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IMPACT OF PROFICIENCY ON EARLY ENTRANTS TO THE LABOUR MARKET: EVIDENCE FROM THE YITS

OECD Education Working Paper No. 29

This research paper was prepared for Human Resources and Skills Development Canada by Torben Drewes of the Trent University Department of Economics.

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**IMPACT OF PROFICIENCY ON EARLY ENTRANTS TO THE LABOUR MARKET:
EVIDENCE FROM THE YITS**

Report Prepared For

THE LEARNING POLICY DIRECTORATE

HUMAN RESOURCES AND SOCIAL DEVELOPMENT CANADA

By

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March, 2008

The views expressed in papers published by the Learning Policy Directorate are the author's and do not necessarily reflect the opinions of Human Resources and Skills Development Canada or of the federal government. The goal of these papers is to encourage broad participation in discussion and debate of important public policy issues.

Un sommaire français se trouve avant la table des matières.

ABSTRACT

The primary purpose of the report is to explore the impact of PISA reading scores on the early labour market outcomes of young Canadians of the Youth in Transition Survey. This inquiry is complicated by two facts. First, family and school characteristics that are positively correlated with PISA scores are also correlated with labour market success, making it difficult to discover the independent effect of those scores. Second, students with higher PISA scores are much more likely to pursue education beyond high school and scores may operate both directly and indirectly through this channel to influence later outcomes. Among females, there is a positive correlation between PISA scores and future earnings, even after controlling for family background and educational attainment. There is no evidence of such a correlation for males. For both genders, the link between PISA scores and unemployment disappears when controls are added. These weak outcomes may be explained by the fact that sufficient time has not elapsed for the YITS respondents to complete schooling and to integrate into the labour market.

RÉSUMÉ

L'objectif premier du présent rapport est d'examiner comment les scores PISA en compréhension de l'écrit influencent les premiers résultats sur le marché du travail des jeunes Canadiens interrogés dans le cadre de l'Enquête auprès des jeunes en transition (EJET). L'analyse est compliquée par deux facteurs : tout d'abord, les caractéristiques en termes de contexte familial et d'établissement scolaire fréquenté qui sont positivement corrélées avec les scores PISA sont également corrélées avec la réussite sur le marché du travail, ce qui empêche d'identifier l'effet indépendant de ces scores. Ensuite, les élèves qui ont obtenu des scores PISA élevés sont beaucoup plus susceptibles de continuer à faire des études après l'enseignement secondaire ; les scores pourraient donc avoir un effet à la fois direct et indirect sur les résultats ultérieurs. Chez les filles, on constate une corrélation positive entre les scores PISA et le revenu futur, même après prise en compte des caractéristiques du contexte familial et du niveau d'études. En revanche, on ne dispose d'aucun élément prouvant une telle corrélation chez les hommes. Pour les femmes comme pour les hommes, le lien entre les scores PISA et le fait d'être sans emploi disparaît dès lors que l'on ajoute des contrôles. La faiblesse de ces résultats peut s'expliquer par le manque de temps écoulé entre le moment où les personnes ont été sondées par l'EJET et le moment où elles ont terminé leurs études pour entrer sur le marché du travail.

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EXECUTIVE SUMMARY

The Youth in Transition Survey allows Canadian researchers, for the first time, to examine the relationship between the outcomes of high school students on international standardized tests of reading, mathematics, and science on labour market outcomes. This paper examines the impact of PISA scores on labour market earnings and unemployment, restricting attention to reading scores so as to preserve sample size.

Performance in the PISA tests is highly correlated with educational attainment. Approximately 65 percent of YITS respondents in the highest score quintile were still in university at the time of the Cycle 4 survey, with another 13 percent still in college. Over three quarters of those in the lowest quintile had finished formal education. This has two important implications for the research. First, in terms of understanding the causal impact of higher PISA scores, clearly much of it may operate through an educational attainment effect. The second implication is that, in trying to quantify the effect, the inquiry is hampered by a lack of data on labour market outcomes of those in the top quintiles who have yet to enter the labour market. Moreover, those that have entered the labour market are still very early in their careers and may have yet to demonstrate their innate productivity to employers.

PISA scores have an impact on the earnings of females. With no controls for background or educational attainment, a one standard deviation increase in the reading score is estimated to be associated with a 5 percent increase in earnings. Adding those controls reduces the estimate to 4.1 percent. The impact of the scores for females as a group is driven primarily by the effects these scores have on those with completed high school or less, although some care should be exercised in interpreting the outcomes for higher levels of education where sample sizes become disconcertingly small.

The estimated effect of a one standard deviation increase in the reading score for males is only 2.1 percent and becomes statistically insignificant when background and educational controls are included. PISA scores are as strongly correlated with educational attainment for males as they are for females and the poor predictive power of PISA scores for earnings for males suggest that they operate only indirectly through the attainment channel.

The impact of PISA scores on the incidence of unemployment is also not particularly large or robust to the inclusion of controls. In this case, unemployment incidence is lower for both genders when raw comparisons are made but the scores lose their statistical significance for both genders when family background and educational attainment controls are introduced.

The analysis of the effects of performance on the PISA tests has clearly been undertaken too early. The fact that a large part of the sample remains in formal schooling has very serious consequences for sample sizes. More troubling is the fact that the sample is not randomly reduced by this phenomenon. Those with higher scores are more likely to be excluded. Moreover, the personal attributes that lead to better performance in the PISA tests will not be immediately evident to employers, who have no knowledge of those scores. We need to have at least one more cycle of observation in the YITS to allow observation of earnings and unemployment outcomes after individuals from across the entire distribution of PISA scores have had time to integrate into the labour market.

I. INTRODUCTION

1. The outcomes of standardised testing in Canadian schools attract considerable attention among parents, educators, and policy-makers. That interest derives from an underlying belief that these outcomes foretell the economic future of the children being tested. Parents are concerned if the school their child attends fares poorly in comparison with others. Any report in the popular press that Canadian children fall behind children in other countries in mathematics tests raise alarms about Canada's longer term ability to maintain its relative standard of economic prosperity.

2. International evidence tends to support the assumption that scores matter, showing significant associations between early cognitive skills among children (as measured by test scores) and later labour market outcomes.¹ Canadian evidence on the issue has not been available to date since data that can link cognitive test achievements among children or teenagers and their later labour market success has simply not been available.² In 2000, the Youth in Transition Survey (YITS) administered the OECD's Programme for International Student Assessment (PISA) tests to high school students who were 15 years old in 1999 and whose education and labour market pathways have been followed since. As this cohort enters the labour market, we are now in a position to examine Canadian evidence on the link between test scores and success in that market.

3. This report presents Canadian evidence on the links between cognitive skills in the areas of reading and early labour market success of young Canadians.³ It finds that PISA reading scores matter a great deal for educational attainment, with those achieving higher scores have a much greater probability of proceeding to educational levels beyond high school. However, conditional on that attainment, the reading scores generally matter very little for either earnings or employment outcomes. What effects are found tend to be among women whose highest educational attainment is completed high school. This rather pessimistic result may be tied to the fact that many of the YITS respondents have yet to enter the labour market, being engaged in university studies, and those who have left formal schooling have yet to establish themselves in that market.

4. The following section briefly reviews the available literature. Establishing an association between success in tests and success in the labour market is not *prima facie* evidence of causality. Section 3 discusses the analytical issues involved in establishing a causal link between test scores and outcomes, and why this is critical for drawing any policy conclusions. Section 4 describes the YITS data while the following section reports the empirical findings.

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1. See, for example, Currie and Thomas (2001) for British evidence and Murnane *et al.* (2000) for American results.
 2. The International Adult Literacy Survey report literacy and numeracy skills and labour market outcomes but those skills are tested contemporaneously.
 3. Sample sizes are too small to produce reliable evidence on the impacts of PISA scores in mathematics and science.

II. LITERATURE REVIEW

5. Canadian research on the link between ability and labour market outcomes has been limited by data availability. Charette and Meng (1998) use the Literacy Skills Used in Daily Activities (LSUDA) data to produce the first empirical look at literacy and numeracy impacts in the Canadian context, examining labour market outcomes that include earnings, participation and unemployment. Generally, literacy and numeracy are found to play significant roles in all of these outcomes. Green and Riddell (2001) confirm the importance of literacy in earnings determination using the International Adult Literacy Survey (IALS). While the impact of literacy on labour force participation and unemployment is not examined separately, earnings are partly determined by the quantity of labour supplied and, in that sense, the impact of literacy on these dimensions is captured indirectly.

6. While these results are informative for the following report, it is important to note that the LSUDA and IALS data measure literacy and/or numeracy contemporaneously with labour market outcomes. Cognitive skills measured at the same time as labour market success will include the effects of post-secondary education and experience to the extent that these contribute to literacy and numeracy skills. In the YITS data, on the other hand, the ability measures are constructed well before any higher education can be taken or labour market experience gained. Although the PISA scores in the YITS data will be influenced by early parental investments in human capital and the quality of the individual's primary and early secondary school experiences, they will be more heavily influenced by innate ability. Moreover, the link between these scores and labour market outcomes will be much more complex, involving considerations of skills depreciation, confounding of early ability measures and subsequent human capital investments, and so on. The YITS data are the first to provide the opportunity to explore the link between early cognitive skills and later labour market outcomes and, subsequently, there is as yet no Canadian literature on the subject. There is, however, considerable international research.

7. Murnane *et al.* (1995) use the American National Longitudinal Study of the High School Class of 1972 and the High School and Beyond survey of high school seniors in 1980 to examine the link between mathematics and reading test scores measured in the senior year of high school and the wages of 24 year old men and women who had completed their formal education. Basic cognitive skills, as measured by those scores, are found to be significant determinants of wages, more so for the later cohort than the earlier. The result is confirmed in Murnane *et al.* (2000) where, for example, the predicted earnings of a 31-year-old male who graduated from high school with strong cognitive skills are 30 percent higher than one who graduated with weak cognitive skills. Much of this difference is explained by the fact that the former is much more likely to achieve post-secondary education credentials. Blackburn and Newmark (1993) show that cognitive skills matter within educational attainment groups as well, finding that the labour market gains from a college education were greater for male high school graduates with stronger cognitive skills. Similarly, Tyler *et al.* (2000) show that cognitive skills matter among young high school dropouts. In a widely cited paper, Neal and Johnson (1996) find that differences in the Armed Services Vocational Aptitude Battery test scores measured among NLSY panel members in 1980 explain much of the racial differences in earnings ten years later.

8. Currie and Thomas (2001), using data from the British National Child Development Survey of children born in 1958, find that age 16 test scores play an important role in wage and employment outcomes at age 33. The potential intermediate role of post-secondary educational attainment is not explored. Interestingly, Currie and Thomas find that the age 16 test score has a smaller effect on the wages and employment probabilities of children from higher socio-economic status families. For example, a one standard deviation increase in the math test score at age 16 would translate into a 14 percent higher wage

rate at age 33 for individuals from low socio-economic status backgrounds, and a 11 percent wage increase for those from high socio-economic status backgrounds.

9. Evidence using the results of the PISA testing done in the YITS is just now starting to emerge. Betsky *et al.* (2008) used the results of a YITS-like survey in Switzerland to examine the possible links between PISA reading scores the quality of the job held five years after the Swiss students completed the tests. The research was restricted to those pursuing vocational education, since only this group had emerged from formal schooling in sufficient numbers to generate a useful sample size. The authors find that PISA scores have no direct effect on the quality of the job but had indirect effects because higher scoring students pursued pathways through more demanding vocational streams and these streams produced better jobs. In other words, PISA scores did not appear to matter within groups pursuing a specific vocational education path.

10. Turning to the impact of working while in school, American research typically shows that working while in school, especially in secondary school, has significant and positive impacts on earnings and employment.⁴ The evidence is not indisputable, however, and Hotz *et al.* (2002) claim to show that any positive impacts of working while in school are statistical artefacts of selection. The most recent Canadian evidence is by Parent (2006) who finds, using the 1991 School Leavers Survey and its 1995 Followup, that working while in high school has no discernible positive impact on subsequent income although there appears to be a negative and causal relationship with the probability of graduating from high school.

4. See, for example, Light (2001).

III. METHODOLOGY

11. The test scores at the centre of this inquiry are those obtained by 15 year old Canadian high school students in the OECD's Programme for International Student Assessment (PISA) initiative, which establishes an internationally comparative assessment of student outcomes in reading, mathematical and scientific literacy. To quote from PISA:

"The OECD Programme for International Student Assessment (PISA) is a collaborative effort undertaken by all member countries and a number of non-member partner countries to measure how well students, at age 15, are prepared to meet the challenges they may encounter in future life. Age 15 is chosen because at this age, in most OECD countries, students are approaching the end of compulsory schooling, and so, some measure of the knowledge, skills and attitudes accumulated over approximately ten years of education is gained from an assessment at this time. The PISA assessment takes a broad approach to assessing knowledge, skills and attitudes that reflect current changes in curricula, moving beyond the school based approach towards the use of knowledge in everyday tasks and challenges. The skills acquired reflect the ability of students to continue learning throughout their lives by applying what they learn in school to non-school environments, evaluating their choices and making decisions. (OECD, p. 7).

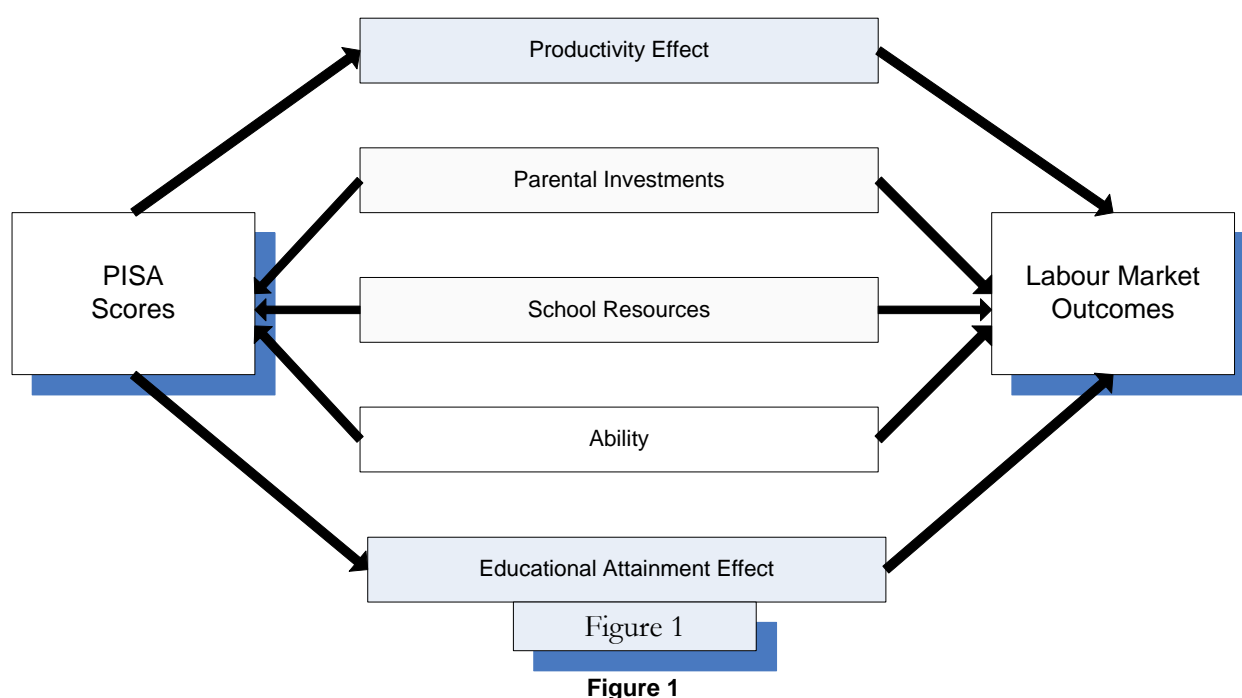
12. The language in the OECD quote above is forward looking and suggests that student performance in the PISA tests measures their potential for future success. The methodology best suited to addressing the question of whether this is, in fact, true requires us to think about the determinants of PISA scores and then consider why we might expect them to influence future labour market success.

13. In and of themselves, PISA scores have no direct currency in the labour market since prospective employers are simply not equipped to evaluate them as signals of expected productivity in the same way that grade point averages might be used. If measures of cognitive skills at age 15 are to have an effect on employment and earnings several years later they must do so through indirect channels. There are two potential ways in which PISA scores may be causality and directly related to future labour market success.⁵ First, higher PISA scores may reflect a larger bundle of productivity enhancing skills and knowledge that the individual retains and markets after leaving schooling. Second, higher scores may reflect an attitude towards learning that portends larger investments in human capital through further education and these investments produce success in the labour market. Complicating matters enormously is the possibility that additional factors may simultaneously determine both PISA scores and labour market outcomes. Higher PISA scores may reflect greater innate ability (as opposed to a bundle of skills and knowledge), greater family investments in the child's development, or school resources. All of these factors continue on after the PISA tests are written and may have independent labour market impacts if, for example, families or schools invest in activities that improve the transition into the labour market.

14. Why is this important? The precise mechanism through which PISA scores affect labour market outcomes matters very much for policy prescriptions. Suppose, for example, that higher PISA scores affect future earnings only because they capture non-cognitive abilities and those abilities are largely the product

5 . Of course, these are not mutually exclusive and multivariate methods will eventually have to be brought to bear to disentangle the independent effects.

of the home environment. Investing more money into school resources (for example, lowering the student to teacher ratio) would then have no impact on PISA scores or on future labour market success. Suppose, on the other hand, that higher scores cause higher future earnings because they measure the cognitive skills that high school students have mastered in school. Then increased school resources to improve learning would have longer term benefits. Finally, suppose that the linkage from scores to success reflects a mechanism whereby high scoring students continue on to PSE and it is the latter human capital process that creates productivity. In this case, public policy to increase access to PSE may be as efficient as policies to increase PISA scores.



15. Inferring the exact nature of the linkages is challenging because an individual's test outcome and his or her labour market success are simultaneously determined by inter-related factors. Figure 1 provides a framework for thinking about these confounding influences.⁶

16. To the extent that PISA scores do capture differences in skills acquired at the age of 15 that will have labour market value in the future, the association between those scores and labour market outcomes operates through the "productivity effects" linkage in Figure 1. Higher scores may also be causally related to the level of educational attainment which is conceptualised as further investments in human capital (which will eventually be rewarded). The three factors influencing both the student's PISA score and early labour market outcomes are shown in Figure 1 as having influences in both directions.

17. To deal with this set of inter-related factors, the following methodology is proposed. The earnings impact of PISA scores will be estimated using the standard human capital earnings function. That function is first estimated using only the PISA score as an explanatory variable in order to capture the difference in mean earnings between individuals with different scores. The model is then re-estimated using a full set of controls for family background, school resources, and individual characteristics and

6. Figure 1 borrows heavily from Rose and Betts (2001), Figure S.6.

behaviours. This intermediate model will then determine how much of the original impact of PISA scores is attributable to these factors. Finally, educational attainment indicators are introduced to estimate how much of the impact of the PISA score remaining in the intermediate model is due to their role in causing greater investments in education.⁷

18. The earnings equation is also estimated separately by educational group. To the extent that PISA scores have a causal role in determining the final educational attainment of the individual, doing so will under-estimate their impact on earnings. Bearing this caveat in mind, however, it is of considerable interest to know whether success in PISA tests is important for those who choose not to pursue higher education, whether test scores are more important for those who choose university rather than college education, and so on.

19. A similar methodology is used to examine unemployment probabilities. Participation rates are sometimes used to gauge labour market success, but are not examined in this paper. For the YITS respondents who have finished formal schooling, participation rates are fairly uniform by PISA score and high. With little variation in a rate close to 100 percent, PISA scores will have little effect.

7. Had sample sizes permitted, it would have been informative to continue with a fourth specification that included post-secondary field of study to determine if higher PISA scores produce better labour market outcomes by inducing students to enter higher paying but more demanding fields of study. I am grateful to a reviewer for pointing this out.

IV. DATA

20. The Youth in Transition Survey is a large, nationally representative longitudinal survey expressly designed to examine transitions of Canadian youth through education and into the labour market. Youth who were 15 years old on December 31, 1999 were targeted. PISA scores are available only in cohort A of the YITS. A reading test was administered to the entire sample, a mathematics test to one half of the sample, and a science test to the other half.

21. To this point, the YITS has gone through 4 cycles every two years. The first cycle was conducted in April 2000 to collect information for 1999 as well as background information. In this first cycle, information on family background was supplied directly by parents and school administrators were asked for detailed information on educational resources available to the YITS individual. A second interview in 2002 collected information on activities in 2000 and 2001, a third interview in 2004 captured activities during 2002 and 2003 and, finally, the last cycle collected information for 2004 and 2005 in the 2006 interview. Individuals were 15 years old on December 31, 1999 and were 21 years old at the end of 2005. The YITS began with 29,330 respondents in cycle 1. The number had fallen to 18,843 in Cycle 4 in 2006.

22. Educational attainment in the following analysis is assessed as of the end of Cycle 4, *i.e.*, the status at December 31, 2005. The following categories were defined:

- *Less than high school.* These individuals had not completed their high school certificate requirements and were either still participating in secondary education or had left the educational system.
- *High School Graduates* had received their secondary school diplomas but had not pursued further formal schooling at any time since leaving high school.
- *PSE Leavers* had entered some form of post-secondary education but had left without receiving qualifications and were not engaged in PSE schooling as of the end of 2005.
- *College Graduates* had completed the requirements for a college certificate but had not pursued university studies.
- *University Graduates* had completed undergraduate studies at the Baccalaureate level.
- *College and university students* were still engaged in full-time studies at the end of Cycle 4 (age 21).

23. Individuals moving from colleges into universities are treated as university students. For example, an individual completing a college diploma and then pursuing university studies is treated as a current university student.

24. Cycle 1 determined the number of hours worked while attending high school. Weekday and weekend hours are combined to determine the average number of hours worked during the week while in

high school. For work hours during PSE, the total number of paid hours plus the number of hours working on a farm in the most recent year of PSE are used.

25. Earnings refer to the hourly earnings in the job held in the last 6 months of 2005. If more than one job was held, the earnings data refer to the job in which the individual worked the most monthly hours during that period.

26. Means and standard deviations of the primary variables used in the following analysis are provided in Appendix Table A1. Note that all estimates in this report are weighted.

V. RESULTS

V.1 Which PISA Score?

27. YITS respondents were assessed in reading, mathematics and science abilities and the data therefore offer three potential PISA scores to use in the subsequent analysis. Although the three scores are highly correlated, they are not perfectly so. A simple regression of the available math and science scores, respectively, on the reading score shows, through the coefficient of determination, the degree of correlation.

$$\begin{aligned} PISA\ Science\ Score &= 164.02 + 0.683\ Reading\ Score: & R^2 &= 0.52 \\ &(0.012) \end{aligned}$$

$$\begin{aligned} PISA\ Math.\ Score &= 211.20 + 0.599\ Reading\ Score: & R^2 &= 0.45 \\ &(0.012) \end{aligned}$$

28. It would be informative to understand how each of these scores affects labour market outcomes but the issue of sample size will become critical and the need to retain the full YITS sample by using only the reading score trumps the desire to look at each score individually.⁸

29. It is important to recognise that PISA scores differ significantly between males and females. For females, the mean and standard deviation of the reading score are 549.2 and 88.2, respectively. The corresponding values for males are 518.8 and 96.2. Were we to look simply at the correlation between PISA scores and labour market earnings using pooled data, the continuing male advantage in earnings will produce an underestimate of the impact of the scores. In the following, estimates are therefore produced separately for males and females.

8 . The power of each score to predict PSE attendance was compared by estimating a simple probit model of PSE attendance against each score separately. For both males and females, the reading score is a better predictor than either the math or the science scores according to the pseudo-R² statistic. It would be interesting to examine the influences of the three scores separately, but the sample sizes would be too small to produce robust results until more of the sample has had time to enter the labour market. Note, as well, that most of the action from PISA scores will be found to work through educational attainment so that use of the score best able to predict that attainment, the reading score, would be the preferred option in any case.

V.2 What are the Determinants of PISA Scores?

Table 1. Determinants of PISA Scores

Determinant	Males	Females
Mother's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	6.86	9.02
College	17.03**	20.85**
University	39.57**	38.38**
Father's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	6.57	15.25*
College	16.29**	12.07**
University	35.92**	36.22**
Parent's Combined Income (\$,000's)	1.14**	0.97**
Province: (ref. group: Ontario)		
NFLD	-20.93**	-7.59
PEI	-26.17**	-16.33**
NS	-16.91**	-4.06
NB	-14.05*	-2.65
QUE	3.39	12.73**
MAN	3.07	14.19**
SASK	-4.42	7.36
ALTA	14.18**	20.71**
BC	10.65*	10.55**
School's Physical Infrastructure Index (SCMATBUI)	1.87	-1.12
School's Educational Resources Index (SCMATEDU)	-4.04*	-1.16
Student Teaching Staff Ratio	1.19*	1.09**
First Generation Immigrant	-32.00**	-23.97**
Second Generation Immigrant	-0.13	2.23
Anglophone in Quebec	13.23*	2.82
Francophone Outside Quebec	-48.60**	-37.93**
Constant	478.20**	504.06**
R ²	0.13	0.12
No. of Obs.	7154	7543

* indicates significance at 5%, ** indicates significance at 1%

30. To what extent do parental characteristics and school inputs influence PISA scores? In other words, what are the influences running from right to left in the diagram above and is there any scope for policy intervention (through, for example, increased school resources). As shown in Table 1, socio-economic background plays a very significant role in determining PISA scores. Having parents with completed PSE is associated with a large increase in the PISA score and family income has an additional positive effect.

31. The evidence on the role of school resources is more mixed. The state of physical and educational infrastructure appears to play no role among females and, in fact, the level of educational infrastructure has a perverse sign in the case of males. Higher staff-to-student ratios do seem to increase PISA scores for both genders. To the extent that school resources are homogeneous within provinces, some of the explanatory power of these variables may be lost through the use of provincial indicator variables which show a very distinct east-to-west geographical pattern, particularly for males. Provinces differ in their per capita expenditure on elementary and secondary schools with a similar geographic pattern, *i.e.*, lower expenditures in the east and higher expenditures in the west.⁹ If public funding of schools is at the root of the provincial differences in PISA scores and if, in turn, we find that higher PISA scores produce better labour market outcomes, the scope for policy intervention is important and obvious.

9. See, for example, Guillemette (2005), Table 1.

32. First generation immigrants performed relatively poorly in the PISA reading tests, although there are no significant differences for second generation immigrant students. Clearly, the inference is that first generation immigrant children are disadvantaged in reading tests by language difficulties. A similar effect may explain the very poor performance on the PISA test by francophone children in some provinces outside Quebec who, unlike Anglophones inside that province, may not have access to schooling in their mother tongue.

33. What can we conclude from Table 1? First, there appears to be some scope for policy intervention that will increase PISA scores, although that scope is limited. If the pattern of provincial differences does represent provincial patterns of funding for primary and secondary education, then student performance in reading tests can be boosted through increases in funding. The second lesson is that PISA scores are heavily influenced by family background. Since factors such as parental education and family income are generally found to be important influences on educational attainment and labour market success as well, they must be controlled for in the wage and unemployment regressions below.

V.3 PISA Scores and Educational Attainment

34. One channel through which PISA scores may influence eventual labour market success is a causal influence on educational attainment. Before turning to an examination of the impact of those scores on earnings and employment, an examination of the educational patterns by score level is informative.

35. The YITS sample was arranged by score quintile and, within each quintile, the population was apportioned among various possible educational states in Cycle 4 or 2006. Those states are: incomplete high school, high school graduation only, PSE leaving without certification (college and university combined), college graduation, university graduation, continuers in college, and continuers in university. The results are reported in a contingency table format in Table 2.

Table 2. PISA Scores and Educational Attainment

PISA Quintile	HS Dropout	HS Graduate	PSE Dropout	College Graduate	University Graduate	College Continuer	University Continuer
1	0.189	0.375	0.082	0.117	0.003	0.151	0.084
2	0.092	0.267	0.116	0.148	0.005	0.154	0.219
3	0.044	0.198	0.121	0.123	0.004	0.153	0.358
4	0.023	0.152	0.101	0.109	0.012	0.107	0.497
5	0.014	0.087	0.082	0.077	0.011	0.074	0.655
Total	0.073	0.216	0.100	0.115	0.007	0.128	0.361

36. There is a very clear and significant correlation between the PISA score and educational attainment. Among those in the lowest quintile, over 56 percent had not proceeded beyond high school by the age of 21. About 8 percent unsuccessfully tried PSE, 27 percent either graduated from college or are continuing a college education, and only 8 percent are university graduates or continuers. By contrast, 90 percent of those in the highest quintile proceeded to PSE. Interestingly, the proportion who had entered college or university but dropped out without completing is the same in the top and the bottom quintiles. College becomes a less attractive destination moving up through the score distribution and the increase in PSE participation is explained by the dramatic increase in university participation. Less than 9 percent of

those in the lowest score quintile are either undertaking university studies or have completed those studies. By contrast, within the highest quintile, almost 67 percent are university graduates or continuers.¹⁰

37. Table 2 does not establish causality. It may be that third factors such as parental income or education cause both higher PISA scores and higher PSE participation. Nevertheless, it is clear that caution must be exercised if the impacts of PISA scores on earnings are taken in isolation within educational categories. For example, simply observing a correlation between scores and earnings among high school graduates would under-estimate the impact of those scores on earnings by ignoring the fact that higher scores are associated with higher educational attainment which, in turn, increases earnings.

V.4 PISA Scores and Earnings

38. Before any multivariate analysis is done, Table 3 tabulates population weighted mean earnings for males and females by PISA quintile in the YITS data. Earnings are hourly wage rates in jobs held by respondents at the end of the cycle. The sample is restricted to those holding jobs at that time. Even in raw dollar amounts, there is surprisingly little variation in hourly earnings by quintile. There is some progression for females, with the average wage for those in the fifth quintile about 13 percent higher than the average in the lowest quintile. For males, however, the top quintile earnings are less than 6 percent higher than the lowest quintile and the increase moving up through the quintiles is not monotonic, with the second quintile receiving the highest hourly earnings. It will not be surprising, then, when the PISA score is found to have little impact on earnings in the multivariate analysis to follow.

Table 3. PISA Scores and Hourly Earnings

Quintile	Males	Females
First	\$12.97	\$10.30
Second	14.10	10.90
Third	13.57	11.20
Fourth	13.87	11.28
Fifth	13.73	11.65

39. As described above, the appropriate methodology for investigating the implications of PISA reading scores on earnings is to conduct a series of earnings regressions, beginning with a simple model of earnings against the score, then adding control variables like family background, and finally accounting for the level of educational attainment. There are several important limitations in the YITS data when investigating earnings impacts of PISA scores. Many YITS respondents were continuing their education during 2006 and the sample needs to be restricted to those who have completed formal education and have entered the labour force. Almost half of the sample is lost. This is not only a matter of losing degrees of freedom in the econometrics to follow. The YITS respondents still in school are predominantly university students and the high correlation between educational attainment and PISA scores means that the missing observations tend to come from the upper end of the distribution of those scores. In looking at the impact of PISA scores, then, there is a limited ability to observe those with high scores. Another important statistical issue arises due to the very short period of time graduates from PSE, especially university

10. Note the very small percentage of all quintiles (0.69%) who are university graduates by the time of the Cycle 4 interview. This will cause serious sample size issues in later estimates.

graduates, have had to establish themselves in the labour market.¹¹ Many graduates of higher education face labour market entry difficulties and show early levels of both earnings and employment that grossly under-estimate their eventual labour market success.¹² Comparing the earnings of high school graduates with relatively low PISA scores but with 4 or 5 years of labour market experience to the earnings of university graduates with relatively high PISA scores but only a few months of labour market experience will clearly tend to bias the case against any positive contribution of those scores to earnings. The estimates with controls do include measures of the time elapsed since graduation but no controls will overcome the fundamental problem here which is that we do not have enough information to know how PSE graduates will do in the labour force. Finally, as has already been noted, 2006 data do not contain a large enough sample size for university graduates to produce statistically reliable estimates for them. This inquiry may be taking place too early to fully understand the impact of PISA scores on the labour market outcomes of PSE graduates.

40. Table 4A provides the estimates of earnings impacts for females, where the natural logarithm of earnings is used as the dependent variable. Recall that the PISA score measure has been standardised within each gender to permit easier interpretation so that a unit change in this dependent variable is a one standard deviation change in the raw PISA score. Thus, for someone with an average score, a one standard deviation increase in the score will move the individual from the 50th percentile to approximately the 85th percentile. Recall, as well, that earnings are wages in the job with the highest number of monthly hours in the last 6 months of 2005. Finally, note many observations in the data are missing values for one or more variables and must be dropped from the estimation, further reducing sample size. To allow comparability, the sample used in all three specifications is that which is available for the most expansive specification.

11 . In the literature, researchers typically use samples of individuals who have had sufficient time to establish themselves in the labour market. For example, Currie and Thomas (2001) use labour market data on 33 year olds while Murnane *et al.* (2000) use earnings data for individuals 10 or 12 years after high school.

12 . See, for example, Drewes and Giles (2002).

Table 4A PISA Scores and Hourly Earning - Females

Dependent Variable: Log of Earnings	No Controls	Background Controls	Educational Controls
PISA Score	0.050**	0.048**	0.041*
Parent's Combined Income (\$,000's)		0.004	0.003
Mother's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		0.089	0.088
College		0.009	0.006
University		0.021	0.026
Father's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		-0.102	-0.112
College		-0.005	-0.009
University		0.015	0.021
School's Physical Infrastructure Index		0.002	0.005
School's Educational Resources Index		0.009	0.009
Student Teaching Staff Ratio		0.003	0.002
Time in Labour Force (months)		-0.000	0.002*
Tenure in Current Job (months)		-0.001	-0.001
First Generation Immigrant		0.079	0.084
1 st Gen. Immigrant * PISA Score		0.069	0.055
Second Generation Immigrant		-0.035	-0.039
2 nd Gen. Immigrant * PISA Score		0.002	0.007
Anglophone in Quebec		-0.064	-0.070
Anglophone * PISA Score		-0.057	-0.076
Francophone Outside Quebec		0.032	0.003
Francophone * PISA Score		-0.058	-0.060
Hrs. Worked While in High School		0.002	0.001
HS Hours*PISA Score		-0.000	-0.000
Hrs. Worked While in PSE		0.003**	0.002
PSE Hrs.*PISA Score		-0.002	-0.002
Province of job: (ref. group: Ontario)			
NFLD		-0.239**	-0.245**
PEI		-0.156**	-0.161**
NS		-0.169**	-0.166**
NB		-0.107**	-0.109**
QUE		0.010	0.028
MAN		-0.004	0.005
SASK		-0.033	-0.030
ALTA		0.068	0.071*
BC		-0.019	-0.017
Constant	2.353**	2.258**	2.101**
Educational Attainment (ref. group: <HS)			
HS grad			0.077*
College Leaver			0.054
University Leaver			0.050
College Graduate			0.219**
University Graduate			0.157
R ²	0.02	0.07	0.10
No. of Obs.	2380	2380	2380

* indicates significance at 5%, ** indicates significance at 1%

Table 4B. PISA Scores and Hourly Earnings - Males

Dependent Variable: Log of Earnings	No Controls	Background Controls	Educational Controls
PISA Score	0.021*	0.018	0.008
Parent's Combined Income (\$,000's)		0.003	0.003
Mother's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		-0.026	-0.028
College		0.027	0.022
University		-0.017	-0.024
Father's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		-0.016	-0.021
College		-0.026	-0.031
University		-0.017	-0.013
School's Physical Infrastructure Index		0.018	0.014
School's Educational Resources Index		-0.011	-0.011
Student Teaching Staff Ratio		0.003	0.003
Time in Labour Force (months)		0.002**	0.003**
Tenure in Current Job (months)		-0.001	0.000
First Generation Immigrant		-0.076	-0.068
1 st Gen. Immigrant * PISA Score		-0.016	0.001
Second Generation Immigrant		0.014	0.012
2 nd Gen. Immigrant * PISA Score		-0.024	-0.017
Anglophone in Quebec		-0.133*	-0.137*
Anglophone * PISA Score		-0.044	-0.042
Francophone Outside Quebec		0.079	0.064
Francophone * PISA Score		0.040	0.036
Hrs. Worked While in High School		0.022**	0.022**
HS Hours*PISA Score		-0.001	-0.001
Hrs. Worked While in PSE		0.003*	0.002
PSE Hrs.*PISA Score		0.000	0.001
Province of job: (ref. group: Ontario)			
NFLD		-0.205**	-0.213**
PEI		-0.191**	-0.200**
NS		-0.155**	-0.152**
NB		-0.173**	-0.174**
QUE		-0.007	0.011
MAN		-0.096**	-0.086**
SASK		-0.022	-0.031
ALTA		0.212**	0.214**
BC		0.094**	0.091**
Constant	2.542**	2.361**	2.235**
Educational Attainment (ref. group: < HS)			
HS grad			0.079**
College Leaver			0.062
University Leaver			0.026
College Graduate			0.178**
University Graduate			0.187
R ²	0.003	0.11	0.12
No. of Obs.	2988	2988	2988

* indicates significance at 5%, ** indicates significance at 1%

41. In the parsimonious regression, the net impact of a one standard deviation increase in an individual's PISA score relative to other females is a statistically significant increase of 5 percent in earnings. Adding the set of family background, school resources, and demographic controls results in only a very minor reduction in the estimated impact. To determine whether the PISA score impact depended on immigrant, francophone outside Quebec, Anglophone inside Quebec statuses, these indicators were interacted with the PISA reading score deviation. The coefficient on the PISA score then becomes the

impact of a one standard deviation increase in the reading score for an individual who is not an immigrant, not a francophone outside Quebec, not an Anglophone inside Quebec, and who did not work while in school. The coefficients on the interactive terms then are interpreted as the difference in the impact of the PISA score on earnings for an individual of each one of those attributes except for hours of work in which case the coefficient on the interaction term allows the impact of the score to vary continuously with hours worked. None of these interactions were significant, suggesting that the impact of the score was uniform across these groups. Indeed, remarkably few of the control variables are significant in the earnings equation. Aside from the provincial indicators, only a measure of work while attending PSE achieves a significance level of at least 5 percent. From the estimates, working while in college or university appears to pay a small dividend in terms of future earnings. Augmenting the equation with indicators of educational attainment further reduces the estimated effect of the PISA score but it remains positive and significant nonetheless. Compared to those females who did not complete high school, high school graduates earn about 8 percent more and college graduates earn approximately 22 percent more. Incomplete college or university studies produce no gains over incomplete high school. The lack of significance on the indicator for university graduation in all likelihood is a result of the small sample size for this group.

42. Taking the three specifications together indicates that PISA scores have a significant effect on earnings for women that is independent of their backgrounds and works primarily within educational classes. As will be seen below, these effects result primarily from a positive impact on earnings for women who have less than completed high school and women who have only a high school certificate.

43. The results are substantially different for males (see Table 4B). The PISA score is statistically significant only in the first specification and, even in this specification, is less than half the effect found for females. Once background controls are introduced into the specification, test scores are found to have no independent effects. This suggests that the effects found in the first specification actually result from the PISA score serving as a proxy for earnings related background characteristics. Of course, given the lack of any significant effect in the model with controls, one would not expect the addition of educational attainment to be of any interest. If males are not rewarded for higher PISA scores, it makes no sense to ask if the rewards occur within educational classes or are the result of greater educational attainment for those with higher scores.¹³

V.5 PISA Scores and Earnings Within Educational Groups

44. As already stated, looking for effects of PISA scores on earnings within educational groups will bias the estimates. Suppose that higher scores are causally linked to a higher probability of pursuing post-secondary education. Restricting our attention to, say, high school graduates will miss that part of the effect of higher scores associated with greater educational attainment. As well, if the sample is restricted to only those who achieve, at best, a high school diploma. Table 2 has already shown that there is a very strong correlation between the PISA score and the probability of pursuing PSE. The use of this group to investigate the effect of the score on earnings, requires the use of observations on individuals whose score is in the upper quintiles but who, for some reason, have chosen not to go on to PSE. If there is an unobserved factor, such as a lack of ambition, that is negatively correlated with both labour earnings and the probability of pursuing higher education then it may well be that individuals in the higher score quintiles suffer more from a lack of ambition than those in the lower quintiles (whose failure to go on in education may be due to lack of ability, not ambition). On this account (which is a selectivity story), the impact of PISA scores would be underestimated again.

13. Note that this does not suggest higher educational attainment does not matter for males. In Table 4B, all coefficients on educational attainment relative to incomplete high school are positive (although not all are statistically significant), indicating gains to males for completing high school and for attending PSE.

45. Nevertheless, examining the impact of PISA scores (if any) within educational attainment classes sheds some light on the results of Tables 4A and 4B. Tables 5 through 8 report the earnings equation estimates for those without completed high school, those with only high school graduation, PSE dropouts (college and university combined), and college graduates. Estimates for university graduates were tried but the sample sizes (69 females and 38 males) were too small to produce reliable results.

Table 5. PISA Scores and Hourly Earnings - Less Than High School

Dependent Variable: Log of Earnings	Females	Males
PISA Score	0.149**	0.047
Parent's Combined Income (\$,000's)	0.100	0.058
Mother's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	0.017	0.003
College	-0.047	-0.037
University	-0.127	-0.114
Father's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	-0.370**	-0.205
College	-0.019	-0.156**
University	-0.023	-0.142
School's Physical Infrastructure Index	-0.045	0.075*
School's Educational Resources Index	-0.015	-0.021
Student Teaching Staff Ratio	0.008	-0.005
Time in Labour Force (months)	0.006**	0.005**
Tenure in Current Job (months)	0.004*	-0.001
First Generation Immigrant	3.266**	-0.298**
1 st Gen. Immigrant * PISA Score	2.125**	0.037
Second Generation Immigrant	-0.475**	0.516
2 nd Gen. Immigrant * PISA Score	-0.305**	0.393
Anglophone in Quebec	-0.238	-0.541*
Anglophone * PISA Score	-0.281*	-0.315
Francophone Outside Quebec	0.356	-0.060
Francophone * PISA Score	0.217	0.027
Hrs. Worked While in High School	-0.004	-0.002
HS Hours*PISA Score	-0.010*	-0.003
Province of job: (ref. group: Ontario)		
NFLD	-0.524**	0.019
PEI	-0.567**	-0.077
NS	-0.347*	-0.192**
NB	-0.219	-0.202*
QUE	-0.085	-0.062
MAN	-0.030	-0.087
SASK	-0.129	-0.189*
ALTA	-0.206	0.234**
BC	-0.114	0.068
Constant	2.026**	2.459**
R ²	0.42	0.28
No. of Obs.	135	367

* indicates significance at 5%, ** indicates significance at 1%

Table 6. PISA Scores and Hourly Earnings - High School Grads

Dependent Variable: Log of Earnings	Females	Males
PISA Score	0.062**	0.010
Parent's Combined Income (\$,000's)	0.010	0.047
Mother's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	0.140	-0.008
College	0.006	0.020
University	-0.150*	-0.039
Father's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	-0.103	0.016
College	0.042	0.026
University	0.110	0.045
School's Physical Infrastructure Index	0.034	-0.004
School's Educational Resources Index	-0.005	-0.012
Student Teaching Staff Ratio	0.005	0.009*
Time in Labour Force (months)	0.000	0.002*
Tenure in Current Job (months)	-0.001	0.000
First Generation Immigrant	0.039	-0.121
1 st Gen. Immigrant * PISA Score	0.077	-0.007
Second Generation Immigrant	-0.073	-0.147*
2 nd Gen. Immigrant * PISA Score	-0.067	-0.075
Anglophone in Quebec	-0.147	-0.160*
Anglophone * PISA Score	0.033	-0.063
Francophone Outside Quebec	0.111	-0.041
Francophone * PISA Score	-0.053	-0.016
Hrs. Worked While in High School	0.001	0.002*
HS Hours*PISA Score	-0.001	-0.001
Province of job: (ref. group: Ontario)		
NFLD	-0.282**	-0.294**
PEI	-0.179**	-0.276**
NS	-0.102	-0.160**
NB	-0.142**	-0.223**
QUE	-0.016	0.017
MAN	-0.019	-0.080
SASK	-0.034	-0.067
ALTA	0.090	0.190**
BC	-0.025	0.057
Constant	2.181	2.236**
R ²	0.12	0.14
No. of Obs.	913	1393

* indicates significance at 5%, ** indicates significance at 1%

Table 7. PISA Scores and Hourly Earnings - PSE Leavers

Dependent Variable: Log of Earnings	Females	Males
PISA Score	0.040	-0.040
Parent's Combined Income (\$,000's)	-0.013	0.029
Mother's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	0.002	-0.055
College	0.018	0.046
University	0.120	-0.004
Father's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	0.051	-0.098
College	-0.094	-0.075
University	-0.164	-0.025
School's Physical Infrastructure Index	-0.012	-0.020
School's Educational Resources Index	0.034	-0.003
Student Teaching Staff Ratio	-0.001	0.009
Time in Labour Force (months)	0.006**	0.004*
Tenure in Current Job (months)	-0.000	0.001
First Generation Immigrant	-0.172	0.012
1 st Gen. Immigrant * PISA Score	-0.048	-0.246
Second Generation Immigrant	0.022	0.102
2 nd Gen. Immigrant * PISA Score	0.110	-0.265
Anglophone in Quebec	-0.091	-0.118
Anglophone * PISA Score	-0.045	-0.082
Francophone Outside Quebec	-0.049	0.101
Francophone * PISA Score	0.019	0.035
Hrs. Worked While in High School	0.002	0.003
HS Hours*PISA Score	0.000	-0.001
Hrs. Worked While in PSE	0.006**	0.004
PSE Hrs.*PISA Score	-0.002	0.001
Province of job: (ref. group: Ontario)		
NFLD	-0.151	-0.241*
PEI	-0.110	-0.180*
NS	-0.105	-0.220**
NB	-0.019	-0.111
QUE	0.041	0.001
MAN	0.069	-0.110
SASK	-0.032	0.032
ALTA	-0.022	0.110
BC	0.080	0.175*
Constant	2.087	2.14**
R ²	0.15	0.15
No. of Obs.	480	561

* indicates significance at 5%, ** indicates significance at 1%

Table 8. PISA Scores and Hourly Earnings - College Grads

Dependent Variable: Log of Earnings	Females	Males
PISA Score	0.019	0.007
Parent's Combined Income (\$,000's)	-0.017	-0.059
Mother's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	0.097	-0.023
College	-0.033	0.034
University	0.093*	-0.038
Father's Education (ref. group: HS or less)		
Some Postsecondary: Incomplete	-0.171	0.093
College	-0.031	-0.010
University	0.063	-0.009
School's Physical Infrastructure Index	-0.043	0.042
School's Educational Resources Index	0.021	-0.024
Student Teaching Staff Ratio	-0.003	-0.006
Time in Labour Force (months)	-0.003	0.004*
Tenure in Current Job (months)	-0.001	-0.000
First Generation Immigrant	0.084	0.106
1 st Gen. Immigrant * PISA Score	0.004	0.157*
Second Generation Immigrant	-0.079	0.121
2 nd Gen. Immigrant * PISA Score	0.141	0.064
Anglophone in Quebec	-0.054	-0.036
Anglophone * PISA Score	-0.154	-0.140*
Francophone Outside Quebec	-0.083	0.199*
Francophone * PISA Score	-0.106	0.026
Hrs. Worked While in High School	0.003	0.002
HS Hours*PISA Score	0.000	-0.001
Hrs. Worked While in PSE	-0.002	0.001
PSE Hrs.*PISA Score	-0.002	0.000
Province of job: (ref. group: Ontario)		
NFLD	-0.284**	-0.172*
PEI	-0.179**	-0.179*
NS	-0.255**	-0.113
NB	-0.123*	-0.146*
QUE	0.053	0.010
MAN	-0.193	-0.122
SASK	0.030	0.029
ALTA	0.152**	0.245**
BC	-0.086	0.123
Constant	2.543**	2.593
R ²	0.11	0.13
No. of Obs.	783	629

46. Table 5 reports the results for females and males without completed high school. The PISA score is insignificant for the earnings of these males but is both significant and numerically very large for women. Some caution should be exercised in interpreting the coefficients in this regression, given the small sample size. The results for first and second generation immigrant women reflect a small but distinctly unrepresentative number of immigrant women within this educational class.

47. The larger sample sizes for high school graduates provide a higher level of comfort with the results and the pattern continues for this group. A standard deviation increase in the PISA score contributes over 6 percent to the earnings of females but has no significant effect on the earnings of males. Aside from the expected pattern of differences between provinces, very few of the explanatory variables are significant.

48. Moving to PSE leavers and college graduates leaves statistical significance for the PISA score behind for females. The positive impact of higher test scores on earnings for women observed in Table 4A may then be interpreted as coming largely from gains made for women with completed high school or less, with only a small contribution from the additional education undertaken by those with higher scores.

V.6 PISA Scores and Unemployment

49. Unemployment is captured by a positive response to the question of whether any job search activity had taken place in the final 6 months of Cycle 4. The overall incidence of this measure was 9.3 percent for females and 12.0 percent for males and the incidence by PISA quintile is provided in the tabulations in Table 9. The relationship between the scores and the incidence of unemployment is considerably stronger than appears to be the case for PISA scores and earnings.

Table 9. PISA Scores and Unemployment

Quintile	Males	Females
First	13.9%	11.9%
Second	12.9	8.4
Third	10.4	10.1
Fourth	10.1	6.1
Fifth	7.9	9.0

50. Tables 10A and 10B report the results of probit regressions of the incidence of unemployment, using the same procedure as used for the earnings regressions, *i.e.*, beginning with a simple probit model where the PISA score is the explanatory variable, incorporating a set of controls, and finally introducing educational attainment indicators.

Table 10A. PISA Scores and Unemployment - Females Probit Estimates of Marginal Effect

Dependent Variable: Binary Indicator for Unemployment	No Controls	Background Controls	Educational Controls
PISA Score	-0.019*	-0.017	-0.012
Parent's Combined Income (\$,000's)		-0.042	-0.042
Mother's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		-0.033	-0.033
College		0.005	0.006
University		-0.002	-0.008
Father's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		0.016	0.017
College		0.005	0.006
University		0.063	0.059
School's Physical Infrastructure Index		0.021	0.021
School's Educational Resources Index		-0.027**	-0.027**
Student Teaching Staff Ratio		-0.003	-0.001
Time in Labour Force (months)		-0.001	-0.001
First Generation Immigrant		0.081	0.081
1 st Gen. Immigrant * PISA Score		-0.019	-0.017
Second Generation Immigrant		0.034	0.039
2 nd Gen. Immigrant * PISA Score		0.015	0.014
Anglophone in Quebec		0.032	0.036
Anglophone * PISA Score		-0.024	-0.019
Francophone Outside Quebec		-0.051	0.059
Francophone * PISA Score		0.075**	0.074**
Hrs. Worked While in High School		-0.000	-0.000
HS Hours*PISA Score		-0.000	-0.000
Hrs. Worked While in PSE		-0.001	-0.001
PSE Hrs.*PISA Score		0.001	0.001
Province (ref. group: Ontario)			
NFLD		0.081*	0.082*
PEI		0.087*	0.096*
NS		0.000	-0.001
NB		0.001	0.010
QUE		-0.005	-0.004
MAN		-0.021	-0.021
SASK		0.016	0.018
ALTA		-0.002	0.001
BC		0.028	0.032
Educational Attainment (ref. group: < HS)			
HS grad			-0.039
College Leaver			-0.020
University Leaver			-0.000
College Graduate			-0.036
University Graduate			-0.014
Pseudo R ²	0.006	0.05	0.05
No. of Obs.	3198	3198	3198

* indicates significance at 5%, ** indicates significance at 1%

Table 10B. PISA Scores and Unemployment - Males Probit Estimates of Marginal Effects

Dependent Variable: Binary Indicator for Unemployment	No Controls	Background Controls	Educational Controls
PISA Score	-0.025**	-0.018	-0.020
Parent's Combined Income (\$,000's)		-0.017	-0.018
Mother's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		0.038	0.034
College		-0.001	0.000
University		-0.008	-0.009
Father's Education (ref. group: HS or less)			
Some Postsecondary: Incomplete		0.036	0.037
College		0.009	0.006
University		-0.034	-0.036
School's Physical Infrastructure Index		-0.011	-0.011
School's Educational Resources Index		0.002	.0.2
Student Teaching Staff Ratio		0.000	0.000
Time in Labour Force (months)		0.000	-0.000
First Generation Immigrant		0.042	0.046
1 st Gen. Immigrant * PISA Score		-0.038	-0.036
Second Generation Immigrant		0.003	0.007
2 nd Gen. Immigrant * PISA Score		0.033	0.034
Anglophone in Quebec		0.109*	0.106*
Anglophone * PISA Score		0.002	0.000
Francophone Outside Quebec		0.002	0.001
Francophone * PISA Score		0.000	-0.001
Hrs. Worked While in High School		-0.001*	-0.001*
HS Hours*PISA Score		0.000	0.000
Hrs. Worked While in PSE		-0.002*	-0.003*
PSE Hrs.*PISA Score		0.000	0.000
Province (ref. group: Ontario)			
NFLD		0.011	0.010
PEI		-0.036	-0.036
NS		-0.038	-0.036
NB		-0.013	-0.013
QUE		-0.060*	-0.059*
MAN		-0.052*	-0.051*
SASK		-0.052*	-0.051*
ALTA		-0.067**	-0.064**
BC		-0.027	-0.026
Educational Attainment (ref. group: < HS)			
HS grad			0.002
College Leaver			0.026
University Leaver			-0.004
College Graduate			0.010
University Graduate			0.203*
Pseudo R ²	0.01	0.04	0.04
No. of Obs.	3809	3809	3809

* indicates significance at 5%, ** indicates significance at 1%

51. For women, the net effect of a standard deviation increase in the PISA reading score, relative to other women, is to reduce the probability of unemployment by approximately 2 percent.¹⁴ Introducing the control variables for family background, school resources and so on reduces the estimated effect, as expected, but the estimate is no longer statistically significant. Adding educational attainment indicators

14. Note that the values reported in Tables 10A and 10B are the marginal effects, not the coefficient estimates of the probit equation.

further reduces the size of the coefficient on the PISA score but, of course, it remains insignificant. Indeed, very few of the control variables achieve statistical significance.

52. A similar story holds for males. Using only the PISA score in column 1, a standard deviation increase in the score reduces the probability of unemployment by 2.5 percent but, once again, the estimate loses its significance once control variables are added.

53. Among these control variables, the male estimates show a more pronounced provincial pattern in the expected way, with unemployment significantly lower in Quebec and the Prairie provinces relative to Ontario. These differences do not appear to apply to women. The genders also differ in the estimates of the benefits of working while in school. For males, working while in high school and while in PSE (for those that go on to PSE) is associated with a reduction in the unemployment probability, albeit a small one. Women seem to derive no such benefits from working while studying.¹⁵

15. This may be related to the fact that males are considerably less likely to work while in school but, when they do, tend to work much longer hours. See Usalcas and Bowlby (2006). This may be more effective in building labour market experience. I am grateful to a reviewer for pointing this out.

VI. CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

54. The primary objective of this paper was to discover whether an individual's performance in the PISA reading tests at the age of 15 has effects on his or her labour market outcomes, in the form of either higher earnings or lower unemployment. In contrast to international findings (using other measures of cognitive skills among teenagers), test scores are found to have little impact on either outcome once account is taken of the students' backgrounds. There is some evidence that scores matter among women with completed high school or less and may be slightly responsible in an indirect way for them through higher educational attainment among them.

55. These results are somewhat surprising given the existing literature on the importance of cognitive skills in the labour market but two important caveats about the results must be born in mind. First, an econometric examination of the link between PISA reading scores and labour market outcomes is really a test of a joint hypothesis: that cognitive skills among teenagers matter upon labour market entry and that these skills are accurately measured by the PISA test. It is conceivable that the PISA tests do not elicit accurate information about the cognitive skills that may eventually be rewarded in the labour market, either because of poorly designed questions or because of the way in which the tests were administered. For example, males are notorious for "not showing up" for tests that they perceive to have little immediate reward.¹⁶ Secondly, respondents, especially those completing post-secondary education, are recent labour market entrants and their early experiences may be very poor predictors of their longer term success. In particular, the types of skills that result in high PISA scores may well be very difficult for employers to measure until some time has passed in the relationship with the employee and the rewards for those skills may therefore be some time in coming. If this investigation were to be conducted several years hence, the results might be quite different.

56. On the other hand, it may simply be true that PISA scores are not very important in the longer run. The particular skill set measured by them may not be of particular value to employers several years later. As well, it may be true that these scores serve only as proxies for parental and school investments in children and it is these investments, not the scores *per se*, that are important. These background factors are important determinants of the scores, as shown in Table 1, and once we control for them, there may be little more that the PISA outcomes can inform us about an individual's future labour market success. In other words, the correlation between PISA scores and family background may be so highly correlated that those scores add very little independent predictive power to an equation that contains measures of that background. Finally, we must remember that a significant amount of time elapsed between the administration of the PISA tests in 2000 and the observed labour market outcomes at the end of 2005. During those years, the YITS cohort A respondents continued to learn through both education and experience. Perhaps it is unreasonable to expect that a teenager's ranking in the ability distribution as measured by PISA scores is a perfect predictor of his or her ranking in the ability distribution as measured by labour market needs five years later.

16. This may explain the gender difference in this paper's findings.

57. If PISA scores do not matter for early labour market outcomes, then why do they matter so much for educational attainment?¹⁷ One possible explanation is that PISA tests do not determine the labour market readiness of the student or the extent of marketable skills he or she possesses. Rather, they might be measuring academic aptitude ... the ability to do well in school work. If that is true, we would expect the impact of higher scores to work almost exclusively through higher educational attainment. Alternatively, the potential labour market productivity of high PISA scorers may exist but may take employers some time to observe. The scores of these new employees will not produce immediate wage gains since PISA scores cannot be interpreted by employers and they may have to wait some time to fully reveal their higher productivity. The YITS does not allow us an adequate opportunity yet to observe wage growth but, in future cycles, we might expect to see higher rates of growth among those with higher PISA scores.

58. This paper may have “jumped the gun” in attempting to assess the impact of PISA scores using the YITS data. The analysis must be conducted again once sufficient time has elapsed both to increase the sample size of YITS respondents who have left formal schooling for the labour market and to allow a better read on their longer term success in that market. As pointed out earlier, YITS respondents from the higher end of the PISA score distribution are more likely to be excluded in the analysis in this report since they are more likely to be university continuers. This early look at outcomes biases the sample to those with lower scores. Waiting for larger sample sizes would also, of course, permit an examination of the impact of the math and science scores.

59. An additional recommendation for further research revolves around the findings in Table 1 that province of residence while in high school matters for PISA scores. If it is determined that raising these scores is a desirable policy objective, some kind of policy lever is required. The only feasible lever is better resourcing of primary and secondary schools. Whether this would be effective requires a clearer understanding of whether the observed provincial differences can be traced to differences in funding levels across provinces.

17. I am indebted to one of the reviewers for raising this question.

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APPENDIX

Table A1. Means and Standard Deviations

Variable	Mean	Std. Dev.
PISA Reading Score	536.74	92.68
Educational Attainment		
Less than High School	0.05	
High School Graduate	0.21	
PSE Leaver	0.10	
College Graduate	0.12	
University Graduate	0.01	
College Student: Continuer	0.10	
University Student: Continuer	0.40	
Parent's Combined Income at Respondent's Age 15 (\$,000's)	66.02	48.70
Mother's Education		
Less than completed High School	0.51	
Some Postsecondary: Incomplete	0.04	
College	0.28	
University	0.17	
Father's Education		
Less than completed High School	0.48	
Some Postsecondary: Incomplete	0.02	
College	0.25	
University	0.18	
School's Physical Infrastructure Index	-0.19	0.78
School's Educational Resources Index	-0.10	1.03
Student Teaching Staff Ratio	19.99	2.93
Time in Labour Force (months)	27.43	15.63
First Generation Immigrant	0.04	
Second Generation Immigrant	0.04	
Anglophone in Quebec	0.03	
Francophone Outside Quebec	0.08	
Hrs. Worked While in High School	9.76	13.01
Hrs. Worked While in PSE	4.56	8.81
Province of Residence at Time of First Interview		
NFLD	0.08	
PEI	0.06	
NS	0.10	
NB	0.09	
QUE	0.16	
ON	0.15	
MAN	0.09	
SASK	0.10	
ALTA	0.09	
BC	0.09	