The magnitude of educational disadvantage amongst indigeneous minority groups in Australia *

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Abstract

Indigenous groups are amongst the most disadvantaged minority groups in the developed world. This paper examines educational disadvantage of indigenous Australians by assessing academic performance at a relatively early age. We find that, by the age of 10, indigenous Australians are substantially behind non-indigenous Australians in academic achievement. Their relative performance deteriorates further over the next two years. School and locality do not appear to be important determinants of the indigenous to non-indigenous achievement gap. However, remoteness, indigenous ethnicity and language use at home have a marked influence on educational achievement. A current focus of Australian indigenous policy is to increase school resources, our results suggest that this will not, on its own, eliminate indigenous educational disadvantage.

KEYWORDS: Educational Achievement, Indigenous Minorities.

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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), 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 is determined by family and school inputs as well as racial factors (Todd and Wolpin 2004).

In this paper we examine the educational performance of indigenous Australians compared to that of non-indigenous Australians. Specifically, we investigate the magnitude of educational disadvantage amongst indigenous groups and show how this becomes progressively worse as these student groups get older. To do this we focus on test score performance in both literacy and numeracy of Queensland students in senior primary school at ages 10 and 12. Evidence from the US documents how gaps develop between racial minorities and the majority group, in some instances widening as the length of time in the school system increases (Carneiro et al 2003, **?**). However, there is very little comparable evidence for indigenous minority groups.

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 (Hunter 1996). 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). Furthermore, for many indigenous children, and especially those in rural and remote areas, English will be a second language (ESL) which may further compound the disadvantage associated with attending relatively poor 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). We also distinguish between Aboriginal Australians and Torres Strait Islanders, who have different ethnic backgrounds, customs and languages. The two groups typically have been treated as a single group in previous research, which as we shall show is incorrect.[1] Lastly, this study provides an analysis of the correlation between geographical remoteness and indigenous educational attainment.[2] As such we provide insights that may be generalised to other indigenous minority populations, such as those in the US and Canada.

[1] A notable exception is Biddle et al (2004) which includes an examination of differences in secondary educational participation between Aborigines and Torres Strait Islanders.

[2] Kuhn and Sweetman (2002) argue, however, that the effect of geographical remoteness on indigenous outcomes may reflect cultural rather than spatial factors.

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 national benchmark standards. 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 by age 12. Furthermore, these differences between ESB and indigenous groups, in most cases, widen between the ages of 10 (year 5) and 12 (year 7). 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. Only a small proportion of the indigenous to ESB education performance gap appears to be due to observable contemporaneous personal, school and spatial characteristics. A large part of the disadvantage is attributable to prior attainment effects, which capture prior family and school effects, as well as endowed individual mental ability.

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, which is followed in section IV by a discussion of our results. Section V concludes with a brief discussion of the implications for policy.

2 Background and Data

2.1 Background

Queensland is the third most populous state in Australia with a population of 3.7 million according to the 2001 census. It covers approximately 1.7 million square kilometres, but roughly 66% of the population live in the area of south east Queensland centred around the state capital of Brisbane (ABS 2002a). According to the 2001 census, there were approximately 112,000 indigenous people living in Queensland, 27% of the total indigenous Australian population (ABS 2002b). The indigenous population is highly spatially concentrated, especially in the remote parts of the state. For instance, while only 1.5% of the population of the Brisbane area is indigenous, 23.5% 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% indigenous.

Two distinct indigenous populations reside in Queensland, Aborigines and Torres Strait Islanders. Aborigines are the predominate group.[3] 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

[3] 87,322 Aborigines resided in Queensland in 2001, compared to 16,415 Torres Strait Islanders.

the main language differs by location. For instance, whilst 81% of Torres Strait Islanders who still reside on the islands report an indigenous language or Creole as their main language, 70% of those residing on the mainland speak English as their main language (ABS 1997).

As at 2001, only 29.8% of indigenous males and 26.0% of indigenous females possessed post-school qualifications compared to 50.1% and 39.5%, respectively, for the non-indigenous population (Hunter and Schwab 2003). 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).

2.2 Data

This study uses four different data sources. The main data source refers to year 5 (age approximately 10 years) and year 7 (age approximately 12 years) records of the population of students in government-funded schools in Queensland in 2001 supplied by the Education Department of the Queensland State Government (hereafter Education Queensland). 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). These data also enable 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. [4] Similarly, unemployment rates for local government areas (LGAs) are linked to the student via the postcode, these were obtained from the Federal Department of Employment and Workplace Relations.

The two variables of particular interest in this study are the pupil's numeracy and literacy scores The test scores are scaled to a national average of 600 for year 5 and 700 for year 7. Hence, the average student will progress 100 points in test score attainment over 2 years of schooling. We focus our discussion on these absolute scaled test scores as a measure of student achievement because they best capture the change in educational performance as students get older (Todd and Wolpin 2004). However, we also report z-score results to provide some illustration of the magnitude of relative indigenous performance.

Our sample consists of all Queensland primary school students who were in year 7 in 2001 and for whom we also observe a year 5 test score in 1999. The data set initially consists of 37,390 students, however 11,428 students are lost through attrition between year 5 and year 7, which we discuss below. Descriptive statistics for the sample of year 7 pupils split according to gender and

[4] Note, however, that variations in income between geographic areas (measured here at a postcode level) are less than within area variations in income (Hunter and Gregory 1996). Note also that non-indigenous groups may locate in remote areas in search of well paid jobs in the mining industries, whereas the location decisions of indigenous groups are associated with their historical ties to the areas.

indigenous group status are presented in Appendix Table A1. 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, but only 7% of Aboriginal students. Indigenous students are much more likely to attend remote schools.

INSERT TABLE 1

Restricting our sample to the set of students with both year 5 and year 7 test scores 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. There is attrition in our sample, one of the reasons is non-attendance. This is particularly an issue for indigenous Australians who increasingly absent themselves throughout the period of compulsory schooling (Groome and Hamilton 1995). To investigate the possible impact of attrition on our results Table 1 presents test scores for students for whom we have year 5 test results but no matching year 7 test score and 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 on average it is less able indigenous students who attrit.[5] Further investigation of the higher moments of the test score distribution for those who attrited revealed that they

[5] Although this average effect might mask variations by reason of attrition, which we do not observe.

were close to normally distributed. Overall, the findings in Table 1 suggest that analysis based on students for whom we observe both year 5 and year 7 test scores will provide a lower bound estimate of the indigenous to non-indigenous difference in educational achievement.

INSERT TABLE 2

The upper panel of Table 2 presents average test scores and associated standard deviations (in parentheses) by gender and ethnicity at both year 5 and year 7. For all ethnic groups, girls outperform boys in literacy. Conversely, boys' numeracy performance is generally better than girls, although this difference is not as marked as that for literacy. ESB students outperform NESB students by approximately 15 to 16 points at year 5, and 14 to 18 points at year 7. 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. At year 5 indigenous students already achieve between 54 and 65 points lower average test scores than comparable ESB students. Generally, for both indigenous groups this gap widens between year 5 and year 7. Aborginal boys appear to perform worse than Torres Strait Islander boys at both literacy and numeracy.

The lower panel of Table 2 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 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 10 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 male Torres Strait Islanders in literacy to as much as 93 points for Aboriginal females in numeracy.

In sum, the substantial differences in the performance of indigenous students in rural/remote areas when compared with their ESB counterparts suggests an achievement gap of almost 2 whole years of schooling, an alarming difference.

3 Empirical Methodology

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. This section describes the models that we are able to estimate with our data, and also highlights the limitations of these models.

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

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

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}). 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). Our first model is the so-called 'contemporaneous specification', referred to as Model I, given by Equation 2:

$$T_{ij12} = \beta_0 + \beta_1 ETH_{ij} + \beta_2 INCOME_{ik12} + \beta_3 U_{ik12} + \beta_4 S_{ij12} + \beta_5 G_{ij12} + \varepsilon_{ij12} \tag{2}$$

Our particular interest is the differences in the test score performance of indigenous and non-indigeneous groups, we specify a variable ETH_{ij}, which is the ethnicity of the child and is obviously fixed over time. It is expected that $\beta_{1NESB}, \beta_{1Aborigine}, \beta_{1Torres} < 0$, and also that $\beta_{1Aborigine}, \beta_{1Torres} < \beta_{1NESB}$. Whilst our data contain several important school level covariates, it is relatively poor with respect to family inputs. We do, however, have the postcode of the household, and therefore map the average income, $INCOME$, for adults in each geographical area, k, to each student. This is crude, but we expect that, after controlling for location, 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. Using a similar mapping process we also include the local area unemployment rates (U). We capture the effect of geographic segregation by including two variables that indicate whether the school is located in a rural area or in a remote area (G_{ij12}). Finally, $\varepsilon^{'}_{ij12}$ is an additive error term. In such a specification the error term includes all the omitted factors; the history of past inputs, endowed mental ability and measurement error (Todd and Wolpin 2003).

This formulation of the production function, whilst standard in the literature, has been shown to have several limitations, such as the assumptions that only contemporaneous inputs 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 2, and this covariate is regarded as a proxy for unobserved historical family and school inputs, 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 2 to give Equation 3 (Model II).

$$T_{ij12} = \beta_0 + \beta_1 ETH_{ij} + \beta_2 INCOME_{ik12} + \beta_3 U_{ik12} + \beta_4 S_{ij12} + \beta_5 G_{ij12} + \beta_5 T_{ij10} + \varepsilon_{ij12} \quad (3)$$

This model makes several restrictive assumptions about the nature of the production technology which relate to the problem of endogeneity of unobserved endowed mental capactiy with respect to lagged test score performance (Todd and Wolpin 2003). 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, such as income and school characteristics, 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 as it constrains $\beta_5 = 1$, however, rather than using inputs measured at age 12 we use those measured at age 10. This assumes 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. This model is given by Equation 4, below:

$$T_{ij12}-T_{ij10} = \beta_0+\beta_1 ETH_{ij}+\beta_2 INCOME_{ik10}+\beta_3 U_{ik10}+\beta_4 S_{ij10}+\beta_5 G_{ij10}+\varepsilon_{ij10} \quad (4)$$

In reality $INCOME$, S and G may change if students change their school and or the locality in which they live. In our data, 12% of students move school and 15% move area of residence between the ages of 10 and 12. Nevertheless, it is likely that these individuals moved between geographic areas with similar income levels, and it is also worth noting that average income levels of Australian local areas do not change substantially over the short-to-medium term (Hunter and Schwab 2003). In addition, indigenous geographic mobility is mostly associated with movement within local districts (Taylor 1997).

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 $INCOME$ and U variables with a series of geographical area fixed effects, one for each postcode (355 in total), which has the advantage of controlling for unobserved non-time varying locality effects (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 a set of school level fixed effects replacing our group of school level characterisitcs (826 in total) and included these in addition to our local area fixed effects (Models III$''$ and IV$''$). Finally, in view of the high degree of spatial sorting of indigenous groups in Queensland, which creates differences in the education process to which students are exposed, 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.

4 RESULTS

Table 3 provides results from the estimation of Models I and II. Model I suggests that after controlling for contemporaneous observable family and school charactersitics there are statistically significant differences in attainment between indigenous and ESB students. Aboriginal boys appear to perform marginally worse than their Torres Strait Islander counterparts in literacy and numeracy. In terms of z-scores, indigenous students lie between 0.66 and 0.80 of a standard deviation below ESB students, which are large effects [6]. 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 at a declining rate. Notice, however, that the estimated z-scores are much smaller than those for the two indigenous variables suggesting that they are quantitatively less important correlates of test score performance. Average teacher hours per pupil is positively related to test score performance.

INSERT TABLE 3

Model II introduces a control for prior attainment at the age of 10. Since

[6] To compute the z-scores the raw test score is transformed using the following formula $\frac{T_{i12}-\overline{T}}{\sigma_T}$ and the models are re-estimated.

this is a value added model, we interpret the estimates as effects on the change in test score performance between the ages of 10 and 12. The estimates indicate that indigenous students educational attainment continues to diverge from ESB students over this period, although the value of the z-scores are substantially lower than for Model I, ranging from -0.12 of a standard deviation for male Torres Strait Islanders in numeracy to -0.34 of a standard deviation for female Torres Strait islanders in literacy. This reflects the extent to which indigenous students are falling behind the average student's improvement in test scores over the period. Furthermore, there is some divergence in educational performance between indigenous groups, namely Aboriginal males literacy performance declines relative to Torres Strait Islander boys (F-Test = 4.85, p-value = 0.03). Educational performance is, however, cumulative for all groups of students, insofar as there is a positive coefficient on the lagged test score variable.[7] Note also 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 4.

In Table 4 we present the estimates of Models III and IV but for brevity we only report 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

[7] The relatively high coefficient for mathematics implies that students who do not have good basic mathematics skills by age 10 find it difficult to catch-up in maths. This is less marked for literacy where the opportunity for catch-up is greater.

4).

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 change in ethnic disadvantage in literacy. However, Aborigines still significantly under-achieve 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. Models III' and III", which incorporate fixed effects for geographic area and school attended respectively were also estimated but are not reported for brevity. The inclusion of controls for local area effects (III') did not markedly change the estimates of *ETH.* However, the introduction of school level effects (III") lead to a widening of the difference between ESB and indigenous test score achievement, particularly in numeracy. [8] Thus, poor indigenous performance appears robust to controls for unobservable school characteristics.

The second panel of Table 4 presents the estimates of the test score gain models (Model IV). The results are broadly similar to those for model III. 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$''$). This suggests that prior attainment, unobserved local area and school fixed effects account for a substantial proportion of the deterioration

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

in test score achievement of Torres Strait Islanders between the ages of 10 and 12. Furthermore, a series of F-tests comparing Aboriginal with Torres Strait Islander coeffecients demonstrate that the two groups significantly differ with respect to literacy performance for males in all models.

4.1 Urban and Rural/Remote

In Table 5 we relax the assumption that the effect of ETH on test performance is the same for students in urban and rural/remote areas. 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. They are one standard deviation below the average performance level for rural/remote female students, wich is the largest educational gap that we observe. Aboriginal boys in rural/remote areas have lower attainment in literacy at age 12 than their Torres Strait Islanders counterparts (F-Test = 3.44, p-value = 0.06).

INSERT TABLE 5

Students for whom English is a second language perform between 23 and 45 points worse on test scores in rural/remote schools (z-scores of -0.25 and -0.60), an effect that is not apparent for urban students. Hence, indigenous 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. 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.

INSERT TABLE 6

Estimates of the model which controls for prior attainment (Model II) are presented in Table 6. Results from these models suggest that urban Torres Strait Islander boys no longer suffer from a relative decline in numeracy with respect to urban ESB boys between age 10 and 12. There is also some decrease in the relative disadvantage of rural/remote indigenous students when compared to urban indigenous students, suggesting that prior attainment accounts for a large fraction of the discrepancy between urban and rural/remote indigenous students' test score performance. Whilst the inclusion of prior attainment results in no effect of ESL on rural/remote numeracy scores for this age period, its impact on literacy performance remains large and significant, indicative of a cumulative effect for students who reside in ESL households. Aboriginal girls in rural/remote areas experience a larger relative decline in test score performance between year 5 and year 7 when compared to their urban counterparts (literacy F-Test = 10.21, p-value = 0.002; numeracy F-Test = 3.60, p-value = 0.06).

To further investigate the differences between urban and rural/remote indigenous students we generated predicted year 7 test scores by indigenous group, location and whether English was their second language. These predictions were generated from Model I coefficient estimates with all other variables evaluated at their sample means. The results suggested that, for instance, male Aboriginal students in rural/remote locations for whom English is a second language are 48 points behind their urban counterparts in literacy. For females the equivalent figure is 83 points. In general, the urban to rural/remote differential is not as severe for Torres Strait Islanders. A series of F-tests also show that there was a statistically significant difference only for Aboriginal students[9]. Hence, in terms of primary school education geographical location does not affect Torres Strait Islander performance.

INSERT TABLE 7

Table 7 presents the estimates of models III and IV modelled separately for urban and rural/remote schools. For urban students, the impact of including the predicted test score variable leads to some reduction in ESB-indigenous literacy test achievement gap, but no such change occurs for numeracy. There is a similar pattern for rural/remote students, except in the case of numeracy performance where indigenous performance decreases.

Again additional models incorporating geographic and school fixed effects (models III' and III") were estimated but are not reported. In the case of urban students, the introduction of local area fixed effects leads to some worsening in indigenous disadvantage for males but there is no clear pattern for females. For rural/remote students, local area fixed effects have little impact. For male students in urban schools, the further inclusion of school level fixed effects serve to increase the estimated ESB to indigenous differential in numeracy test score

[9] Test statistic results for urban versus rural/remote Aborigines (p-values): male literacy (0.01), female literacy (0.00), male numeracy (0.00), female numeracy (0.00). Test statistic results for urban versus rural/remote Torres Strait Islanders (p-values): male literacy (0.99), female literacy (0.38), male numeracy (0.23), female numeracy (0.77).

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% 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.

Model IV estimates for urban students are largely consistent with model III, except female Aboriginal literacy displays no relative deterioration. However, the finding that female indigenous students in urban schools suffer a substantial decrease in numeracy test score achievement appears robust. Also, in this model rural/remote indigenous boys' literacy performance does not decline relative to ESB students over this time period. However, they do suffer from a widening gap in numeracy test scores. Indigenous girls in rural/remote schools face a relative decline in both literacy and numeracy test scores.

For urban students, the inclusion of local area fixed effects (model IV') 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. For urban students, the gap between ESB and indigenous students is robust to the inclusion of school fixed effects (modle IV").

For rural/remote students, the main change brought about by 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 differential is 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.

5 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 non-indigenous students (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 gap. 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 at the age of 12 are on average over 70 points behind in numeracy and roughly 60 points behind in literacy (where the benchmark average is 700 points). This differential was robust and large in magnitude across all models, even after the introduction of controls for observable and unobservable school and local area characteristics.

Our findings suggest that a substantial indigenous educational disadvantage appears to take hold quite early in the education process, through the impact of historical education and family inputs. This is similar, but greater in magnitude, to evidence for black-white primary school educational differentials in the US (Todd and Wolpin 2004).

Our results show that indigenous students in rural and remote areas experience, in general, worse outcomes than those in urban areas, which has been recognised by the Australian government in its strategy on disadvantaged areas. Nevertheless, the focus of Federal intiatives on indigenous education policy has been through the provision of additional grants with little specific direction on how these should be applied (Mellor and Corrigan 2004). The evidence in this paper would suggest that targeting early school years would be appropriate to build up core skills. However, policy must go beyond intervention in the early stages of schooling because there is substantial evidence that other pre-market factors, such as parental roles and cultural factors also have a large conditioning effect on subsequent labour market performance for minority groups (Neal and Johnson 1996, Carneiro et al 2003, Todd and Wolpin 2004). The finding that school characterisitcs play a relatively minor part in the development of educational disadvantage in our own study certainly adds weight to this view. Some indication of this can be gained from the significant additional negative effect on test score outcomes for indigenous students who reside in rural or remote households where English is not the language spoken at home. In this respect we are, in general, supporting the 'contact/assimilation' hypothesis of Kuhn and Sweetman (2002). Thus, Federal initiatives to provide homework/tutoring centres might be beneficial, though access to such centres in remote areas might be an issue. This is not to suggest, however, that school factors are unimportant since it has been shown that teacher interaction with indigenous students and the appropriatness of the educational materials used do have an effect on their educational attainment (Ruge 1999, Tatum 2000).

There is some evidence from our analysis that, when data allows, Aborigine and Torres Strait Islander should be treated separately in further research. Our evidence supports the earlier findings of Biddle et al (2004) who reported that Torres Strait Islander education participation rates were significantly better than those of Aborigines. We add to this picture by demonstrating that there are geographic and gender differences in performance. Geographic location matters much more for Aboriginal student performance than it does for Torres Strait Islanders. In addition, Torres Strait Islander boys attain appreciably better test scores in literacy than their Aboriginal counterparts.

In sum, it is evident that policy initiatives will need to be undertaken early in the education process, and address more than school resources to improve the educational performance of indigenous students particularly in disadvantaged areas, a policy which runs counter to much of the current focus of Australian indigenous education policy.

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Table 1: Attrition Statistics [10]

	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
Observations	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

[10] Source: Education Queensland.

Table 2: Test Scores by Ethnicity and Region [11]

	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	603.51 [66.99]	629.51 [66.58]	587.45 [66.32]	613.44 [67.79]	546.98 [59.50]	572.96 [67.75]	549.40 [67.16]	571.31 [70.09]
Literacy Year 7	674.00 [71.98]	706.45 [70.54]	657.89 [70.41]	691.27 [72.20]	620.02 [62.80]	639.59 [73.41]	611.35 [68.12]	642.13 [79.72]
Numeracy Year 5	603.32 [70.85]	597.53 [66.27]	587.22 [74.41]	582.47 [70.52]	538.13 [76.02]	539.27 [70.47]	538.54 [75.55]	540.12 [72.75]
Numeracy Year 7	688.80 [86.05]	681.85 [83.26]	670.24 [93.53]	667.95 [91.38]	617.20 [87.75]	605.44 [83.05]	610.87 [87.75]	605.74 [86.19]
Urban								
	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	606.03 [67.83]	631.25 [67.76]	590.99 [67.38]	615.16 [68.51]	550.82 [61.91]	580.90 [66.32]	560.86 [61.68]	586.22 [64.31]
Literacy Year 7	676.76 [72.98]	708.03 [71.27]	660.40 [71.81]	693.37 [73.30]	625.20 [59.47]	651.68 [66.12]	621.58 [63.89]	662.20 [68.92]
Numeracy Year 5	605.00 [70.87]	597.52 [66.44]	589.19 [74.78]	583.83 [70.52]	544.56 [71.68]	546.23 [65.41]	551.78 [67.98]	556.43 [65.25]
Numeracy Year 7	690.08 [86.72]	681.40 [84.29]	671.30 [93.17]	669.99 [92.06]	626.72 [84.39]	613.25 [77.44]	622.87 [84.67]	620.28 [83.05]
Rural and Remote								
	ESB		NESB		Torres Strait Islander		Aborigine	
	Male	Female	Male	Female	Male	Female	Male	Female
Literacy Year 5	597.81 [64.69]	625.60 [63.71]	575.09 [60.96]	605.05 [63.65]	541.12 [55.28]	559.89 [68.41]	535.05 [71.02]	554.59 [72.79]
Literacy Year 7	667.76 [69.28]	702.89 [68.74]	649.24 [64.61]	681.33 [65.75]	611.81 [67.12]	618.92 [80.59]	598.76 [71.21]	619.52 [85.27]
Numeracy Year 5	599.49 [70.64]	597.59 [65.89]	580.07 [72.78]	575.73 [70.32]	527.18 [81.51]	526.41 [77.05]	521.58 [81.16]	521.80 [76.66]
Numeracy Year7	685.92 [84.45]	682.88 [80.90]	666.21 [94.83]	657.49 [87.49]	602.86 [91.21]	591.93 [90.61]	596.37 [89.47]	589.78 [87.06]

[11] Source: Education Queensland. Standard deviations in parentheses.

Table 3: Year 7 Attainment Models [12]

	Model I			
	Literacy		Numeracy	
	Males	Females	Males	Females
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
NESB	-15.67[2.82] -0.21	-12.21[3.27] -0.17	-17.83[3.56] -0.20	-14.13[3.74] -0.16
Aborigine	-55.08[3.43] -0.75	-57.59[4.18] -0.79	-69.72[4.45] -0.78	-69.79[4.30] -0.81
Torres Strait Islander	-47.70[4.22] -0.66	-58.20[6.41] -0.80	-64.50[5.71] -0.72	-68.54[6.99] -0.80
ESL	-2.75[4.71] -0.04	-8.00[5.55] -0.11	-2.11[5.89] -0.03	1.64[5.81] 0.02
School Size	0.01[0.006] 0.00	0.02[0.005] 0.00	0.01[0.007] 0.00	0.01[0.007] 0.00
Remote School	-11.71[3.91] -0.16	-7.07[4.04] -0.10	-8.03[4.75] -0.09	-5.98[4.49] -0.07
Rural School	1.50[2.76] 0.02	3.00[2.71] 0.04	7.55[3.21] 0.09	10.89[3.37] 0.13
Average Income	0.11[0.02] 0.00	0.11[0.02] 0.00	0.13[0.02] 0.00	0.13[0.02] 0.00
Unemployment Rate	-0.91[0.29] -0.01	-0.87[0.27] -0.01	-0.99[0.34] -0.01	-0.98[0.33] -0.01
Teacher Hours:Pupil	18.00[7.09] 0.25	24.61[6.09] 0.33	27.18[9.02] 0.31	37.28[8.18] 0.43
Average Teacher Ex	0.40 [0.11] 0.01	0.40 [0.09] 0.01	0.57[0.12] 0.01	0.45[0.11] 0.01
Average Teacher Ex^2	-0.001 [0.0003] -0.00	-0.001 [0.0002] -0.00	-0.001 [0.0003] -0.00	-0.001 [0.0002] -0.00
Constant	577.82 [13.45]	606.86 [13.20]	561.67 [14.44]	558.26 [13.70]
r^2	0.08	0.08	0.09	0.09
	Model II			
Prior Attainment	0.68[0.01] 0.01	0.68[0.01] 0.01	0.92[0.01] 0.01	0.94[0.01] 0.01
NESB	-5.73[1.96] -0.08	-3.04[2.39] -0.04	-7.06[2.17] -0.08	-2.81[2.56] -0.03
Aborigine	-22.49[2.44] -0.31	-21.60[2.60] -0.30	-15.92[2.54] -0.18	-20.85[2.77] -0.24
Torres Strait Islander	-13.09[3.40] -0.18	-24.94[4.45] -0.34	-10.35[4.51] -0.12	-20.43[3.91] -0.24
ESL	1.15[3.24] 0.02	-2.74[3.49] -0.04	8.50[3.50] 0.10	6.97[3.20] 0.08
School Size	0.006[0.005] 0.00	0.01[0.004] 0.00	0.003[0.004] 0.00	0.004[0.004] 0.00
Remote School	-5.45[3.08] -0.08	-1.84[2.89] -0.03	1.64[3.13] 0.02	-1.00[2.83] -0.01
Rural School	2.05[2.02] 0.03	2.18[2.03] 0.03	5.68[2.21] 0.06	5.89[2.17] 0.07
Average Income	0.04[0.01] 0.00	0.04[0.01] 0.00	0.04[0.01] 0.00	0.05[0.01] 0.00
Unemployment Rate	-0.44[0.21] -0.01	-0.54[0.19] -0.01	-0.11[0.22] -0.00	-0.04[0.25] -0.00
Teacher Hours:Pupil	12.21[5.27] 0.17	11.79[4.74] 0.16	15.54[6.68] 0.17	15.74[6.64] 0.18
Average Teacher Ex	0.11[0.08] 0.00	0.17[0.07] 0.00	0.24[0.08] 0.00	0.013[0.07] 0.00
Average Teacher Ex^2	-0.0001[0.0002] -0.00	-0.0004[0.0002] -0.00	-0.0005[0.0002] -0.00	-0.0002[0.0002] -0.00
Constant	227.03 [11.21]	238.67 [10.43]	79.35 [11.18]	75.94 [11.13]
r^2	0.45	0.46	0.61	0.60
Observations	13048	12875	13048	12875

[12] [ ] 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 as the student's first language.

Table 4: Year 7 Estimates - Model III (predicted year 5 test score) and Model IV (test score gain model) [14]

	Model III			
	Literacy		Numeracy	
	Male	Female	Male	Female
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
NESB	-3.56[2.55] -0.05	-1.42[2.78] -0.02	-7.23[3.12] -0.08	-2.83[3.43] -0.03
Aborigine	-15.00[3.19] -0.21	-14.78[3.44] -0.20	-16.23[4.19] -0.18	-20.65[4.16] -0.24
Torres Strait Islander	-5.19[4.04] -0.07	-18.59[4.82] -0.26	-10.70[6.18] -0.12	-20.45[5.52] -0.24
	Model IV			
	Male		Female	
	Lit	Num	Lit	Num
NESB	-0.87[2.06] -0.02	1.31[2.58] 0.02	-5.98[2.28] -0.10	-1.98[2.49] -0.04
Aborigine	-8.49[2.63] -0.12	-5.97[2.46] -0.09	-13.06[2.49] -0.20	-18.92[2.67] -0.31
Torres Strait Islander	2.09[3.86] 0.06	-10.28[4.57] -0.16	-7.30[4.97]-0.10	-19.24[3.81] -0.31

[14] [ ] 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, urban school and English is the student's first language.

Table 5: Year 7 Attainment Models - Urban vs Rural/Remote Students, Model I [16]

	Model I			
	Literacy		Numeracy	
URBAN	Males	Females	Males	Females
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
NESB	-16.95[3.21] -0.23	-15.93[3.20] -0.22	-19.42[3.83] -0.22	-16.67[4.01] -0.20
Aborigine	-47.06[3.93] -0.64	-41.38[3.91] -0.57	-57.89[5.21] -0.65	-58.36[4.95] -0.66
Torres Strait Islander	-47.33[4.95] -0.64	-52.51[6.48] -0.73	-58.84[6.90] -0.66	-65.66[7.30] -0.76
ESL	2.43[4.80] 0.03	3.50[4.75] 0.05	4.01[5.97] 0.05	12.91[5.66] 0.15
School Size	0.18[0.008] 0.00	0.02[0.006] 0.00	0.02[0.008] 0.00	0.02[0.01] 0.00
Remote School				
Average Income	0.22[0.03] 0.00	0.22[0.02] 0.00	0.23[0.03] 0.00	0.23[0.03] 0.00
Unemployment Rate	-0.37[0.33] -0.01	-0.40[0.30] -0.01	-0.38[0.40] -0.00	-0.59[0.38] -0.01
Teacher Hours:Pupil	16.70[16.55] -0.23	23.16[13.50] -0.32	32.80[17.94] -0.37	39.88[16.47] -0.51
Average Teacher Ex	0.67[0.19] 0.01	0.51[0.15] 0.01	0.96[0.23] 0.01	0.76[0.18] 0.01
Average Teacher Ex^2	-0.001[0.0005] -0.00	-0.001[0.0004] -0.00	-0.002[0.0007] -0.00	-0.002[0.0005]- 0.00
Constant	519.41 [20.96]	565.25 [18.80]	504.52 [24.82]	525.58 [22.34]
r^2	0.09	0.08	0.09	0.09
Observations	9088	8995	9088	8995

	Literacy		Numeracy	
RURAL/REMOTE	Males	Females	Males	Females
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
NESB	-13.12[4.69] -0.18	-2.11[6.89] -0.03	-14.74[6.86] -0.16	-0.07[7.25] -0.08
Aborigine	-62.24[5.44] -0.87	-74.37[6.40] -1.00	-81.67[6.88] -0.91	-83.83[6.41] -0.96
Torres Strait Islander	-45.58[7.70] -0.64	-64.00[12.38] -0.86	-70.88[9.79] -0.79	-66.88[13.19] -0.78
ESL	-23.85[9.25] -0.33	-45.20[11.63] -0.61	-23.11[11.40] -0.26	-38.52[10.07] -0.45
School Size	0.01[0.01] 0.00	0.005[0.008] 0.00	-0.01[0.01] -0.00	-0.02[0.01] -0.00
Remote School	-9.14[3.84] -0.13	-4.30[3.78] -0.06	-12.78[4.93] -0.14	-13.65[4.56] -0.16
Average Income	0.02[0.02] 0.00	0.01[0.02] 0.00	0.05[0.02] 0.00	0.05[0.02] 0.00
Unemployment Rate	-0.31[0.50] -0.00	-0.13[0.51] -0.00	-0.49[0.58] -0.01	-0.25[0.67] -0.00
Teacher Hours:Pupil	9.57[7.13] -0.13	15.05[5.75] -0.20	14.00[8.98] -0.16	20.74[7.44] -0.25
Average Teacher Ex	0.18[10.2] 0.00	0.24[0.09] 0.00	0.35[0.12] 0.00	0.23[0.12] 0.00
Average Teacher Ex^2	-0.003[0.0004] -0.00	-0.001[0.0002] -0.00	-0.0006[0.0003] -0.00	-0.0002[0.0003] -0.00
Constant	648.77 [13.20]	685.19 [12.78]	650.61 [14.73]	659.08 [14.64]
r^2	0.08	0.12	0.10	0.12
Observations	3960	3618	3960	3618

[16] [ ] 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 6: Year 7 Attainment Models - Urban vs Rural/Remote Students, Model II [18]

	Model II			
	Literacy		Numeracy	
URBAN	Males	Females	Males	Females
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
Prior Attainment	0.68[0.01] 0.01	0.66[0.01] 0.01	0.93[0.01] 0.01	0.95[0.01] 0.01
NESB	-8.66[2.36] -0.12	-4.79[2.56] -0.07	-8.01[2.32] -0.09	-2.07[2.93] -0.02
Aborigine	-21.11[3.22] -0.29	-13.80[3.02] -0.19	-14.94[3.34] -0.17	-20.54[3.52] -0.24
Torres Strait Islander	-12.89[3.98] -0.18	-21.21[4.19] -0.29	-6.82[4.70] -0.08	-18.81[4.44] -0.22
ESL	6.49[3.70] 0.09	2.54[3.46] 0.04	2.05[8.41] 0.12	8.06[3.31] 0.09
School Size	0.007[0.006] 0.00	0.01[0.005] 0.00	-0.006[0.006] 0.00	0.01[0.005] 0.00
Remote School				
Average Income	0.09[0.02] 0.00	0.09[0.02] 0.00	0.04[0.01] 0.00	0.07[0.02] 0.00
Unemployment Rate	-0.44[0.24] -0.01	-0.45[0.23]-0.01	0.62[0.41] -0.00	0.06[0.30] 0.00
Teacher Hours:Pupil	13.79[11.98] 0.19	11.92[11.29] 0.17	7.92[6.78] 0.31	26.81[13.10] 0.31
Average Teacher Ex	0.19[0.15] 0.00	0.18[0.12] 0.00	0.15[0.08] 0.01	0.39[0.11] 0.00
Average Teacher Ex^2	-0.0004[0.0004] -0.00	-0.0004[0.0003] -0.00	-0.0003[0.0003] -0.00	-0.001[0.0003] -0.00
Constant	202.55 [17.72]	224.09 [16.22]	118.56 [17.85]	24.83 [16.22]
r^2	0.46	0.45	0.60	0.60
Observations	9088	8995	9088	8995

	Literacy		Numeracy	
RURAL/REMOTE	Males	Females	Males	Females
	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score	Coeff [s.e.] Z-Score
Prior Attainment	0.67[0.02] 0.01	0.71[0.01] 0.01	0.89[0.02] 0.01	0.89[0.02] 0.01
NESB	0.73[3.31] 0.01	0.037[5.10] 0.01	-3.70[4.51] -0.04	-4.46[4.90] -0.05
Aborigine	-22.92[3.64] -0.32	-29.50[3.96] -0.40	-18.53[3.84] -0.21	-23.50[4.10] -0.27
Torres Strait Islander	-11.25[6.09] -0.16	-30.65[9.09] -0.41	-16.70[8.71] -0.19	-22.51[7.35] -0.26
ESL	-15.58[5.78] -0.22	-18.20[6.97] -0.25	2.05[8.40] 0.02	-2.00[7.50] -0.02
School Size	0.01[0.01] 0.00	0.007[0.006] 0.00	-0.005[0.007] -0.00	-0.01[0.005] -0.00
Remote School	-4.97[3.08] -0.07	-0.10[2.82] -0.00	-4.39[3.46] -0.05	-7.18[3.00] -0.08
Average Income	0.002[0.02] 0.00	-0.01[0.015] -0.00	0.04[0.01] 0.00	0.02[0.01] 0.00
Unemployment Rate	0.036[0.40] 0.01	0.14[0.35] 0.00	0.62[0.41] 0.01	0.55[0.43] 0.01
Teacher Hours:Pupil	7.63[5.74] 0.11	6.76[4.60] 0.09	7.91[6.78] 0.09	5.85[6.13] 0.07
Average Teacher Ex	-0.004[0.10] -0.00	0.10[0.07] 0.00	0.15[0.08] 0.00	0.009[0.08] 0.00
Average Teacher Ex^2	0.0001[0.0003] 0.00	-0.0002[0.0001] -0.00	-0.0003[0.0003] -0.00	0.00[0.00] 0.00
Constant	254.25 [14.78]	248.81 [12.66]	118.56 [14.15]	135.18 [13.62]
r^2	0.45	0.50	0.60	0.59
Observations	3960	3618	3960	3618

[18] [ ] 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 7: Year 7 Estimates - Model III (predicted test score)- Urban vs Rural/Remote [20]

	Model III			
	Literacy		Numeracy	
URBAN	Male	Female	Male	Female
	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score
NESB	-7.03[2.78] -0.09	-3.66[2.96] -0.05	-7.42[3.42] -0.08	-1.73[3.70] -0.02
Aborigine	-15.92[3.89] -0.21	−9.23[4.17] -0.12	-13.28[5.13] -0.16	-17.03[5.03] -0.19
Torres Strait Islander	-5.13[4.85] -0.07	-16.52[5.08] -0.23	-4.12[6.65] -0.06	-16.83[6.16] -0.19
	Model IV			
	Literacy		Numeracy	
	Male	Female	Male	Female
NESB	-4.78[2.43] -0.08	0.58[2.48] 0.02	-7.51[2.30] -0.13	-1.60[2.34] -0.02
Aborigine	-9.44[3.39] -0.15	-0.38[3.46] -0.01	-13.22[3.20] -0.21	-19.52[3.26] -0.34
Torres Strait Islander	3.05[4.43] 0.06	-6.14[4.55] -0.09	-3.66[4.19] -0.06	-18.12[4.29] -0.30

	Model III			
	Literacy		Numeracy	
RURAL/REMOTE	Male	Female	Male	Female
	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score	Coeff[S.E.] Z-Score
NESB	2.42[4.05] 0.03	2.03[5.40] 0.02	-5.67[5.92] -0.06	-3.72[6.76] -0.05
Aborigine	-19.13[4.63] -0.26	-24.68[5.05] -0.34	-27.29[6.17] -0.32	-30.13[5.81] -0.38
Torres Strait Islander	-7.67[6.32] -0.09	-27.73[7.41] -0.37	-23.70[8.28] -0.26	-26.38[8.59] -0.32
	Model IV			
	Literacy		Numeracy	
	Male	Female	Male	Female
NESB	7.68[3.75] 0.13	2.32[4.68] 0.02	−1.70[3.77] -0.04	-3.51[4.67] -0.07
Aborigine	-4.69[3.84] -0.07	-11.31[3.71] -0.20	-12.26[3.86] -0.18	-17.24[3.71] -0.29
Torres Strait Islander	4.34[5.66] 0.10	-16.36[5.97] -0.30	-12.22[5.69]-0.17	-20.06[5.96] -0.31

[20] [ ] 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 and English is the student's first language.

Table 8: Appendix Summary Statistics [21]

	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 (%)	8.60	8.65	9.02	9.35	9.20	9.19	9.27	9.07
Teacher Hours: Pupil	0.61	0.62	0.61	0.61	0.57	0.56	0.58	0.59
Average Teacher Experience (months)	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

[21] Source: Education Queensland.