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An Investigation of the Magnitude of Educational Disadvantage Amongst Indigeneous and Non-Indigeneous Minority Groups in Australia

by

Steve Bradley, Mirko Draca, Colin Green and Gareth Leeves

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THE UNIVERSITY OF QUEENSLAND

An investigation of the magnitude of educational disadvantage amongst indigeneous and non-indigenous minority groups in Australia *

Steve Bradley[†], Mirko Draca[‡], Colin Green[§] and Gareth Leeves[¶]

Abstract

Indigenous minority groups in countries such as the US, Canada and Australia are amongst the most disadvantaged minority groups in the developed world. This disadvantage is strongly associated with 'pre-market' factors. This paper examines pre-market disadvantage of indigenous Australians by assessing academic performance at a relatively early age. We find that, when compared to non-indigenous Australians, indigenous Australians are already, on average, 1 year behind in academic achievement by the age of 10. Furthemore, their performance continues to deteriorate over the next two years of schooling. Only a limited proportion of their poor achievement can be accounted for by observable personal characteristics or unobservable variations in school and spatial characteristics.

KEYWORDS: Educational Achievement, Indigenous Minorities.

JEL CODE: I21, J15.

*Corresponding Author: Gareth Leeves.

†Department of Economics, The Management School, Lancaster University, Lancaster LA1 4YX UK. ecasb@exchange.lanc.ac.uk fax +44 (0)1524 594855

‡Centre for Economic Performance, London School of Economics and Political Science ,Houghton Street, London WC2A 2AE, UK m.draca@lse.ac.uk, fax +44(0)20-7955 7595

§Centre for Economic Policy Modelling, University of Queensland, St Lucia, Qld 4075, Australia. c.green@economics.uq.edu.au, fax +61 7 3365 7299

¶School of Economics, University of Queensland, St.Lucia, Qld 4075, Australia. g.leeves@economics.uq.edu.au, fax +61 7 3365 7299

1 INTRODUCTION

Indigenous minority groups in countries such as Australia, Canada, New Zealand and the United States are severely disadvantaged according to a range of socioeconomic indicators (Kimmel 1997, Kuhn and Sweetman 2002, Maani 2004). Table 1 shows that these groups suffer poor labour market outcomes, such as low participation rates, high unemployment rates and low wages, which are strongly associated with 'pre-market' factors (George and Kuhn 1994). In particular, educational attainment is critical due to its impact on labour market success, and because it reduces the risk of other negative social outcomes, such as criminality and substance abuse (Borland and Hunter 2000). Educational disadvantage can start at an early age and be determined by family and school inputs as well as racial factors (Todd and Wolpin 2004). Moreover, Australian evidence suggests that there is less incentive for indigenous youths to improve their prospects in the labour market through education as the estimated private rates of return to post compulsory secondary education are far lower for indigenous than for non-indigenous students (Daly and Liu 1997).

INSERT TABLE 1.

In this paper we examine the educational performance of indigenous Australians compared to that of non-indigenous Australians. To do this we focus on test score performance in both literacy and numeracy of Queensland students in senior primary school (age 10 to 12). This is an important age to study indigenous performance because early education, and particularly basic skills such as numeracy and literacy, provide the building blocks for later educational development. Evidence from the US documents how gaps develop between racial minorities and the majority group, and in some instances widen as time in the school system increases(Fryer and Levitt 2002, Carneiro et al 2003), but there is very little comparable evidence for Australia.

The population of indigenous minority groups tend to be highly spatially concentrated, often residing in remote communities or concentrated in particular urban areas. This is particularly true of indigenous Australians. Approximately half of the working indigenous population live in rural or remote areas (Borland and Hunter 2000), while urban indigenous Australians are often concentrated in lower income residential areas. This spatial segregation poses particular problems in terms of education policy, as indigenous Australians are often schooled in circumstances that differ markedly from other Australians (ABS 1995). For instance, their concentration in remote and/or poorer areas will lead to them attending schools where the peer group is poorer and the quality of teachers is lower because of the difficulties encountered in their recruitment and retention. Furthermore, for many indigenous children, and especially those in rural and remote areas, English will be a second language (ESL) as their indigenous language will be the primary language spoken at home. Hence, English language difficulties may further compound the disadvantage associated with attending relatively poorer schools.

This study is novel in a number of ways. It represents the first econometric study comparing indigenous and non-indigenous educational differentials for primary age pupils. This is examined by contrasting indigenous educational performance to that of non-indigenous Australians from an English Speaking Background (ESB) and those from a non-English Background (NESB). In particular, we utilise data for Queensland where there are two distinct and sizeable indigenous populations, Aboriginal Australians and Torres Strait Islanders, who have different ethnic backgrounds, customs and languages. The former are the original custodians of the Australian mainland and have a culture related strongly to ties with the tribal lands, whereas the latter are mainly of Polynesian descent and have an Islander culture. The two groups typically have been treated as a single group in previous research, which as we shall show is incorrect. Also, in view of the geographical segregation of indigenous groups, this study also provides an analysis of geographical remoteness on indigenous educational attainment[1], and as such provides insights that may be generalised to other indigenous minority populations, such as those in North American and Canadian.

We find that, even at the age of 10 years, indigenous students perform markedly worse on numeracy and literacy tests when compared to non-indigenous students. At this stage indigenous students are already approximately 1 year behind on literacy and numeracy performance when compared to ESB students. This disparity is even more marked for rural and remote indigenous students, who are on average approximately 2 years behind the literacy and numeracy skills of ESB children in similar geographic areas. Furthermore, these differences between ESB and indigenous groups, in most cases, widen between the

[1] Although as Kuhn and Sweetman (2002) note, geographical remoteness effects on indigenous outcomes may reflect cultural rather than spatial factors.

ages of 10 (year 5) and 12 (year 7). A similar pattern was found for Black versus White test performance in the US (Todd and Wolpin 2004), although the gaps we observe for indigenous students are substantially larger. We find that only a small proportion of the indigenous to ESB education performance gap is due to observable personal, school and spatial characteristics. We also show that indigenous students in rural areas for whom English is a second language perform particularly poorly, especially in the case of girls. To investigate the robustness of our results we adopt a number of sensitivity tests in the spirit of Todd and Wolpin (2003). Our findings suggests that a large part of the disadvantage is attributable to prior effects, which capture unobserved family and school effects, as well as unobservable individual mental capacity. This finding supplements the evidence presented by Hunter and Schwab (1998) who found that poor family and local social environments are strongly correlated with increased attendance and retention rates at school, and hence early school performance.

The remainder of the paper is organised as follows. Section II provides background on the state of Queensland and its indigenous population along with an overview of the data source. Section III sets out the empirical methodology. This is followed in section IV by a discussion of the methodological approach adopted in this paper. Section V discusses our findings, which is followed by our conclusions and a brief discussion of the implications for policy.

2 Background and Data

2.1 Background

Queensland is the third most populous state in Australia, after New South Wales and Victoria, with a population of 3,664,284 as at the end of 2001 (approximately 20% of the Australian population). It covers a large area of land (approximately 1,727,000 square kilometres), but roughly 66 per cent of the population reside in the relatively small south east corner of the state (ABS 2002a) centred around the state capital of Brisbane. At the time of the 2001 census, there were approximately 112,000 indigenous people living in Queensland, 27 per cent of the total indigenous Australian population (ABS 2002b). Although this represents only 3.2 per cent of the total Queensland population, it is a significant fraction of the indigenous population and reflects their very high spatial concentration, especially in the remote parts of the state. For instance, while only 1.5 per cent of the population of the Brisbane area is indigenous, 23.5 per cent of the Mount Isa region (in the far west of the state) is indigenous and in some areas of far northern Queensland and the Torres Strait Islands, the populations are up to 90 per cent indigenous.

There are two distinct indigenous populations in Queensland, Aborigines and Torres Strait Islanders. Aborigines are the predominate group with 87,322 residing in Queensland in 2001, compared to 16,415 Torres Strait Islanders. Whilst Aborigines are indigenous to mainland Australia, Torres Strait Islanders originate from islands in the stretch of water between the north of mainland

Australia and Papua New Guinea (the Torres Strait). However, a large proportion of the Torres Strait Islander population now resides on the mainland. Both groups have native languages other than English, but the extent to which these are the main language differs by location. For instance, whilst 81 percent of Torres Strait Islanders who still reside on the islands report an indigenous language or Creole as their main language, 70 percent of those residing on the mainland speak English as their main language (ABS 1997).

The Australian indigenous population was 21.6% more likely to be unqualified (Hunter and Schwab 1998). Only 22% of indigenous males and 23.4% of indigenous females continued their education up to age 17 years or beyond, whereas the figures or non-indigenous groups were 38.7% and 36.8%, respectively (Hunter and Schwab 2003). These differences in educational attainment partly reflect the fact that the estimated private rates of return to post compulsory secondary education is far lower for indigenous than for non-indigenous students (Daly and Liu 1997), although the rate of return is still significantly greater than zero (Hunter and Gray 2001). Indigenous students are substantially more likely to be suspended or expelled from school (Commonwealth 1997) and lose on average two to four years of schooling through absenteeism. The equivalent figure for non-indigenous groups is about one half of the indigenous level (Groome and Hamilton 1995).

3 Data

In this study we use four different data sources to construct an overall data set of pupil educational attainment. The primary data source refers to year 5 and year 7 records of the population of young people in government-funded schools in Queensland in 2001 supplied by the Education Department of the Queensland State Government (hereafter Education Queensland). Year 5 students in Queensland are approximately 10 years old and year 7 students are approximately 12 years old. The second data source is drawn from teacher personnel data (based on Education Queensland's human resource information system) for the year 2001. This includes data on the average experience of teachers employed at the school along with the total number of teacher hours per week for the school. Additionally we can control for the size of the school, which previous research has suggested creates scale economies in education production (Bradley and Taylor 1998). This data also enables us to identify whether the school is in a rural, remote or urban area. The inclusion of student's residential postcode in the primary data enables us to link this to 1996 Census data, which contains average adult income within each postcode district. Similarly, unemployment rates for local government areas (LGAs) are linked to the student via the postcode, which was obtained from the Federal Department of Employment, Workplace Relations and Small Business.

The two variables of particular interest in this study are the pupil's numeracy and literacy scores, and their ethnic group. The former are scaled to a national average of 600 for year 5 and 700 for year 7. Pupils can be categorized into one of four ethnic groups: those from a non-indigenous English speaking background (ESB), those from a non-indigenous non-English speaking background (NESB), Torres Strait Islanders and Aborigines.

INSERT TABLE 2

Our sample consists of all Queensland primary school students who were in year 7 in 2001 and who had a matching year 5 test score from 1999. The data set initially consists of 37,390 students, however 11,428 students are lost through attrition between year 5 and year 7. Table 2 presents some descriptive statistics for the sample of year 7 pupils split according to gender and indigenous group status. English is the second language spoken for a large proportion of NESB students, as well as for over a fifth of Torres Strait Islander students, and 7 percent of Aboriginal students. NESB students are the least likely to attend rural and remote schools, which reflects the urban bias in post-migration settlement, whereas indigenous students are much more likely to attend remote schools. Indigenous students also attend smaller schools, on average, than ESB and NESB students. There are only small differences in the average income of geographic areas of residence by ethnicity.

INSERT TABLE 3

Restricting our sample to this matched set of students has the potential to introduce bias in our statistical analysis, since attrition may be non-ignorable because of the non-random nature of the process. Several groups of students may fall out of the sample. First, individuals who have exited the public school system in favour of the private school sector in the period between year 5 and year 7. Second, our matched sample will also exclude individuals who were held back between years 5 and 7, those students whose families have migrated to other states or overseas and individuals who are no longer attending school. In the case of indigenous students this last point is worth noting as there is substantial evidence that indigenous Australians increasingly absent themselves throughout the period of compulsory schooling (Groome and Hamilton 1995). To investigate these issues in more depth, Table 3 presents test scores for students for whom we have year 5 test results but no matching year 7 test score. This set of individuals includes those students who attrit for the reasons previously mentioned, however, for comparison the table also includes test scores on our matched sample. For both ESB and NESB students, year 5 test scores are only marginally lower amongst attriters when compared to our matched sample, which implies that the year 5 test results for these groups for the matched sample should not be severely biased. However, for both indigenous groups test scores in the attrited sample are substantially (up to 40 points) lower than in the matched sample, which must mean that it is the less able indigenous groups who attrit. Hence, the findings in Table 3 suggest that analysis based on year 7 test scores will provide a lower bound estimate of the indigenous to non-indigenous difference in educational achievement.

INSERT TABLE 4

Table 4 presents average test scores by gender and ethnicity at both year 5 and year 7. For all ethnic groups girls outperform boys in literacy in both year 5 and year 7. Conversely, boys' numeracy performance is generally better than girls, although this difference is not as marked as that for literacy. ESB students at year 5 achieve test scores in line with the national benchmark of 600, as do NESB girls in literacy, however, by year 7 only the literacy levels of ESB girls reached the national benchmark of 700 points. Both groups of indigenous students underperform markedly when compared to the national benchmarks, and only just perform above the year 5 benchmark for numeracy at year 7, although Torres Strait Islanders do slightly better than Aboriginals. This suggests that by the age of 12 these groups are, on average, already 2 years behind the national average for numeracy.

To aid comparison across ethnic groups, mean deviations in average test score from the comparable ESB group are also presented. ESB students outperform NESB students by approximately 15 to 16 points at year 5, and 14 to 18 points at year 7. In turn, Torres Strait Islander and Aboriginal students perform substantially worse than NESB students. For instance, at year 5 indigenous students already score between 54 and 65 points lower average test scores than comparable ESB students, which also means that they lag the NESB group by 40 to 50 points, a group that one would have expected would be more seriously impeded by their relatively poorer language skills. Furthermore, for all indigenous groups this gap widens between year 5 and year 7, except in the case of literacy for male Torres Strait Islanders where there is a slight fall. Aborginal boys appear to perform worse than Torres Strait Islander boys at both literacy and numeracy. Thus, this data suggests that indigenous students significantly underperform in test scores taken early on in their educational careers and, relative to ESB students, this underperformance widens substantially between the ages of 10 and 12.

Table 5 extends the analysis further by presenting average test score attainment stratified by whether the student was attending an urban school or a rural/remote school. What is striking about the findings in Table 5 is that for ESB students there are only minor differences in average test scores between students from urban and rural/remote schools, becoming more pronounced for NESB students, and very marked for indigenous students. For instance, indigenous students in rural/remote schools score between 22 and 31 points less than their urban counterparts, which means that rural/remote indigenous students vastly underperform in comparison to rural/remote ESB students. At year 7 this differential ranges from 50 points for Torres Strait Islanders in literacy to 83 points for Aboriginal students in literacy, and as much as 93 points for Aboriginal females in numeracy. Indigenous girls in rural and remote locations appear to be particularly disadvantaged with respect to their ESB counterparts. In sum, the substantial differences in the performance of indigenous students in rural areas when compared with their ESB counterparts suggests an achievement gap of almost 2 whole years of schooling, an alarming difference.

4 Empirical Methodology

There is large literature on the determinants of educational attainment (reviewed in Hanushek (1986) and Haveman and Wolfe (1995)) which demonstrates the importance of family background on educational attainment (Loeb and Bound 1996, Jensen and Seltzer 2000). However, there are no consistent results on the impact of school quality on educational attainment. To date, there is no literature on educational attainment amongst indigenous groups, other than descriptive analyses referred to above.

Our modelling is based on the familiar educational production function (Hanushek 1992), and draws heavily on the notation and discussion in Todd and Wolpin (2003). They rightly describe a child's educational development as a cumulative process, influenced by the history of family and school inputs as well as inherited endowments, which can be described as a 'true' education production function technology. They also describe a wide range of education production functions that have been estimated in the literature, the underlying assumptions of these models and their shortcomings. In this section we describe the models that we are able to estimate with our data, and also highlight the limitations of those models.

Thus, the test scores (T) achieved by individual i in household j at age a is given by the equation (1) (i.e. equation (3) from Todd and Wolpin, 2003):

$$T_{ija} = f(F_{ij}(a), S_{ij}(a), \mu_{ij0}, \varepsilon_{ija}) \qquad (1)$$

where $F_{ij}(a)$ and $S_{ij}(a)$ are vectors of all relevant family and school variables, reflecting the input decisions of both sets of agents into the educational development of the child. Note that these inputs vary with age a. The two remaining terms refer to endowed mental capacity at conception (μ_{ij0}) and an error term (ε_{ija}), which captures measurement error in test scores. The main problem in attempting to estimate the regression analogue of equation (1) is that μ_{ij0} is not observable, but is sometimes proxied by parental education, and that available data typically has missing information on contemporaneous and historical family and school inputs. In view of these problems a host of approaches have been developed in the literature, a typical one being the so-called 'contemporaneous specification'. Given our particular interest in the differences in the test score performance of indigenous and non-indigeneous groups, an example of the contemporaneous specification is given by equation (2):

$$T_{ij12} = f[(ETH_{ij}, F_{ija} + S_{ija}) + \varepsilon^{'}_{ija}] \quad (2)$$

ETH_{ij} is the ethnicity of the child, in our case, non-English speaking background (NESB), Aboriginal, Torres Straight Islander or non-Indigenenous English speaking background (ESB), which are fixed over time. Notice that test score performance at age 12, T_{ij12}, is determined by current values of inputs, reflected by the fact that the vectors F and S no longer vary with age. Whilst our data contain several important school level covariates, such as per pupil teacher hours, teacher experience and school size, it is relatively poor with respect to family inputs. However, we do have the postcode of the household, and these postcode areas refer to fairly small geographical areas, which are assumed to be reasonably homogenous with respect to population characteristics. We map the average income, $INCOME$, for adults in each postcode location, k, as a proxy for family inputs. This is crude, but we expect that families in postcode areas with higher incomes are able to provide more complementary inputs to the education of their child than are families in low income areas. Family location choices may also affect school input decisions, however, in our particular context the issue is the geographic segregation of the indigenous ethnic groups, described earlier. To capture this latter effect we add two variables that refer to whether the school is located in a rural area or whether it is located in a remote area, reflected by the vector G_{ija}. Thus, the first model that we estimate is given by equation 3:

$$T_{ij12} = \beta_0 + \beta_1 ETH_{ij} + \beta_2 INCOME_{ik} + \beta_3 S_{ija} + \beta_4 G_{ija} + \varepsilon_{ija} \tag{3}$$

Given our earlier discussion, we expect that $\beta_{1NESB}, \beta_{1Aborigine}, \beta_{1Torres} < 0$, and also that $\beta_{1Aborigine}, \beta_{1Torres} < \beta_{1NESB}$. This formulation of the production function, whilst standard in the literature, has been shown to have several limitations, such as the idea that it is only contemporaneous inputs that matter for current attainment, that inputs do not change over time and that the contemporaneous inputs are uncorrelated with the unobservable, μ_{ij0}. Each of these assumptions can be challenged. For instance, if education production is a cumulative process then historical values of the inputs clearly matter, and also input decisions by families may change in response to prior (poor) test scores. Consequently, researchers have increasingly moved in the direction of estimating value-added education production functions.

The value-added specification involves adding a (baseline) measure of prior test score attainment, T_{ija-1}, to equation 3, and this covariate is regarded as a good proxy for unobserved family and school inputs, both historical and contemporaneous, as well as unobservable mental capacity, μ_{ij0}. The baseline measure of attainment should ideally be measured at the beginning of schooling, or the commencement of a particular stage of the educational process (i.e. primary or secondary schooling). Data limitations mean that we have to use test score performance at age 10, which is included in Equation 3 to give Equation 4. This is the second model (Model II) that we estimate.

$$T_{ij12} = \beta_0 + \beta_1 ETH_{ij} + \beta_2 INCOME_{ik} + \beta_3 S_{ija} + \beta_4 G_{ija} + \beta_5 T_{ij10} + \varepsilon_{ija} \quad (4)$$

Although this is now a very popular specification of the education production function for the reasons cited, it does make several restrictive assumptions about the nature of the production technology, and relaxing these assumptions also creates the problem of endogeneity with respect to lagged test score performance (Todd and Wolpin 2003). They show that this can lead to biased inference on all covariates, including ETH. We therefore estimate two further models in an attempt to get round these problems. In the first of these approaches (Model III) we simply replace the lagged test performance score, T_{ij10}, by its predicted value using earlier observations on inputs as instruments. Insofar as this approach gives consistent estimates of β_5 it should minimise the bias on other inputs, including ETH. The second approach (Model IV) involves the estimation of the 'test score gain' model, which is more restrictive than Models II and III because $\beta_5 = 1$, however, rather than using inputs measured at age 12 we use those measured at age 10. The assumption being made in this model is that decisions regarding inputs made by families and schools in response to test score performance at age 10 do not vary between the age of 10 and 12 but simply play out over the intervening period and affect the change in test score performance over the period. This model is given by equation 5, below:

$$T_{ij12} - T_{ij10} = \beta_0 + \beta_1 ETH_{ij} + \beta_2 INCOME_{ik} + \beta_3 S_{ij10} + \beta_4 G_{ij10} + \varepsilon_{ij10} \quad (5)$$

Notice that ETH is by definition fixed, whereas we fix the vectors $INCOME$, S and G at the value when is the pupil is aged 10, though in reality these may change if students change their school, for instance. In our data, 12% of students move school between age 10 and 12, and 15% move postcode (local area) across this period.

Finally, we perform a series of sensitivity tests on Models III and IV by estimating alternative specifications to investigate how these changes affect the parameters on ETH. We replace the $INCOME$ variable with a series of postcode fixed effects, which has the advantage of controlling for household behaviour within each particular postcode area. The results of this test are reported in Models III$'$ and IV$'$. It could also be argued that our vector of school inputs is incomplete. To test whether this is the case we use the school identification number to create school level fixed effects, and the results of this test are reported in Models III$''$ and IV$''$. In view of the high degree of spatial sorting of indigenous groups in Queensland, which creates very different peer groups for students at school, we remove the restriction that β_1 is the same for students in very different localities by re-estimating all of the models separately for students in urban and rural/remote areas.

5 RESULTS

Table 6 provides results from the estimation of Models I and II. In comparison to the raw differentials presented in Table 3, there is for all minority groups some reduction in the size of the achievement gap with respect to ESB students. Model I suggests that a proportion of the difference in test score performance is due to indigenous students possessing unfavourable observable family and school characteristics, since the estimated (negative) impact of ETH for both indigenous groups is less than the raw differences in test score performance. The raw gaps in performance between girls and boys are preserved, and Aboriginal boys perform marginally worse than their Torres Strait Islander counterparts in literacy and numeracy. School inputs also determine test score performance, insofar as students in remote schools and schools where teachers have less experience have a statistically significant negative effect on performance, albeit the latter is at a declining rate. For instance, students at remote schools attain, on average, between 6 and 12 points less than their equivalents at urban schools, except in the case of girls' numeracy. Average teacher hours per pupil appears to be positively related to test score performance.

INSERT TABLE 6

The introduction of a control for prior ability (Model II) results in a substantial reduction in the size of the differential between ESB pupils and other groups, with the indigenous groups test score gaps now looking more like the NESB 'raw' gap. Taken at face value our estimates suggest that educational performance is cumulative, insofar as there is a positive coefficient on the lagged test score variable, and that the achievement gap at age 12 ranges from -10 points for male Torres Strait Islanders in numeracy to -25 points for female Torres Strait islanders in literacy. For Aborigines the gap is roughly 20 points, which although lower than the raw gap is still substantial. Note, however, that all of the other estimates in Model II are reduced in magnitude by the inclusion of the lagged test score variable, reflecting the bias that can be induced as suggested in the previous section.

INSERT TABLE 7.

In Table 7 we presents the estimates of models III, III', III", IV, IV' and IV". For brevity we only present estimates of *ETH.* Model III replaces the lagged test performance score in model II, with a predicted lagged test score that is generated using characteristics as at age 10. Model IV is the test score gain model (equation 5). Model III' and IV' add a fixed effect to capture unobservable local area inputs and in turn III" and IV" include additional fixed effects for unobservable school inputs.

Looking first at the literacy results. The use of the predicted lagged test score variable suggests that the estimates of ETH in model II may have overstated the ethnic disadvantage in literacy. However, Aborigines still significantly underachieve against ESB and NESB students, whereas for Torres Strait Islanders this is only true of females. There are no clear indications of bias in the numeracy estimates of ETH in model II.

The inclusion of controls for local area effects (III') does not markedly change the estimates of ETH. However, the introduction of additional school level effects (III") leads to a widening of the difference between ESB and indigenous test score achievement, particularly in numeracy.[2]

The second panel of Table 7 presents the estimates of the test score gain models (Model IV). For literacy, the NESB group perform almost identically to the ESB group, however, Aboriginals and Torres Strait Islander experience a relative decline in achievement between ages 10 and 12. The only exception to this result is Torres Strait Islander boys who experience no relative decline. The largest decline in test score achievement is for female Aboriginals and Torres Strait Islanders in numeracy where achievement deteriorates by 19 points compared to their ESB counterparts. When we introduce controls for unobservable local area effects (Model IV') the estimates for the aboriginal group are largely unaffected, whereas there is an improvement in the achievement of Torres Strait Islanders in both literacy and numeracy, an effect that is further amplified when school fixed effects are introduced (Model IV''). These findings contrast with the raw differentials figures in Table 4, and suggest that prior

[2] In addition, the estimate of the difference between Torres Strait Islander and ESB literacy performance widens and becomes significant for boys.

attainment and unobserved family and school effects account for a substantial proportion of the deterioration in test score achievement of indigenous groups between the ages of 10 and 12. As we show there is also variation in the impact of these factors between the Aboriginal and Torres Strait Islander groups and between boys and girls.

5.1 Urban and Rural/Remote

In Table 8 we relax the assumption that the effect of ETH on test performance is the same for students in urban and those in rural/remote areas, because schooling and family inputs may differ substantially between these types of location and reflecting the high degree of spatial segregation of indigenous groups in Queensland. The education production functions that we report in Tables 8, 9 and 10 are otherwise identical to those reported earlier. Comparing the ETH coefficients across the urban and rural/remote models, we see that female indigenous students in rural/remote schools have substantially inferior test score achievement compared with their urban counterparts, after controlling for observable differences. The magnitude of these differentials between ESB and indigenous groups when compared to the raw differences (see Table 5) suggest that, whereas observable family and school inputs have only a limited impact on urban indigenous students, they have a marked impact on the size of the differential for rural/remote indigenous students, particularly in the case of girls. This implies that rural/remote indigenous students have observably less favourable characteristics.

INSERT TABLE 8

The different impact of ESL on test score performance between urban and rural/remote schools is also notable (see Table 8). Students for whom English is a second language perform between 23 and 45 points worse on test scores in rural/remote schools, an effect that is not apparent for urban students. Hence, indigenous and NESB students in the more remote areas of Queensland will have a larger educational disadvantage than their ethnicity alone would suggest if English is their second language.[3] For instance, Aboriginal girls in rural/remote areas for whom an indigenous language was their first language would be expected to achieve a literacy test score some 109 points less than an ESB student, which equates to a schooling deficit of more than 2 years.

The inclusion of controls for prior ability (Model II) leads to a large reduction in the estimates of indigenous education disadvantage. In fact, urban Torres Strait Islander boys no longer significantly underperform when compared to urban ESB boys. There is also a marked decrease in the relative disadvantage of rural/remote indigenous students when compared to urban indigenous students, suggesting that prior attainment, which in turn reflects unobserved mental capacity and family and school inputs up to the age of 10, accounts for a large fraction of the discrepancy between urban and rural/remote indigenous students' test score performance. Whilst the inclusion of prior ability controls results in the disappearance of the impact of ESL on rural/remote numeracy scores, its impact on literacy performance remains large and significant.

[3] This may explain why the estimate on the NESB variable becomes weaker in the rural/remote models.

INSERT TABLE 9

Table 9 presents the estimates of models III, III', III" modelled separately for urban and rural/remote schools. For urban students, the impact of including the predicted test score variable lead to a reduction in ESB-indigenous literacy test achievement gap, but no such change occurs for numeracy. For rural/remote students, the negative impact of being indigenous on literacy performance, relative to ESB students, decreases slightly, whereas the indigenous group effects move in the opposite direction for numeracy. In the case of urban students, the introduction of local area fixed effects leads to some worsening in indigenous effects for males but there is no clear patterns for females. For rural/remote students, local areas fixed effects have little impact, suggesting that there may be more limited variation in unobservables factors across these geographic areas.

For male students in urban schools, we note that the further inclusion of school level fixed effects serves to increase the estimated ESB to indigenous differential in numeracy test score achievement. A similar but less pronounced effect is evident for females. Torres Strait Islander boys in rural/remote schools appear to perform even worse relative to ESB students once school fixed effect controls are incorporated. This is quite marked, leading to a 70 per cent or greater increase in the size of estimated test score differential. For rural/remote Aborigines, only the estimates for numeracy are particularly affected by the inclusion of school level fixed effects.

INSERT TABLE 10

In Table 10 the estimates of models IV, IV', IV" modelled separately for urban and rural/remote students are presented. Model IV for urban students suggests that Aboriginal boys' test score achievement deteriorates between the ages of 10 and 12 when compared to ESB students. However, Torres Strait Islander boys in urban schools do not appear to suffer further cumulative disadvantage in relative educational achievement. Female indigenous students in urban schools suffer a substantial decrease in numeracy test score achievement. Also, whereas rural/remote indigenous boys' literacy performance does not decline relative to ESB students over this time period, they do suffer from a decrease in the test scores in numeracy. Indigenous girls in rural/remote schools do not face a relative decline in literacy test scores, but do suffer a large decrease in relative numeracy performance.

For urban students, the inclusion of local area fixed effects has no impact on the estimated ESB to indigenous test score gain differential. The only exception is female Torres Strait Islander's numeracy performance, where local area fixed effects reduce the estimated impact from -18 to -12 test score points. It is also the case for urban students that the gap between ESB and indigenous students is robust to the inclusion of school fixed effects (Model IV').

For rural students, the main impact of local area fixed effects is to make the differential insignificant for Torres Strait Islander boys in numeracy and girls in literacy. This suggests that the estimates in model (IV) were due to these students residing in areas that were unobservably worse (in terms of generating the respective test scores). The inclusion of school fixed effects leads to the female Aboriginal literacy differential becoming insignificant, and the female

Torres Strait Islander numeracy effect becomes only marginally significant. The impact of being an Aboriginal on test score gain in numeracy appears to be robust to the inclusion of school fixed effects.

6 CONCLUSION

This paper provides the first econometric study of primary school test score achievement for indigenous groups in Australia. We use a unique database to examine the magnitude of the test score differential between indigenous and students from a non-indigenous English speaking background (ESB) at age 12 and analyse how this gap evolves between the ages of 10 and 12. To do this, we estimate a range of education production functions, following Todd and Wolpin (2003), in an attempt to minimise the bias in our estimates of the test score differential. Furthermore, not only do we disaggregate indigenous students into two distinct ethnic groups, namely Aboriginal Australians and Torres Strait Islanders, we also investigate the impact of the spatial segregation of these groups on their educational attainment.

Our raw data suggests that indigenous students are on average over 70 points behind in numeracy and roughly 60 points behind in literacy (where the benchmark average is 700 points). Controlling for observable family and school inputs leads to a modest reduction in the level and change in the gaps, suggesting that contemporaneous inputs are not substantial determinants of the observed differential. However, the inclusion of prior attainment, which captures historical inputs of family and school, as well as reflecting unobservable individual mental capacity, causes the differential to fall substantially. For example, the ESB to indigenous literacy differential reduces to approximately 20 points, and between 10 to 20 points for numeracy. Indigenous students in rural/remote areas do particularly poorly, especially those for whom whom English is a second language. Controlling for prior ability again leads to a reduction in the magnitude of relative disadvantage, such that it is more comparable with their urban counterparts. This suggests that indigenous students in rural/remote schools have historically worse family and school characteristics than their urban indigenous counterparts.

We undertake of sensitivity tests. In particular, we estimate models with predicted prior attainment and a test score gain model for performance between ages 10 and 12. These show that the impact of being indigenous is over-estimated especially with respect to literacy, and in the case of Torres Strait Islander boys there is no longer an estimated differential. However, for rural/remote students, particularly girls, the estimated differentials were robust to controlling for this potential source of endogeneity. The test score gain model suggests that indigenous students are falling further behind in numeracy between the ages of 10 and 12. In addition, female indigenous students in rural/remote schools experience a relative decline in literacy performance. Further sensitivity analyses involved the use of fixed effects for the local area and school. Largely our estimates of indigenous to ESB achievement differentials were robust to their inclusion.

Our results show that Aborigine and Torres Strait Islander should be treated separately in studies of indigenous educational disadvantage. Nevertheless, for both groups it is evident that early interventions are required to address indigenous underperformance, particularly in rural/remote areas, as their performance is far inferior to ESB students even at the age of 10, and in some key skill areas deteriorates over the next two years. Addressing indigenous underachievement in education is clearly important due to the evidence that pre-market factors have a large conditional in subsequent labour market performance for minority groups (Neal and Johnson 1996, Carneiro et al 2003, Todd and Wolpin 2004). An aim of future research is to further disentangle the effect of unobserved family and unobserved ability in contributing pre-market disadvantage of indigenous communities.

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Table 1: International Comparisons of Indigenous Arrest and Labour Market Outcomes: 1990-1991. [4]

	No of Arrests per 1,000 adults	Unemployment Rate	Employment to Population	Participation Rate
Australian Indigenous	168.5 (8.10)	30.84 (2.66)	37.10 (0.67)	53.5 (0.85)
Canadian Aborigine	34.2 (7.44)	19.40 (1.94)	51.83 (0.85)	64.3 (0.94)
New Zealand Maori	216.5 (4.78)	24.70 (2.84)	45.70 (0.78)	60.7 (0.95)
American Indian	138.2 (1.48)	7.90 (2.31)	47.20 (0.89)	55.1 (0.97)

[4] Source: Borland and Hunter (2000).
Ratio of indigenous to non-indigenous in brackets

Table 2: Summary Statistics

	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
ESL	-	-	0.40	0.46	0.20	0.25	0.07	0.07
Rural School	0.23	0.23	0.14	0.11	0.17	0.15	0.22	0.23
Remote School	0.08	0.08	0.08	0.06	0.22	0.22	0.22	0.23
School Enrolment	519.19	518.54	545.80	542.45	450.56	457.38	430.79	437.45
Adult Average Income ($)	398.79	399.09	407.03	403.73	390.71	390.10	388.75	396.08
Unemployment Rate	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Teacher Hours: Pupil	0.61	0.62	0.61	0.61	0.57	0.56	0.58	0.59
Average Teacher Experience (days)	148.56	148.34	148.26	151.29	140.77	139.38	138.26	140.54
Observations	10891	10832	1340	1242	295	272	552	546

Table 3: Attrition Statistics

	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Not in Sample								
Literacy Year 5	596.56	623.42	585.07	609.91	528.00	539.85	501.84	532.66
Numeracy Year 5	596.44	590.81	581.60	571.92	507.33	504.88	492.82	506.96
No.	4812	4371	567	517	227	149	395	390
In Sample								
Literacy Year 5	603.51	629.51	587.45	613.44	546.98	572.96	549.40	571.31
Numeracy Year 5	603.32	597.53	587.22	582.47	538.13	539.27	538.54	540.12
Observations	10891	10832	1340	1242	295	272	552	546

Table 4: Test Scores by Ethnicity

	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	603.51	629.51	587.45	613.44	546.98	572.96	549.40	571.31
Literacy Year 7	674.00	706.45	657.89	691.27	620.02	639.59	611.35	642.13
Numeracy Year 5	603.32	597.53	587.22	582.47	538.13	539.27	538.54	540.12
Numeracy Year 7	688.80	681.85	670.24	667.95	617.20	605.44	610.87	605.74
				Differences from ESB				
Literacy Year 5			-16.06	-16.07	-56.53	-56.55	-54.11	-58.20
Literacy Year 7			-16.11	-15.18	-53.98	-66.86	-62.65	-64.32
Numeracy Year 5			-16.11	-15.06	-65.19	-58.26	-64.78	-57.41
Numeracy Year 7			-18.56	-13.90	-71.60	-76.41	-77.93	-76.11
Observations	10891	10832	1340	1242	295	272	552	546

Table 5: Test Scores by Ethnicity and Region

	Urban							
	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	606.03	631.25	590.99	615.16	550.82	580.90	560.86	586.22
Literacy Year 7	676.76	708.03	660.40	693.37	625.20	651.68	621.58	662.20
Numeracy Year 5	605.00	597.52	589.19	583.83	544.56	546.23	551.78	556.43
Numeracy Year 7	690.08	681.40	671.30	669.99	626.72	613.25	622.87	620.28
				Differences from ESB				
Literacy Year 5			-15.04	-16.09	-55.21	-50.35	-39.17	-45.03
Literacy Year 7			-16.36	-14.66	-51.56	-56.35	-56.08	-45.83
Numeracy Year 5			-15.81	-13.49	-60.44	-51.29	-53.22	-41.09
Numeracy Year 7			-18.78	-11.41	-63.36	-68.15	-67.21	-61.12
Observations								
				Rural and Remote				
	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	597.81	625.60	575.09	605.05	541.12	559.89	535.05	554.59
Literacy Year 7	667.76	702.89	649.24	681.33	611.81	618.92	598.76	619.52
Numeracy Year 5	599.49	597.59	580.07	575.73	527.18	526.41	521.58	521.80
Numeracy Year7	685.92	682.88	666.21	657.49	602.86	591.93	596.37	589.78
				Differences from ESB				
Literacy Year 5			-22.72	-20.55	-56.69	-65.71	-62.76	-71.01
Literacy Year7			-28.52	-21.56	-55.95	-51.97	-69.84	-83.37
Numeracy Year 5			-18.52	-23.76	-72.31	-71.18	-77.91	-75.79
Numeracy Year 7			-19.42	-21.86	-83.06	-90.85	-89.55	-93.10
Observations								

Table 6: Year 7 Attainment Models [5]

	Model I			
	Literacy		Numearcy	
	Males	Females	Males	Females
NESB	-15.67[2.82]	-12.21[3.27]	-17.83[3.56]	-14.13[3.74]
Aborigine	-55.08[3.43]	-57.59[4.18]	-69.72[4.45]	-69.79[4.30]
Torres Strait Islander	-47.70[4.22]	-58.20[6.41]	-64.50[5.71]	-68.54[6.99]
ESL	-2.75[4.71]	-8.00[5.55]	-2.11[5.89]	1.64[5.81]
School Size	0.01[0.006]	0.02[0.005]	0.01[0.007]	0.01[0.007]
Remote School	-11.71[3.91]	-7.07[4.04]	-8.03[4.75]	-5.98[4.49]
Rural School	1.50[2.76]	3.00[2.71]	7.55[3.21]	10.89[3.37]
Average Income	0.11[0.02]	0.11[0.02]	0.13[0.02]	0.13[0.02]
Unemployment Rate	-0.91[0.29]	-0.87[0.27]	-0.99[0.34]	-0.98[0.33]
Teacher Hours:Pupil	18.00[7.09]	24.61[6.09]	27.18[9.02]	37.28[8.18]
Average Teacher Experience	0.01[0.003]	0.01[0.002]	0.02[0.004]	0.02[0.003]
Average Teacher Experience^2	-7.7e-07[3.8e-07]	-8.5e-07[2.8e-07]	-1.0e-06[4.2e-07]	-7.8e-07[3.7e-07]
Constant	577.82	606.86	561.67	558.26
r^2	0.08	0.08	0.09	0.09
	Model II			
Prior Ability	0.68[0.01]	0.68[0.01]	0.92[0.01]	0.94[0.01]
NESB	-5.73[1.96]	-3.04[2.39]	-7.06[2.17]	-2.81[2.56]
Aborigine	-22.49[2.44]	-21.60[2.60]	-15.92[2.54]	-20.85[2.77]
Torres Strait Islander	-13.09[3.40]	-24.94[4.45]	-10.35[4.51]	-20.43[3.91]
ESL	1.15[3.24]	-2.74[3.49]	8.50[3.50]	6.97[3.20]
School Size	0.006[0.005]	0.01[0.004]	0.003[0.004]	0.004[0.004]
Remote School	-5.45[3.08]	-1.84[2.89]	1.64[3.13]	-1.00[2.83]
Rural School	2.05[2.02]	2.18[2.03]	5.68[2.21]	5.89[2.17]
Average Income	0.04[0.01]	0.04[0.01]	0.04[0.01]	0.05[0.01]
Unemployment Rate	-0.44[0.21]	-0.54[0.19]	-0.11[0.22]	-0.04[0.25]
Teacher Hours:Pupil	12.21[5.27]	11.79[4.74]	15.54[6.68]	15.74[6.64]
Average Teacher Experience	0.11[0.08]	0.17[0.07]	0.24[0.08]	0.013[0.07]
Average Teacher Experience^2	-0.0001[0.0002]	-0.0004[0.0002]	-0.0005[0.0002]	-0.0002[0.0002]
Constant	227.03	238.67	79.35	75.94
r^2	0.45	0.46	0.61	0.60
Observations	13048	12875	13048	12875

[5] [ ] are the standard errors. Standard errors are estimated using the Huber/White robust estimator and are clustered on the student's school. Observations are not necessarily independent within a school but are independent across schools. The omitted cases are ESB, Urban School and English is the student's first language.

Table 7: Year 7 Estimates - Model III (predicted year 5 test score) and Model IV (test score gain model) [6]

	III				IV			
	Male		Female		Male		Female	
	Lit	Num	Lit	Num	Lit	Num	Lit	Num
NESB	-3.56[2.55]	-7.23[3.12]	-1.42[2.78]	-2.83[3.43]	-0.87[2.06]	-5.98[2.28]	1.31[2.58]	-1.98[2.49]
Aborigine	-15.00[3.19]	-16.23[4.19]	-14.78[3.44]	-20.65[4.16]	-8.49[2.63]	-13.06[2.49]	-5.97[2.46]	-18.92[2.67]
Torres Strait Islander	-5.19[4.04]	-10.70[6.18]	-18.59[4.82]	-20.45[5.52]	2.09[3.86]	-7.30[4.97]	-10.28[4.57]	-19.24[3.81]
	III' (Local Area Fixed Effects)				IV'(Local Area Fixed Effects)			
NESB	-5.98[2.35]	-9.14[3.03]	-2.76[2.63]	-3.01[3.28]	-1.74[1.98]	-7.26[1.96]	0.50[2.37]	-2.31[2.16]
Aborigine	-17.28[3.07]	-17.66[4.10]	-16.10[3.39]	-21.20[4.03]	-7.77[2.60]	-13.30[2.47]	-4.99[2.58]	-17.82[2.55]
Torres Strait Islander	-6.21[4.03]	-8.81[5.47]	-15.85[4.46]	-18.50[5.36]	4.84[3.71]	-2.15[4.00]	-6.31[3.93]	-13.78[3.69]
	III" (Local Area & School Fixed Effects)				IV"(Local Area & School Fixed Effects)			
NESB	-9.11[2.51]	-11.72[3.27]	-4.67[2.83]	-4.20[3.53]	-3.05[2.05]	-7.15[2.01]	0.01[2.42]	-2.15[1.34]
Aborigine	-17.75[3.53]	-22.00[4.73]	-15.34[3.80]	-23.78[4.44]	-6.34[2.67]	-15.35[2.57]	-1.99[2.64]	-15.98[2.63]
Torres Strait Islander	-10.32[4.63]	-12.45[6.19]	-17.25[4.88]	-24.56[6.03]	2.37[3.79]	-3.50[4.04]	-1.96[4.11]	-10.38[3.65]

[6] [ ] are the standard errors. Standard errors are estimated using the Huber/White robust estimator and are clustered on the student's school. Observations are not necessarily independent within a school but are independent across schools.The omitted case is ESB.

Table 8: Year 7 Attainment Models - Urban vs Rural/Remote Students [7]

	Model I							
	Urban				Rural and Remote			
	Literacy		Numearcy		Literacy		Numearcy	
	Males	Females	Males	Females	Males	Females	Males	Females
NESB	-16.95[3.21]	-15.93[3.20]	-19.42[3.83]	-16.67[4.01]	-13.12[4.69]	-2.11[6.89]	-14.74[6.86]	-0.07[7.25]
Aborigine	-47.06[3.93]	-41.38[3.91]	-57.89[5.21]	-58.36[4.95]	-62.24[5.44]	-74.37[6.40]	-81.67[6.88]	-83.83[6.41]
Torres Strait Islander	-47.33[4.95]	-52.51[6.48]	-58.84[6.90]	-65.66[7.30]	-45.58[7.70]	-64.00[12.38]	-70.88[9.79]	-66.88[13.19]
ESL	2.43[4.80]	3.50[4.75]	4.01[5.97]	12.91[5.66]	-23.85[9.25]	-45.20[11.63]	-23.11[11.40]	-38.52[10.07]
School Size	0.18[0.008]	0.02[0.006]	0.02[0.008]	0.02[0.01]	0.01[0.01]	0.005[0.008]	-0.01[0.01]	-0.02[0.01]
Remote School					-9.14[3.84]	-4.30[3.78]	-12.78[4.93]	-13.65[4.56]
Average Income	0.22[0.03]	0.22[0.02]	0.23[0.03]	0.21[0.03]	0.02[0.02]	0.01[0.02]	0.05[0.02].	0.05[0.02]
Unemployment Rate	-0.37[0.33]	-0.40[0.30]	-0.38[0.40]	-0.59[0.38]	-0.31[0.50]	-0.13[0.51]	-0.49[0.58]	-0.25[0.67]
Teacher Hours: Pupil	16.70[16.55]	23.16[13.50]	32.80[17.94]	39.88[16.47]	9.57[7.13]	15.05[5.75]	14.00[8.98]	20.74[7.44]
Average Teacher Experience	0.67[0.19]	0.51[0.15]	0.96[0.23]	0.76[0.18]	0.18[10.2]	0.24[0.09]	0.35[0.12]	0.23[0.12]
Average Teacher Experience^2	-0.001[0.0005]	-0.001[0.0004]	-0.002[0.0007]	-0.002[0.0005]	-0.0003[0.0004]	-0.001[0.0002]	-0.0006[0.0003]	-0.0002[0.0003]
Constant	519.41	565.25	504.52	525.58	648.77	685.19	650.61	659.08
r^2	0.09	0.08	0.09	0.09	0.08	0.12	0.10	0.12
	Model II							
Prior Ability	0.68[0.01]	0.66[0.01]	0.93[0.01]	0.95[0.01]	0.67[0.02]	0.71[0.01]	0.89[0.02]	0.89[0.02]
NESB	-8.66[2.36]	-4.79[2.56]	-8.01[2.32]	-2.07[2.93]	0.73[3.31]	0.037[5.10]	-3.70[4.51]	-4.46[4.90]
Aborigine	-21.11[3.22]	-13.80[3.02]	-14.94[3.34]	-20.54[3.52]	-22.92[3.64]	-29.50[3.96]	-18.53[3.84]	-23.50[4.10]
Torres Strait Islander	-12.89[3.98]	-21.21[4.19]	-6.82[4.70]	-18.81[4.44]	-11.25[6.09]	-30.65[9.09]	-16.70[8.71]	-22.51[7.35]
ESL	6.49[3.70]	2.54[3.46]	2.05[8.41]	8.06[3.31]	-15.58[5.78]	-18.20[6.97]	2.05[8.40]	-2.00[7.50]
School Size	0.007[0.006]	0.01[0.005]	-0.006[0.006]	0.01[0.005]	0.01[0.01]	0.007[0.006]	-0.005[0.007]	-0.01[0.005]
Remote School					-4.97[3.08]	-0.10[2.82]	-4.39[3.46]	-7.18[3.00]
Average Income	0.09[0.02]	0.09[0.02]	0.04[0.01]	0.07[0.02]	0.002[0.02]	-0.01[0.015]	0.04[0.01]	0.02[0.01]
Unemployment Rate	-0.44[0.24]	-0.45[0.23]	0.62[0.41]	0.06[0.30]	0.036[0.40]	0.14[0.35]	0.62[0.41]	0.55[0.43]
Teacher Hours: Pupil	13.79[11.98]	11.92[11.29]	7.92[6.78]	26.81[13.10]	7.63[5.74]	6.76[4.60]	7.91[6.78]	5.85[6.13]
Average Teacher Experience	0.19[0.15]	0.18[0.12]	0.15[0.08]	0.39[0.11]	-0.004[0.10]	0.10[0.07]	0.15[0.08]	0.009[0.08]
Average Teacher Experience^2	-0.0004[0.0004]	-0.0004[0.0003]	-0.0003[0.0003]	-0.001[0.0003]	0.0001[0.0003]	-0.0002[0.0001]	-0.0003[0.0003]	0.00[0.00]
Constant	202.55	224.09	118.56	24.83	254.25	248.81	118.56	135.18
r2	0.46	0.45	0.60	0.60	0.45	0.50	0.60	0.59
Observations	9088	8995	9088	8995	3960	3618	3960	3618

[7] [ ] are the standard errors. Standard errors are estimated using the Huber/White robust estimator and are clustered on the student's school. Observations are not necessarily independent within a school but are independent across schools. The omitted cases are ESB and student's first language is English.

Table 9: Year 7 Estimates - Model III (predicted test score)- Urban vs Rural/Remote [8]

	Urban III				Rural/Remote III			
	Male		Female		Male		Female	
Urban	Lit	Num	Lit	Num	Lit	Num	Lit	Num
NESB	-7.03[2.78]	-7.42[3.42]	-3.66[2.96]	-1.73[3.70]	2.42[4.05]	-5.67[5.92]	2.03[5.40]	-3.72[6.76]
Aborigine	-15.92[3.89]	-13.28[5.13]	-16.52[5.08]	-17.03[5.03]	-19.13[4.63]	-27.29[6.17]	-24.68[5.05]	-30.13[5.81]
Torres Strait Islander	-5.13[4.85]	-4.12[6.65]	-9.23[4.17]	-16.83[6.16]	-7.67[6.32]	-23.70[8.28]	-27.73[7.41]	-26.38[8.59]
	III' (Local Area Fixed Effects)				III' (Local Area Fixed Effects)			
NESB	-8.97[2.79]	-8.48[3.51]	-4.79[3.01]	-3.40[3.75]	1.97[4.60]	-9.68[6.28]	-1.38[5.80]	-1.10[7.07]
Aborigine	-19.14[3.93]	-17.82[5.19]	-10.88[4.32]	-15.55[5.21]	-16.41[5.12]	-28.79[6.90]	-23.95[5.73]	-31.79[6.71]
Torres Strait Islander	-7.74[4.92]	-5.68[6.88]	-14.62[5.22]	-11.86[6.40]	-4.62[7.42]	-19.48[9.53]	-20.76[9.06]	-29.83[10.74]
	III" (Local Area & School Fixed Effects)				III" (Local Area & School Fixed Effects)			
NESB	-10.67[2.94]	-12.77[3.79]	-5.99[3.27]	-5.90[4.03]	-6.82[5.50]	-12.42[7.31]	-2.05[6.49]	-0.08[8.30]
Aborigine	-19.94[4.43]	-24.94[5.99]	-13.18[4.79]	-19.51[5.70]	-20.17[6.57]	-36.25[9.16]	-17.99[7.07]	-31.19[8.38]
Torres Strait Islander	-9.74[5.65]	-13.53[7.88]	-13.74[3.27]	-23.56[7.41]	-19.44[9.17]	-33.33[11.81]	-25.08[10.27]	-31.31[11.97]

[8] [ ] are the standard errors. Standard errors are estimated using the Huber/White robust estimator and are clustered on the student's school. Observations are not necessarily independent within a school but are independent across schools.The omitted case is ESB.

Table 10: Year 7 Estimates - Models IV (test score gain)- Urban vs Rural/Remote [9]

	Urban IV				Rural/Remote IV			
	Male		Female		Male		Female	
Urban	Lit	Num	Lit	Num	Lit	Num	Lit	Num
NESB	-4.78[2.43]	-7.51[2.30]	0.58[2.48]	-1.60[2.34]	7.68[3.75]	−1.70[3.77]	2.32[4.68]	-3.51[4.67]
Aborigine	-9.44[3.39]	-13.22[3.20]	-0.38[3.46]	-19.52[3.26]	-4.69[3.84]	-12.26[3.86]	-11.31[3.71]	-17.24[3.71]
Torres Strait Islander	3.05[4.43]	-3.66[4.19]	-6.14[4.55]	-18.12[4.29]	4.34[5.66]	-12.22[5.69]	-16.36[5.97]	-20.06[5.96]
	IV' (Local Area Fixed Effects)				IV' (Local Area Fixed Effects)			
NESB	-5.77[2.45]	-6.77[2.30]	0.34[2.51]	-2.12[2.32]	8.70[3.93]	-9.14[3.89]	0.20[4.90]	-3.20[4.80]
Aborigine	-8.99[3.40]	-13.29[3.19]	-1.40[3.49]	-17.29[3.24]	-4.11[4.07]	-13.70[4.03]	-9.58[3.95]	-17.54[3.88]
Torres Strait Islander	3.50[4.44]	-1.43[4.16]	-4.71[4.62]	-11.83[4.28]	10.14[6.31]	-2.21[6.25]	-11.15[7.39]	-17.70[7.25]
	IV" (Local Area & School Fixed Effects)				IV" (Local Area & School Fixed Effects)			
NESB	-6.45[2.48]	-7.47[2.31]	0.53[2.53]	−1.61[2.32]	8.14[4.25]	−6.91[4.08]	-4.42[5.36]	-1.81[5.22]
Aborigine	-8.73[3.50]	-14.09[3.26]	-0.15[3.57]	-13.26[3.27]	0.71[4.45]	-17.86[4.29]	-6.08[4.44]	-17.61[4.32]
Torres Strait Islander	2.76[4.53]	-3.34[4.21]	1.61[4.77]	-11.22[4.37]	4.07[6.75]	-6.17[6.51]	-9.53[7.76]	-13.06[7.55]

[9] [ ] are the standard errors. Standard errors are estimated using the Huber/White robust estimator and are clustered on the student's school. Observations are not necessarily independent within a school but are independent across schools.The omitted case is ESB.