0.104*	0.037	-0.111	-0.057*
	[0.050]	[0.062]	[0.104]	[0.127]
Speaks English at home	0.236**	0.159**	-0.163+	-0.011
	[0.048]	[0.053]	[0.096]	[0.029]
Has a disability	-0.472**	-0.532**	0.686**	-0.439**
	[0.074]	[0.082]	[0.138]	[0.155]
One parent born overseas	-0.007	-0.052+	-0.144*	0.044
	[0.029]	[0.029]	[0.058]	[0.054]
Both parents born overseas	-0.035	-0.058	-0.219**	-0.118
	[0.048]	[0.044]	[0.081]	[0.033]
Mother born in non-English speaking country	0.006	0.088+	0.013	0.260**
	[0.042]	[0.046]	[0.081]	[0.097]
Both parents have no qualifications	-0.171**	-0.087**	-0.053	
	[0.029]	[0.028]	[0.056]	
Both parents have a degree	0.298**	0.343**	0.027	
	[0.031]	[0.036]	[0.067]	
Father white collar worker	0.354**	0.299**	-0.207**	0.036+
	[0.033]	[0.037]	[0.064]	[0.022]
Father blue collar high skilled worker	0.199**	0.145**	-0.158*	0.01
	[0.034]	[0.037]	[0.061]	[0.021]
Father blue collar low skilled worker	0.093*	0.031	-0.167*	0.012
	[0.037]	[0.038]	[0.069]	[0.025]
Catholic school	0.094+	-0.022	0.196+	0.042
	[0.049]	[0.056]	[0.101]	[0.043]
Independent school	0.203**	0.137+	0.125	0.003
	[0.059]	[0.071]	[0.105]	[0.098]
Metropolitan residence	-0.01	-0.012	-0.003	
	[0.036]	[0.036]	[0.074]	
Class size	0.006*	0.008*	-0.006	
	[0.003]	[0.004]	[0.005]	
Share of class female	0.077	0.1	0.177	
	[0.073]	[0.093]	[0.146]	
Share of class intending to do Year 12	1.151**	1.324**	-1.228**	
	[0.138]	[0.142]	[0.207]	
Share of class with mother born in NES countries	-0.157	-0.226	0.262	
	[0.125]	[0.151]	[0.167]	
Number of observations	9802	9801	9944	5162

Notes:

1. (1) All regressions use distance to enrolment cut-off as an instrument for age at entry to Year 1. A constant is included in all regressions.
2. (2) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
3. (3) Cluster-corrected standard errors are in brackets.
4. (4) + significant at 10%; * significant at 5%; ** significant at 1%

Appendix Table 7: Full IV regression results on schooling outcomes for Y03				
	Math test score	**Reading test score**	**Ever repeated a grade**	**Attended university by ca. age 19-20**
	(1)	(2)	(3)	(4)
Age at Year 1 entry	0.092	0.171	-2.697**	-0.621
	[0.287]	[0.296]	[0.375]	[0.507]
Female	-0.540**	-0.626**	2.758**	0.749**
	[0.199]	[0.208]	[0.138]	[0.371]
Indigenous background	0.423*	0.541*	-2.281**	-0.701**
	[0.209]	[0.215]	[0.230]	[0.010]
Year 9 at test	0.389**	-0.123**	-0.082*	0.345**
	[0.031]	[0.032]	[0.036]	[0.010]
Year 11 at test	-0.503**	-0.577**	-0.029	-0.035
	[0.066]	[0.061]	[0.099]	[0.024]
Migrant	0.015	0.079	0.11	0.160+
	[0.066]	[0.064]	[0.075]	[0.091]
Speaks English at home	0.02	0.037	0.01	-0.290**
	[0.060]	[0.066]	[0.107]	[0.019]
One parent born overseas	0.047	0.053+	-0.051	-0.033**
	[0.033]	[0.032]	[0.052]	[0.060]
Both parents born overseas	-0.111*	-0.086+	-0.108	0.009
	[0.054]	[0.051]	[0.078]	[0.094]
Mother born in non-English speaking country	0.057	0.094+	0.125+	0.053**
	[0.056]	[0.056]	[0.075]	[0.015]
Both parents have no qualifications	-0.148**	-0.102**	0.055	
	[0.032]	[0.033]	[0.055]	
Both parents have a degree	0.311**	0.307**	-0.044	
	[0.039]	[0.042]	[0.062]	
Father white collar worker	0.493**	0.243**	-0.015	0.576**
	[0.045]	[0.049]	[0.093]	[0.123]
Father blue collar high skilled worker	0.307**	0.059	0.038	0.052
	[0.044]	[0.050]	[0.088]	[0.032]
Father blue collar low skilled worker	0.202**	-0.037	0.08	0.207
	[0.051]	[0.052]	[0.094]	[0.139]
Catholic school	0.228**	0.187**	-0.131*	0.427**
	[0.051]	[0.051]	[0.060]	[0.017]
Independent school	0.312**	0.281**	-0.025	-0.001
	[0.069]	[0.065]	[0.058]	[0.020]
Metropolitan residence	-0.013	-0.05	0.03	
	[0.043]	[0.040]	[0.050]	
Living with only one parent	-0.027	-0.097**	0.108*	
	[0.029]	[0.029]	[0.045]	
Not living with parents	-0.452**	-0.433**	0.456**	
	[0.084]	[0.082]	[0.133]	
Has no siblings	0.037	-0.017	0.125	-0.116
	[0.056]	[0.054]	[0.086]	[0.018]
Eldest child	0.105**	0.088**	-0.06	-0.003
	[0.021]	[0.022]	[0.045]	[0.048]
Books at home: 0-25	-0.539**	-0.679**	0.022	
	[0.042]	[0.041]	[0.073]	
Books at home: 26-100	-0.285**	-0.449**	-0.113+	
	[0.039]	[0.038]	[0.060]	
Books at home: 101-500	-0.025	-0.159**	-0.112+	
	[0.037]	[0.037]	[0.061]	

Mother is working full time	0.058*	0.044	-0.034	
	[0.029]	[0.030]	[0.049]	
Mother is working part time	0.079*	0.109**	-0.061	
	[0.032]	[0.031]	[0.061]	
Father is not working	-0.025	-0.07	0.216*	
	[0.064]	[0.056]	[0.093]	
Number of observations	7944	7944	7944	5354

Notes:

(1) All regressions use distance to enrolment cut-off as an instrument for age at entry to Year 1. A constant is included in all regressions.
(2) Test scores have been standardised to having a mean of 0 and standard deviation of 1.
(3) Cluster-corrected standard errors are in brackets.
(4) + significant at 10%; * significant at 5%; ** significant at 1%