



Annex B

TECHNICAL INFORMATION AND DATA TABLES FOR CHAPTER 5



TECHNICAL INFORMATION

The likelihood functions for the grade transition model

The probability of transiting from one grade level ($g-1$) to the next (g) is modelled as follows:

$$\Pr(D_g = 1 | \mathbf{X}_g, D_{g-1} = 1) = H_{g-1,g}$$

where

$$H_{g-1,g} = \frac{\exp(\hat{\mathbf{a}}'_g \mathbf{X}_g)}{1 + \exp(\hat{\mathbf{a}}'_g \mathbf{X}_g)}$$

where \mathbf{X}_g is a vector of observable characteristics, including PISA scores and $\hat{\mathbf{a}}'_g$ represents grade specific

effects of these characteristics. Completed schooling can be written as $\sum_{j=1}^{\bar{G}} D_j$ where \bar{G} is the highest attainable

grade. The probability of acquiring grade level G , $\Pr\left(\sum_{j=1}^{\bar{G}} D_j = G | \mathbf{X}_g\right)$ is then given by

$$\Pr\left(\sum_{j=1}^{\bar{G}} D_j = G | \mathbf{X}_g\right) = [1 - H_{G+1,G}] * \prod_{s=1}^G H_{s-1,s}$$

where $H_{\bar{G}+1,\bar{G}} = 0$. One can derive expected level schooling by

$$E\left(\sum_{g=1}^{\bar{G}} D_g | \mathbf{X}_g\right) = \sum_{g=1}^{\bar{G}} g \Pr\left(\sum_{j=1}^{\bar{G}} D_j = g | \mathbf{X}_g\right)$$

The effects of unmeasured characteristics is assumed to be represented by α and it is assumed that

- i) $\Pr(D_g = 1 | \mathbf{X}_g, D_{g-1} = 1, \alpha_g) = F(\alpha_g + \hat{\mathbf{a}}'_g \mathbf{X}_g)$
- ii) α_g is independent of \mathbf{X}_g
- iii) $\alpha_g = \alpha$ for all g .
- iv) α is distributed normal with a mean of zero and a variance equal to one.



DATA TABLES

Table B5.1 Comparison of characteristics for students included and excluded from the analysis – Males

	Included (N=2156)		Excluded (N=1933)	
	% Missing	Mean	% Missing	Mean
PISA reading score	0	545.00	0	509.00
PISA mathematics score	0	558.00	0	526.00
Minority language	0	0.05	1933	-
Number of siblings	0	1.73	38	1.75
Second-generation immigrant	0	0.20	1933	-
Family income (in thousands of CAD)	0	80.00	1933	-
Nuclear family	0	0.89	0	0.6
Mother's education				
High school	0	0.29	732	0.32
Post-secondary school	0	0.62	732	0.56
Father's education				
High school	0	0.23	732	0.23
Post-secondary school	0	0.65	732	0.62
Participation in school activities	0	0.66	130	0.62
Paid or unpaid work	0	0.54	6	0.48
High school graduate in cycle 3	4	0.92	32	0.79
Some post-secondary education in cycle 3	4	0.64	32	0.48

Source: OECD PISA and HRSDC.

Table B5.2 Comparison of characteristics for students included and excluded from the analysis – Females

	Included (N=2156)		Excluded (N=1933)	
	% Missing	Mean	% Missing	Mean
PISA reading score	0	573.00	0	543.00
PISA mathematics score	0	545.00	0	521.00
Minority language	0	0.05	1 761	-
Number of siblings	0	1.82	24	1.93
Second-generation immigrant	0	0.20	1 761	-
Family income (in thousands of CAD)	0	77.70	1 761	-
Nuclear family	0	0.88	0	0.57
Mother's education				
High school	0	0.30	745	0.35
Post-secondary school	0	0.61	745	0.52
Father's education				
High school	0	0.24	745	0.27
Post-secondary school	0	0.63	745	0.58
Participation in school activities	0	0.71	132	0.63
Paid or unpaid work	0	0.69	1	0.65
High school graduate in cycle 3	3	0.95	26	0.87
Some post-secondary education in cycle 3	3	0.78	26	0.64

Source: OECD PISA and HRSDC.

Table B5.3 Effects of PISA reading and mathematics scores on the probability of grade completion

	Grade 11	Grade 12	Grade 13	Grade 14	Grade 15	Grade 16
Males						
PISA reading score/100	0.014	0.029	0.057	0.123	0.085	0.070
S.E.	-0.005	-0.011	-0.017	-0.020	-0.028	-0.033
PISA mathematics score/100	-0.007	0.024	0.103	0.122	0.036	0.102
S.E.	-0.005	-0.012	-0.02	-0.024	-0.031	-0.035
Females						
PISA reading score/100	0.008	0.043	0.073	0.034	0.042	0.085
S.E.	-0.004	-0.010	-0.016	-0.019	-0.022	-0.027
PISA mathematics score/100	0.004	0.005	0.071	0.093	0.069	0.024
S.E.	-0.004	-0.010	-0.018	-0.021	-0.023	-0.027

	p < 0.05
	p < 0.01
	p < 0.001

Note: The entries in the first column show the effects on the probability of completing grade 11 (transitioning from grade 10 to grade 11). The other columns show similar effects.

Source: OECD PISA and HRSDC.



Table B5.4a Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for males who were in education in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	0.008	0.003	-0.006	0.003	-0.001	0.001
PISA mathematics score/100	0.005	0.004	-0.005	0.003	0.000	0.001
Minority language	-0.002	0.007	0.003	0.007	-0.001	0.002
Number of siblings	0.000	0.002	0.001	0.002	-0.001	0.001
Second-generation immigrant	0.002	0.007	0.001	0.007	-0.003	0.002
Family income (in thousands of CAD)	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear family	0.003	0.008	-0.002	0.008	-0.001	0.002
<i>Mother's education</i>						
High school	-0.006	0.009	0.006	0.009	0.000	0.002
Post-secondary school	0.006	0.009	-0.007	0.008	0.001	0.002
<i>Father's education</i>						
High school	-0.004	0.009	0.003	0.008	0.002	0.003
Post-secondary school	-0.002	0.008	0.002	0.007	0.001	0.002
School activities	-0.007	0.005	0.008	0.005	-0.001	0.001
Paid or unpaid work	-0.005	0.005	0.007	0.005	-0.003	0.001
Highest grade completed	0.030	0.001	-0.025	0.001	-0.005	0.000
Average probability	0.935		0.058		0.007	

	p < 0.05
	p < 0.01
	p < 0.001

Source: OECD PISA and HRSDC.

Table B5.4b Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for males who were in work in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	0.007	0.009	-0.014	0.010	0.008	0.006
PISA mathematics score/100	0.049	0.011	-0.037	0.012	-0.013	0.007
Minority language	0.024	0.023	-0.007	0.025	-0.017	0.010
Number of siblings	-0.007	0.007	-0.003	0.007	0.010	0.003
Second-generation immigrant	-0.006	0.018	0.021	0.021	-0.015	0.011
Family income (in thousands of CAD)	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear family	0.029	0.018	-0.027	0.022	-0.002	0.013
<i>Mother's education</i>						
High school	0.040	0.032	-0.069	0.036	0.029	0.022
Post-secondary school	0.022	0.027	-0.05	0.031	0.028	0.017
<i>Father's education</i>						
High school	0.017	0.028	-0.027	0.032	0.010	0.018
Post-secondary school	0.057	0.024	-0.062	0.028	0.004	0.015
School activities	0.017	0.013	-0.018	0.015	0.001	0.009
Paid or unpaid work	-0.029	0.013	0.045	0.016	-0.016	0.010
Highest grade completed	0.028	0.008	-0.026	0.009	-0.002	0.004
Average probability	0.106		0.849		0.045	

	p < 0.05
	p < 0.01
	p < 0.001

Source: OECD PISA and HRSDC.



Table B5.4c Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for males who were inactive in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	0.028	0.028	0.036	0.044	-0.064	0.044
PISA mathematics score/100	0.006	0.029	-0.090	0.042	0.083	0.043
Minority language	0.070	0.105	-0.078	0.111	0.008	0.116
Number of siblings	-0.024	0.017	0.008	0.029	0.016	0.027
Second-generation immigrant	0.086	0.080	-0.059	0.098	-0.027	0.086
Family income (in thousands of CAD)	0.000	0.001	-0.001	0.001	0.001	0.001
Nuclear family	0.015	0.039	0.014	0.083	-0.029	0.084
<i>Mother's education</i>						
High school	0.143	0.099	0.062	0.115	-0.205	0.095
Post-secondary school	0.082	0.057	0.066	0.102	-0.149	0.097
<i>Father's education</i>						
High school	0.056	0.067	0.019	0.100	-0.075	0.092
Post-secondary school	0.108	0.050	-0.096	0.098	-0.012	0.093
School activities	-0.011	0.035	-0.073	0.061	0.084	0.058
Paid or unpaid work	-0.022	0.035	0.076	0.062	-0.053	0.061
Highest grade completed	-0.013	0.016	-0.007	0.033	0.020	0.032
Average probability	0.102		0.461		0.437	

	p < 0.05
	p < 0.01
	p < 0.001

Source: OECD PISA and HRSDC.

Table B5.5a Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for females who were in education in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	0.004	0.003	-0.005	0.003	0.000	0.000
PISA mathematics score/100	0.007	0.003	-0.006	0.003	-0.001	0.000
Minority language	0.002	0.005	-0.003	0.005	0.001	0.001
Number of siblings	-0.001	0.001	0.001	0.001	0.000	0.000
Second-generation immigrant	0.004	0.004	-0.003	0.004	-0.001	0.001
Family income (in thousands of CAD)	0.000	0.000	0.000	0.000	0.000	0.000
Nuclear family	0.003	0.005	-0.002	0.005	-0.001	0.001
<i>Mother's education</i>						
High school	-0.002	0.006	0.004	0.006	-0.002	0.001
Post-secondary school	0.003	0.005	-0.002	0.005	-0.001	0.001
<i>Father's education</i>						
High school	0.005	0.005	-0.004	0.005	-0.001	0.001
Post-secondary school	0.005	0.005	-0.005	0.005	-0.001	0.001
School activities	0.002	0.004	-0.003	0.004	0.000	0.001
Paid or unpaid work	-0.007	0.004	0.009	0.003	-0.002	0.001
Highest grade completed	0.021	0.001	-0.018	0.001	-0.002	0.000
Average probability	0.959		0.038		0.003	

	p < 0.05
	p < 0.01
	p < 0.001

Source: OECD PISA and HRSDC.



Table B5.5b Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for females who were in work in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	0.022	0.014	-0.018	0.015	-0.004	0.007
PISA mathematics score/100	0.033	0.013	-0.032	0.014	0.000	0.006
Minority language	-0.028	0.022	0.027	0.025	0.001	0.015
Number of siblings	0.000	0.008	-0.001	0.008	0.001	0.003
Second-generation immigrant	0.061	0.028	-0.070	0.030	0.009	0.014
Family income (in thousands of CAD)	0.001	0.000	0.000	0.000	0.000	0.000
Nuclear family	0.031	0.021	-0.027	0.025	-0.004	0.014
<i>Mother's education</i>						
High school	0.043	0.031	-0.039	0.032	-0.005	0.012
Post-secondary school	0.085	0.028	-0.069	0.030	-0.016	0.012
<i>Father's education</i>						
High school	0.004	0.026	0.001	0.028	-0.005	0.013
Post-secondary school	0.010	0.024	-0.018	0.026	0.007	0.011
School activities	0.040	0.017	-0.034	0.019	-0.006	0.009
Paid or unpaid work	-0.014	0.020	0.017	0.022	-0.003	0.011
Highest grade completed	0.014	0.008	-0.005	0.009	-0.009	0.005
Average probability	0.134		0.830		0.036	

	p < 0.05
	p < 0.01
	p < 0.001

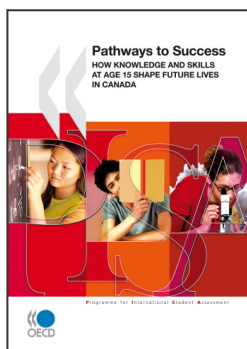
Source: OECD PISA and HRSDC.

Table B5.5c Estimated marginal effects on the conditional probability of being in education, working or being inactive in autumn 2005 for females who were inactive in spring 2005

	Probability of being in education		Probability of working		Probability of being inactive	
	Marg. Effect	S.E.	Marg. Effect	S.E.	Marg. Effect	S.E.
PISA reading score/100	-0.013	0.028	-0.035	0.055	0.048	0.054
PISA mathematics score/100	0.095	0.036	-0.020	0.060	-0.075	0.058
Minority language	0.111	0.101	-0.209	0.094	0.099	0.106
Number of siblings	-0.035	0.021	0.057	0.029	-0.023	0.029
Second-generation immigrant	-0.021	0.045	0.099	0.092	-0.077	0.091
Family income (in thousands of CAD)	-0.001	0.001	0.000	0.001	0.001	0.001
Nuclear family	0.023	0.051	-0.008	0.093	-0.015	0.095
<i>Mother's education</i>						
High school	0.045	0.056	-0.120	0.098	0.075	0.097
Post-secondary school	0.199	0.064	-0.152	0.104	-0.047	0.102
<i>Father's education</i>						
High school	-0.053	0.040	0.006	0.109	0.047	0.106
Post-secondary school	-0.053	0.046	0.096	0.106	-0.043	0.102
School activities	-0.050	0.047	-0.062	0.073	0.112	0.070
Paid or unpaid work	-0.035	0.044	0.056	0.072	-0.022	0.072
Highest grade completed	0.032	0.021	0.026	0.037	-0.058	0.037
Average probability	0.111		0.410		0.479	

	p < 0.05
	p < 0.01
	p < 0.001

Source: OECD PISA and HRSDC.



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