Aboriginal Performance on Standardized Tests: Evidence and Analysis from Provincial Schools in British Columbia

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Abstract

Many indigenous populations are experiencing rural-to-urban migration, motivated by the prospect of better socio-economic opportunities. In making this transition, indigenous peoples are entering industrial societies where most income derives from wages or salaries, and formal education achievement is crucial in determining economic prospects. This research analyzes the gap in test score results between Aboriginal and non-Aboriginal students in public schools in the Canadian province of British Columbia. It finds a strong effect of school quality, as measured by non-Aboriginal achievement, on Aboriginal achievement. It also finds a non-linear negative relationship between Aboriginal achievement and the number of Aboriginal students in a school over the empirically observed range. It thus suggests a possible tradeoff – and dilemma – between policies that enable Aboriginal students to concentrate in a few schools able to provide a culturally sensitive curriculum and, on the other hand, policies to maximize Aboriginal academic achievement.

I. Introduction

Two trends have dominated the lives of Aboriginals in Canada over the last half-century. The first has been rural-to-urban migration. In 1941, fewer than 4 percent of Aboriginals resided in cities; but by 2006, 53 percent did so (Drost 1995, table 1; Canada 2008a). The second trend has been the persistence of low Aboriginal educational attainment levels relative to the non-Aboriginal population. These lower educational attainment levels continue to be a proximate cause of significant Aboriginal disadvantage in terms of employment, income, health status, and self-esteem.

The majority of rural Aboriginals are "registered Indians" who reside on designated reserved lands. In Canada, very few urban Aboriginals live "on-reserve" although there are some urban reserves. Hence, rural-to-urban migration has led to a decline in the share of Aboriginal children attending federally funded on-reserve schools and to a rise in the share attending provincial schools together with non-Aboriginal children. In this article, we consider an important intersection of the two trends: the educational performance of Aboriginal students who attend provincially managed schools in British Columbia (B.C.). One in six of the Canadian Aboriginal population resides in this west coast province, and the 60,000 self-identified Aboriginal students who attend B.C. provincial public schools comprise approximately 10 percent of the provincial student population.

Specifically, we assess Aboriginal student performance via standardized tests administered to all students in public schools in B.C. at grades four and seven in reading, writing and numeracy; these are collectively known as Foundations Skills Assessment (FSA) tests. Better performance on tests of core cognitive skills is important because of its significant correlation with subsequent desirable outcomes, including better education achievement and higher wages for young workers (Hanushek 2002, Murphy and Peltzman

2004). We explore the potential of three sets of variables to explain the Aboriginal/non-Aboriginal gap in performance: socio-economic conditions among Aboriginal and non-Aboriginal families in school catchment areas, various aspects of school quality, and the Aboriginal education policies pursued by school districts. We include the latter variables because districts are an important intermediate level of administration between schools and the provincial government.

Around the world, many indigenous populations are experiencing rural-to-urban migration, motivated by the prospect of better socio-economic opportunities (Muedin 2008; UN 2008). In making this transition, indigenous peoples are entering industrial societies where most income derives from wages or salaries, and formal education is crucial in determining economic prospects (Harmon, Oosterbeek and Walker 2003; Psacharoulos and Patrinos, 2004; Hechman, Lochner and Todd 2006). If their children fail to converge in education levels with those of the non-indigenous majority, then much of the economic potential from rural-to-urban migration is forgone.

Casual empiricism suggests that, in Canada, the United States, and elsewhere, the average performance of indigenous children in "mainstream" schools is below that of non-indigenous students in terms of conventional performance measures. However, evidence on the extent of the gap, and analysis of reasons for it, are scarce. As we discuss later, the reasons that children of African American and Hispanic parents in the United States perform less well on standardized tests than do other children has been extensively studied. Yet, as William Demmert and his colleagues observe, "In comparison, there has been very little research and data collected on measuring and explaining the achievement of Native American students" (Demmert et al. 2006, 5). Similarly, Patrick McEwan (2004, 158) notes the "dearth of empirical research on the magnitude of differences in the mean achievement

of indigenous and nonindigenous students" in Latin America. This dearth of empirical research extends to indigenous student performance in Canada.

In the first part of this study we review Canadian Census data on Aboriginal demographic and education trends. We next describe school-level achievement in B.C. as measured by the FSA tests of core competencies. In the second half of the study, we assess the relative importance of various factors that potentially explain Aboriginal school achievement. To summarize these results, socio-economic variables affect performance in the expected direction, but their impact is much less important than the school quality proxies that we use: performance of non-Aboriginal students in the relevant school, and size of the Aboriginal student cohort. The incremental effect of non-Aboriginal student performance is positive; increasing the number of Aboriginal students in a school lowers Aboriginal performance. Finally, in ten districts (of a total of 43), district-level policies may have statistically significant impacts (some positive, some negative) on Aboriginal performance. These results suggest some tentative policy conclusions for Aboriginal education. However, they also suggest an emerging dilemma for both the Aboriginal community, as well as educational policy makers.

II. Aboriginal Rural-Urban Migration and Identity

Who is an Aboriginal? As with all issues of identity in the modern world, the criteria are debatable. The Canadian Census defines the Aboriginal population in several ways. The most widely used is based on self-identification. Individuals can self-identify as belonging to one of three Aboriginal groups: (1) North American Indian or First Nation (Mohawk, Ojibway, Cree, and so on), (2) Métis (descendents of communities formed from the intermarriage of Indians and coureurs de bois engaged in the fur trade), or (3) Arctic Inuit.

Self-identification as an Aboriginal in the Census does not necessarily mean an individual has Aboriginal ancestry. Another Census definition is based on an individual indicating that he or she is a "registered Indian" under provisions of the *Indian Act*, a Canadian statute dating from the late 19th century. The great majority of those who self-identify as Indian/First Nation are also registered Indians. Only registered Indians have the right to live on designated reserve lands and receive the associated benefits. The Census defines the "Aboriginal identity population" as those who self-identify as Aboriginal or indicate that they are registered Indians.

At the time of the most recent Census, in 2006, the Aboriginal identity population was 1.18 million, or approximately 3.8 percent of the Canadian population. A total of 698,000 identified as Indian/First Nation; 390,000 as Métis, and 50,000 as Inuit. Among those self-identified as Indian/First Nation, a subset of 624,000 indicated they were also registered Indians (Canada 2008a, 2008b).

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Figure 1 compares the distribution of the Aboriginal identity population by location, in the 1996 and 2006 censuses. The on-reserve share (which is overwhelmingly rural) has continued to decline and the urban share, particularly in cities over 100,000 in population, has continued to increase.[1] Concomitantly, the Aboriginal population is growing more quickly than the non-Aboriginal, leading to a rising Aboriginal share of the total. The rising share is due both to higher fertility and to an increase in self-identification. With the

[1] The definitions used in figure 1 are consistent between 1996 and 2006. Exact comparisons cannot be made over the 20th century because Census definitions of the Aboriginal population have varied over the longer period. The on-reserve proportion has unambiguously been in decline, but the on-reserve Census count increased modestly over the decade. One qualification is that the 1996 data have been adjusted for on-reserve under-enumeration; the 2006 data have not been similarly adjusted.

emergence of indigenous pride, high-profile Aboriginal organizations, and less overt racial discrimination, more Canadians have chosen to identify as Aboriginal.

Although net rural-to-urban migration has occurred, there is considerable Aboriginal "churning" within cities, as well as between urban and rural locations. Aboriginals are roughly twice as mobile as non-Aboriginals (Richards 2001; Canada 2004). In rural areas—usually on-reserve in the case of registered Indians—preservation of some aspects of indigenous culture is more feasible. In contrast, residence in urban areas accentuates Aboriginals' sense of minority status, entails more interaction with non-Aboriginals, and changes individuals' identities, for better or worse. On the other hand, economic outcomes are, on average, superior in urban locations.

III. Aboriginal Educational Attainment in Canada

In contemporary industrial societies, escape from poverty for historically marginalized populations requires major investments in education. The first step is adequate preparation for K-12 schooling. Early childhood education programs are particularly valuable when families have limited education and income resources (Barnett 1995; Richards and Brzowzoski 2006; Wolfe and Tefft 2009). The second step is successful completion of primary and secondary education (Walters, White, and Maxim 2004). This second step turns out to be the minimum education level for significant participation in the labor force. For both Aboriginals and non-Aboriginals, the Canadian employment rate nearly doubles with high school certification, and continues to rise, if more modestly, at higher education levels. The employment rate among Aboriginals rises from 34 percent among those with incomplete secondary education to 64 percent among those with high school certification and reaches 80 percent among Aboriginals with university degrees (Canada 2008d). In turn, average incomes rise with the employment rate and education level (Sharpe, Arsenault, and

Lapointe 2008). Some evidence suggests that educational premiums for Aboriginals may even be higher than for other Canadians (Walters, White, and Maxim 2004).

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Figure 2 summarizes Aboriginal/non-Aboriginal education gaps for three age cohorts using the Census's five-level cumulative education hierarchy: (1) incomplete secondary studies, (2) high school certification, (3) trades certification, (4) college certification, and (5) university degree.[2] The gap is defined as the difference between the shares of the relevant populations having achieved the indicated education level or higher within three age cohorts: 45 and over, 35-44, and 25-44.[3] While, in general, there has been an intergenerational increase in Aboriginal education attainment, the gaps have widened among younger cohorts. (Although the disaggregation is not shown, the widening of gaps is much less pronounced among Métis than among the Indian/First Nation population.)

Among non-Aboriginals, high school certification is now nearly universal. While 26.3 percent of those ages 45 and over lack this credential, this is true of only 10.0 percent of those in the ages 25-34 cohort. Among Aboriginals, universality remains a long way off. Within the Indian/First Nation population, the share without certification declines, from oldest to youngest cohort, by less than 10 percentage points (from 47.1 percent to 37.6 percent). Among Métis, the intergenerational progress has been more substantial. The comparable decline is about 17 percentage points (from 36.9 percent to 20.3 percent).

[2] The Census education data specify a hierarchy based on the amount of classroom time. A university education is considered to be a higher level than a college education, while a college education is considered to be at a higher level than a trade qualification. Although some trades requirements may take as long, or longer, to complete than a given college or university program, more time is spent in on-the-job paid training and less time in the classroom. Colleges include non degree-granting institutions such as community colleges, CEGEPs, private business colleges and technical institutes.

[3] Census data are available for groups age 15 and over. However, the 25-34 age cohort is the youngest for which it is reasonable to expect completion of post-secondary education.

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No comprehensive data on educational achievement, comparable to the FSA test results discussed below, are gathered for on-reserve schools. However, the Census does permit some disaggregation of education data by location. Figure 3 shows the share of Aboriginals in the ages 20-24 cohort who have achieved high school certification with the equivalent non-Aboriginal cohort included for comparison. Fewer than 40 percent of North American Indians who reside on reserves have completed high school; among Inuit, the overall percentage is similar. There are a number of reasons for the very low on-reserve completion rates, including the paucity of well-paid employment on or near most rural reserves and out-migration by many who have completed high school.[4]

Sharpe, Arsenault, and Lapointe (2008) decompose the Aboriginal/non-Aboriginal difference in annual wages among the employed and conclude that about 30 percent of the difference is due to differences in educational attainment levels. Fewer annual hours worked explained about 20 percent of the difference. Hours worked are, in turn, related to education levels. In sum, better educated Aboriginals have higher incomes (Walters, White, and Maxim 2004). These statistics suggest that improving Aboriginal educational outcomes is a key, perhaps *the* key, to improving their quality of life, particularly in urban areas.

IV. British Columbia's FSA Testing and Data Sources

Research documents a strong link between student achievement in tests on basic cognitive skills conducted at intervals during the K-12 cycle and subsequent high school graduation.

[4] Figure 4 does not show gender differences. Education profiles for women are superior. For example, only 36 percent of on-reserve Indian/First Nation men ages 20-24 have completed high school, while 42 percent of women in that age group have completed.

Most U.S. states and Canadian provinces have introduced jurisdiction-wide standardized testing at selected grades in the K-12 system (Bishop 1997; Hanushek 2002). Within Canada, B.C. is the only province to publish standardized test results, disaggregated by school and various characteristics of the students—including Aboriginal identity. Starting with the 1999/2000 school year, the B.C. education ministry has conducted annual province-wide tests in reading, writing, and numeracy at selected grades. Currently, children sit these FSA tests in grades 4 and 7, approximately at ages of 9 and 12.

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The FSA results classify student achievement in terms of three levels: "exceeding expectations," "meeting expectations," and "not meeting expectations." A widely used summary statistic is the "meet-exceed ratio" (MER), the number of test scores in which students meet or exceed expectations relative to the number of test scores in that school, school district, or province. Figure 4 summarizes the province-wide MERs over the five school years 2001/2002 to 2005/2006 in the three skills tested, for both Aboriginal and non-Aboriginal students. By Grade 4, sizeable gaps exist between average Aboriginal and non-Aboriginal student performance; by Grade 7, the gaps in all three skills are larger.

Our sample of schools includes all B.C. schools that satisfy two criteria: first, that the school reported more than 30 Aboriginal student scores over the years under review; and second, that Statistics Canada could provide appropriate census socio-economic data, disaggregated to the estimated school catchment area, for both Aboriginal and non-

Aboriginal families.[5] A total of 366 schools in 43 school districts met these criteria; half of British Columbia's school districts are represented in the sample. For these schools, we examined school-level FSA results for the five school years 1999/2000 to 2003/2004. While these FSA school-level data can be disaggregated in various ways (grade, skill area, student gender, and whether or not the student self-identified as Aboriginal), the data do not identify individual students.

Aggregating scores for each school over the five years for all grades and subjects, we generated two meet-exceed ratios per school, one for Aboriginal and another for non-Aboriginal students. Across the 366 schools, the average school-level Aboriginal MER is 63.8 percent, the average non-Aboriginal MER, 78.5 percent. The significance of the gap can be appreciated by the fact that the Aboriginal average is at the second percentile of the non-Aboriginal distribution. A noteworthy feature is the much higher dispersion of MERs across schools for Aboriginal relative to non-Aboriginal students. The standard deviation for Aboriginal MERs is 11.7 percentage points, nearly twice the 6.0 percentage points for the non-Aboriginal MER distribution.

A common concern among US school administrators is that concentrations of African American students—or students from other minority communities—in very poor urban neighborhoods can induce a syndrome of low-performing schools. The performance of minority and majority students may converge over time within most schools, but the aggregate gap will not converge significantly if the minority groups are concentrated in low-performing schools. Rivkin and Hanushek (2006), for example, in a study of Texas schools conclude that the black/white achievement gap is increasingly attributable to black

[5] Assembling catchment area socio-economic data required a special tabulation from the 2001 Canadian Census master file.

concentration in low-performing schools.[6] In B.C., Aboriginals are over-represented in low-performing schools, although to a much lesser extent than African Americans in the Texas schools that Rivkin and Hanuskek studied. The inter-school component of the Aboriginal/non-Aboriginal gap is relatively small (14 percent) and the intra-school component (86 percent) is far larger. This is not a reason for optimism in itself, however, as one important reason for this difference is that our data do not include Aboriginal students attending on-reserve schools. Were such schools included, the inter-school weighting would almost certainly rise considerably.

VI. Interpreting the "Gap"

The two "usual suspects" in explaining school outcomes are first various school-related factors and second various socio-economic characteristics of students' families (especially parental education and family income). In many studies of black/white performance gaps in U.S. schools and of indigenous/non-indigenous performance gaps elsewhere, socio-economic differences play some role, but they explain less than do in-school factors (Cook and Evans 2000; McEwan 2004; McEwan and Trowbridge 2007). Of course, if the value-added (in terms of education outcomes) of school-related factors varies according to the socio-economic characteristics of students' families, then the

[6] See Rivkin and Hanushek (2006, Appendix) for the decomposition formula. The motivation for the decomposition exercise is to determine the extent to which the performance gap is attributable to a particular group's over-representation in low-performing schools, as opposed to dynamics operating within all schools, good and bad. If Aboriginal and non-Aboriginal students were identically distributed across schools, then the proportions of Aboriginal and non-Aboriginal students in low- and high-ranking schools would be equal. In this limiting case, the inter-school component would fall to zero and the gap must be entirely attributable to in-school dynamics that adversely affect Aboriginal performance in whatever schools they attend. In the converse limiting case, Aboriginals and non-Aboriginals realize equal average MERs within all schools; the intra-school gap is zero, and the gap must be entirely attributable to an over-representation of Aboriginals in low-performing schools.

decomposition of the relative importance of school-related factors and family characteristics becomes more complex.

The specific variables that have been used to measure school-related factors include expenditures per student, the quality of teachers, the curriculum, the quality of management within schools and at higher levels such as school districts (Rivkin, Hanushek, and Kain 2005; Anderson 2006). When considering the educational attainment of marginalized minority groups, these school-related factors also include the complex issue of peer effects, both positive and negative.[7] The potential impact of peer effects is inseparable from the general issue of designing school curriculum and hiring faculty in a culturally sensitive manner.

Many studies—for example many discussed in the comprehensive survey of Native American education by Demmert (2006)—stress the importance of Native teachers and a school curriculum oriented to their experience. These are inevitably going to be more in evidence in schools with many Aboriginal students, as they are more likely to be able to achieve minimum efficient scale. However, the presence of a large Aboriginal student cohort may encourage a school culture of low academic expectations: perhaps some combination of low teacher expectations of their students' academic potential and low student expectations of their peers' potential. This is consistent with evidence that finds that larger numbers of minority/indigenous students (whether in absolute numbers or as a share of a school population) tends to lower minority/indigenous achievement, at least in terms of standardized test scores. In his study of indigenous education outcomes in Bolivia and Chile, for example, McEwan (2004) found a statistically significant, albeit modest, negative peer effects on school outcomes the higher the indigenous share of the school's population.

[7] For a theoretical and empirical review, see MacCoun et al. (2008).

Similar issues have arisen in the analysis of U.S. white/black student performance gaps. Cooley (2007) studied white and non-white students in North Carolina public elementary schools and concluded that desegregation resulted in small reductions in between-race achievement gaps (see also, Angrist and Lang 2004; Guryon 2004). As mentioned earlier, Hanushek and Rivkin (2006) found sizeable achievement differences related, directly or indirectly, to large low-income black student cohorts in their Texas school study. They stress three school-related factors that lower black student performance: the negative externality of a high student turnover rate (which adversely affects student performance whether or not the student in question has changed school), the negative effect on outcomes of teachers with limited experience, and a negative externality from a high share of black students. Hanushek and Rivkin (2006, 23) conclude:

> The estimation results provide strong evidence that higher levels of student turnover negatively affect achievement and that the impact is comparable for both blacks and whites and across schooling levels. This mobility externality is … particularly important given the prevalence of high turnover schools for low income and black students …Having a higher proportion of teachers with little or no experience also adversely affects achievement, and the costs are substantially higher for blacks and for elementary school students. …Consistent with other recent work on racial composition, the negative effect of a higher proportion of black [students] is highly significant for blacks and much larger for blacks than for whites.

In total, these findings suggest that indigenous and minority peer effects in schools are likely to be deleterious, at least in terms of achievement on standardized tests for basic subjects. The evidence is only suggestive in considering Aboriginal education outcomes, because there are few large-scale studies that have assessed these questions carefully.

VII. Regression Analysis and Results

A. Socio-economic Gradients

We assembled six socio-economic variables pertaining to the population in the school catchment area.[8] In regressing subsets of these variables on school MERs, income and education generate the highest adjusted R^2. For purposes of illustration we constructed a simple index using these two variables to summarize the average socio-economic status (SES) for each of 732 catchment populations (two per school, one for Aboriginal another for non-Aboriginal families). The index is standard normal, with equal weighting for each variable. For the 366 Aboriginal populations, the average SES value is –0.59; for the 366 non-Aboriginal populations, the average is, by construction, 0.59.

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In figure 5 we plot the 732 school MERs (two per school) against their respective SES index values. Two socio-economic gradients are superimposed on this scatter plot.[9] The gradients provide an initial summary of the impact of catchment socio-economic conditions on school outcomes. If the two gradients coincided and possessed a shallow slope, this would indicate that racial distinctions are immaterial and that differences in catchment socio-economic conditions have little impact on student outcomes. Obviously, the Aboriginal gradient lies well below the non-Aboriginal gradient. At the average SES index (of zero), the expected Aboriginal MER is 66 percent. All but 3 percent of schools report a higher non-Aboriginal MER. The gradients for both Aboriginals and non-

[8] The six variables comprise the following: (1) the percentage of lone-parent families, (2) a measure of family mobility, (3) the family employment rate, (4) the percentage of families with incomes below the after-tax Low Income Cutoff (the most frequently used poverty threshold in Canadian studies), (5) parental education, and (6) family income.

[9] These are OLS regressions of school MERs, for Aboriginal and for non-Aboriginal scores, on the relevant SES index values.

Aboriginals have similar slopes. For both Aboriginal and non-Aboriginal families, improvements in socio-economic status are associated with similar expected improvements in school performance. For example, Aboriginal parents in a catchment area at the top decile of the SES index can expect their children's school to achieve a MER that is 10 percentage points above a school whose catchment area's Aboriginal population lies at the bottom decile.[10]

B. Multivariate Regression Analysis

Socio-economic conditions alone explain some of what's going on, but not a lot; other dynamics matter. Other factors constant, do Aboriginal students perform better or worse when there are many Aboriginal students in the school? Do Aboriginal students perform better in "good schools" proxied by superior performance among the school's non-Aboriginal students? To what extent do general, or Aboriginal-specific, policies set at the school district level affect Aboriginal achievement? These questions require multivariate analysis. As MER is bounded between 0 and 1 and we expect variables to have less impact near either extreme, we consider models in which the logit of MER, ln[MER/(1-MER)], is the dependent variable.

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In general, we have a system of two equations:

$$\text{Logit}[\,\text{MER}_A\,] = f(\text{SES}_A,\ \text{MER}_{NA},\text{District Quality},\ N_A) + e$$

$$\text{MER}_{NA} = g(\text{SES}_{NA}) + \eta$$

[10] This calculation assumes the Aboriginal gradient slope of 3.7303 and that the Aboriginal catchment area SES index rises from -1.28 to 1.28.

where MER_A is the Aboriginal MER for the school, SES_A includes variables measuring the socioeconomic status of the Aboriginal community in the school's catchment area; MER_{NA} is the MER for non-Aboriginal students in the school (a proxy for school quality); District Quality allows for an average effect of the district; N_A is the number of Aboriginal students in the school (which may have a non-linear effect); SES_{NA} includes variables measuring the socioeconomic status of the non-Aboriginal community in the school's catchment area, and e and η are errors. As common excluded factors are likely to induce a correlation between e and η, MER_{NA} may be endogenous in the first equation.

Table 1 shows several model specifications and estimation approaches. Regression (1) summarizes an ordinary least squares model (OLS) that includes the number of Aboriginal test scores and its square, and the two socio-economic variables ("median family income" and "percent of families with trades or above as highest education level") for the Aboriginal populations of each school catchment area. The socio-economic variables have the expected signs.

In our data, the impact of the Aboriginal test score count on Aboriginal student performance appears to be non-linear. As defined, the regression incorporates the number of test scores as a quadratic. The coefficient of the test score count is negative and of the squared count positive. This implies that an increasing Aboriginal test score count lowers a school's forecast Aboriginal MER, but that the incremental effect declines as the count rises and ultimately turns positive. Given our coefficient estimates, there does not appear to be a positive peer effect over the observed range of the Aboriginal test score count. This is shown in figure 6 which plots Aboriginal school MERs against the Aboriginal student count.

It also includes the forecast incremental effect of an increasing count.[11]

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A plausible interpretation of these results, that is consistent with other studies, is that large Aboriginal student counts foster a culture of low academic expectations—among teachers, students' peers or both. However, the Aboriginal test score count is negatively correlated (r = -0.22) with the Aboriginal SES index. Thus, in addition to measuring expectations, it may also be capturing socio-economic effects.

In the next three columns of table 1 we present more complete models of Aboriginal achievement. Regression (2) adds fixed effects for all school districts; this approximately doubles the R^2. Regression (3) shows a further increase in the R^2 when we include the non-Aboriginal MER. However, the Wu-Hausman test rejects the hypothesis that non-Aboriginal MER can be treated as an exogenous variable. Regression (4) employs two-stage least squares (2SLS) analysis to allow for endogenous non-Aboriginal MER. We use two socio-economic variables for the non-Aboriginal population of the school catchment area ("median family income" and "percent of families with trades or above as highest education level") as instruments. The estimated coefficient for non-Aboriginal MER is smaller than in the OLS model, but is still statistically significant.

The 2SLS model in table 1 shows statistically significant results for all variables except Aboriginal community educational attainment. The substantive impacts of the socio-economic variables, however, are relatively small. When we replace all estimated coefficients with their means across the 366 schools in the sample (141 "Aboriginal student test score

[11] Based on the parameters of the completely specified model in regression (4), the effect of the Aboriginal test score count becomes positive for a count above 915. The intercept sets other regressors at mean values.

count," $37 thousand "Aboriginal median family income in catchment area," 53 percent of "Aboriginal families in catchment area with education level of trades certificate or above," and 79 percent "non-Aboriginal MER") the results yield an Aboriginal mean MER of 64 percent. Raising Aboriginal income to the mean non-Aboriginal income would increase MER by only 3 percentage points.

The substantive impact of the school quality variables is larger. A doubling of the number of Aboriginal students from 140 to 280 reduces the forecast Aboriginal MER by 6 percentage points or a 0.5 standard deviation. The non-Aboriginal MER serves as a measure of school-level instructional effects plus the impact on Aboriginals of non-Aboriginal peers. Moving the non-Aboriginal MER from the 25th percentile (74.7 percent) to the 75th percentile (82.4 percent) increases Aboriginal MER by 5 percentage points (a standard deviation of 0.4).

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Next, we use 3SLS to estimate simultaneously equations disaggregated by subject matter and by gender. Table 2 summarizes these results. Our purpose is to test whether the results of the analyses in table 1 hold at the subject/gender level. The 3SLS estimation takes advantage of the correlation among the errors of the equations. Some of the same unmeasured factors that affect, say, girls' achievement in numeracy may also affect girls' achievement in reading. Indeed, ten of the fifteen pair-wise correlations of the residuals of equations are statistically significant at the 0.05 level. These correlations range between 0.04 (girls' numeracy and boys' writing) to 0.37 (girls' numeracy and girls' reading). The substantive results of the aggregated data largely hold. There is a difference in terms of the effect on MER of the number of Aboriginal test scores. The estimated relationships suggest

that, in five of six cases, much lower Aboriginal score numbers turn the peer effect from negative to positive. The required thresholds are, however, still well above the numbers of students taking the tests.[12]

At present, much of the policy "entrepreneurship" around Aboriginal education takes place below the radar screen at the school district level. In B.C., the provincial education ministry provides broad direction on Aboriginal policy: provided their programs fall within ministry-approved guidelines, school districts have discretion in determining program content and direction.

What evidence is there that district initiatives matter? In the 2SLS model, the fixed-effect coefficients for 10 (out of a total of 43) districts indicate that average Aboriginal student achievement in the relevant schools differs—either positively or negatively—in a statistically significant manner from forecasts based on the other variables. (At the 5 percent significance level, we would expect to find only two or three of the fixed effects statistically significant if there were no differences among school districts.) In two of the 10 districts (with a total of 16 schools), Aboriginal student performance is above forecast values based on the regression specification. In the other eight districts (with a total of 36 schools), Aboriginal performance is below analogous forecast values.

VIII. Economic Development *or* Cultural Change?

If Aboriginals are to raise their incomes and their standard of living, many will have to continue their historical migration from reserves and rural areas to urban areas with better school opportunities. Under the current policy environment, these schools will display varying degrees of sensitivity to Aboriginal cultural matters. The regression results suggest

[12] In the 2SLS results, the threshold at which the negative peer effect turns positive is an Aboriginal test score count of 915. In the 3SLS results, the analogous thresholds are above 100.

three broad policy implications. First, school boards and policymakers should be cautious about explicit or implicit policies that concentrate Aboriginal students in one or a few schools. After allowing for all relevant variables, schools with larger Aboriginal test score counts generally realize lower academic outcomes. Some counter-examples exist. A few schools are simultaneously appealing to Aboriginal culture and pursuing a reasonably rigorous academic strategy, with the result that the Aboriginal/non-Aboriginal MER gaps are low.

Second, publicly available FSA test results provide Aboriginal parents with useful information about the academic performance of schools and may enable them to choose "good schools" with better prospects for their children.

Third, there may be lessons for school and school district managers to learn from the strategies of school boards that exhibit superior performance. In a related study (Richards et al. 2008), one of us interviewed school district personnel and stakeholders in eight school districts. In four districts, over half of district schools included in the 366-school sample had realized school-level Aboriginal MERs above forecasts based on coefficients (excluding the district fixed effects) of the completely specified 2SLS regression. In the remaining districts, fewer than half of district schools had realized Aboriginal MERs above forecast. To summarize the qualitative results, the more successful districts outperformed the less successful in the following sense: school administrators and teachers have more consistently emphasized Aboriginal education success as a long-term priority; they have more successfully engaged Aboriginal leaders and the broader community; they make more consistent use of objective data on Aboriginal student performance; and they have a reputation of following through on policy implementation.

IX. Conclusion

We want high quality schools not just for their own sake but because they also improve Aboriginal achievement. In our study, school quality and district fixed effect variables loom large in explaining Aboriginal student achievement as measured by performance on standardized tests. These results are consistent with studies elsewhere that stress the importance of various school-related factors. Yet, those same studies demonstrate that school and district quality is complex: it is not a function of easily adjusted input variables, such as class size.

In improving indigenous education outcomes, there has been much recent interest, in Canada and elsewhere, in providing culturally sensitive education for Aboriginals (Canadian Council on Learning 2007). Provision of such education is unlikely to occur until the number of Aboriginal students in a school exceeds some threshold. In the absence of more interventionist policies, the number of Aboriginal students in a school will depend on the racial composition of the local school catchment area. However, some school districts have attempted to realize threshold Aboriginal student cohorts by inviting Aboriginal parents to send their children to particular schools. Such a strategy appears to pose a tradeoff: greater cultural sensitivity but probably lower overall educational performance in core academic skills.

Finally, it is important to highlight that some schools and some school districts have provided a culturally sensitive curriculum *and* achieved above-average Aboriginal achievement levels. Therefore, it appears potentially possible to avoid a tradeoff between cultural sensitivity and achievement.

TABLE 1

FACTORS AFFECTING ABORIGINAL MER IN 366 SCHOOLS
(Dependent variable: ln[MER/(1-MER)]

	1 (OLS)	2 (OLS)	3 (OLS)	4 (2SLS)
Number of Aboriginals taking FSA	-.0039** (.00082)	-.0043** (.00079)	-.0023** (.00068)	-.0032** (.00082)
Square of number of Aboriginal taking FSA	.0000040** (.0000016)	.0000048** (.0000015)	.0000025* (.0000013)	.0000035** (.0000013)
Aboriginal community median family income ($1000s)	.0053** (.0018)	.009** (.0022)	.0048** (.0018)	.0068** (.0021)
Aboriginal community education (percentage points)	.0045* (.0019)	.0044 (.0023)	.0011 (.0019)	.0026 (.0020)
Non-Aboriginal MER (assumed exogenous)	—	—	4.8** (.040)	—
Non-Aboriginal MER (assumed endogenous)	—	—	—	2.7* (1.2)
Fixed effects for school districts	no	yes	yes	yes
Constant	0.61** (.15)	1.2** (.37)	-2.8** (.45)	-1.4 (.98)
R^2	.21	.43	.61	.57

p-values, two-sided t-tests: **.01, *.05
Cells display coefficients, with standard errors in parentheses.

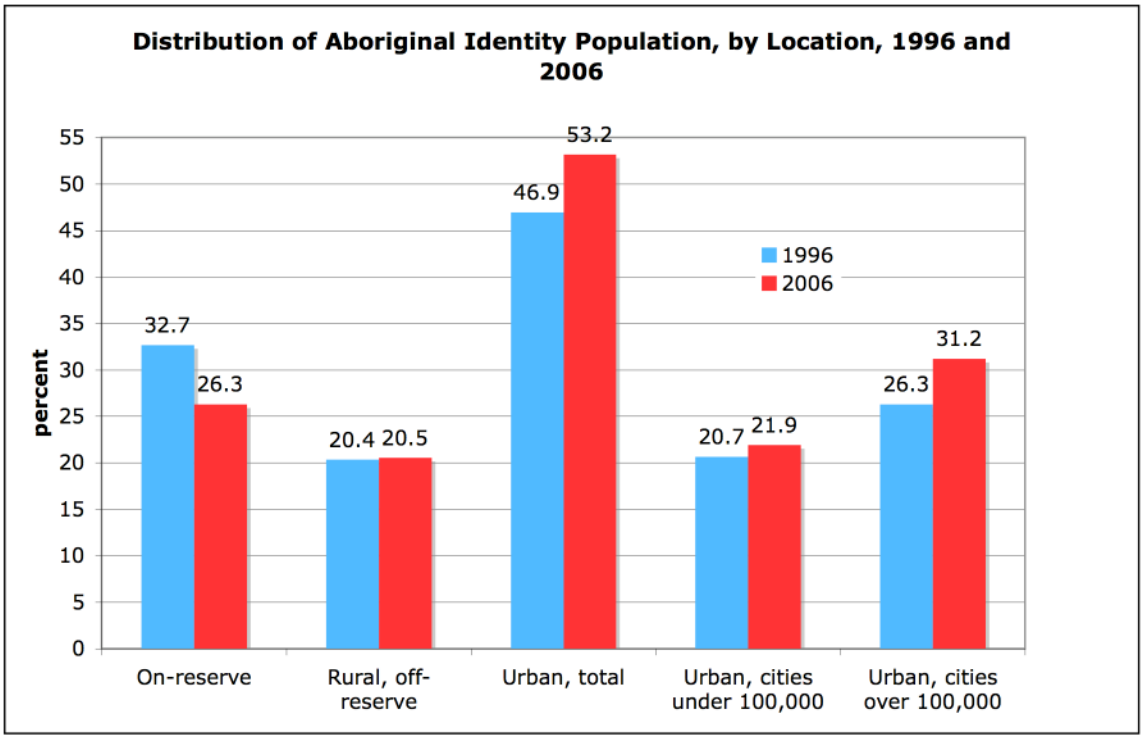
TABLE 2

FACTORS AFFECTING ABORIGINAL MER BY SUBJECT AND GENDER
(Dependent variable: ln[MER/(1-MER)];
Estimation by 3SLS with School District Fixed Effects)

Coefficients (Standard Errors)	Girls			Boys		
	Numeracy	Reading	Writing	Numeracy	Reading	Writing
Number of Aboriginals taking FSA	-.018** (.0070)	-.023** (.0057)	-.055** (.011)	-0.35** (.0075)	-.010 (.006)	-.027* (.013)
Square of number of Aboriginal taking FSA	.00014 (.000071)	.00014* (.000056)	.00044** (.00013)	.00030** (.000081)	.000046 (.000068)	.00025 (.00016)
Aboriginal community median family income ($1000s)	.013** (.0039)	.0034 (.0033)	.0080 (.0051)	.0088* (.0037)	.0070* (.0033)	.0026 (.043)
Aboriginal community education (percentage points)	-.0055 (.0039)	.010** (.0035)	.0031 (.0052)	-.0015 (.00038)	-.0024 (.0034)	.0068 (.0046)
Non-Aboriginal Gender/Subject MER (assumed endogenous)	7.0** (1.3)	4.0** (1.3)	7.6 (4.1)	2.7* (1.3)	4.9** (1.0)	4.2 (2.6)
Constant	-4.7** (1.1)	-2.2 (1.2)	-4.5 (3.8)	-2.3* (1.2)	-2.9** (.81)	-2.7 (2.2)
Pseudo R^2	.37	.46	.34	.38	.38	.30

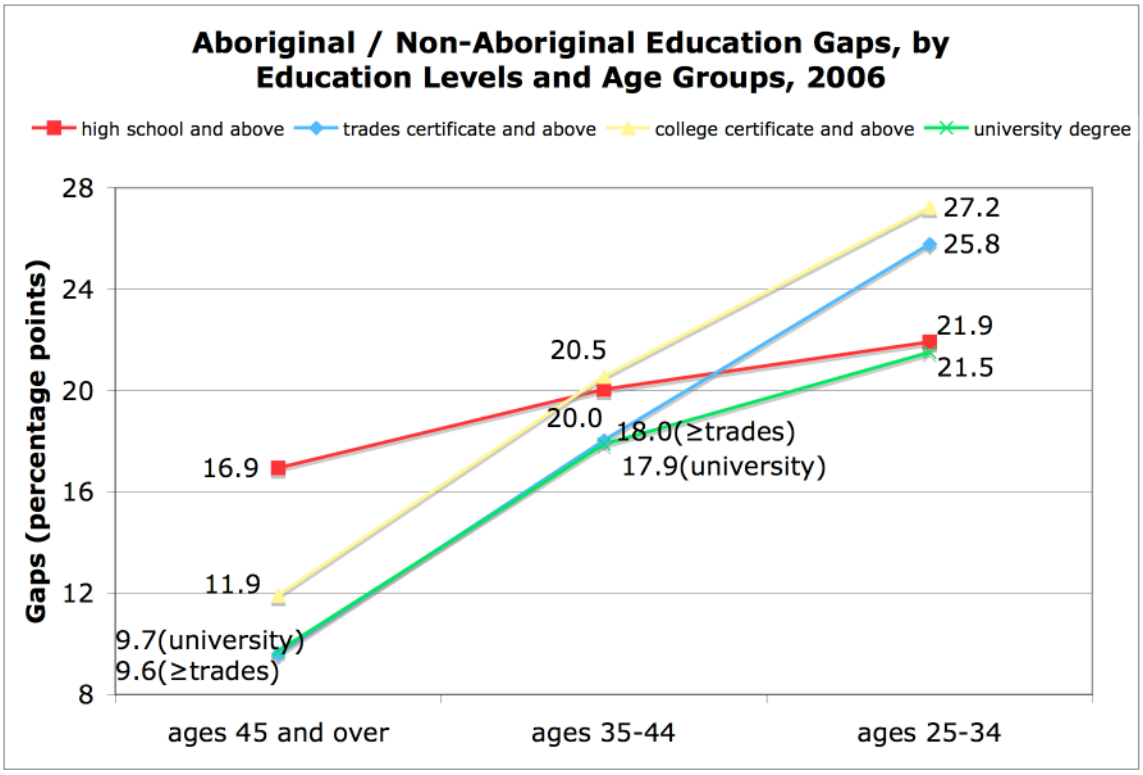
p-values, two-sided t-tests: **.01, *.05

Figure 1



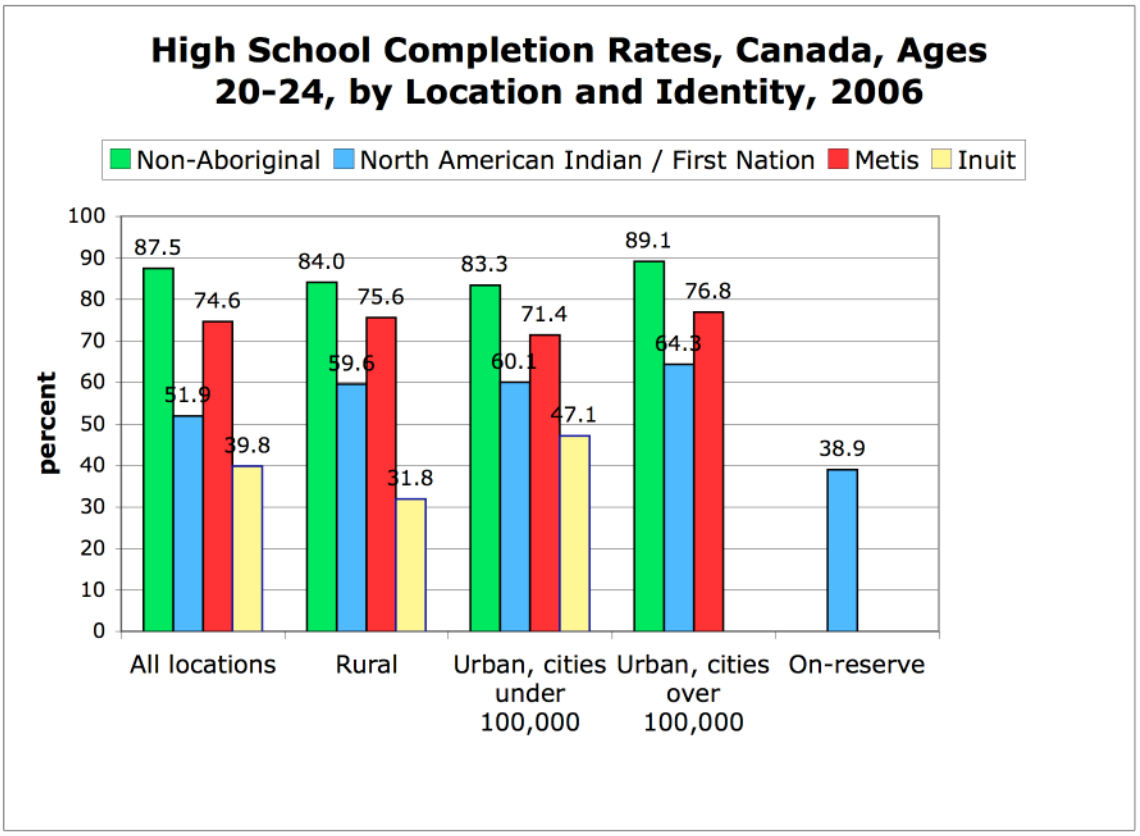
Source: authors' calculations from Canada (2004a, 2008a)

Figure 2



Source: authors' calculations from Canada (2008c)

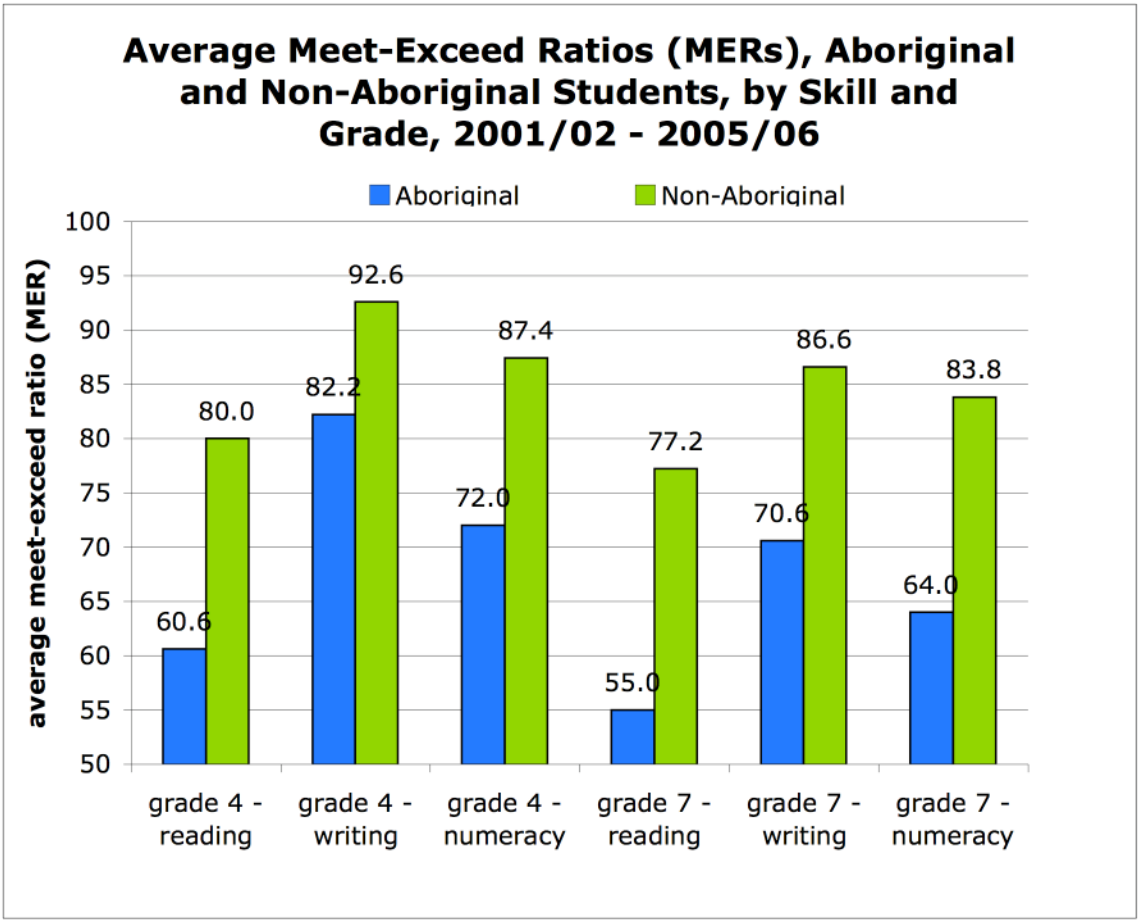
Figure 3



Source: calculated from Canada (2008c).

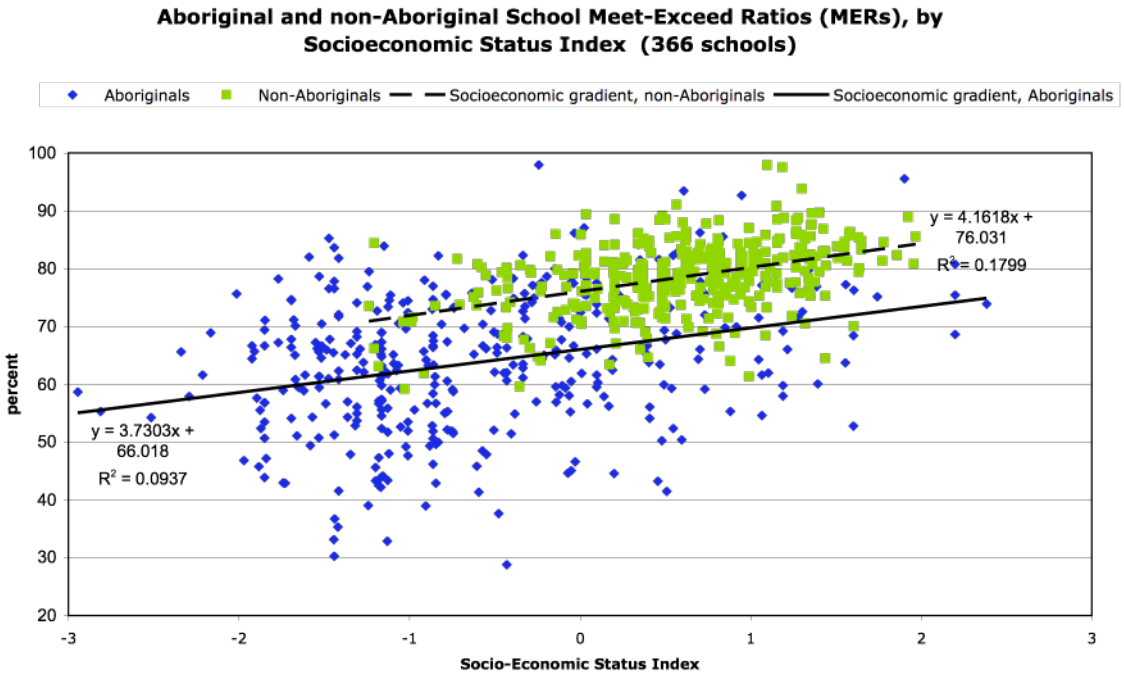
Note: The figure ignores several very small cohorts: Inuit living in CMAs, and those living on-reserve who are not North American Indian by identity.

Figure 4



Source: authors' calculations from British Columbia (2007)

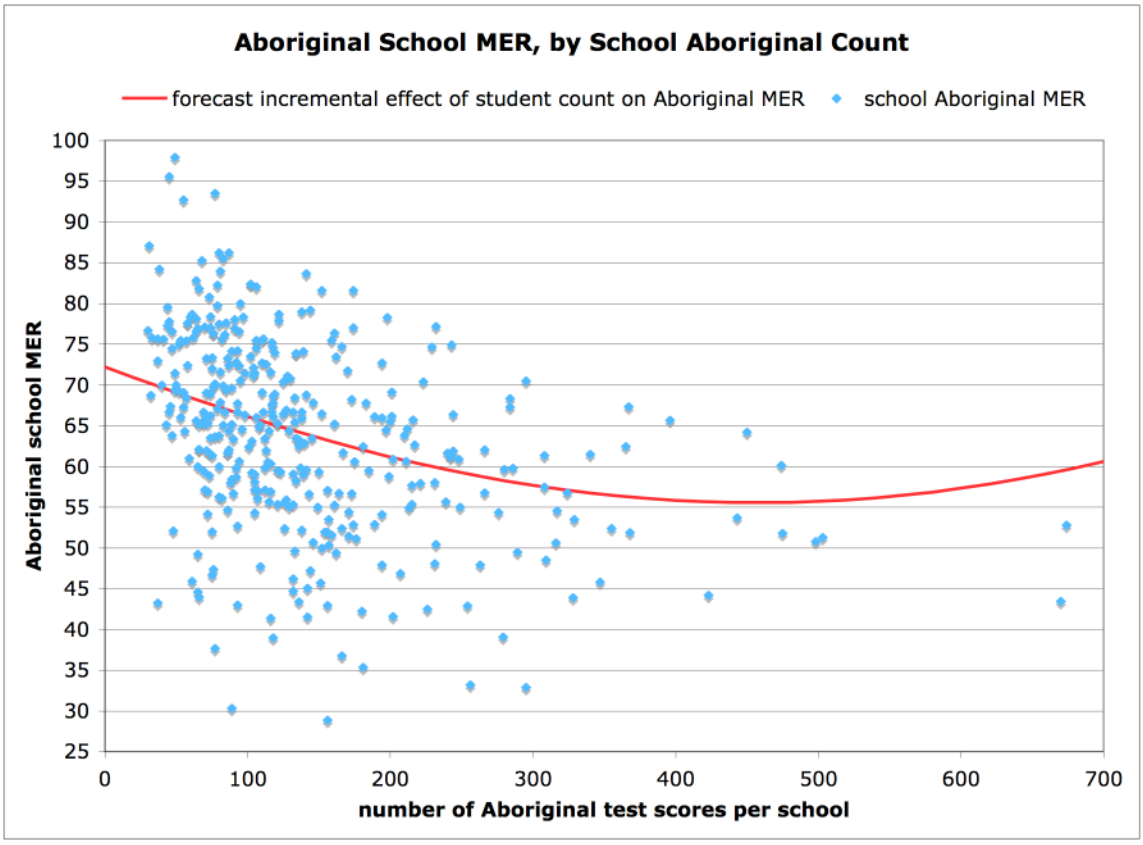
Figure 5



Source: Authors'calculations from data prepared by Statistics Canada from 2001 Census master file and British Columbia Ministry of Education

Note: The gradients are OLS regressions of MER scores on the relevant socioeconomic status index values.

Figure 6



Source: authors' calculations

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