Competition Between Schools and Student Performance – A Canadian Perspective –

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In Canada and the United States, families are given the opportunity to enroll their children in various types of school settings. Whether the school is defined as being private or public, wealthy or poor, inner city or suburban, student performance is measured by standardized tests. In the United States, researchers have focused on two types of parameters affecting the outcome of these test scores: school effects, such as student-teacher ratios, educational funding, and teacher salaries; and family effects, such as the average income of families and parental education. A new dimension that has been introduced by recent studies is competition within the educational process. Typically, this competition is defined in two ways; the degree of market concentration, and the performance of contiguous school districts. As there is an absence of academic research in Canada on this topic, this study will strive to serve as a foundation for further development of the determinants of student performance.

In order to extend the results found in the US, this study will focus on the Canadian setting of the province of Alberta. The educational system of Alberta is not unlike the US educational system, in which competition exists primarily on the basis of funding. Competition within the Alberta public educational system exists as a result of the following: corporate presence in schools; the individual interests of school and jurisdiction administrators; the provincial funding base; and the presence of private, ECS, charter schools, and separate schools.

Before proceeding, it is important to understand why competition exists within the US educational system. Currently, the allocation of funding is derived from formulas that seem to favour district performance, geographic location, and community effects. Additionally, some local districts compete on the basis of eligibility for funding alone, whereby the criteria for eligibility often involves performance reviews over specific periods of time (Pennsylvania Department of Education, 2000). Competition between public schools is further heightened with the adoption of open enrollment choice plans in some states. Under these open enrollment plans, students are permitted to enroll in any school or district of their choice. Furthermore, these open enrollment plans allow for state funding to follow the student. As a result, this creates an incentive for school districts to increase student population as a way to increase funding (ERIC, 1990).

Equally as important as the factors of competition, are the different dimensions of competition. In general, competition can take on the following forms: competition between public school jurisdictions, competition between schools of a public school jurisdiction, and competition between public school jurisdictions and alternative forms of education. The first form involves jurisdictional competition between school and jurisdiction (or districts in the US) administrators. It will be shown, in both the literature review and in this study itself, that the presence and performance of one jurisdiction will impact the performance of others, through the actions of the administrators. The second form, competition within a jurisdiction, is similar to competition between jurisdictions. The use of individual school data is needed to analyze competition at this level. Despite the lack of micro-level data to test for the presence of competition at this level, it is believed that schools might compete with one another in the same way that school jurisdictions compete with one another. Lastly, the third form, again similar to the previous two forms, involves the reaction of administrators to the presence of alternative forms of education. This dimension of competition is briefly discussed in the literature review but will be thoroughly discussed in this study, where it will be shown that an increased supply of alternative educational choices acts as competition to public school administrators. The implicit assumption of analyses of each of these forms of competition, though, is that each is expected to yield increased student performance and achievement.

This paper is comprised of five sections. Section I will review US studies that examine public school competition as a determinant of student academic performance. In this section, considerable emphasis is placed on whether or not their findings constitute an important contribution to the literature on public education. In Section II, I will provide an overview of Alberta's educational system. Section III will involve a detailed analysis of the findings of the provincial models. Section IV will focus on a migration model in order to test whether school performance is one of the factors that may lead families to migrate from one jurisdiction to another. Section V will offer concluding remarks.

Section I Literature Review

In this section, three studies that examine public school competition as a determinant of student academic performance will be reviewed. These studies were chosen because their focus is similar to the focus of my study, which examines the effects of competition between public schools at lower grade levels. The similarities between each of these studies involve their approaches to analyzing this relationship. The uniqueness of each of these studies arises from differences in modeling techniques and the form of competition examined. For instance, the first study, by Borland and Howsen (1992), focuses on market concentration as a determinant of student performance. Using a similar approach, Blair and Staley (1995) focus on student performance in contiguous school districts. Finally, Marlow (1995) incorporates elements from both the previous studies and focuses on the effects of funding on student performance. [1]

Previous studies leading up to the Borland and Howsen study have concluded, for the most part, that family effects are a major determinant of student performance. However, whereas the results of family effects have proven to be significant, the results for school effects have been inconclusive (Borland and Howsen, 1992, 31). These school effects include teacher education, teacher experience, class size, and average expenditure per pupil (Hanushek, 1986). Hanushek also concedes that the impact of school effects on student achievement is important but difficult to define. Despite this, Borland and Howsen believe that the degree of competition facing a school district is one variable that can account for these effects.

[1] Other notable studies that have examined competition within the educational system include Hoxby (1994, 1998) and Zanzig (1997). As the nature of this Canadian study, and the other studies examined in this paper for that matter, focus primarily of lower grade levels, the amount of attention devoted to these studies will be minor in nature.

Borland and Howsen hypothesize that when faced with competition from other districts, the administrators of a school will be more apt to comply with the objectives of both parents and students. The basis for competition is the potential to lose students and the associated subsidy to another school district (Borland and Howsen, 1992, 32). Thus, in order to gain a competitive edge in the recruitment of new students, while also retaining existing students, school administrators must establish criteria to achieve these measures. This would involve maximizing test scores, increasing student achievement, and offering a wider variety of courses. To effectively do so, administrators would then likely have to hire those teachers with the necessary skills in order to enhance student academic performance (Borland and Howsen, 1992, 32).

The authors developed an empirical model that includes novel measures involving both a measure of market concentration and a measure of student innate ability. To measure market concentration, a Herfindahl index was constructed. [2] This index is made possible because of statewide open enrollment policies. The construction of this index involved treating third graders, including students from both public and independent schools, as a measure of output; each county within the state as a market; and each district within a county as a firm. The larger the value of the Herfindahl index, the smaller the degree of competition. To measure student innate ability, cognitive test scores were used.

The sample set consists of 170 school districts, at an aggregate level, for the school year 1989-1990, in the state of Kentucky. The two equations below describe the general form of their model:

$$sa = f(h, iq, ts, a, c, pt, u) \quad (1)$$

$$ts = g(sa, t, h, r, ad, u) \quad (2)$$

[2] The Herfindahl index is defined as the sum of the squares of third grade enrollment shares of districts within the county, i.e., $H = \Sigma_{n, i=1} P_i^2$. Where $Pi = E_i/\Sigma_{n, i=1}$. E_i represents the enrollment share of the i^{th} district or independent school in the county. Hence, if only 1 school district exists within a county, the Herfindahl index (H) is equal to 1. As the degree of competition within the county increases, the Herfindahl index approaches 0. Thus, the larger the Herfindahl index is the less there is competition and vice versa (Borland and Howsen, 1002, 32).

In these equations, *sa* is a measure of student achievement (test results at the grade 3 level); *h* represents the Herfindahl index; *iq* is a measure of innate ability; *ts* represents teacher salaries; *a* represents the attendance rate; and *c* is the percentage of graduating students who enroll in college. Additionally, *pt* is the pupil teacher ratio; *u* represents the presence of a teachers' union; *t* is a measure of tax effort; *r* is the rank earned by teachers, defined as the percentage of teachers in a district with at least a masters degree; and *ad* is the cost of administration in a school district.[3]

Using the two-stage least-squares technique, the authors found several significant results that they believe could have implications for the public educational system. For instance, in the student achievement equation, both of the coefficients for the Herfindahl index and teacher salary variables are negative and significant, at a ten-percent (one-tail test) and a five-percent (two-tail test) significance level, respectively. The results of these coefficients imply that an increase in the measure of market concentration (i.e., a decrease in competition) and increases in teacher salaries lead to a decrease in performance (Borland and Howsen, 1992, 36). Both coefficients for innate abilities and college were positive and significant, both at a five-percent (one-tail test) significance level.[4] Additionally, the coefficients for attendance, the pupil/teacher ratio, and the presence of a teacher union were insignificant. In the teacher salaries equation, the coefficients for the Herfindahl index and cost of administration are negative and significant, both at a five-percent (one-tail test) significance level. As well, the coefficients for student achievement, the presence of a teachers' union, tax effort, and rank earned were positive and significant, all with five-percent (one-tail test) significance levels.

The economic significance of their overall findings is based on the negative and significant coefficients of the Herfindahl index in both the student achievement and the teacher salary equations. In the student achievement equation, the negative effect of the Herfindahl index

[3] The authors state that their production function uses expenditure amounts as proxies for such inputs (i.e., real inputs) and that to the extent that prices for inputs are constant, the expenditures and quantities of real inputs and technology are perfectly correlated and are substitutable in a statistical model.
[4] The authors contend that the significance of the student innate ability variable constitutes a bias in previous empirical work, which have not included this measurement.

suggests that when faced with competition for students, school administrators will then take the necessary actions to apply measures that will significantly improve student performance (Borland and Howsen, 1992, 36-37). To simplify, increased school district competition generates increased pressure for individual districts to perform. Additionally, the negative effect the Herfindahl index has on the teacher salary equation seems to suggest that as the number of school districts in a county increase, teacher salaries increase. This finding tends to support the monopsonist theory of wage determination (Borland and Howsen, 1992, 37). A possible conclusion reached by the authors is that competition within the educational process leads to higher test scores, and that higher market power leads to lower student achievement.[5]

Although this study does provide empirical support for the view that competitive pressures increase student performance, it does nonetheless, have weaknesses that are clearly worth noting. For instance, the authors' district-level empirical model does not condition on family income, family structure or parental education. Additionally, the authors' reliance on district level data in order to capture competition from both public schools and independent schools in a single Herfindahl index, does not seem to account for the endogeneity of the private school competition variable (Jepsen, 1999). The presence of these weaknesses essentially introduces an element of bias within their model.

Blair and Staley (1995) extend the model used by Borland and Howsen by incorporating test performances of neighbouring jurisdictions as opposed to using market concentration (as measured by the Herfindahl index). They show that increased test performance of neighbouring jurisdictions has a positive and significant effect on the jurisdiction in question. Competition is

[5] In a related study that incorporates both independent schools and a Herfindahl index of enrollment shares, Hoxby (1994, 1998) shows that competition from the presence of private schools has a positive affect on student performance. In this study, focusing on metropolitan areas, the measure of competition is defined as the percentage of secondary school students attending private schools. The results of her study show that competition from private schools raised the quality of public schools, and improves such areas as years of schooling, high-school graduation rates, educational attainment, and wages.

modeled in this way despite the fact that open enrollment policies exist within the state, since the authors' data set involved school districts in metropolitan areas.[6]

Using ordinary least-squares regression, the authors examine 266 school districts, at an aggregate level, in the six largest metropolitan statistical areas in the state of Ohio.[7] This sample was chosen on the belief that the 'consequences of intergovernmental competition will be most apparent within a metropolitan area because they approximate local labour markets and represent a practical range of residential mobility' (Blair and Staley, 1995, 194). The measure of achievement in their model is the composite index of mean scores for reading, mathematics, and language arts, among students in the 4th, 6th, and 8th grades.[8] The hypothesis tested by the study is that quality competition affects school district performance as measured by SCORE.

The authors also included student environmental background factors that they believe have more of an impact from a socioeconomic viewpoint on student academic performance. These factors include variables such as gross family income, number of dependent children, and ethnic diversification. The authors also believe that neighbouring suburbs are likely to have similar social and economic characteristics, and that any attempt to explain variations in the dependent variable, *SCORE*, should account for variations in student background (Blair and Staley, 1995, 195). The general form of their estimating equation is:

$$SCORE = \beta_0 + \beta_1 SALARIES + \beta_2\, P/T\ RATIO + \beta_3 AGI + \beta_4 MINOR + \beta_5 ADC + \beta_6 NEIGHBOR + \beta_7 COUNT,$$

where *SALARIES* represents teacher salaries in thousands of dollars (included as a measure of quality of the teaching staff), *P/T RATIO* represents the pupil teacher ratio, and *AGI* represents per family adjusted gross income in thousands of dollars. Additionally, *MINOR* represents the percentage of minority students, *ADC* represents the percentage of families in the district

[6] In addition, the authors contend that the focus of this extension is on quality competition as opposed to competition as measured by 'market structure' (Blair and Staley, 1992, 194).
[7] These involved the following areas: Akron, Cincinnati, Cleveland, Columbas, Dayton, and Toledo.
[8] These tests are comprised of the Stanford Achievement Test, The California Achievement Test, and the Iowa Test.

receiving aid to families with dependent children, *NEIGHBOR* represents average test scores in contiguous school districts, and *COUNT* represents the number of jurisdictions bordering the subject district.

Using this model, the authors found several estimated coefficients to be significant at the one-percent level. The coefficients of both *AGI* and *ADC* were statistically significant, with the coefficient of *AGI* being positive and that of *ADC* being negative. As well, the coefficients for both *SALARIES* and *NEIGHBOR* were shown to be positive and significant.

The authors believe that the implications of their analysis for public policy are important (Blair and Staley, 1995, 197). They believe their data confirms what Borland and Howsen set out to show in their study: that competition can have important impacts on the quality of public services. In the Blair and Staley case, the educational performance of contiguous school districts clearly has an impact on student achievement in public schools. Thus this study also makes a significant contribution to the literature on public education in the US.

However, one weakness of this study is that the authors control for only a few inputs into the educational production function (Holmes, 2001).[9] They exclude factors such as community influences - graduation rates and the number of students who enroll in college or university; and family background characteristics - parental education and family structure. Another weakness within this study is that the model may have a possible simultaneity problem. If school administrators do in fact concern themselves with other jurisdictions' scores, then *NEIGHBOR* may be an endogenous variable. The use of lagged test scores for this variable would perhaps correct for this simultaneity problem. Because of these weaknesses, their model may in fact be biased.

[9] The production function approach relies heavily on multiple regression analysis in order to relate a series of inputs, e.g., cost factors, to an output, e.g. student achievement (US Department of Education, 1998). In the context of education, a production function typically takes the form of the following generalized equation (Levin, 1974): $A_{it} = g(F_{i(t)}, S_{i(t)}, P_{i(t)}, O_{i(t)}, I_{i(t)})$. The subscript *i* refer to the *i*th student and *t* refers to time t. The other symbols are as follows: *A* pertains to the educational outcomes; *F* involves individual and family background characteristics; and *S* pertains to school inputs. Additionally, *P* represents peer or fellow student characteristics; *O* involves external influences (e.g., community effects); and *I* is initial or innate endowments.

The study undertaken by Marlow incorporates several components from both of the previous studies. Like his predecessors, Marlow finds support for the hypothesis that greater competition improves student performance (Marlow, 2000, 89). Where he differs is in the examination of the role of public spending as a determinant of student performance. [10] The author believes that increased public spending will not have the intended effects on student performance, since it is likely that spending hikes will flow to administrators, teachers, and staff in a manner that bears little connection to student achievement (Marlow, 2000, 92 - 103).[11]

In his study, Marlow samples 57 counties and over 1000 school districts in the State of California. Performance scores were collected from students in the fourth, eighth, and tenth grades during the 1993/1994 academic year. The empirical models used in the study consisted of a set of five equations, with the dependent variables being education spending, reading achievement, math achievement, writing achievement, and teacher-student ratio. The explanatory variables include the Herfindahl index, previously introduced in the Borland and Howsen study as a measure of public school market competition.[12]

The following models of cross county spending and performance are estimated:

$$EXP_i=f(Y_i, DENSITY_i, STUDENT_i, STATE_i, FEDERAL_i, BLACK_i, HISPANIC_i, ASIAN_i, HERF_i) \quad (3)$$

$$PERF_i=f(EXP_i, Y_i, DENSITY_i, STATE_i, FEDERAL_i, BLACK_i, HISPANIC_i, ASIAN_i, HERF_i), \quad (4)$$

where *EXP* represents education spending per pupil at both the primary and secondary school levels; *Y* represents per capita personal income; *DENSITY* represents population divided by square miles; *STUDENT* represents the student share of the population; and *STATE* represents the state share of education spending. Additionally, *FEDERAL* represents the federal share of public

[10] Note that educational spending per student is usually comprised of two parts: classroom instruction time, and non-instructional time. Non-instructional time includes the following areas: administration costs, preparation costs, teacher training and seminars, and the provision of the appropriate facilities and materials.

[11] Marlow believes that the relationship between spending and performance is one that is ambiguous in nature and, as such, cannot rule out that higher spending may be reflected simply as a function of greater monopoly power of schools.

[12] The use of the Herfindahl index is warranted is this study since open enrollment school policies exist within the state of California.

education spending; *BLACK*, *HISPANIC*, and *ASIAN* represent the respective race percentage of the student population; *HERF* represents the Herfindahl index; and *PERF* represents the reading, writing, math achievement, and teacher-student ratios (Marlow, 2000, 96).

Although the model is simultaneous, because of its recursive structure and because it is reasonable to assume that the error terms are contemporaneously correlated – due to the close relationship between spending, measures of student-performance (reading, math, and writing), and teacher-student ratios - the seemingly unrelated regression (SUR) technique was used to estimate the model. Using this SUR technique, Marlow estimates six different five-equation models, where the dependent variables involve education spending (*EXP*), and the four measures of performance (*PERF*), such as reading, math, writing, and teach-student ratio. In order to estimate these six models, Marlow divides them into two separate categories; education spending per student for each grade level, and education spending as a percentage of personal income for each grade level.

Marlow's findings in this study support several of his hypotheses. First, when education spending is defined as spending per pupil, education spending has a negative and significant effect on student achievement in six out of nine cases. These nine cases involve the student achievement equations for reading, math, and writing from all three grades. More specifically, these six cases involve the reading achievement equation for all grades, the math achievement equation for grades 8 and 10, and the writing achievement equation for grade 8. [13] When spending is defined as a percentage of personal income, a negative and significant effect on student achievement is also found in five out of nine cases (Marlow, 2000, 102). A negative and significant effect is found in the math achievement equation for grades 4 and 10, the reading achievement equation for grades 8 and 10, and the writing achievement equation for grade 10

[13] For the grade 4 level, reading was significant at a ten-percent level; at the grade 8 level, reading was significant at a one-percent level; and at the grade 10 level, reading was significant at a five-percent level. All significant levels estimated in this study use two-tailed tests. For the math achievement equation, education spending was significant at ten-percent and five-percent levels for grades 8 and 10, respectively. And for the writing equation, at the grade 8 level, education spending is significant at a ten-percent level.

students.[14] The author examines education spending in this alternate way as spending per capita is often the measure used to gage the adequacy of educational resources allocated to the average student (Marlow, 2000, 100).

Second, education spending tends to be highest in those counties exhibiting the highest monopoly control of public education institutions, as measured by the Herfindahl index. This result seems to reinforce the predictions of bureaucracy theory, since the ability of attracting public funds appears to be positively related to the degree of market power. [15] The author believes this result may explain why increased spending has not been found to increase student performance since the flows of higher spending bear little connection to student achievement (Marlow, 2000, 103).

Third, median levels of education of county residents exert strong influences on student academic achievement in 15 out of 18 cases.[16] These eighteen cases are comprised of the three student achievement equations, i.e., reading, math, and writing from all six models. The three exceptions of the effects of median education levels on student performance pertain to the reading achievement equations for grades 8 and 10 when spending is defined as a percentage of personal income, and the writing achievement equation at the grade 10 level when spending is defined as spending per pupil. Overall, these results are consistent with the conventional wisdom that family influences, such as parental education and involvement, play instrumental roles in student achievement.

[14] In the math achievement equation, education spending is significant at five-percent and one-percent levels for grades 4 and 10, respectively. In the reading achievement equation, it is significant at one-percent and five-percent levels for grades 8 and 10, respectively. And in the writing achievement equation, it is significant at a one-percent level for grade 8 students.

[15] Recall that the degree of monopoly power is measured by the Herfindahl index. Values under one represent competition within a market; a value of one represents a perfect monopoly. In this respect, higher monopoly power implies that a county has a larger share of the market for students and schools over another county and, as such, obtains more funding on a per student basis.

[16] Recall from earlier that education spending is broken down into two categories: spending per pupil and spending as a percentage of personal income. For the first category, median education has a significant effect on several achievement equations. For instance, in the reading equation, it is significant at five-percent and ten-percent levels for grades 4 and 10, and grade 8, respectively; and for the math equation, significant at one-percent and ten-percent levels for grade 4, and grades 8 and 10, respectively. Additionally, for the writing equation, significant at a one-percent and at a five-percent level for grades 4 and 10 respectively. For the second category, in the reading equation, median education is significant at a five-percent level for grade 4 students. In the math equation, significant at a one-percent and at a five percent level for grades 4 and 8, and grade10 respectively. Lastly, for the writing equation, significant at one-percent and ten percent levels for grades 4 and 8, and grade10 respectively.

Fourth, there is strong support, in 9 out of 12 cases for the fourth and eighth grades, for the public exchange view that higher market power leads to lower levels of student achievement. The twelve cases involve the student achievement equations for the two education spending categories of the grade 4 and 8 models. Specifically, when education spending is defined as spending per pupil at the grade 4 level, this result can be seen in the reading and writing achievement equations.[17] When defined as spending as a percentage of personal income, this result can be seen in the reading achievement equation. When education spending is defined in both manners, all of the achievement equations at the grade 8 level also show significant results. Marlow finds no evidence to support the hypothesis that higher market power raises student performance (Marlow, 2000, 104). [18]

As a result of these findings, it is clear that this study provides a significant contribution to the literature on public education in the US, with respect to the impacts of both school effects and competitive pressures on student performance. Another contribution of this study is its examination of the allocation of funds for school districts and school administrators.

In addition to the study's contributions, several weaknesses are apparent; in fact, they are quite similar to those of the previous studies. For instance, Marlow also controls for too few inputs into the educational production function. By doing so, he excludes factors that have potential effects on student performance. Specifically, these exclusions pertain to family structure, and community effects. Additionally, the data used in the study is highly aggregated. It

[17] When education spending is defined as spending per pupil, significant effects at the grade 4 and 8 levels are as follows: for grade 4, in the reading equation, significant at a five-percent level; and in the writing equation, significant at a five-percent level. For grade 8, in the reading equation, significant at a one-percent level; and in the writing equation, significant at a five-percent level. When education spending is defined as spending as a percentage of income, several significant effects at the grade 4 and 8 levels can be seen. For instance, at the grade 4 level, in the reading equation, significant at a five-percent level. For grade 8, in the reading equation, significant at a one-percent level; in the math equation, significant at a one-percent level; and in the writing equation, significant at a five-percent level.

[18] In a similar study, by Zanzig (1997) he examines whether greater school competition among districts improves student performance. In this study, using 1970 data from the state of California, he focuses on 337 school districts and uses arithmetic scores as a basis for measuring student performance for high-school seniors. In order to test for the competitiveness of school districts, two alternative measures of competition are used: a Herfindahl index and the number of school districts per county. The results showed that greater competition was found to have a positive effect on student test scores, and that it takes between three and five school districts to make a completely competitive market (Marlow, 2000, 95). Zanzig also shows a negative relationship between public school spending and the percentage of students who attend private schools in the county. The conclusion reached by Zanzig is that competition has beneficial impacts on student achievement, and that counties that have only one or two school districts should consider restructuring their school system into three or four school districts in order to facilitate competition.

only covers total spending on behalf of the federal, state, and local levels. Having more disaggregated data at the individual school levels, would almost certainly provide for more conclusive results, although it is unlikely that such data are available.

Section II. The Alberta Educational system

In order to extend the previous studies using a Canadian setting, the province of Alberta has been selected. As in the United States, in Alberta the potential for competition arises from the following aspects of the educational system: corporate presence in schools; the individual interests of school and jurisdiction administrators; the provincial funding base; and the presence of private, early childhood services (ECS), charter schools, and separate schools.

While the analysis of the effects of corporate presence and the individual interests of school and jurisdiction administrators will be speculative in nature, the analysis of the remaining elements of competition will involve econometric modeling and testing. The following section provides a general description of the educational system in the province. Also included in this section is a table of jurisdiction profiles, which includes the number of operating schools; the number of registered full-time students; and the number of private, ECS and charter schools.[19] It is important to note, however, that the table includes only those public school jurisdictions that are included in both the sample years that are used in this study. This section is then followed by a detailed discussion of the nature of competition within the Alberta public educational system.

Section II.I. The Educational Process in Alberta

The educational system in the province of Alberta includes schools that are operated by school boards and schools that are owned and/or operated by individuals or groups. Three types of school boards exist within the province: public, separate, and francophone. These school

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[19] Separate schools have not been included in this table due to the unavailability of such jurisdiction profile data.

boards are responsible for overseeing specific educational regions, also known as jurisdictions. In addition, two types of schools run by individuals or groups are present within the province: independent and early childhood services (ECS), either accredited or registered; and charter schools.

The educational system in the province consists of 42 public school jurisdictions, 17 separate school jurisdictions, and 3 francophone school jurisdictions.[20] Each is required to provide free education up to the end of high school for all citizens and permanent residents under the age of 20. Additionally, each jurisdiction is entitled to receive the same amount of funding on a per student basis (Alberta Learning, 2000).

The educational system supplied by the private market is comprised of independent and early childhood services, and charter schools. This sector includes 316 independent and ECS schools, and 9 charter schools. Turning our attention to independent and ECS schools, alternatively known as private schools, two types are present in Alberta: accredited and registered schools. In *accredited private schools* in Alberta, students can earn credits toward an Alberta graduation diploma. Accredited schools must also satisfy several provincial requirements, such as following the Alberta Program of Studies, employing only certified teachers, and allowing themselves to be monitored by Alberta Learning. As well, these schools may receive provincial general revenue if operated by a non-profit society or corporation, and in the case of severe special needs children, receive the same funding as public schools. In contrast, *registered private schools* do not receive provincial funding and their students cannot earn credits towards an Alberta graduation diploma. Additionally, registered private schools do not have to follow the Alberta Program of Studies, do not have to employ certified teachers, and do not have to be monitored by Alberta Learning (Alberta Learning, 2001).

[20] Note that for the purposes of this study, francophone jurisdictions have not been examined. This exclusion is due to a limited numbers of jurisdictions and schools.

Alberta's charter schools are autonomous non-profit schools organized by parents and educators who are looking for an alternative choice of educational philosophy, governance, and methodology. They are granted flexibility and autonomy in the implementation of these programs and/or services. Charter schools must follow the basic provincially mandated school curriculum, and can hire certified teachers who are not members of the Provincial Teachers' Association. They can also manage their own funding, and are eligible for the same per-pupil grants as public schools (Policy Options, 1998).

The following table provides an illustration of these alternative educational choices, while also including factors such as the number of operating schools in each jurisdiction, and the school population of each jurisdiction.

Table 1. Public school jurisdiction profiles

Jurisdiction	Number of Public Schools	Public School Population	Number of Private and ECS Schools	Number of Charter Schools[21]
Aspen View Regional Division No.19	16	3,700	2	0
Battle River Regional Division No. 31	37	7,616	16	0
Black Gold Regional Division No. 18	26	8,832	3	0
Buffalo Trail Division No. 28	28	4,894	7	0
Calgary School District No. 19	222	43,669	94	4
Canadian Rockies Regional Division No. 12	6	2,760	2	0
Edmonton School District No. 7	214	82,442	50	3
Elk Island Public Schools Regional Division No. 14	43	16,128	2	1
Foothills School Division No. 38	24	6,900	4	0
Fort Vermillion School Division No. 52	16	3,391	2	0
Golden Hills Regional Division No. 15	35	6,621	5	0
Grande Prairie School District No. 2357	13	5,590	2	0
Grande Yellowhead Regional Division No. 35	23	6,285	1	0
Grasslands Regional Division No. 6	19	3,760	2	0
High Prairie School Division No. 48	12	3,894	2	0
Horizon School Division No. 67	28	3,550	2	0
Lethbridge School District No. 51	19	8,195	7	0
Livingstone Range Division No. 68	29	4,904	1	0
Medicine Hat School District No. 76	18	2,542	5	1
Northern Gateway Regional Division No. 10	21	5,829	1	0
Northern Lights School Division No. 69	24	6,409	10	0
Northland School Division No. 61	22	2,903	0	0
Palliser Regional Division No. 26	33	4,087	12	0
Parkland School Division No. 70	24	9,620	5	0
Peace River School Division No. 10	19	3,776	3	0
Peace Wapiti Regional Division No. 33	26	5,662	2	0

[21] Note: One charter school not accounted for in this table pertains to a charter school belonging to the Fort McMurray jurisdiction.

Pembina Hills Regional Division No. 7	21	5,995	1	0
Prairie Land Regional Division No. 25	19	2,020	1	0
Prairie Rose Regional Division No. 8	36	3,769	8	0
Red Deer School District No. 104	33	4,775	10	0
Rocky View School Division No. 41	33	14,209	14	0
St. Albert Protestant Separate School District No. 6	16	6,595	3	0
St. Paul Education Regional Division No. 1	18	4,021	2	0
Sturgeon School Division No. 24	15	4,927	0	0
Wetaskiwin Regional Division No. 11	20	4,661	4	0
Wild Rose School Division No. 66	19	5,557	3	0

Source: Alberta Learning, 2000

Section II.II Competition in the Alberta Educational system

As stated in the previous section, there are several features of the educational system that are likely to promote competition. These involve the following: corporate presence in schools; the individual interests of school and jurisdiction administrators; the provincial funding base; and private, ECS, charter schools, and separate schools. A detailed description of these features follows.

First, the fact that corporations are allowed to establish a presence within schools is likely to encourage competition between schools and/or jurisdictions. Currently, the Alberta Government allows corporations to establish a presence within schools by allowing them to provide donations and endowments for athletic or pedagogical purposes, and to supply commercial curricula material (ATA, 2000). In a survey undertaken by the Alberta Teacher's Association, it was reported that already one-third of public schools have business partnerships or sponsorships (ATA, 2000). Although corporate presence in schools exists, there is no legislation governing it. School board decision-making is autonomous and, as such, schools can form business partnerships or receive sponsorships at their own discretion (Alberta Learning, 2000). The motive behind these practices almost certainly is an attempt to compensate for lack of resources and funding from the provincial government. The problem with the establishment of corporate presence, and where the competitive element comes into play, is that once schools and corporations are allowed to form strategic alliances, schools will be forced to compete with one another in order to form these alliances. Those jurisdictions that are not as well endowed as other jurisdictions, or perhaps have small population numbers (e.g., rural areas) might be at a tremendous disadvantage. Without the additional aid of corporate funding, the schools may be unable to expand and develop better programs and services that may improve student academic performance.

In order to understand the individual interests of school and jurisdiction administrators, one must be able to see a school in the same light as a firm and administrators as the managers of this firm. Like administrators, managers of a firm are often expected to provide services in areas of budgeting, employment, supervision, procurement, and departmental or company performance. Although this notion seems ambiguous, in the sense that managers of a firm are in the business of maximizing profits, the individual interests of school and jurisdiction administrators can be defined as bringing recognition to the firm, growth to the firm, and job security. The "firm" in this case is the school or jurisdiction. Bringing recognition to the firm will heighten reputation, thereby increasing parental awareness and teaching interest. This recognition factor may then have a spillover effect, bringing growth to the firm in the form of increased enrollment. It will also allow the administrators to select teachers who have the necessary skills to help improve student academic performance as a result of the increased interest in available teaching positions. As a result of these factors, school and jurisdiction administrators would then likely increase their own job security. Thus, the individual interests of school and jurisdiction administrators lead to direct competition with each other for students and teachers.

Although funding data by the Alberta Government is made available only at an aggregate level, the distribution of the funding base can still lead to competition within the public educational system. To explore the avenue of competition for funding, some background information about the structure of funding in this province is needed. In general, provincial school funding is based on three components of a funding formula – instruction block grants, support block grants, and capital block grants. An *instruction block grant* is based simply on the number of students. All school districts receive the same amount of funding per student.

Variations in these amounts are subject to the special criteria as described under the instruction block. Additionally, this block grant includes the cost of principals, teachers, instructional support staff, learning resources and supplies, equipment, and furnishings used in the instructional program (Alberta Learning, 2001). A *support block grant* provides for the reasonable costs of plant operations and maintenance, board governance and system administration, student transportation, and boarding students away from home (Alberta Learning, 2001). Lastly, *capital funding* provides for the cost of school facilities, some of which include: building quality restoration programs, funding for modernization projects, funding for new construction projects such as new schools, funding for innovate school facility projects, and funding for technology equipment (Alberta Learning, 2001).

School funding in Alberta is managed by the Alberta School Foundation Fund, whose mandate is to govern two key areas of provincial funding, revenue and payments. The source of revenue for funding is education property taxes, collected on an annual basis from all municipalities. This tax is centered on a uniform provincial mill rate, a rate applied to property assessments to determine the amount of tax owed from individual taxpayers. Its calculation involves taking the total amount of dollars required from property taxes and dividing by the total property assessment value. [22] Quarterly payments are made by the ASFF to all school jurisdictions. These payments are based on a per student rate, calculated using the eligible student count (i.e., total funds available from education property taxes are divided by the total number of eligible students for the year). This per student amount is then distributed to all of the school jurisdictions depending on the number of funded students (Alberta Learning).[23] Specific

[22] Property is assessed and taxed based upon two different categories; residential and farmland, and non-residential.

[23] Separate school boards are allowed to 'opt out' of the ASFF, whereby they can requisition and collect property taxes directly from the municipalities themselves. However, the minimum amount of requisitions is determined by the ASFF. The total property tax amount used to determine per student rates then consists of all opted out revenues and revenues from the ASFF itself. No financial gain is permitted by opting out of the ASFF (Alberta Learning, 2001).

funding rates for the 2000/2001 school year, provided by the ASFF, can be observed from the ASFF reproduced table below.[24]

Table 2. Funding rates for all Alberta public school jurisdictions

School Jurisdictions Instruction Block:	2000/2001 School Year
Basic Instruction: Grades 1 – 9 Amount of funding per student in Basic Instruction includes support of programs for students with mild to moderate special needs, and those who are considered gifted.	$4,096
Outreach Programs: Grades 1 – 9	$4,096
Students with Severs Disabilities a) Severe mental, multiple, physical/medical, deaf, or blind disability. b) Severe emotional/behavioral disability	 $12,307 $10,325
English as a Second Language	$697.50
Enhanced Education	Per approved project
Native Education	Per approved project
Institutional Programs	Per approved final costs
Regional Assessment Services	Per approved allocation
Sparsity/Distance -Sparsity rate -Distance rate for distance from office to urban centre -Per kilometre for distance from office to school over 25 km (does not include Hutterite schools) The sparsity factor minimum is lowered from 0.25 to 0.07 for school boards serving more than 6000 students, of which more than 25 per cent but less than 50 per cent are rural students.	 $530.50 42 cents per km 29 cent per km
Teacher Assistants Program	$40.25 per student based on September 30 count for grades 1 to 6
Early Literacy Initiative	$212.25 per funded student based on September 30 for grades 1 and 2
Learning Resources	$9.90 credit per student
Home Education * plus 50% of the cost of ADLC courses for grades 7 to 12 to a maximum of	$1,051 per funded home educated student $1,051
French as a Second Language	$697.50 per funded student
Regional Consortium	$154,500 per consortium
Growth and Density In-year growth Year-to-year growth	 50% of the amount received for each full-year (gr. 1 – 9) funded student $512 per funded student over the school growth rate of 8%
Alberta Initiative for School Improvement	$121 per student

Source: Alberta School Foundation Fund, Alberta Learning 2001

[24] Funding rates for subsequent school years are also publicly available. These rates increase each year to reflect rising costs and so forth. Additional funding components (i.e., support block grant and capital funding) can be found at the following location: http://www.learning.gov.ab.ca/funding

According to the popular belief of both parents and educators, increased funding is the key to improving programs, services, and curriculum that in turn increase the level of education available to students. They believe that student academic performance will increase with this higher level of education. According to funding information provided by the ASFF, teachers' unions and associations believe that current funding levels are inadequate.

One way to increase total funding under the instruction block grant scheme is to qualify for one of the following sections of the instruction block grants: enhanced education, native education, instructional programs, and regional assessment services. These grants are given on the basis of per approved project, with the funds being allocated on the premise of educational improvement. In effect, in order to gain funding and attract more students, a school needs to improve programs and services so as to outperform other schools. The increased enrollment from these improved programs will then allow the school to receive more funding. The increase in funding in turn will allow the school to further improve programming, which in turn will improve the quality of education, thereby, positively affecting student academic performance. Thus, schools are placed in a competitive position by having to compete for a finite commodity, this being the student body (ATA, 2000). [25]

The competition discussed above occurs between individual schools in each jurisdiction since the distribution of funding for schools is allocated initially to the jurisdiction according to the eligible student count. The basis for competition in this regard, is more or less in-line with the principal's (or school administrator's) self-interests, as discussed earlier. However, a similar argument can be made for jurisdiction administrators. Hence, it is quite possible that they too

[25] Note that the relationship between attracting more students and increased resources is based on the assumption of increasing returns to scale and decreasing marginal costs of the education production function. Recall from earlier Levin's educational production function: $A_{it} = g\ (F_{i(t)}, S_{i(t)}, P_{i(t)}, O_{i(t)}, I_{i(t)})$. Increasing returns to scale implies output increases more than in proportion to inputs. Thus, an increase in any one of these components/inputs leads to a more proportionate increase in student performance. Decreasing marginal costs implies that since both the infrastructure and teachers are already in place, the effect of having another student will serve to lower costs, since additional funding will be granted but overall costs including salaries remain the same.

would try to implement measures or encourage local school boards to improve their schools in order to increase student academic performance.

Another feature of the educational system that is likely to encourage competition is the presence of independent, ECS, charter, and separate schools. The competition that occurs between these alternative educational choices and public schools arises from their ability to offer parents who are frustrated or otherwise dissatisfied with the public educational system an alternative. Many parents believe that the public educational system has become defective over time because of overcrowding in classrooms, lack of funding, and decreases in the quality of teaching. Competition is further heightened between public schools and alternative educational choices due to provincial funding guidelines. Under the provincial School Act, funding levels for public, separate, and charter schools must be equivalent. Additionally, the provincial government distributes funding to accredited private schools at rates that are not quite as high as those for public schools, but still quite comparable (Alberta Learning, 2000). Thus the public concern over these educational choices involves a fear of greater competition, including more accessible forms of alternative education; loss of confidence in the public educational system; and in the case of charter schools, the creation of niche schools serving homogeneous-value communities (Policy Options, 1998).

However, the extent of competition between the public system and alternatives to it is likely to be influenced by limitations on the ease of enrollment. Parents can send their children to separate schools or charter schools, where such educational facilities are present, for no additional enrollment costs and without having to move residences.[26] In contrast, private schools charge tuition fees.

[26] Separate schools are granted the authority to exclude those students who do not belong to the religious minority faith.

Section III. An Empirical Analysis of Student Performance in the Educational System in Alberta

Section III.I. Data and Empirical Models

The ideal model to estimate, based on the review of the theoretical and empirical analyses, and also on my own analysis, is one that is similar to the education production function model developed by Levin (1974). The ideal model would almost certainly have to incorporate components from the previous studies discussed in this paper as well as including corrections for their respective weaknesses.

Therefore, a general form of the ideal model, incorporating elements from Levin and the previous studies, is as follows:

$$SAit = g\ (F_{it},\ S_{it},\ P_{it},\ O_{it}, C_{it},\ I_{it}),$$

where *SA* represents student achievement, *F* is individual and family background characteristics, *S* is school inputs, *P* is peer or fellow student characteristics, *O* is other external influences (e.g., community effects), *C* is competitive educational pressures, and *I* is initial or innate endowments. The subscripts *i* and *t* refer to students and time, respectively.

Although estimating such an ideal model would allow for a thorough analysis of the determinants of student achievement, data limitations prevent this model from being examined. However, data currently available from the province and from the 1991 and 1996 Census Profiles for Alberta will allow for estimation of most components of this model. The province provides data sets for grades 3, 6, and 9 that are jurisdiction and Census specific (1991 Census) for the 1994/1995 school year, and that are jurisdiction specific for the 1997/1998 school year. For the latter school year, Census information will be collected from the 1996 Census Profile for Alberta. As a result of having data sets that contain different variables for two different school periods, two separate models of student performance on the language arts component of the provincial standardized tests will be examined in this study. In light of having some dissimilar variables between the data sets, the advantage of having two different models is the fact that both models are able to examine different determinants of student performance. A disadvantage of estimating two different models is that one cannot draw any comparisons across time. It is also important to note that neither of the two models estimated in this study will be able to match the ideal model and, as such, the omission of important explanatory variables may yield biased results. Despite the possibility of having biased results, the models used in this study may still allow for inference of the determinants of student performance.

In each of these two models, the respective estimating equation will be based on a data set comprised of 36 public school jurisdictions. Although there are currently 42 public jurisdictions present in the province, only 36 of these jurisdictions correspond between both school periods. Furthermore, in the second model, the estimating equation will also incorporate an explanatory variable that will reflect the presence of 9 separate school jurisdictions from the 1994/95 school year. Only 9 separate school jurisdictions are included because they are the only ones that correspond across periods.

It is also worth noting that a drawback of using jurisdictional or macro-level data is that the aggregated data cannot be scaled down into micro-level data and, as such, may not be able to tell us much about the individual. As a result, this study can only make inferences at the jurisdictional level. Despite this drawback, the use of aggregated data does have an advantage. Aggregated data can provide for a statistical snapshot of the overall jurisdiction including such factors as family income, size of families, educational levels, and employment levels.

Returning to the ideal model, the following discussion will focus on the data sets available from both the province and the 1996 Census Profile for Alberta. The text contained in brackets is the name of the variable that will be used in the estimating equation of both models. Additionally, the model used for each school year is the same for all grade levels, with the data for the explanatory variables also being the same with each grade level. The only difference for each grade level will be the test scores from the language arts component of the provincial standardized tests. Essentially, we are testing whether each variable, based on macrodata, has an effect on student performance for each grade level.

The dependent variable used in the models involves student test scores (*SCORE*) for language arts based on grade level performance for grades 3, 6, and 9. For individual and family background statistics, factors such as the percentage of families with single parents (*PAR*), parental education (*DIPLOMA* and *DEGREE*), and average family income (*AGI*) will be examined. For school inputs, student-teacher ratios (*P/T*), teacher education levels (*CERT*), and spending levels (*SPEND*) will be used. For external characteristics, the proportion of landed immigrants (*IMMIG*) within the community will be used. Lastly, for competitive pressures, alternative educational choices such as the presence of independent, ECS, charter (*PRVT*), and separate schools (*SEPARATE*), as well as the number of operating schools is a given jurisdiction (*COUNT*) will be focused on. Table 3 provides for a detailed explanation of each of these variables. Additionally, appendix 1 provides the reader with complete documentation for the sources of each variable used in this section and throughout the remaining sections of this study.

Table 3. Description of variables used in this study

Variable	Description
Provincially provided information	
SCORE	A measure of performance in language arts testing for grades 3, 6, and 9.
P/T	Student-teacher ratio
CERT	Proportion of teachers who are provincially certified teachers having a Masters degree or better in any program.
SPEND	Represents estimated full-time enrollment student expenditure or spending per student (i.e., public funding)
DIPLOMA	Proportion of people in the jurisdiction, age 15 and over, who have at least a high school diploma. This includes the proportion of individuals with a university degree, university without a degree, trade certificate and non-university diplomas, and secondary school certificates.
SEPARATE	Represents schools belonging to the separate school board (i.e., Catholic schools). These test scores are lagged, and represent test scores from the 1994/1995 period.
COUNT	Number of operating schools in each jurisdiction.
PRVT	Proportion of private schools, including ECS and charter schools, in each public school jurisdiction.
Data from the 1996 Census Profile for Alberta	
DEGREE	Proportion of people in jurisdiction, age 15 and over, who have at least a bachelor's degree.
PAR	Proportion of single parents raising families in each jurisdiction.
AGI	Average gross income per family in each jurisdiction.
IMMIG	Proportion of the population considered landed immigrants. This composition involves both permanent and new immigrants.

Based on the description of the models and the variables above, the following two models will be examined within this study.

$$SCORE = \beta_1 P/T + \beta_2 CERT + \beta_3 SPEND + \beta_4 AGI + \beta_5 PAR + \beta_6 DIPLOMA + \beta_7 CONSTANT + v \quad (1)$$

$$SCORE = \beta_1 P/T + \beta_2 CERT + \beta_3 AGI + \beta_4 PAR + \beta_5 DEGREE + \beta_6 IMMIG + \beta_7 SEPARATE_{-1} + \beta_8 COUNT + \beta_9 PRVT + \beta_{10} CONSTANT + v \quad (2)$$

Recall that equation (1) and equation (2) refer to the 1994/1995 and 1997/1998 school years respectively. Again, because of the discrepancies in the jurisdictional data for each sample period, two different models are estimated. An advantage of having two models is that each model is able to examine different determinants of student performance. For instance, although both equations include variables that account for school effects, equation (1) includes an additional school effect variable (*SPEND*) that allows for the examination of the effect of increased education spending on student performance. Equation (2), on the other hand, incorporates variables that allow for competitive pressures to be tested as a determinant of student performance. [27]

An interesting component that differs between the two equations pertains to the educational attainment of parents (*DIPLOMA* and *DEGREE*). In equation (1), the *DIPLOMA* variable is used as the educational background of parents. The inclusion of this variable was based on data provided by the province. However, I hypothesize that the higher educational attainment of parents is, as will be shown through the *DEGREE* variable in equation (2), the greater the demand will be for quality education. As such, parents may enroll their children in schools that they deem as having a higher quality of education over public schools. The inclusion of this variable was based on the 1996 Census Profile for Alberta. Although one cannot directly compare these two variables since they are from two different equations, the results may still allow for inference of their effects on student performance.

Incorporating both the empirical analyses of the previous studies and my own analysis will allow me to infer the anticipated signs of the coefficients. In this respect, it is anticipated that the following coefficients will be negative: *P/T*, *PAR*, *DEGREE* and *IMMIG*. The coefficient of

[27] Note that because the spending variable (SPEND) is specific to model (1), in the sense that education spending per student is not published for any other academic year, it would not have been possible to estimate model (1) using both data sets. A similar argument follows for model (2). Since this model also has variables not included in model (1), it would not have been possible to estimate this model using both data sets.

P/T is expected to be negative, such that if *P/T* increases, student performance is expected to decline. Factors associated with this decline could involve the following: teachers finding themselves with increased disciplinary problems, leaving less time devoted to classroom instruction; and less time being spent per child. The coefficient *PAR* is also expected to be negative, yielding a decline in student performance. This is based on the belief that children of single-parent families have a possibly higher incidence of academic and emotional/behavioural problems than do other children with both parents (US Dept. of Education, 1994). One would suspect that these negative results would perhaps be more profound at lower grade levels, since these early years are considered to be the most important in the development of the child. The *DEGREE* coefficient, although theoretically expected to have a positive effect on student performance, may in fact be negative as parents with post secondary education, and presumably higher incomes, may enroll their children in non-public schools. As a result, public schools could have a smaller proportion of strong students, which could translate into lower test scores. Lastly, the coefficient *IMMIG* is expected to be negative, due to the notion that immigrants may possibly have a higher incidence of educational problems due to language and cultural barriers.

The coefficients of the remaining variables, *CERT*, *SPEND*, *AGI*, *DIPLOMA*, *DEGREE*, *SEPARATE*, *PRVT*, and *COUNT* are all anticipated to be positive. The coefficient of *CERT*, representing a proxy for teacher salaries, is expected to be positive. This implies an increase in student performance, as higher levels of education lead to higher levels of salaries for teachers. And since salaries are often associated with morale, an increase in salary is generally expected to yield greater morale, leading to stronger teaching performance. The coefficient of *SPEND* is also expected to be positive since it believed that increased funding will allow for improved facilities, updated learning materials, and stronger learning environments that will aid in improving overall student performance. In terms of the effect that family income has on performance, the *AGI* coefficient is expected to be positive, reflecting the belief that the higher the family's income the greater demand for quality education of students (Marlow, 2000, 97). The anticipated sign for the coefficient of the *DIPLOMA* variable is expected to be positive, given that the higher the local educational attainment is, the greater is the demand for higher academic achievement for students (Marlow 2000, 97). The coefficient of *SEPARATE*, similar to the *NEIGHBOR* variable used by Blair and Staley (1995), is expected to be positive since a neighbouring jurisdiction will exert a positive impact on the test performance of a given jurisdiction. The sign of the coefficient for *PRVT* is anticipated to be positive, as it is believed that school and jurisdiction administrators will find the presence of alternative educational choices as in incentive to implement measures to increase student performance. [28] Finally, the anticipated sign of the *COUNT* coefficient, representing the number of schools in each jurisdiction, is expected to be positive. This anticipation is sustained by the idea that those jurisdictions having a large student population (e.g., large metropolitan areas or large urban areas) probably have disproportionately more strong students than jurisdictions whose populations may consist of rural area students.

As an aside, I have not replicated all of the variables used in the previous studies simply because I lacked some of the necessary data. Rather than use a variable such as student innate ability, like that used by Borland and Howsen (1992), I included family background indicators, such as single parents and education of parents; and community effects, such as and landed immigrant status. Furthermore, I have not followed Borland and Howsen (1992) and Marlow (2000) in their use of the Herfindahl index, since open enrollment choice plans are nonexistent within the province, with the exception of Edmonton.[29] Additionally, like Blair and Staley (1995), the major focus of this study is on quality competition, as opposed to the previous studies that focused instead on market concentration.

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[28] An extension of the argument that the coefficient for private schools will be positive and significant, can perhaps relate to the fact private schools may attract the "best" students. This belief almost certainly coincides with the anticipated sign and effect of the coefficient for the DEGREE variable. Thus, parents who have university education, and who presumably have higher levels of income would perhaps be less prone to enroll their children in a public school setting. Implicit within this belief is that parents with higher levels of education might take a more active role in their children's educational development.

[29] This form of open enrollment within the jurisdiction represents only a limited form of competition.

The major hypothesis of this study, similar to Borland and Howsen (1992), is that the performance of competing jurisdictions will serve as an incentive for school administrators to establish those measures that seek to improve student performance. The implementation of these measures would almost certainly be consistent with both the parents' and students' objectives, and would involve increasing test scores and offering a wider range of programs and activities. To effectively do so, school administrators would then have to hire those teachers with the necessary skills.

Comparing these two models to models developed in previous studies, several similarities are clearly evident. In terms of school effects, both equations include student teacher ratio (*P/T*) and certification of teachers (*CERT*). In terms of socioeconomic variables, both equations include variables relating to average income of families (*AGI*) and education of the population (*DIPL* and *DEGREE*), a variable used in both the Borland and Howsen (1992) and Marlow (2000) studies. Additionally, equation (2) includes the number of operating schools in each jurisdiction (*COUNT*), similar to the *COUNT* variable included in the Blair and Staley (1995) study.

In contrast to these similarities, this study includes several variables that are not present in the previous studies. These variables are single-parent families (*PAR*), the proportion of immigrants (*IMMIG*), and the alternative educational choice of charter schools (*PRVT*) and separate schools (*SEPARATE*). Also, instead of constructing a Herfindahl index as both Borland and Howsen, (1992) and Marlow (2000) do in their studies, equation (2) simply focuses on the proportion and presence of independent, ECS, and charter schools (*PRVT*), to public schools in each jurisdiction.

Section III.II Diagnostic Testing

In order to test the adequacy and validity of each model, diagnostic tests for normality, heteroskedasticity, and multicollinearity were performed. The results of tests for the first two, for each individual grade level, are summarized in tables 4 and 5 below. The results of the diagnostic tests for multicollinearity, using a similar format, can be found in the tables of appendix 2.

For both equations, two sets of tests were used to examine the normality of the errors – the Jarque-Bera and the Goodness-of-Fit tests. These tests were carried out at a significance level of five-percent with the null hypotheses being that the errors are normally distributed. Additionally, the Breusch-Pagan-Godfrey test and White's test were used in testing for heteroskedasticity. These tests again were carried out at a five-percent significance level with the null hypotheses that the errors are homoskedastic.

Table 4 – Equation (1): 1994/1995 School Period - Tests for Normality and Heteroskedasticity

Tests for Normality of the Errors					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Jarque-Bera	2	5.99	1.3423	Do not reject
	Goodness-of-Fit	1	3.84	3.8842	Reject
Grade 6	Jarque-Bera	2	5.99	2.4161	Do not reject
	Goodness-of-Fit	1	3.84	6.7035	Reject
Grade 9	Jarque-Bera	2	5.99	0.1139	Do not reject
	Goodness-of-Fit	1	3.84	4.0021	Reject
Tests for Heteroskedasticity					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Breusch-Pagan-Godfrey	6	12.59	15.141	Reject
	White's test	12	21.03	19.964	Do not reject
Grade 6	Breusch-Pagan-Godfrey	6	12.59	4.544	Do not reject
	White's test	12	21.03	6.338	Do not reject
Grade 9	Breusch-Pagan-Godfrey	6	2.796	12.59	Do not reject
	White's test	12	11.853	21.03	Do not reject

In equation (1), since the two tests for the normality of the errors give conflicting results for each sample grade, it is clear that the errors may be non-normal. Thus, there is sufficient evidence to reject the null hypothesis in favour of the alternative hypothesis that the errors are not normally distributed. A consequence of the errors being non-normal is that the t and F tests will be valid only asymptotically.

In testing for heteroskedasticity, the results in the above table imply that the errors are homoskedastic for grades 6 and 9, and heteroskedastic for grade 3. Having results that are heteroskedastic implies that the OLS estimator is not efficient, and that the estimators of the variances are biased. Additionally, if the problem of heteroskedasticity is not corrected for, incorrect conclusions may be made if OLS results are used in hypothesis tests. In order to correct for the problem of heteroskedasticity, White's heteroskedastic-consistent variances and standard errors were used. Using this correction will allow one to draw valid inferences about the coefficients (Shazam, University of British Columbia, 2001). The results of this correction can be seen in Section III.III

To test for the presence of multicollinearity, three tests were used: simple correlation coefficients, auxiliary R^2 values, and the condition index. The results of the simple correlation coefficients and the auxiliary R^2 tests can be observed in the diagnostic testing for equation (1) section of appendix 2. For the simple correlation coefficients, it is evident that multicollinearity may be present in the model since some of the values are close to, or over, 0.8. The pair-wise correlation between the diploma variable (*DIPL*) and both the student-teacher variable (*P/T*) and the average family income variable (*AGI*) are the highest. In examining the results of the auxiliary R^2 values, note that each of the explanatory variables in equation (1) are the same for each grade level. This is because only the dependent variable, *SCORE*, differs in the estimation for the grade levels. Evidence of multicollinearity using this test can be seen by the high values of the spending variable (*SPEND*) and the diploma variable (*DIPL*). In the former case, the auxiliary R^2 value is very close to the overall R^2 value and, in the latter case, the auxiliary R^2 value is greater than the overall R^2 value.

Using the third test for multicollinearity, the condition index test, a value of 46.425 was obtained for each grade level. This large value may indicate a severe case of multicollinearity.

Table 5 – Equation (2): 1997/1998 School Period - Tests for Normality and Heteroskedasticity

Tests for Normality of the Errors					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Jarque-Bera	2	5.99	9.4863	Reject
	Goodness-of-Fit	3	7.81	15.8403	Reject
Grade 6	Jarque-Bera	2	5.99	14.0239	Reject
	Goodness-of-Fit	3	7.81	17.8780	Reject
Grade 9	Jarque-Bera	2	5.99	19.1193	Reject
	Goodness-of-Fit	3	7.81	13.3545	Reject
Tests for Heteroskedasticity					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Breusch-Pagan-Godfrey	9	16.9190	27.264	Reject
	White's test	18	28.8693	35.146	Reject
Grade 6	Breusch-Pagan-Godfrey	9	16.9190	24.689	Reject
	White's test	18	28.8693	33.313	Reject
Grade 9	Breusch-Pagan-Godfrey	9	16.9190	23.430	Reject
	White's test	18	28.8693	31.049	Reject

The same normality tests and the same heteroskedasticity tests that were applied to equation (1) were also applied to equation (2). The results of these tests are similar to the results found in equation (1). The implications resulting from this are that the errors are non-normal and heteroskedasticity is present, this time for all grade levels.

The results of testing for multicollinearity can be observed by examining the simple correlation coefficients and the auxiliary R^2 values in the diagnostic testing for equation (2) section of appendix 2. The simple correlation coefficients effectively show that multicollinearity may be present within the model since some of the values are close to, or over, 0.8, particularly between the following variables: *IMMIG* and *DEGREE*, and *COUNT* and *IMMIG*, from each sample grade. The auxiliary R^2 values, in contrast to equation (1), are presented in three sets; one for each grade level. The reason for multiple sets is due to one explanatory variable, *SEPARATE*, being different for each grade level. According to these tests, a case for multicollinearity may exist as only a few of the auxiliary R^2 values are actually smaller than the overall R^2 value, in each sample grade. Based on each grade level, these variables are as follows: for grades 3 and 6, *PAR* and *PRVT*; and for grade 9, *AGI*, *PAR*, *SEPARATE*, and *PRVT*.

Finally, the condition index values for each grade indicate a severe case of multicollinearity. These values are as follows: for grade 3, a value of 42.957; for grade 6, a value of 43.329; and for grade 9, a value of 42.067. Note that the condition index values in equation (2) are different in each grade level since the coefficient for separate schools varies in each grade level model.

To summarize, the various diagnostic tests undertaken for both equations (1) and (2) seem to indicate high correlations between the explanatory variables. In such circumstances, inclusion of all the explanatory variables must be questioned. However, the justification of the inclusion of each of the explanatory variables is rooted in previous studies and economic theory itself. In other words, the exclusion of any one of the explanatory variables would ultimately lead to a bias within the equations. [30]

Section III.II Analysis of Results

Tables 6 and 7 show the OLS regression results for equations (1) and (2) respectively. Summary statistics for each equation can be found in appendix 3. Specifically, these descriptive statistics can be in found in tables 1 and 2 for equation (1) and equation (2) respectively.

Table 6 – Equation (1): 1994/1995 Standardized test results for grades 3, 6, and 9 – Language Arts

Variable Name	Grade 3		Grade 6		Grade 9	
	Coefficient	T- Statistic	Coefficient	T- Statistic	Coefficient	T- Statistic
P/T	-0.20075E-03	-0.31819E-01	-0.15619E-01	-1.9815†	-0.49271E-02	-0.89705
CERT	0.42802E-01	0.12812	-0.20774E-01	-0.52954E-01	0.30026	1.0984
SPEND	-0.28659E-04	-2.3659**	-0.74365E-04	-6.9763*	-0.38873E-04	-5.2336*
AGI	-0.63486E-06	-0.35804	0.44942E-05	1.5628	-0.43718E-06	-0.21817
PAR	-1.6346	-4.5220*	-0.95419	-2.3715**	-1.3497	-4.8142*
DIPL	0.38577	2.4128**	0.19470E-01	0.89015E-01	0.17704	1.1616
CONST	0.99308	5.9578	1.4553	8.2084	1.2121	9.8116
R^2 Value	0.7547		0.7817		0.7801	
Adj. R^2 Value	0.7039		0.7365		0.7346	
F Statistic	10.700452		19.368102		52.324833	
N	36		36		36	

* Significant at the one-percent level, two-tail test
** Significant at the five-percent level, two-tail test
† Significant at the ten-percent level, two-tail test

[30] Modifications were made to both models in an effort to curtail a possible multicollinearity problem; however, this had little effect on either of the models.

As a prelude to the analysis of the results, a discussion of the goodness of fit and on the overall significance of the model is first in order. In examining the goodness of fit for the grade 3 level, the R^2 value implies that the model is able to explain 75.47% of the variation in test scores. A similar conclusion follows for the remaining grade levels, with the R^2 value at the grade 9 level being the strongest. These values essentially mean that the model is able to explain a fairly large proportion of the variation in test scores. In examining the overall significance of the model, the values of each grade level F-statistic, imply that student performance, as measured by test scores, is dependent on at least one of the variables in the model.

Within this 1994/1995 model, the coefficients of four variables are statistically significant. For the *SPEND* variable, the coefficient was found to be negative and statistically significant for all grade levels. The significance levels for each grade are as follows: for grade 3 students, significant at a five-percent level; and for both grades 6 and 9, significant at a one-percent level. These results indicate that increased spending has a negative effect on student performance. Recall that educational spending in Alberta is distributed according to a block-funding scheme. This means, essentially, that the funding scheme allows for no scope for funding to increase as a result of low test scores - a direct contrast to the US system. Thus, the SPEND coefficient may suggest that higher education spending may simply be diverted away from students, instead flowing to administrators, teachers, and staff. Analyzing the coefficients of this variable for each grade level shows that a $1 increase in public spending will decrease test scores by less than one-percent for each grade level.

Of course this negative relationship between spending and performance goes against those people who believe that spending levels are inadequate and that students will ultimately bear the burden of low spending. In actuality though, this result may not be all that surprising given the findings of a study by Hanushek (1996). In this study, he examined the relationship between spending and student performance over the twenty-year period from 1970 to 1990 in the US, and found that real expenditures per student increased 70 per cent (Hanushek, 1996, 12). Over this same period, Hanushek also showed that quality of performance has been 'flat'. He confirms this by finding considerable support through micro-level analyses, that student population has become more difficult to educate over time; perhaps due to divorce rates, child poverty, and possibly due to female labour participation rates (Hanushek, 1996, 12).

Observing the block-funding scheme in Table 2 can provide another possible explanation as to why increased spending may not have the desired effects on student performance. For example, under this scheme, educational funding would be higher for students with severe disabilities, and/or for students studying English as a second language. Thus a jurisdiction having a higher proportion of such students would likely obtain higher spending per pupil. However, the performance of these students on the language arts component of the provincial standardized tests may in fact lower the jurisdiction's average test scores. Hence, in this instance, increased funding may not constitute stronger test performance.

For the *PAR* variable, its coefficient was negative and statistically significant at all three grade levels. Specifically, it was found to be significant at the one-percent level for grades 3 and 9, and at the five-percent level for grade 6. The results for the coefficient for this variable seem to confirm that a higher incidence of single-parent families leads to a drop in student performance. These overall results can be observed by examining the coefficients for *PAR* at each grade level, which effectively show that a one-percentage point increase will lead to a drop in test scores. While the impacts of single-parent families on student performance certainly showed strong effects at the grade 9 level, its biggest effect was felt at the grade 3 level, as observed by the magnitude of the coefficients. One possible explanation for this could be that children at the grade 3 level are perhaps more susceptible to the impact of changes in the family structure than in any other later periods in their life cycle. Hence, any lack of stability in the home at such an early age could possibly have adverse effects on the emotional and psychological well being of the child.

For the educational level of parents, the coefficient of *DIPL* was found to be positive and significant at a five-percent significance level, for grade 3 students. This implies that the higher the proportion of people with at least a high school diploma, the greater is the academic achievement of students. Alternatively stated, a one-percentage point increase of parents who have as a minimum a high school diploma is expected to have a small increase in student performance on standardized tests.

Lastly, the coefficient of *P/T* was found to be negative and significant at the grade 6 level. This essentially means that an increase in the student-teacher ratio will lead to a decrease in test scores. Thus a one-percentage increase in the student-teacher ratio is expected to yield a small decrease in test scores. A possible explanation for the negative and significant effect of the student-teacher ratio at the grade 6 level could perhaps be attributed to the fact that children are approaching the onset of puberty. Thus children may find themselves discovering a host of new physical, psychological, and emotional changes which may be difficult to deal with. As a result, this adjustment period, coupled with the notion of increased student-teacher ratios, could adversely affect their learning skills in the classroom.

Table 7 – Equation (2): 1997/1998 Standardized test results for grades 3, 6, and 9 – Language Arts

Variable Name	Grade 3		Grade 6		Grade 9	
	Coefficient	T- Statistic	Coefficient	T- Statistic	Coefficient	T- Statistic
P/T RATIO	0.14090E-01	1.4245	0.17902E-01	1.4600	0.16525E-01	1.1663
CERT	0.36110	1.7262†	0.52740	1.8878†	0.25149	0.72883
AGI	0.10756E-05	0.66093	0.36100E-06	0.26610	0.16542E-06	0.12054
PAR	-0.38403	-1.2974	-0.43843	-1.2879	-0.70100	-2.0927**
DEGREE	-0.93997	-2.2576**	-1.1365	-2.0530†	-0.84797	-1.4561
IMMIG	-0.42135	-0.74443	-0.46643	-0.79971	-0.68510	-1.1030
SEPARATE	0.80927E-02	0.60453E-01	0.16435	1.5010‡	-0.17724	-0.96851
COUNT	0.19305E-03	0.44397	0.34635E-03	0.71091	0.66364E-03	1.2019
PRVT	0.11001	1.7022	0.13198	1.6208	0.20107	1.8715†
CONSTANT	0.59579	2.2456	0.37533	1.6270	0.77567	2.4576
R^2 Value	0.5299		0.5151		0.4536	
Adj. R^2 Value	0.3672		0.3472		0.2644	
F Statistic	15.273926		5.4519740		1.6218885	
N	36		36		36	

* Significant at the one-percent level, two-tail test
** Significant at the five-percent level, two-tail test
† Significant at the ten- percent level, two-tail test

As for equation (1), the goodness of fit and the overall significance of the model will also be examined for equation (2). The R^2 value for the grade 3 level implies that the model is able to explain only 52.99% of the variation in test scores. Using a similar analysis, grades 6 and 9 are only able to explain 51.51% and 45.36% of the variation in test scores in the model, respectively. These values essentially mean that the model is only able to explain a small proportion of the variation in test scores. [31] As was the case for equation (1), in examining the overall significance of the model it can be concluded that student performance, as measured by test scores, is dependent on at least one of the variables in the model.

In examining this 1997/1998 model, the coefficients for several variables are found to be statistically significant. These include the following: teacher certification (*CERT*); single-parent families (*PAR*); parental education (*DEGREE*); and private, ECS, and charter schools (*PRVT*).

The teacher certification (*CERT*) coefficient was found to be positive and significant at a ten-percent significance level for both grades 3 and 6. This result appears to confirm that higher levels of education for teachers, which lead to higher levels of salaries, lead to stronger teaching performances. This can be observed in the table above, where for every one teacher that has or will obtain a Masters' degree in education or another program, a small increase in test performance will occur for grades 3 and 6.

In terms of single parent families (*PAR*), as was shown and discussed in equation (1), its coefficient is negative and significant at the five-percent significance level, but only for grade 9 students. Based on this model, one could rationalize this result based on the notion that students entering this grade level are perhaps going through a phase of mental, emotional, and psychological changes. As such, the combination of these changes and trauma experienced from family situations might have adverse effects on their test performance.

[31] An interesting observation worth noting is that for each grade level the R^2 values in equation (2) are smaller than the R^2 values in equation (1). Although we cannot directly compare the R^2 values of the two different models since we are dealing with two different data sets, there is some literature that addresses the concept of comparing R^2 values between regression models under the name of "separate families". However, a single data set is assumed (B. Wheeler, 1997).

The results of the coefficient for parental education (*DEGREE*) are negative and significant for both grades 3 and 6, with significant levels of five-percent and ten-percent, respectively. These results confirm my earlier hypothesis that public school test performance may decrease for children whose parents have a university bachelor's degree. [32] As ambiguous as this may sound, a possible explanation for this might be that parents, who have as a minimum amount of education a university bachelor's degree, might want to enroll their children in schools they deem as having a higher quality or as having a higher standard of excellence. As a result of not having their children educated in a public setting, public schools could possibly have a smaller distribution of strong students, which could translate into poorer test scores. Another possible explanation for low public school test scores could be tied to the notion that increased competition might increase parental expectations of student performance. While in theory increased competition is expected to increase student performance, parents may simply be less willing to fight or wait for better public schools, preferring instead to send their children to alternative educational choices.

Alternatively stated, based on the coefficients of the *DEGREE* variable for all grade levels, a one-percentage increase in the proportion of parents who have a bachelor's degree translates into a small decrease in test scores.

Closely tied to this, is the significant effect that the coefficient of independent, ECS, and charter schools (*PRVT*) has on student performance at the grade 9 level. Since the university education of parents has a negative and significant effect, it makes sense that alternative forms of education would have a positive effect on student performance. The logic behind this is as follows: as a result of parents having a preference for schools outside the public school system,

[32] Note that in equation (2) parental education was also estimated using the DIPLOMA variable from equation (1). Since equation (2) is based on the 1997/1998 school year, data for the DIPLOMA variable was then collected from the 1996 Census Profile for Alberta. The OLS estimates of this model effectively showed that the coefficient of DIPLOMA was insignificant. It had no effect on student performance.

the demand for these alternative educational choices will increase. This demand for alternative education will then soon lead to a greater supply of independent, ECS, and charter schools. And, as a result of the pressure of competition from these alternative educational choices, public school administrators would then be pressed to implement measures to increase student performance. This would include maximizing test scores, increasing student achievement and offering a wider variety of courses. To effectively do so, school administrators would then have to hire those teachers with the necessary skills. Shown numerically, a one-percent increase in the proportion of these schools leads to a decrease of 1.8 marks in student test scores on standardized tests.

Although the coefficient for *PRVT* was found to be insignificant at the ten-percent significance level for grades 3 and 6, using the exact level of significance (p-value) may instead allow for inference of its effect on student performance. The exact level of significance for each grade was 10.1% and 11.71% respectively. Based on these levels of significance, one could reject a null hypothesis that *PRVT* has no effect on student performance, in favour of the alternative hypothesis that competition does have an effect on student performance.

As a final note on both models, it is possible that the small number of significant coefficients is the result of multicollinearity existing within the models. Certainly one variable whose coefficient is insignificant and may be a consequence of multicollinearity is average family income (*AGI*). At this point in time, obtaining a larger sample, which perhaps would serve to otherwise correct for multicollinearity, is not possible.

Section IV. Migration Model

Section IV.I Data and Empirical Models

The purpose of an outward migration model, in the context of this paper, is to test for influencing factors, if any, that may lead families to migrate from one jurisdiction to another. As this paper focuses on student performance, introducing a migration model into this study makes sense since we are trying to see to what lengths parents will go to in order to further their children's educational development. Factors that are considered to affect migration between authorities are economic characteristics, including unemployment, labour force status, household and personal income, poverty, public assistance, and occupation; demographic characteristics, including age, gender, race and ethnicity; and social characteristics including educational conditions and attainment, and household living arrangements (Johnson and Lovelady, 1995).

An obvious limitation, as discussed in the above previous models, is the unavailability of obtaining data on some of the components described above. Despite this limitation, a basic outward migration model can be constructed, taking into account specific jurisdiction information such as the number of migrants, standardized test scores, student-teacher ratios, average family income, jurisdiction population, and distance.

The dependent variable of this migration model involves outward migration (*MIGRATE*) during the 1997/1998 school year from 23 jurisdictions, allowing for a sample of 506 observations. [33] Although 36 jurisdictions have been examined in the two previous models of this study, lack of distance information between each jurisdiction limited the scope of interest to 23 jurisdictions. The explanatory variables used in this model involve school effects, parental effects, and external effects. In testing for school effects, lagged student-teacher ratios (*P/T*) from the 1994/1995 school year will be used. The use of lagged values from this period is necessary because of the fact that parents can only base their decision to migrate on past observations or current available data. Lagged standardized test scores (*SCORE*) for the language arts components of the provincial standardized tests for grades 3, 6 and 9 from the 1994/1995 school year will be used as well. These three grade levels are used as three different proxies for student achievement. For parental effects, average family income (*AGI*) will be utilized. As well, for external effects, factors such as jurisdiction population (*POP*) and distance between jurisdictions (*DISTANCE*) will be used. Data for the AGI and POP variables were collected from the 1996

[33] The sample of 506 observations is calculated as the number of origins times the number of destinations. Specifically, the number of observations is equal to 23 origins times 22 destinations, providing for a total of 506 observations.

Alberta Census. Measurements for distance, on the other hand, were based on provincial tourism and road maps. Documentation of this process can be found in appendix 1. As a final note, the explanatory variables for the migration model will be the same for each grade level, with the exception of *SCORE*. Using the variables described above, the following outward migration model will be examined within this study:

$$MIGRATE_{ijl} = \beta_1 SCORE_{jl} + \beta_2 P/T_j + \beta_3 AGI_j + \beta_4 POP_j + \beta_5 DISTANCE_j + \beta_6 CONSTANT + v \quad (3),$$

where the subscript i refers to the original jurisdiction, j refers to the jurisdiction destination, and l refers to the grade level. As stated before, note that each of the explanatory variables in equation (3) is the same for each grade level.[34]

Before estimating equation (3), the coefficients of the following variables are expected to be positive: SCORE, AGI, and POP. The coefficient of *SCORE* is anticipated to have a positive sign since it is assumed that parents who take a more active role in their children's education may migrate to another jurisdiction if they believe the educational system of that jurisdiction is superior to that of their current jurisdiction. The *AGI* coefficient is anticipated to have a positive sign reflecting the belief that higher levels of family income of another jurisdiction may act as an incentive for outward migration. Additionally, the *POP* coefficient is expected to be positive on the basis of the perception that parents might have on the strength of another jurisdiction's economy as a result of large populations in metropolitan areas, cities, or towns. This perception could stem from the idea that larger population sizes equals a stronger economy.

The remaining signs of the coefficients *P/T* and *DISTANCE* are expected to be negative. The coefficient of *P/T* is anticipated to be negative based on the belief that increased student-teacher ratios of another jurisdiction would serve as a disincentive to migrate. And, for the coefficient of *DISTANCE,* its sign is anticipated to be negative due to the belief that most

[34] It is presumed in this model that outward migration is based on a number of factors, one of which is student performance. As such, it is implicitly assumed that student performance at the origin destination does not matter in parental decisions to migrate. Instead, it is believed that parents would base their decision to migrate on, among other factors, greater student performance in destination jurisdictions.

domestic migration between jurisdictions takes place with those jurisdictions that are either neighbouring or close-by (Johnson and Lovelady, 1995). Thus, longer distances and the associated increased costs of moving longer distances are expected to act as impediments to migrate for families.

Section IV.II Results of Diagnostic Testing

As discussed in Section III.II, in order to test the adequacy and validity of this migration model, diagnostic tests for normality, heteroskedasticity, and multicollinearity were performed. The results of the diagnostic tests for normality and heteroskedasticity can be observed in table 8 below; the results of the diagnostic tests for multicollinearity can be found in the diagnostic testing for equation (3) section of appendix 2. The testing for normality of the errors and for heteroskedasticity will involve the same tests and significance levels as in Section III.II.

Table 8 – Equation (5): 1997/1998 School Period - Tests for Normality and Heteroskedasticity

Tests for Normality of the Errors					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Jarque-Bera	2	***	***	Reject
	Goodness-of-Fit	22	33.92	524.0482	Reject
Grade 6	Jarque-Bera	2	***	***	Reject
	Goodness-of-Fit	22	33.92	504.8732	Reject
Grade 9	Jarque-Bera	2	***	***	Reject
	Goodness-of-Fit	22	33.92	523.4014	Reject
Tests for Heteroskedasticity					
Grade	**Test**	**Degrees of Freedom**	**Critical Value**	**Observed Value**	**Conclusion**
Grade 3	Breusch-Pagan-Godfrey	5	12.59	20.559	Reject
	White's test	10	18.31	26.096	Reject
Grade 6	Breusch-Pagan-Godfrey	5	12.59	20.646	Reject
	White's test	10	18.31	26.895	Reject
Grade 9	Breusch-Pagan-Godfrey	5	12.59	20.559	Reject
	White's test	10	18.31	25.791	Reject

In testing for the normality of the errors, it is clear that the errors are not normally distributed. In testing for heteroskedasticity, it is also clear that the errors are heteroskedastic for each grade level.

Testing for the presence of multicollinearity will involve the same tests as were used in Section III.II. Specifically, these tests involve simple correlation coefficients, auxiliary R^2 values, and the condition index. Based on the results of the simple correlation coefficients, multicollinearity does not appear to be a problem within this model since none of the pair-wise correlations are close to, or more than 0.8. In the case of the auxiliary R^2 values, note that as for equation (2) in Section III.II there are three sets of auxiliary R^2 values, one for each grade level that serve as separate proxies for student achievement. The auxiliary R^2 values suggest that a strong case for multicollinearity may be made. This inference is clear since some of the auxiliary R^2 values are greater than the overall R^2 value in each grade level. When using grade 3 level test scores, these values pertain to following variables: *SCORE*, *P/T*, *AGI*, and *POP*. For the remaining grade level test scores, these values pertain to the *P/T* and *POP* variables.

As was the case for equations (1) and (2), the condition index values for each grade indicate that there may be a strong to moderate case of multicollinearity. These values are as follows: for grade 3, a value of 26.653; for grade 6, a value of 23.653; and for grade 9, a value of 24.779.

In terms of an overall analysis, as indicated in the previous sections, the diagnostic tests seem to indicate that the variables are highly correlated. These tests show that the potential for multicollinearity is strong within this model. However, based upon the previous discussion of the presence of multicollinearity (see Section III.II) the inclusion of each of the explanatory variables appears justified.

Section IV.III Analysis of results

Table 9 – Equation (3): 1997/1998 Outward migration model

Variable Name	with Grade 3 scores		with Grade 6 scores		with Grade 9 scores	
	Coefficient	T- Statistic	Coefficient	T- Statistic	Coefficient	T- Statistic
SCORE	-9.4947	-1.1720	-9.8360	-1.6385	-13.817	-1.5260
P/ T	0.60836	1.2293	0.58404	1.2583	0.54783	1.1796
AGI	0.14578E-03	0.88036	0.14360E-03	0.90089	0.13927E-03	0.86887
POP	0.35922E-04	2.6236*	0.36576E-04	2.6524*	0.37080E-04	2.6789*
DISTANCE	-0.28584E-01	-7.4118*	-0.28496E-01	-7.3914*	-0.28483E-01	-7.3857*
CONSTANT	7.5058	0.53706	8.0090	0.58302	12.430	0.83537
R^2 Value	0.1788		0.1797		0.1795	
Adj. R^2 Value	0.1709		0.1719		0.1717	
F Statistic	11.993194		12.047044		12.010316	
N	506		506		506	

* Significant at the one-percent level, two-tail test

As for both equations (1) and (2), the goodness of fit and the overall significance of equation (3) will be analyzed. Using the grade 3 level as an example, the low R^2 value implies that equation 3 is able to explain only 17.88% of the variation in outward migration. Similar conclusions can be drawn for the remaining grade levels as proxies for student performance, with the R^2 value at the grade 6 level being the largest. These values imply that the model is only able to explain a small proportion of the variation in outward migration. The results of the F test of overall significance imply that outward migration is dependent on at least one of the variables in equation (3).

Within this outward migration model, several results clearly warrant discussion. For instance, although average family income *(AGI)* was hypothesized to have a positive and significant effect on student performance, the results of the coefficient for this variable showed otherwise. This implies that the average family income of a destination jurisdiction has no effect on parental migratory decisions. Two variables within the model that were found to be statistically significant involve the coefficients for jurisdiction population (*POP*) and the distance between jurisdictions (*DISTANCE*). For the jurisdiction population variable (*POP*), its coefficient was found to be positive and significant at one-percent significant levels for each grade level proxy of student performance. This result could tie in with the notion that the perception parents place on the strength of another jurisdictions' economy could act as an incentive for migration.

For the *DISTANCE* variable, its coefficient was found to be negative and significant at a one-percent significance level for all grades. This result confirms that increased distance between origin and destination leads to lower levels of actual migration. Examining the coefficients of the grade level test scores shows that a 1 kilometer increase in distance between jurisdictions, leads to a small decrease in total outward migration. These results seem to confirm Johnson and Lovelady's findings, in that if migration were to take place, it would in all likelihood involve migration to nearby jurisdictions.

Although it was hypothesized that the coefficient for *SCORE* would have a positive and significant effect on outward migration, its coefficient was instead found to be negative and insignificant. The reason for including this variable into the migration model was simply because it allowed for all of the models to become interconnected on the basis on student performance. In this aspect, it would have been quite interesting to see not only what effects student performance, but also what student performance affects as well. However, as the results show, student performance does not have an effect on outward migration in this model.

As a final note on equation (3), although diagnostic tests indicate that there is potential for multicollinearity to be problem, it does not appear that multicollinearity has posed a problem. The coefficients of the variables that were expected to be statistically significant were in fact.

Section V. Concluding Remarks

The purpose of this study was to provide an extension, using a Canadian setting, of recent studies in the US of determinants affecting student achievement. To the best of my knowledge, this is the first study of its kind in Canada. As such, the implications of some of the study's most significant findings may be profound for public policy purposes. For instance, in terms of school effects, spending was found to have a negative effect on student performance; a finding that goes against the conventional beliefs of many advocates of increased spending. This result may indicate that increased funding might not have the intended effects on student performance. In terms of parental effects, single parent families and parental education were found, in most cases, to have significant effects on student performance. In the case single parent families, this may suggest that issues from family situations may carry over into the classroom. In the case of parental education, this may indicate that those parents who have post secondary education may, more so now than ever, take a more active role in the educational development of their children. Additionally, in terms of competitive effects, the presence of independent, ECS, and charter schools was found to positively affect (weakly) overall student performance. This suggests that when faced with the pressure of competition from these alternative educational institutions, public school administrators would then be pressed to implement all the necessary measures in order to increase student performance.

The inclusion of the migration model was meant to offer another means of inference as to the importance that parents place on their children's education. However, the results showed that student performance is not a factor in parents' migratory decisions. The only inference the migration model allows for is that parents might be willing to move to nearby jurisdictions on the perception that larger population sizes equals a stronger economy.

As a final note, the presence of competition within the educational process may lead to higher test scores and, as such, those policies undertaken in order to compete may lead to higher student achievement. As this is the first study to examine these issues in Canada, it is hoped that this study will inspire others to see if these findings can be confirmed using other data.

Appendix 1

This particular appendix provides a detailed description of the sources of information for the variables used in this study. Additionally, this appendix will provide information on how some variables were collected, organized, and calculated.

Variable	Source/Description
Provincially Provided Information	
AGI **(For model 1 only)**	Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
CERT	Canada: Alberta Learning. 1996 and 1998. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
COUNT **(For model 1 only)**	Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
DIPLOMA	Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
MIGRATE	Canada: Alberta Learning. 1998. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
PAR **(For model 1 only)**	Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
PRVT	Canada. Alberta Learning. 2000. *Alberta Learning Private Schools* [online]. Alberta: Educational Information Services, Information Services, Alberta Learning [cited June 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/maps Additionally, a custom made database detailing which independent, ECS, and charter schools are located in each public school jurisdiction was created from Information Access and Reporting Department of Alberta Learning.
P/T	Canada: Alberta Learning. 1996 and 1998. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
SCORE	Canada: Alberta Learning. 1996 and 1998. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
SEPARATE	Canada: Alberta Learning. 1996 and 1998. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/

SPEND	Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/
Information Obtained from 1996 Census Profile for Alberta	In order to collect and estimate data for the 1996 census variables used in models 2 and 3, a map of the public school jurisdictions in the province was consulted. This map, which provides an outline of the geographic boundaries of each jurisdiction, can be found at the following address: http://www.learning.gov.ab.ca/ei/maps. As this map provided for only an outline of the geographic boundaries of each jurisdiction, a database provided by Alberta Learning containing the cities, towns, and/or rural areas in each jurisdiction was then used. This database can be found at the following address: http://www.learning.gov.ab.ca/ei/maps, under the 'authority and school lists' section. Additionally, the University of Calgary also provides a partial listing of the geographic areas of each public school jurisdiction. This list can be found at the following address: http://www.ualberta.ca/~esa/public_school_divisions.htm.
AGI **(For models 2 & 3)**	Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.
DEGREE	Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.
IMMIG	Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.
PAR **(For model 2)**	Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.
POP	Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.
Other Specific Information	
COUNT	Information for the number of operating schools in model 2, was obtained from a database provided by Alberta Learning. This database can be found at the following address: http://www.learning.gov.ab.ca/ei/maps, under the 'authority and school lists' section.
DISTANCE	In order to calculate distance between jurisdictions, two maps were consulted. One map, published by the government of Alberta, provides a distance chart between selected cities. This map is titled as the 'official 1995 road map', and is provided by the Alberta Economic Development and Tourism Department. A second map, published by International Travel Maps for the provinces of Alberta and British Columbia, was also used to calculate distance between jurisdictions. Using this map, distance was calculated between jurisdictions using the scale provided by the map.

Appendix 2

This appendix contains tables for the diagnostic testing of each model used in this study. These diagnostic tests involve tests for multicollinearity, such as simple correlation coefficients, and auxiliary R^2 values.

Diagnostic testing for equation (1):

$$SCORE = \beta_1\, P/T\, RATIO + \beta_2\, CERT + \beta_3\, SPEND + \beta_4\, AGI + \beta_5\, PAR + \beta_6\, DIPLOMA + \beta_7\, CONSTANT$$

Simple Correlation Coefficients

Grades 3, 6, and 9

	P/T	CERT	SPEND	AGI	PAR	DIPL
P/T	1.0000					
CERT	0.42335	1.0000				
SPEND	-0.57131	-0.22868	1.0000			
AGI	0.48881	0.18389	-0.26848	1.0000		
PAR	0.17627	0.33530	0.15818	-0.13859	1.0000	
DIPL	0.61370	0.27051	-0.42366	0.84173	-0.43225E-02	1.0000

Auxiliary R^2 Values

Overall R-Square – Grade 3 = 0.7547
Overall R-Square – Grade 6 = 0.7817
Overall R-Square – Grade 9 = 0.7801

R-SQUARE OF P/T ON OTHER INDEPENDENT VARIABLES =	0.5796
R-SQUARE OF CERT ON OTHER INDEPENDENT VARIABLES =	0.2575
R-SQUARE OF SPEND ON OTHER INDEPENDENT VARIABLES =	0.4446
R-SQUARE OF AGI ON OTHER INDEPENDENT VARIABLES =	0.7460
R-SQUARE OF PAR ON OTHER INDEPENDENT VARIABLES =	0.2965
R-SQUARE OF DIPL ON OTHER INDEPENDENT VARIABLES =	0.7797
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =	0.0000

Diagnostic Testing for equation (2):

$$SCORE = \beta_1\, P/T\, RATIO + \beta_2\, CERT + \beta_3\, AGI + \beta_4\, PAR + \beta_5\, DEGREE + \beta_6\, IMMIG + \beta_7\, SEPARATE_{-1} + \beta_8\, COUNT + \beta_9\, PRVT + \beta_{10}\, CONSTANT$$

Simple Correlation Coefficients

Grade 3

	P/T	CERT	AGI	PAR	DEGREE	IMMIG	SEPARATE	COUNT	PRVT
P/T	1.0000								
CERT	0.61758	1.0000							
AGI	0.27973	0.25091	1.0000						
PAR	0.97623E-01	0.13988	0.38907E-01	1.0000					
DEGREE	0.34347	0.35455	0.54099	0.33129	1.0000				
IMMIG	0.36319	0.58598	0.39232	0.33343	0.76091	1.0000			
SEPARATE	-0.23129	-0.19588E-01	-0.42564	-0.32796E-01	-0.79141E-01	0.16421	1.0000		
COUNT	0.20650	0.47276	0.15401	0.29921	0.58753	0.84135	0.74299E-01	1.0000	
PRVT	0.36958	0.18138	0.82268E-01	0.29000	0.44803	0.43580	-0.39488E-04	0.29651	1.0000

Grade 6

	P/T	CERT	AGI	PAR	DEGREE	IMMIG	SEPARATE	COUNT	PRVT
P/T	1.0000								
CERT	0.61758	1.0000							
AGI	0.27973	0.25091	1.0000						
PAR	0.97623E-01	0.13988	0.38907E-01	1.0000					
DEGREE	0.34347	0.35455	0.54099	0.33129	1.0000				
IMMIG	0.36319	0.58598	0.39232	0.33343	0.76091	1.0000			
SEPARATE	-0.13250	-0.60402E-01	-0.34681	0.10827	0.63725E-01	0.11131	1.0000		
COUNT	0.20650	0.47276	0.15401	0.29921	0.58753	0.84135	0.10694E-01	1.0000	
PRVT	0.36958	0.18138	0.82268E-01	0.29000	0.44803	0.43580	0.25543	0.29651	1.0000
	P/T	**CERT**	**AGI**	**PAR**	**DEGREE**	**IMMIG**	**SEPARATE**	**COUNT**	**PRVT**

Grade 9

	P/T	CERT	AGI	PAR	DEGREE	IMMIG	SEPARATE	COUNT	PRVT
P/T	1.0000								
CERT	0.61758	1.0000							
AGI	0.27973	0.25091	1.0000						
PAR	0.97623E-01	0.13988	0.38907E-01	1.0000					
DEGREE	0.34347	0.35455	0.54099	0.33129	1.0000				
IMMIG	0.36319	0.58598	0.39232	0.33343	0.76091	1.0000			
SEPARATE	-0.13774	-0.80034E-01	0.34859E-01	-0.32658E-01	0.16835	0.77038E-01	1.0000		
COUNT	0.20650	0.47276	0.15401	0.29921	0.58753	0.84135	-0.55037E-01	1.0000	
PRVT	0.36958	0.18138	0.82268E-01	0.29000	0.44803	0.43580	0.27391E-01	0.29651	1.0000
	P/T	**CERT**	**AGI**	**PAR**	**DEGREE**	**IMMIG**	**SEPARATE**	**COUNT**	**PRVT**

Auxiliary R^2 Values

Overall R-Square – Grade 3 = 0.5299

R-SQUARE OF P/T ON OTHER INDEPENDENT VARIABLES =	0.5323
R-SQUARE OF CERT ON OTHER INDEPENDENT VARIABLES =	0.5978
R-SQUARE OF AGI ON OTHER INDEPENDENT VARIABLES =	0.6462
R-SQUARE OF PAR ON OTHER INDEPENDENT VARIABLES =	0.1930
R-SQUARE OF DEGREE ON OTHER INDEPENDENT VARIABLES =	0.6972
R-SQUARE OF IMMIG ON OTHER INDEPENDENT VARIABLES =	0.9134
R-SQUARE OF SEPARATE ON OTHER INDEPENDENT VARIABLES =	0.5386
R-SQUARE OF COUNT ON OTHER INDEPENDENT VARIABLES =	0.8151
R-SQUARE OF PRVT ON OTHER INDEPENDENT VARIABLES =	0.3960
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =	0.0000

Overall R-Square – Grade 6 = 0.5151

R-SQUARE OF P/T ON OTHER INDEPENDENT VARIABLES =	0.5231
R-SQUARE OF CERT ON OTHER INDEPENDENT VARIABLES =	0.5963
R-SQUARE OF AGI ON OTHER INDEPENDENT VARIABLES =	0.5726
R-SQUARE OF PAR ON OTHER INDEPENDENT VARIABLES =	0.1668
R-SQUARE OF DEGREE ON OTHER INDEPENDENT VARIABLES =	0.7021
R-SQUARE OF IMMIG ON OTHER INDEPENDENT VARIABLES =	0.8792
R-SQUARE OF SEPARATE ON OTHER INDEPENDENT VARIABLES =	0.3713
R-SQUARE OF COUNT ON OTHER INDEPENDENT VARIABLES =	0.7913
R-SQUARE OF PRVT ON OTHER INDEPENDENT VARIABLES =	0.3976
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =	0.0000

Overall R-Square – Grade 9 = 0.4536

R-SQUARE OF P/T ON OTHER INDEPENDENT VARIABLES =	0.5174
R-SQUARE OF CERT ON OTHER INDEPENDENT VARIABLES =	0.5964
R-SQUARE OF AGI ON OTHER INDEPENDENT VARIABLES =	0.4458
R-SQUARE OF PAR ON OTHER INDEPENDENT VARIABLES =	0.1754
R-SQUARE OF DEGREE ON OTHER INDEPENDENT VARIABLES =	0.7099
R-SQUARE OF IMMIG ON OTHER INDEPENDENT VARIABLES =	0.8694
R-SQUARE OF SEPARATE ON OTHER INDEPENDENT VARIABLES =	0.1585
R-SQUARE OF COUNT ON OTHER INDEPENDENT VARIABLES =	0.7767
R-SQUARE OF PRVT ON OTHER INDEPENDENT VARIABLES =	0.3821
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =	0.0000

Diagnostic testing for equation (3):

Outward Migration = β_1 SCORE + β_2 *P/T RATIO* + β_3 AGI + β_4 *POP* + β_5 *DISTANCE*

Simple Correlation Coefficients

Grades 3

	SCORE	P/T	AGI	POP	DISTANCE
SCORE	1.0000				
P/T	0.25264	1.0000			
AGI	-0.30014	0.12460	1.0000		
POP	-0.42356E-01	0.44795	0.26028	1.0000	
DISTANCE	-0.68213E-01	-0.58515E-01	0.16322	-0.10533	1.0000

Grade 6

	SCORE	P/T	AGI	POP	DISTANCE
SCORE	1.0000				
P/T	0.19156	1.0000			
AGI	-0.21443	0.12460	1.0000		
POP	0.42189E-01	0.44795	0.26028	1.0000	
DISTANCE	-0.41474E-01	-0.58515E-01	0.16322	-0.10533	1.0000

Grade 9

	SCORE	P/T	AGI	POP	DISTANCE
SCORE	1.0000				
PT	0.16839	1.0000			
AGI	-0.23266	0.12460	1.0000		
POP	0.88054E-01	0.44795	0.26028	1.0000	
DISTANCE	-0.48396E-01	-0.58515E-01	0.16322	-0.10533	1.0000

Auxiliary R^2 Values

Overall R-Square - Grade 3 = 0.1788

```
R-SQUARE OF SCORE    ON OTHER INDEPENDENT VARIABLES =   0.1855
R-SQUARE OF P/T      ON OTHER INDEPENDENT VARIABLES =   0.2835
R-SQUARE OF AGI      ON OTHER INDEPENDENT VARIABLES =   0.1907
R-SQUARE OF POP      ON OTHER INDEPENDENT VARIABLES =   0.2657
R-SQUARE OF DISTANCE ON OTHER INDEPENDENT VARIABLES =   0.0504
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =   0.0000
```

Overall R-Square - Grade 6 = 0.1797

```
R-SQUARE OF SCORE    ON OTHER INDEPENDENT VARIABLES =   0.0946
R-SQUARE OF P/T      ON OTHER INDEPENDENT VARIABLES =   0.2333
R-SQUARE OF AGI      ON OTHER INDEPENDENT VARIABLES =   0.1553
R-SQUARE OF POP      ON OTHER INDEPENDENT VARIABLES =   0.2567
R-SQUARE OF DISTANCE ON OTHER INDEPENDENT VARIABLES =   0.0504
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =   0.0000
```

Overall R-Square - Grade 9 = 0.1795

```
R-SQUARE OF SCORE    ON OTHER INDEPENDENT VARIABLES =   0.0996
R-SQUARE OF P/T      ON OTHER INDEPENDENT VARIABLES =   0.2196
R-SQUARE OF AGI      ON OTHER INDEPENDENT VARIABLES =   0.1689
R-SQUARE OF POP      ON OTHER INDEPENDENT VARIABLES =   0.2615
R-SQUARE OF DISTANCE ON OTHER INDEPENDENT VARIABLES =   0.0505
R-SQUARE OF CONSTANT ON OTHER INDEPENDENT VARIABLES =   0.0000
```

Appendix 3

This appendix contains tables for the descriptive statistics for both models used in this study.

Table 1 – Summary statistics of all the variables for equation (1)

NAME	N	MEAN	ST. DEV	VARIANCE	MINIMUM	MAXIMUM	COEF. OF VARATION
P/T RATIO	36	21.106	1.8584	3.4537	16.300	23.900	0.88053E-01
CERT	36	0.55833E-01	0.28098E-01	0.78951E-03	0.10000E-02	0.11800	0.50325
SPEND	36	6102.6	1195.7	0.14296E+07	4875.0	11923.	0.19593
AGI	36	49015.	6554.2	0.42957E+08	39092.	66393.	0.13372
PAR	36	0.10350	0.28146E-01	0.79220E-03	0.66000E-01	0.17800	0.27194
DIPL	36	0.56811	0.92528E-01	0.85614E-02	0.35500	0.76700	0.16287

Table 2 – Summary statistics of all the variables for equation (2)

NAME	N	MEAN	ST. DEV	VARIANCE	MINIMUM	MAXIMUM	COEF. OF VARATION
P/T RATIO	36	21.157	2.1048	4.4301	15.090	24.930	0.99485E-01
CERT	36	0.15647	0.43221E-01	0.18681E-02	0.85000E-01	0.25300	0.27622
PRVT	36	0.18347	0.12985	0.16862E-01	0.10000E-02	0.43200	0.70776
AGI	36	52611	6524.0	0.42562E+08	43373	70177	0.12400
PAR	36	0.12117	0.23691E-01	0.56129E-03	0.87000E-01	0.18400	0.19553
DEGREE	36	0.88056E-01	0.32597E-01	0.10626E-02	0.52000E-01	0.18700	0.37019
IMMIG	36	0.87139E-01	0.47314E-01	0.22386E-02	0.30000E-01	0.27300	0.54297
SEPARATE	36	0.85297	0.75377E-01	0.56817E-02	0.63300	0.93900	0.88370E-01
COUNT	36	34.389	46.350	2148.4	6.0000	222.00	1.3478

Table 3 – Summary statistics of all the variables for equation (3)

NAME	N	MEAN	ST. DEV	VARIANCE	MINIMUM	MAXIMUM	COEF. OF VARATION
SCORE (Grade 3)	529	0.81705	0.96212E-01	0.92567E-02	0.40800	0.90400	0.11775
SCORE (Grade 6)	529	0.78639	0.12249	0.15005E-01	0.25000	0.88200	0.15577
SCORE (Grade 9)	529	0.81180	0.83425E-01	0.69598E-02	0.46700	0.90500	0.10277
P/ T RATIO	529	20.915	2.0432	4.1745	16.300	23.900	0.97691E-01
AGI	529	53155.	5718.9	0.32706E+08	45016.	70177.	0.10759
POP	529	84663.	0.17968E+06	0.32285E+11	10810.	0.70958E+06	2.1223
DISTANCE	529	491.02	270.54	73194.	0.0000	1280.0	0.55099

Bibliography

Alberta Teachers Association. 2000. *Corporate Presence in Schools* [online]. ATA – Position Papers. Alberta, Canada [cited May 2001]. Available from World Wide Web: http://www.teachers.ab.ca/policy/papers.cfm?p_ID=90

Association of Independent Schools and Colleges in Alberta (2000) *Directory of Independent Schools 2000-2001* (Edmonton, Canada: AISCA)

Black, S.E. (1999) 'Do better schools matter? Parental valuation of elementary education,' *Quarterly Journal of Economics* May 1999, 577-599

Blair, J.P., and S. Stanley (1995) 'Quality competition and public schools: further evidence,' *Economics of Education Review* 14, 193-198

Borland, M.V. and R.M. Howsen (1998) 'Effect of student attendance on student performance: A comment on Lamdin,' *The Journal of Educational Research* 91, 195-197

Borland, M.V., and R.M. Howsen (1992) 'Student achievement and the degree of market concentration in education,' *Economics of Education Review* 11, 31-39

Borland, M.V. and R.M. Howsen (1996) 'Teacher-associated expenditures and student achievement,' *Applied Economics Letters* 3, 591-593

Canada. Alberta Learning. 2000. *Alberta Public School Districts, School Divisions and Regional Divisions* [online]. Alberta: Educational Information Services, Information Services, Alberta Learning [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/maps

Canada. Alberta Learning. 2000. *Alberta Learning Private Schools* [online]. Alberta: Educational Information Services, Information Services, Alberta Learning [cited June 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/maps

Canada. Alberta Learning. 2000. *Alberta Learning Public, Separate, Francophone, and Charter Authorities* [online]. Alberta: Educational Information Services, Information Services, Alberta Learning [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/maps

Canada: Alberta Learning. 2001. Customized Database on Private Schools. Supplied by: Information Access and Reporting, Information and Technology Management Department.

Canada: Alberta Learning. 1996. *Jurisdictional Profile Reports* [online]. Alberta: Department of Education [cited May 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/ei/jpr/

Canada. Government of Alberta (1995) *Official Road Map* (Alberta Economic Development and Tourism)

Canada: Alberta Learning. 1996. *School Choices* [online]. Alberta: Department of Education [cited June 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/educationsystem/choices.asp

Canada. Alberta Learning. 2000. *Technology Integration Funding* [online]. Alberta. Department of Education [cited July 2001]. Available from World Wide Web: http://www.learning.gov.ab.ca/technology/integration_funding.asp

Canada. Statistics Canada. 1996. *Census Profile for Alberta (data products: area profiles: 1996 Census of Population)* Census Operations Division, Ottawa: Ministry of Industry.

Canada. Statistics Canada. 2000. *Education in Canada 1999*. Statistics Canada Culture, Tourism and the Center for Education Statistics. Ottawa: Ministry of Industry.

Education Students' Association. Public School Division [online]. Edmonton: University of Alberta [cited July 2001]. Available from World Wide Web: http://www.ualberta.ca/~esa/public_school_divisions.htm

Fulton, M. (1996) *The abc's of investing in student performance* (Denver, Co: Education Commission of the States)

Hanushek, E.A. (1996) 'Measuring Investment in Education,' *Journal of Economic Perspectives* 10, 9-30

Hanushek, E.A. (1998) 'The evidence on class size,' Occassional Paper 98-1, University of Rochester

Howley, C. (1996) 'Compounding disadvantages: the effects of school and district size on standard achievement in West Virginia,' *Journal of Research in Rural Education* 12, 25-32

Holmes, George M. 2000. *Does school choice increase school quality?* [online]. Department of Economics, East Carolina University, Working Paper [cited July 2001]. Available from World Wide Web: http://personal.ecu.edu/holmesg/papers/charter_dfm.pdf

Holmes, George M. 2001. *The effect of charter school competition on traditional school quality* [online]. Department of Economics, East Carolina University, Greenville, NC. [cited July 2001]. Available from World Wide Web: http://econpapers.hhs.se/paper/wopeacaec/0107.htm

Holmes, M. (1998) *The reformation of Canada's schools. Breaking the barriers to parental choice.* (Canada: McGill-Queen's University Press)

Hoxby, C. M. (1994) 'Do private schools provide competition for public schools?' National Bureau of Economic Research Working Paper W4978

Hoxby, C.M. 1998. *The economics of school reform* [online]. *National Bureau of Economic Research* [cited August 2001]. Available from World Wide Web: http://www.nber.org/reporter/spring98/hoxby_spring98.html.

International Travel Maps *Alberta & British Columbia* (Vancouver, Canada: ITMB Publishing Ltd.)

Jepsen, C. 1999. *The effects of private school competition on student achievement* [online]. Northwestern University [cited July 2001]. Available from World Wide Web: http://www.northwestern.edu/IPR/publications/papers/jepsenwp99.pdf

Johnson, H.P. and R. Lovelady. 1995. *Migration between California and Other States: 1985-1994* [online]. California Research Bureau of the California State Library and the Demographic Research Unit of the California Department of Finance [cited August 2001]. Available from World Wide Web: http://www.dof.ca.gov/html/Demograp/dommig.pdf

Judd, D.G. and J.M. Watts (1981) 'Schools and housing values,' *Land Economics* 57, 459-470

Lamdin, D.J. (1996) 'Evidence of student attendance as an independent variable in education production functions,' *The Journal of Educational Research* 89, 155-162

Lee, V. and J. Smith (1996) 'High school size: which works best and for whom?' *Educational Evaluation and Policy Analysis* 19, 205-227

Levin, Henry M. (1974) 'Measuring Efficiency in Educational Production,' *Public Finance Quarterly*, 2 (January): 3-24

Levin, B. and J. Young (1994) *Understanding Canadian schools. An introduction to educational administration.* (Canada: Harcourt Brace & Company Canada, Ltd.)

Lewington, J. and G. Orpwood (1995) *Overdue Assignment. Taking responsibility for Canada's schools.* (Canada: John Wiley & Sons)

MapArt Publishing *Alberta Road Atlas, First Edition* (Oshawa, Canada: Peter Heiler Ltd.)

Marlow, M.L. (2000) 'Spending, school structure, and public education quality. Evidence from California,' *Economics of Education Review* 19, 89-106

Minter-Hoxby, C (1995). 'Is there an equity-efficiency trade-off in school finance? Tiebout and a theory of the local public goods producer,' National Bureau of Economic Research Working Paper W5265 [cited August 2001]. Available from World Wide Web:
http://papers.nber.org/papers.html

United States. Department of Education. 2000. *Public School Choice: Issues and Concerns for Urban Educators* [online]. ERIC/CUE Digest No. 63 [cited July 2001]. Available from World Wide Web:
http://www.ed.gov

United States. Pennsylvania Department of Education. 2000. *School Performance Funding School-by-School Results* [online]. Pennsylvania. Department of Education [cited June 2001]. Available from World Wide Web:
http://www.pde.psu.edu/spf00/spf00.html

US Department of Education. 1998. *Class size and students at risk: What is known? What is next?* [online] [cited July 2001]. Available from World Wide Web:
http://www.ed.gov/pubs/ClassSize/assess.html

US Department of Education. 1994. *Education Reforms and Students at Risk: A Review of the Current State of the Art*, Ch. 2 [cited July 2001]. Available from World Wide Web:
http://www.ed.gov/pubs/EdReformStudies/EdReforms/chap2c.html

Vedder, R. and J. Hall (2000) 'Private school competition and public school teacher salaries,' *Journal of Labor Research* XXI, 161-168

Weeler, B. 1997. *Separate families* [online]. University of Pittsburgh [cited September 2001]. Available from World Wide Web:
http://www.pitt.edu/~wpilib/statfaq/97regrxx.html

Wisconsin Education Association Council. 1998. *Variables affecting student achievement* [online] [cited July 2001]. Available from World Wide Web:
http://www.weac.org/resource/primer/variable.htm

White, K. J. 2000. *Estimation of Models with Heteroskedastic errors* [online]. British Columbia: University of British Columbia [cited July 2001]. Available from World Wide Web:
http://shazam.econ.ubc.ca/intro/glshet.htm

Zanzig, B.R. (1997) 'Measuring the impact of competition in local government education markets on the cognitive achievement of students,' *Economics of Education Review* 16, (4), 431-441