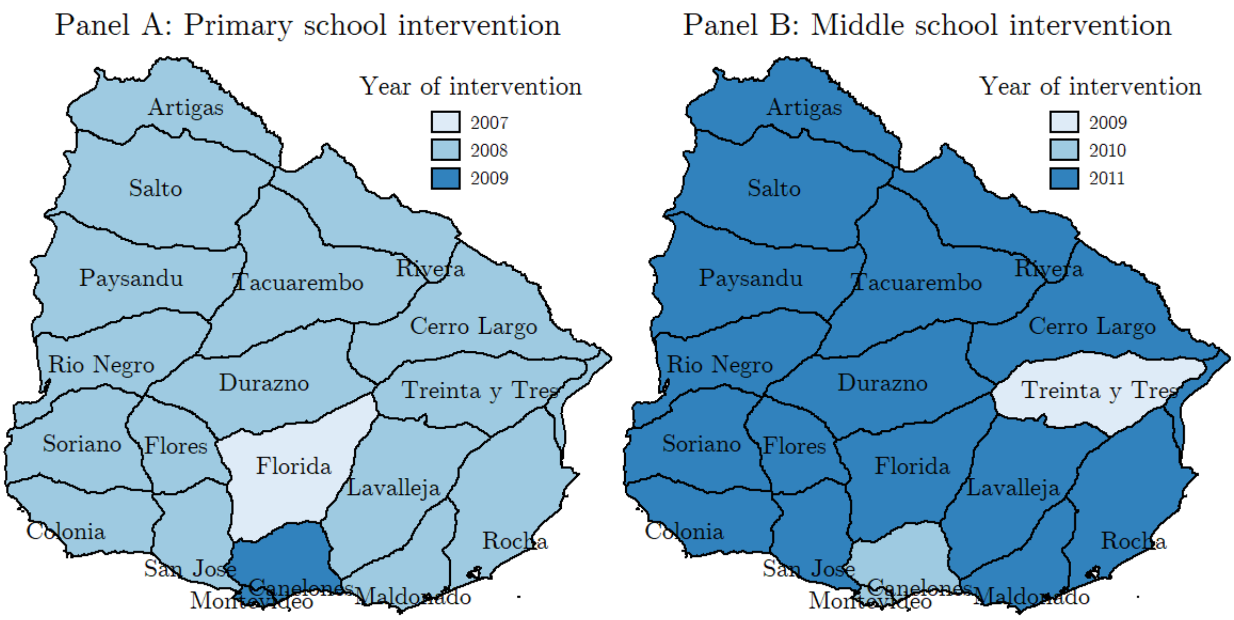
Technology and Educational Choices: Evidence from a One-Laptop-per-Child Program
Web Appendix

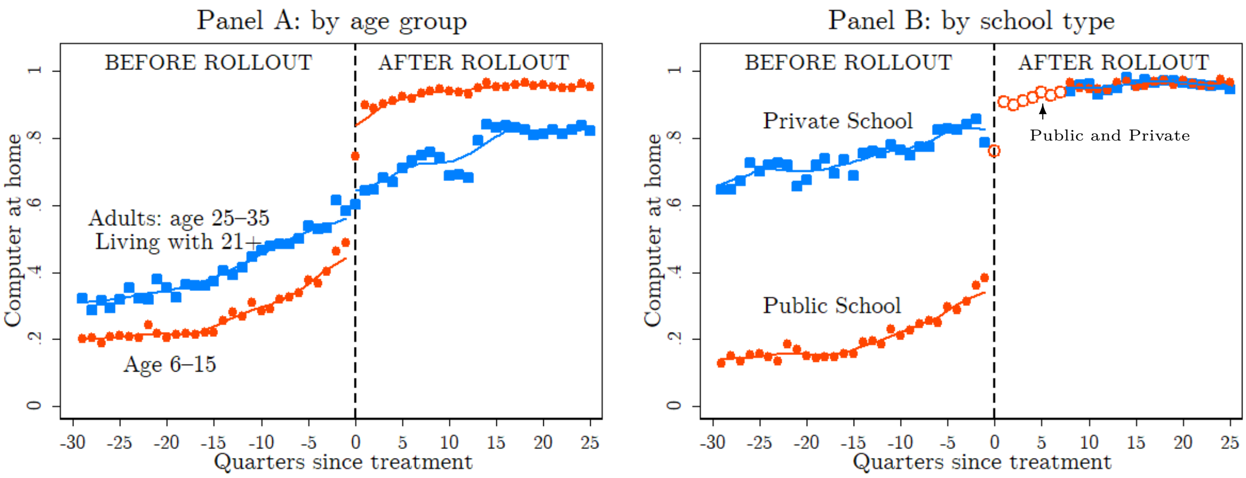
A Figures and Tables

Figure A1: Year of Plan Ceibal's initiation in Uruguay by province



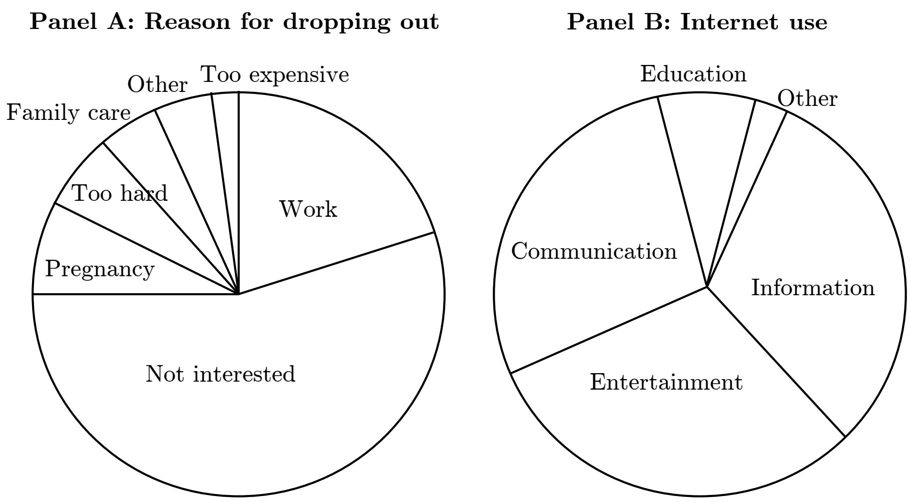
Notes: Panel A summarizes the rollout of Plan Ceibal in Uruguay among primary school students between 2007 and 2009, when full coverage was attained. Panel B summarizes the rollout of Plan Ceibal among middle school students between 2009 and 2011.

Figure A2: Quarterly computer access for children aged 6–15
Variations across school type and age groups



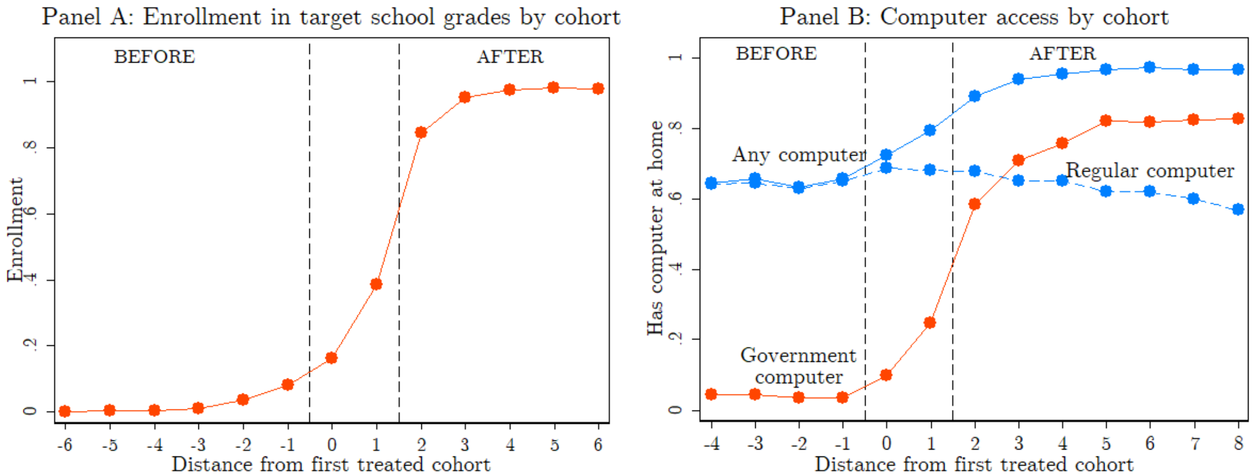
Notes: This figure shows the fraction of individuals with a computer at home for the population aged 6–15 at the quarterly level, stacked according to the timing of the primary school intervention in each province. The blue line in Panel A corresponds to a sample of adults without children. The empty circles in Panel B correspond to the entire student population, for quarters in which data on school type is not available for most provinces. The majority of students are enrolled in the public school system. The sample includes only urban areas with 5000+ inhabitants.
Source: Encuesta Continua de Hogares 2001–2018.

Figure A3: Reasons for not completing secondary school and internet usage



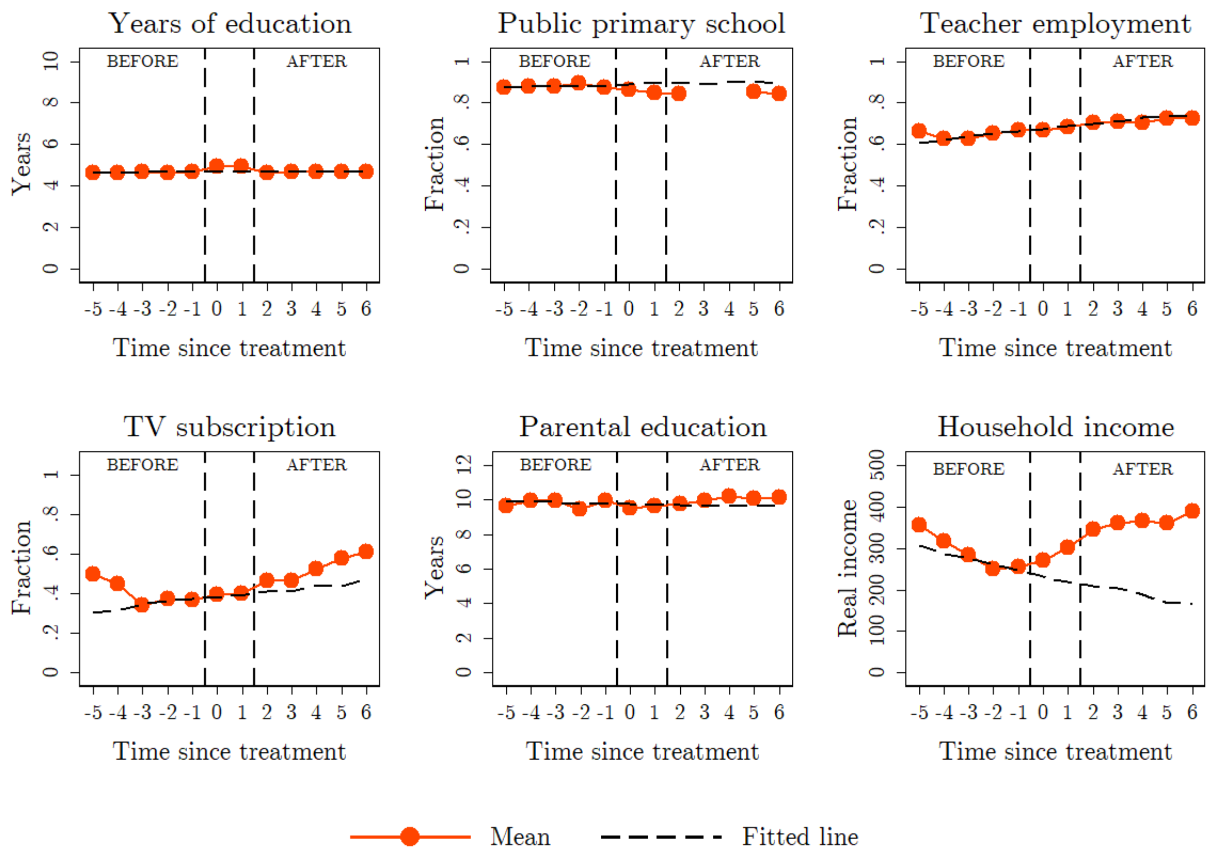
Notes: The pie chart in Panel A shows the main reasons for dropping out of secondary school, as reported by dropouts aged 18–20. Panel B shows the main tasks people use the internet for, as reported by internet-users aged 12–20.
Source: ECH 2011–2018; 2008–2018.

Figure A4: Correspondence between birth cohort and program participation
Variation across cohorts and provinces in 2011



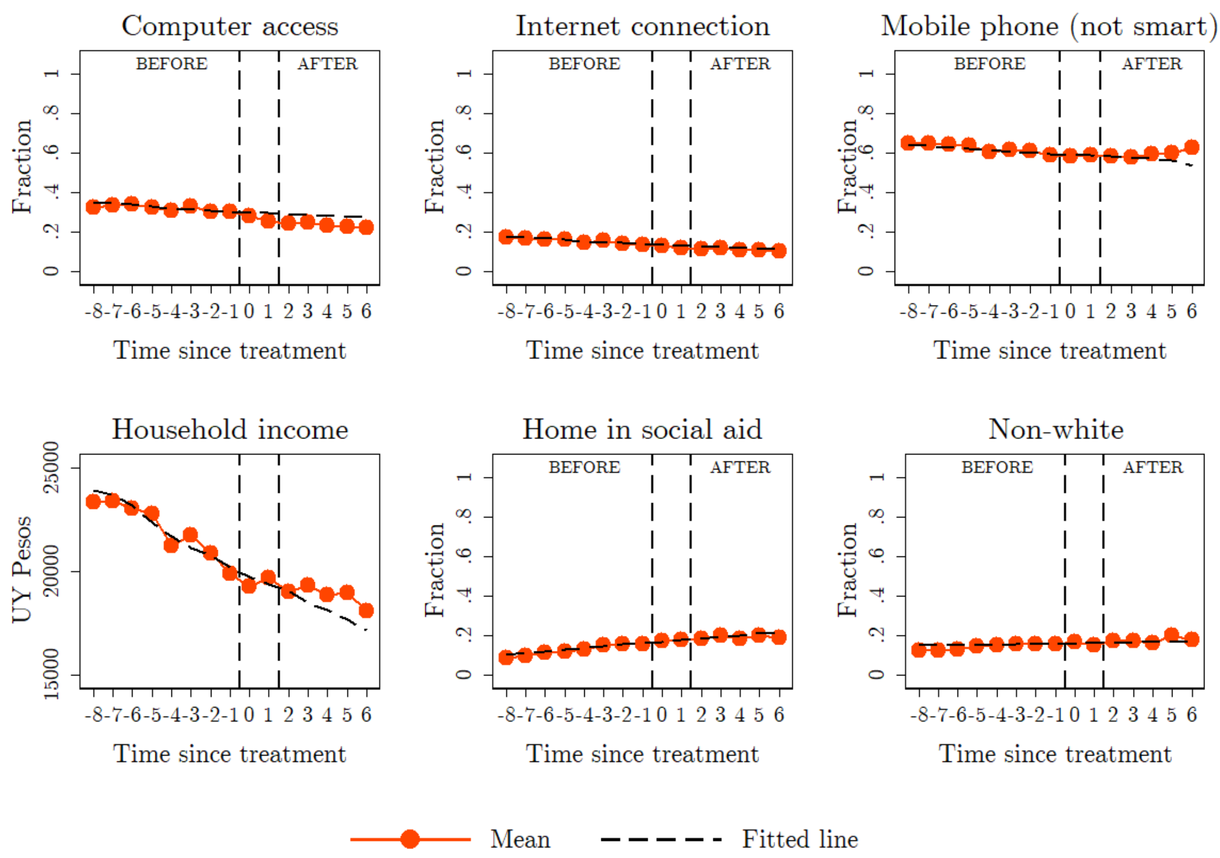
Notes: This figure shows the correspondence between birth cohort and program participation in the year 2011, stacked according to the timing of the middle school intervention in each province. Panel A shows the share of individuals in each cohort that were enrolled in a school grade that was targeted by the government program in their provinces. Panel B shows the fraction of individuals in each cohort that have a government computer, regular computer or any kind of computer at home.
Source: ECH 2001–2018.

Figure A5: No major discontinuities in other variables
Measured around age 11 (grade 6)



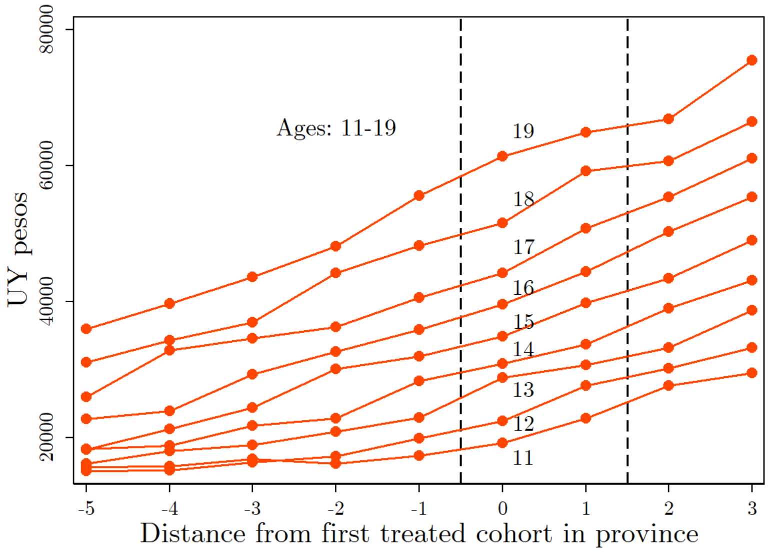
Notes: This figure plots potential confounding variables across cohorts for individuals age 11, based on distance from treatment in their respective provinces of residence. The dashed line represents a fitted line estimated among pre-intervention cohorts within each province, excluding any additional controls. I explore the the evolution of household income and show that it is not a concern in section 5.
Source: ECH 2001–2018.

Figure A6: No major discontinuities in other variables
Measured around age 9 (grade 4)



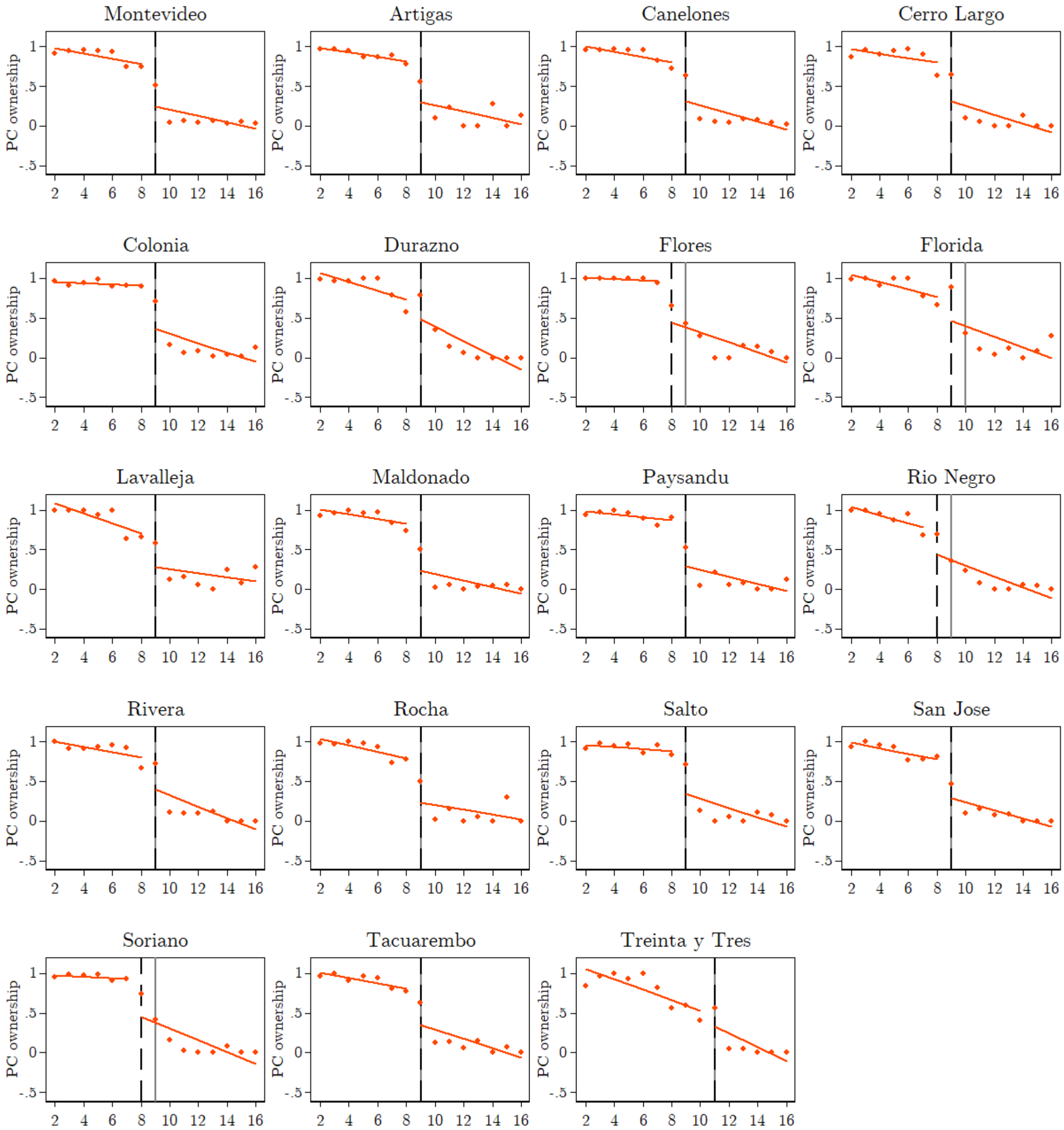
Notes: This figure plots potential confounding variables across cohorts for individuals in the year 2006, based on distance from treatment in their respective provinces of residence. The dotted line represents a fitted line estimated among pre-intervention cohorts within each province, excluding any additional controls.
Source: ECH 2006.

Figure A7: Household income across cohorts, by age corresponding to the 6th–14th school grade



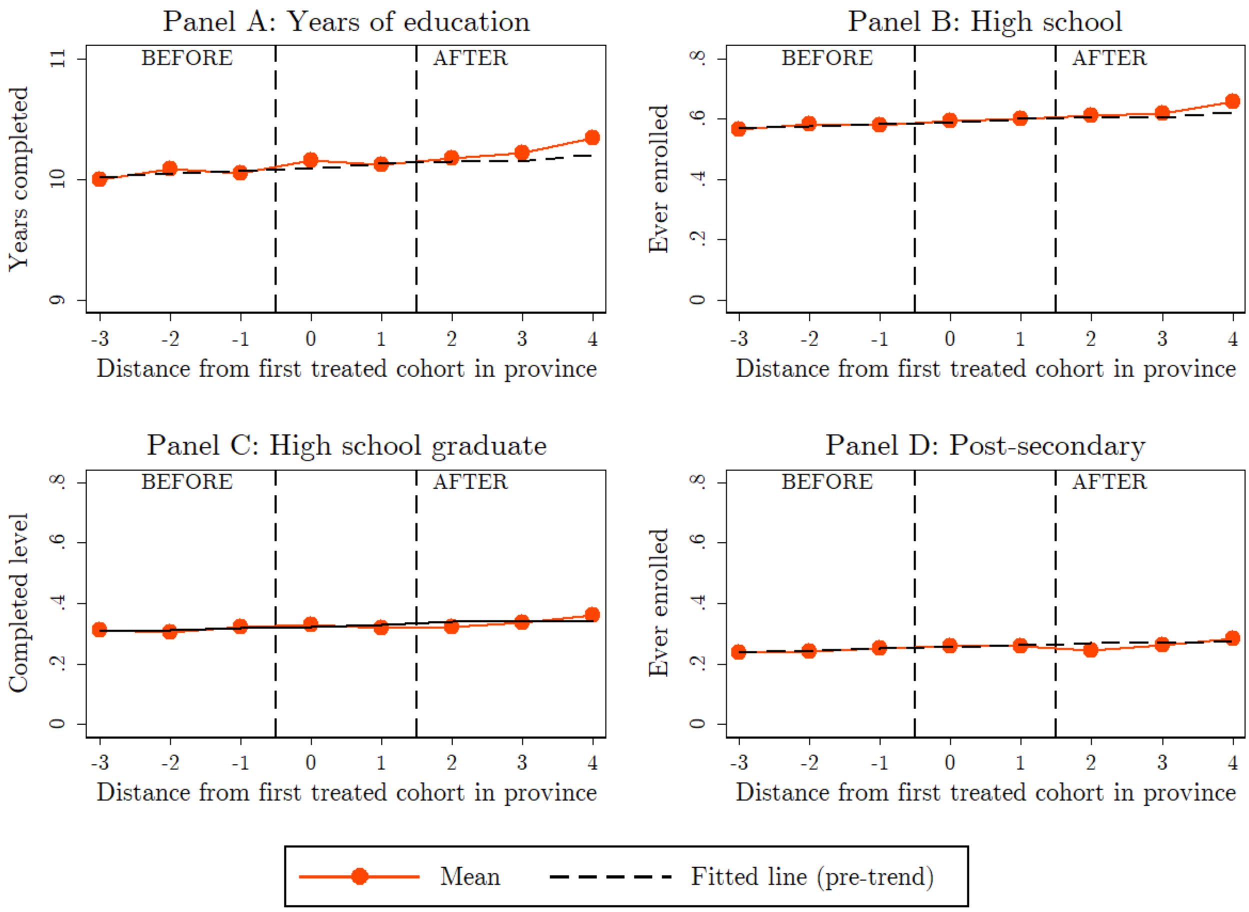
Notes: This figure shows the average income (in current local currency) across cohorts, based on time since treatment in their respective provinces. Each line corresponds to a different age. For instance, the upper line corresponds to individuals from different cohorts observed around age 19, which would correspond to the 14th year of schooling for somebody who progressed continuously through the education system since age 6. This figure suggests that there were no major shocks to household income across cohorts at any given age.
Source: ECH 2001–2018.

Figure A8: Government laptop access across school grades in 2011, by province



Notes. School grade is 1 in first grade of primary school, 7 in first grade of secondary school and 13 in first grade of post-secondary education. The red dashed line represents grade of trend-break. The solid gray line represents expected grade of trend-break according to official information on the implementation of the program. I use current enrollment to test whether the students that were supposed to be targeted by the program actually have a government computer at home. Sample: Currently enrolled, living with parents, no younger siblings, attend(ed) public school.
Source: ECH 2001–2015.

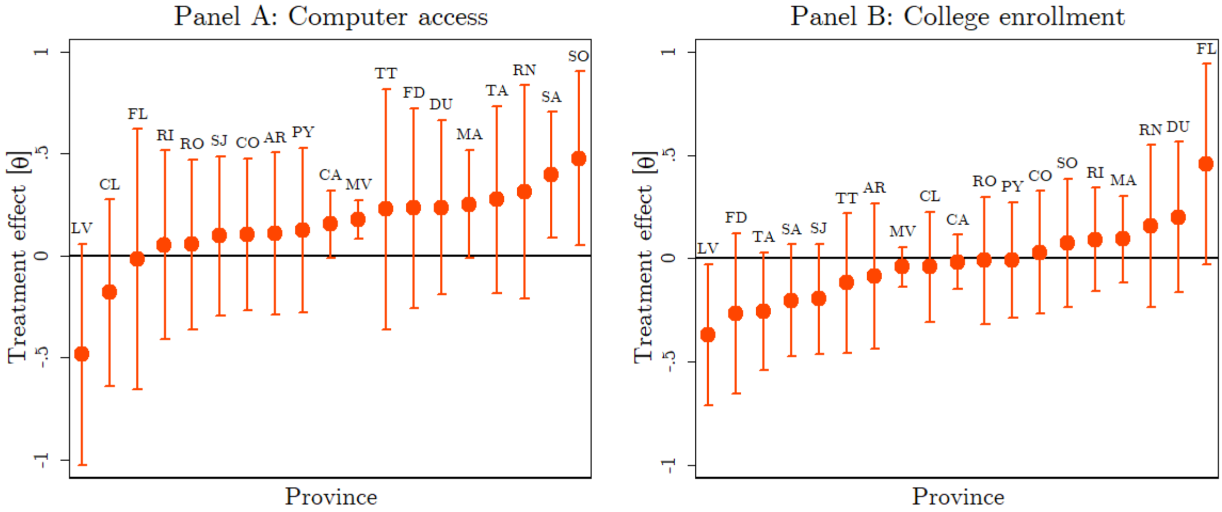
Figure A9: Evolution of fraction enrolled in high school and post–secondary education Measured around age 19 across cohorts and provinces



Notes: This figure plots educational attainment by age 19 across cohorts based on time since treatment in their respective provinces. Panel A plots the average schooling in the population (years completed). The subsequent panels plot the fraction of individuals who enrolled in high school (B), who graduated from high school (C) and who enrolled in postsecondary education (D). A cohort is defined as the group of individuals who are expected to start primary school in the same academic year, and is estimated based on age, year, and month of the survey. In-between cohorts were exposed to the program to the extent that some individuals started primary school later than expected or repeated grades by the time the program arrived in their province.

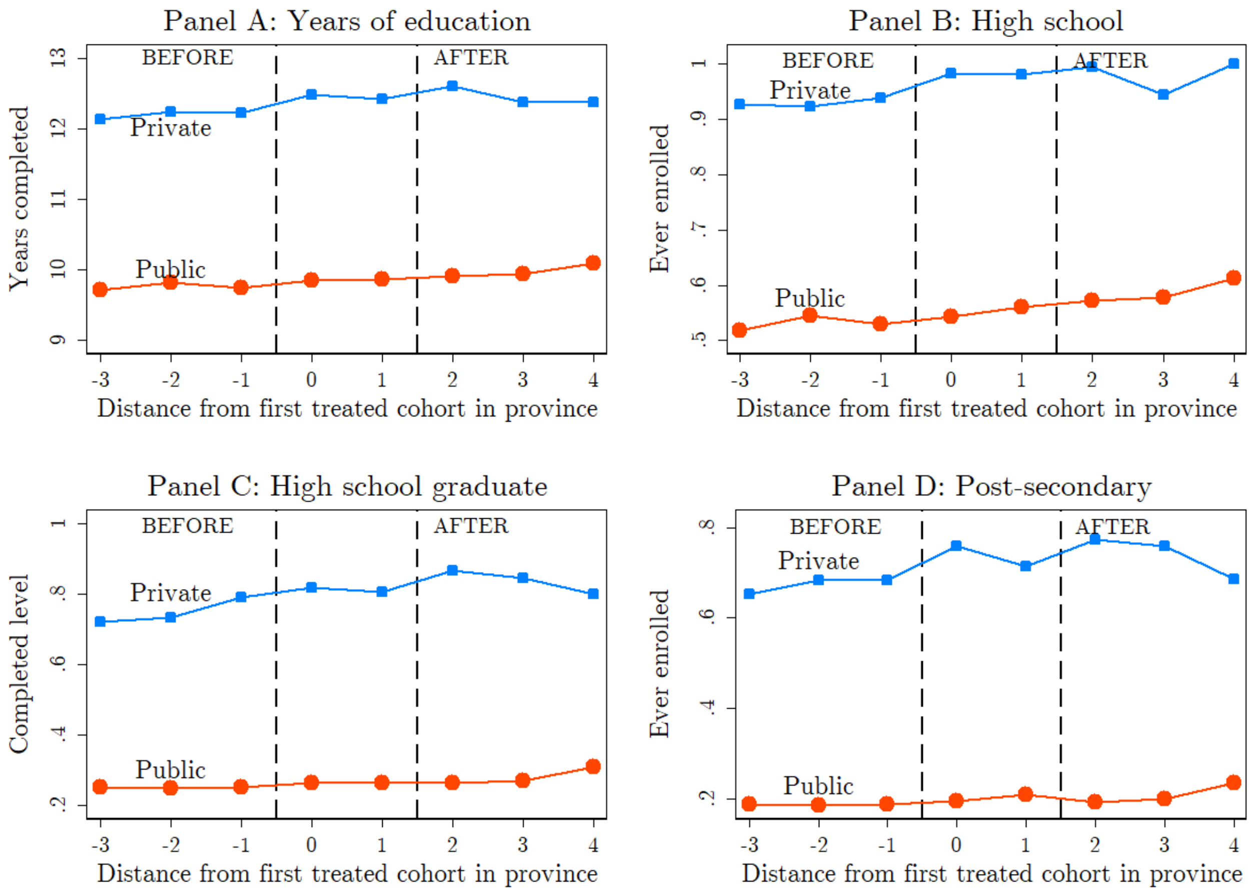
Source: ECH 2001–2018.

Figure A10: Treatment effects on computer access in 2011 (province-by-province)



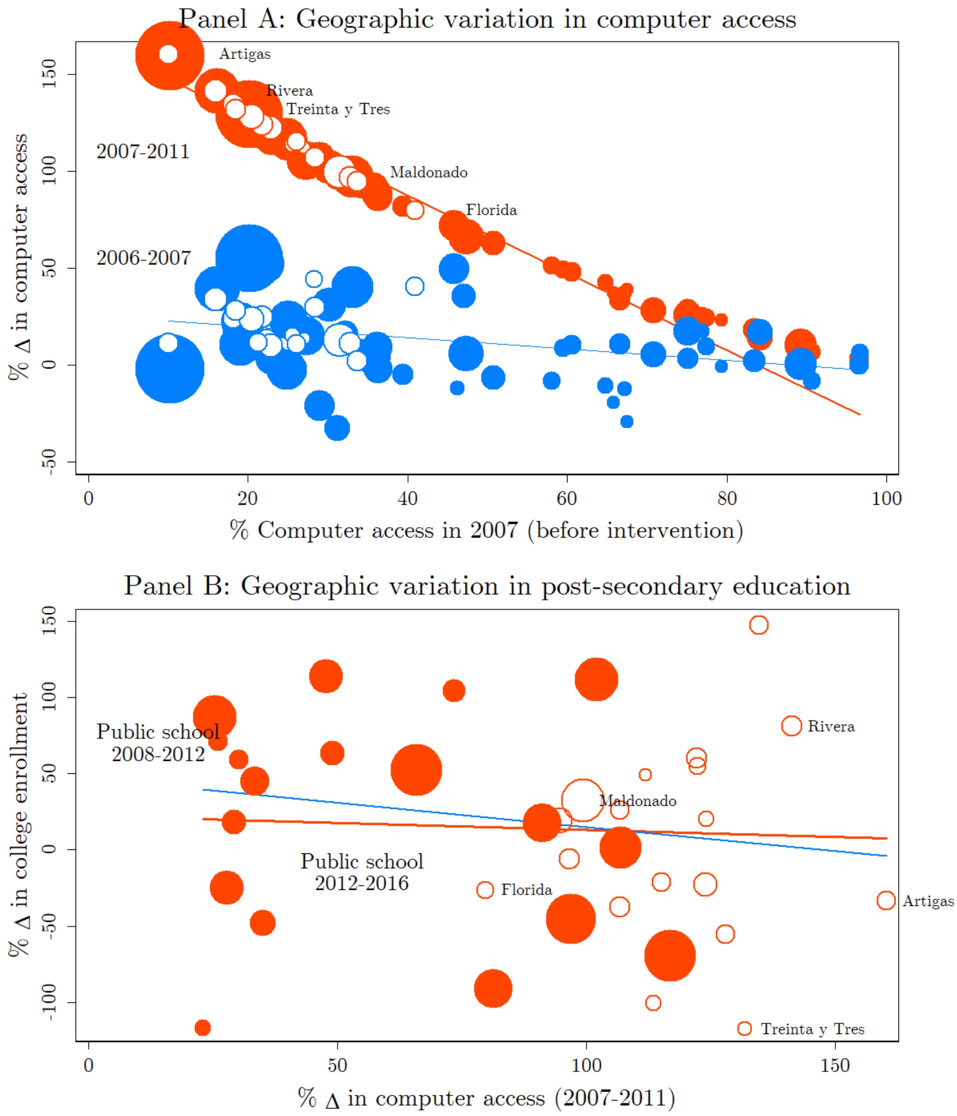
Notes: The figure shows the province-specific treatment effects obtained from estimating equation 1, separately by province, on the probability of having a computer at home in 2011 (Panel A) and on the probability of having enrolled in post-secondary education by early adulthood (Panel B). Controls include age, gender, and race fixed effects, as well as household income and parental education. Regressions include ten cohorts in total, with three pre-intervention and three post-intervention cohorts in each province. The sample in Panel B is restricted to individuals living with no younger siblings. The vertical lines represent confidence intervals using robust standard errors.
Source: ECH 2001–2018.

Figure A11: Effects of the program on educational attainment (level reached)
Variation across cohorts, provinces, and school-type at age 19



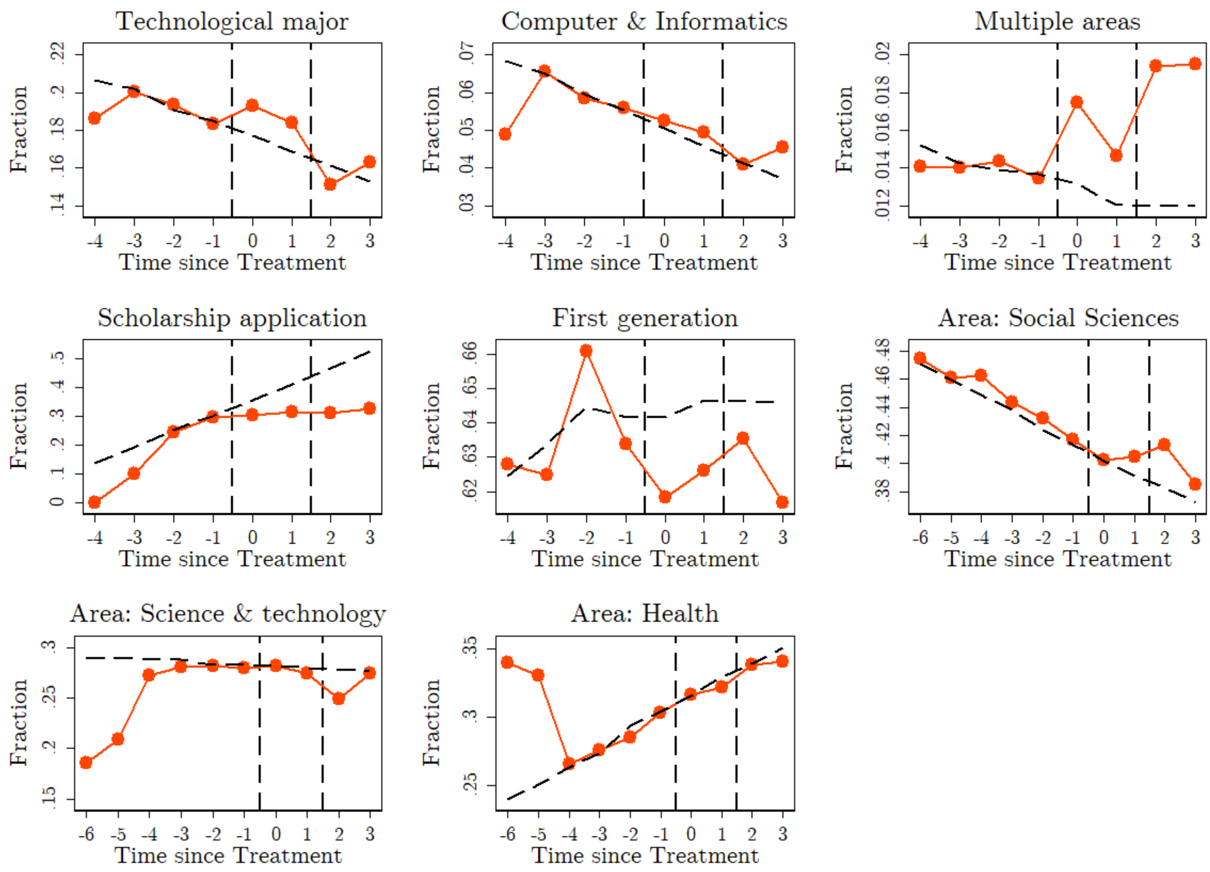
Notes: This figure plots educational attainment by age 19 across cohorts based on time since treatment in their respective provinces. Panel A plots the average schooling in the population (years completed). The subsequent panels plot the fraction of individuals who enrolled in high school (B), who graduated from high school (C), and who enrolled in postsecondary education (D). A cohort is defined as the group of individuals who are expected to start primary school in the same academic year; it is estimated based on age, year, and month of the survey. In-between cohorts were exposed to the program to the extent that some individuals started primary school later than expected or repeated grades by the time the program arrived in their province.
Source: ECH 2001–2018.

Figure A12: Geographic variation in computer access and college enrollment



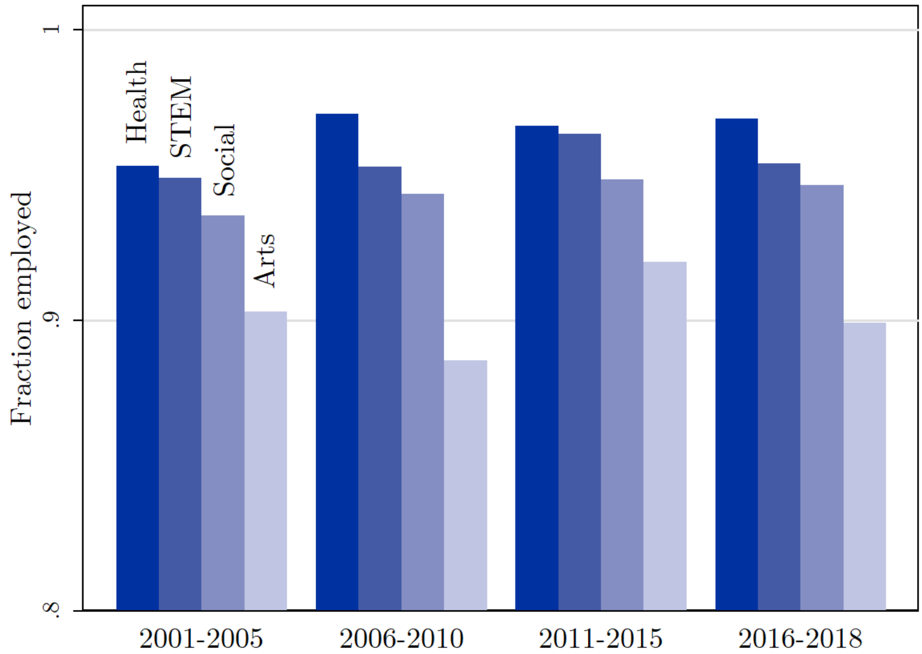
Notes: Each circle corresponds to a particular region, encompassing each of the 19 provinces (hollow circles) with Montevideo divided in 62 neighborhoods (full circles). Extreme values are dropped out for visual clarity without consequence for findings. Computer access is measured on population age 6–15 attending school at the time and region of observation. College enrollment is measured at approximately age 19, and assigned to the province of residence five years prior. Because of lack of migration information across neighborhoods, for students formerly residing in Montevideo, the current neighborhood of residence is assigned. Changes are measured as mid-point percent changes to guarantee symmetry around zero. The marker size is proportional to population. A 2SLS analysis performed on individuals enrolled in the public school system, reveals that a 1 percentage point increase in computer access in a region during the expansion of the program is associated with a 0.12 percentage point decrease in postsecondary enrollment between 2012 and 2016; a figure not statistically different from zero. Excluding population weights, a 1 percentage point increase in computer access is associated with a 0.19 percentage point decrease in postsecondary enrollment; also non statistically different from zero.
Source: ECH 2006–2016.

Figure A13: Educational outcomes among students in the public university system



Notes: This figure plots educational outcomes among students who enrolled in the public university system of Uruguay between 2006 and 2016. The dotted line represents a fitted line estimated among pre-intervention cohorts within each province, excluding any additional controls.
Source: Universidad de la Republica 2006–2016.

Figure A14: Trends in employment by area of study (2001–2018)



Notes: This figure shows trends in employment among university graduates aged 30–50 in four areas of study in the period 2001–2018. The employment rate is consistently highest among graduates of health-related majors and lowest among graduates of art-related majors. For consistency before and after 2005, the sample was restricted to urban areas with 5000+ inhabitants.

Source: ECH 2001–2018.

Table A1: Descriptive Statistics: individuals aged 18–20

Household Survey Data [2011–2018]		Administrative Data From Public University System [2012–2016]	
Variable	Mean	Variable	Mean
Male	0.5	Age	18.99
Nonwhite	0.171	Male	0.368
Below poverty line	0.128	Born in Montevideo	0.539
Parent post-secondary education	0.175	Public primary school	0.665
Household size	4.297	Public secondary school	0.605
Lives with parents	0.835	Children	0.001
Has children	0.101	Lives with parents	0.728
Employed	0.409	Lives alone	0.043
Has computer at home	0.8	Father post secondary education	0.219
Has internet at home	0.639	Mother post secondary education	0.312
Has a non-Ceibal computer at home	0.623	First to attend post secondary	0.496
Computers per person	0.489	First to attend university	0.636
Used computer last month	0.752	Works	0.102
Uses internet every day	0.678	Scholarship	0.304
Primary school was public	0.86	Technical major	0.162
Middle school was public	0.847	Computer major	0.045
University was public	0.864	Enrollment across fields	0.052
Years of education	10.081	Previous post-secondary studies	0.038
Ever enrolled in high school	0.604		
Graduated from high school	0.294		
Ever enrolled in technical school	0.118		
Graduated from technical school	0.039		
Ever enrolled in post-secondary education	0.227		
Ever enrolled in university	0.186		

Notes: Summary statistics (means) for individuals aged 18–20.
Source: ECH 2011–2018 and Universidad de la Republica del Uruguay 2012–2016.

Table A2: List of technological majors in the public university system (2018)

Technological Major	Length	Field	Province	Start
Computing Engineering	5 years	STEM	Montevideo	≤2006
Production Engineering	5 years	STEM	Montevideo	2010
Electrical Engineering	5 years	STEM	Montevideo	≤2006
Mechanical Industrial Engineering	5 years	STEM	Montevideo	≤2006
Chemical Engineering	5 years	STEM	Montevideo, Salto	≤2006
Biological Engineering	4 years	STEM	Montevideo, Salto, Paysandú	2013
Technologist in Informatics	3 years	STEM	Montevideo, Maldonado, Paysandú	≤2006
Technologist in Telecommunications	2 years	STEM	Rocha	2009
Technologist in Cartography	2 years	STEM	Montevideo	2011
Communication	4 years	Social	Montevideo	≤2006
Electronic and Digital Art	4 years	Arts	Montevideo	2014
Technical Degree in Technologies of Photographic Image	3 years	Arts	Paysandú	2008
Architecture	5 years	STEM	Montevideo	≤2006
Medical Physics	4 years	STEM	Montevideo	2008
Clinical Biochemist	5 years	STEM	Montevideo, Salto	≤2006
Water Resources and Irrigation	4 years	STEM	Salto	2011

Notes: Technological majors are those which contain any of the following keywords (used in adequate context): "computer", "computing", "digital" , "informatics", "telecomunications", "technology", or "technological". A subcategory of majors directly related to computing (computer-related majors) are: Electrical Engineering, Computing Engineering, Technologist in Informatics and Electronic and Digital Art.
Source: Web-scrapped from Universidad de la Republica (http://www.universidad.edu.uy/carreras/index/majorTypeId/1).

Table A3: Grade and year of program exposure by province groups and birth cohort

	Group 1					Group 2					Group 3									
Province	Treinta y tres					Florida					Montevideo, Canelones					Rest (15 provinces)				
Cohort	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Grade																				
																			+	2007
5th	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008
6th	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
7th	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
8th	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
9th	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
10th	2009	2010	**2011***	2012	2013	2009	2010	**2011***	2012	2013	2009	2010	**2011***	2012	2013	2009	2010	**2011***	2012	2013
11th	2010	**2011***	2012	2013	2014	2010	**2011***	2012	2013	2014	2010	**2011***	2012	2013	2014	2010	**2011***	2012	2013	2014
12th	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
College 1st	2012	**2013**	**2014**	**2015**	**2016**	2012	2013	**2014**	**2015**	**2016**	2012	2013	2014	**2015**	**2016**	2012	2013	2014	**2015**	**2016**
College 2nd	2013	**2014**	**2015**	**2016**	**2017**	2013	2014	**2015**	**2016**	**2017**	2013	2014	2015	**2016**	**2017**	2013	2014	2015	**2016**	**2017**

Notes: Diagram based on documentation from Plan Ceibal, newspapers, blogs, and interviews. I corroborated the timing of the intervention across cohorts and provinces using data from the ECH survey. Cohort 1 is born between May 1993 and April 1994. Primary school starts in first grade, middle school starts in seventh grade, high school starts in tenth grade. Shaded cells indicate exposure to intervention conditional on public school attendance.

* Individuals in these cohorts were exposed to the intervention conditional on being enrolled in the technological high school track; slightly over 10% of high school students were enrolled in the technological track in 2011.

Table A4: Analysis of baseline characteristics

	Mean[A]	A. Complete sample		B. Doughnut sample	
		θ	T-Stat	θ	T-stat
A. At rollout: age 11					
Male	0.532	−0.035	(1.502)	−0.028	(−1.275)
Public school	0.844	−0.041	(−1.456)	−0.049	(−1.633)
Lagging behind	0.333	0.021	(1.003)	0.015	(0.679)
Years of education	4.682	−0.054	(−1.291)	−0.046	(−1.127)
Younger siblings	0.452	−0.009	(−0.372)	−0.009	(−0.338)
Household size	4.877	−0.092	(−0.882)	−0.108	(−0.945)
Parent w/high school	0.781	−0.038	(−1.049)	−0.042	(−1.168)
Parent w/college	0.179	0.021	(0.731)	0.022	(0.775)
Parental education (years)	10.02	−0.090	(−0.298)	−0.075	(−0.259)
Household real income	359.1	114.7*	(3.679)	126.1*	(3.555)
TV subscription	0.534	0.061	(0.949)	0.061	(0.963)
Teacher employment	0.711	0.007	(0.463)	0.01	(0.634)
Teacher income (> p50)	0.641	0.001	(0.093)	0.006	(0.509)
B. Before rollout: 2006					
Computer at home	0.19	−0.035**	(−1.956)	−0.041**	(−2.304)
Internet connection	0.081	−0.013	(−1.128)	−0.014	(−1.032)
Mobile phone (not smart)	0.543	−0.017	(−1.435)	−0.016	(−0.886)
Government aid	0.206	0.012	(1.327)	0.012	(0.861)
Household income ($ UY)	16,815	−561.6	(−0.731)	−391.8	(−0.466)
Nonwhite	0.179	0.005	(0.294)	−0.003	(−0.176)
Province FE		✔		✔	
Province trends		✔		✔	
Controls		✘		✘	

Notes: The first column reports the average values for each variable. The other columns report estimates of θ obtained from estimating equation 1 without control variables. Regressions include twelve cohorts in total, including four pre-intervention and four post-intervention cohorts in each province. This classification is based on current province of residence. T-statistics from wild cluster bootstrap are presented in brackets (clusters: 19 provinces).
Source: ECH 2001–2018.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
[A] Mean among treatment cohorts.

Table A5: Descriptive statistics for cohort 1, cross-sectional variation (2005–2006)

		Regional variation					
	Total	Florida – Rest	Florida – Canelones & Montevideo	Florida – Treinta y Tres	Rest – Canelones & Montevideo	Rest – Treinta y Tres	Canelones & Montevideo – Treinta y Tres
Age (years)	11.652	0.364***	0.349**	-	-0.015	-0.364***	-0.349**
Male	0.512	-0.267***	-0.314***	-0.278***	-0.047	-0.011	0.036
Lag behind	0.380	-0.143**	-0.173***	-0.283***	-0.031	-0.141**	-0.110***
Lives with parents	0.683	-0.255***	-0.239***	-0.307***	0.016	-0.052	-0.069*
Father HS graduate	0.212	-0.216***	-0.215***	-	0.001	0.216***	0.215***
Mother HS graduate	0.190	0.02	0.031**	0.219***	0.012	0.200***	0.188***
Father College grad	0.031	-0.028	-0.034**	-	-0.007	0.028	0.034**
Mother College grad	0.047	-0.044**	-0.051*	-	-0.007	0.044**	0.051*
Household income	13807	-188	138	4386***	326	4575***	4248**
Household size	5.350	0.913***	1.057**	1.104***	0.144	0.192	0.048
Car ownership	0.214	-0.054	0.046*	-0.029***	0.099**	0.024	-0.075**
Heater ownership	0.505	0.609***	0.419***	0.746***	-0.191**	0.137**	0.327**
Fridge ownership	0.899	0.086***	0.114**	-	0.029	-0.086***	-0.114**
PC in house	0.150	0.084***	0.058	0.219***	-0.026	0.136***	0.161**
Internet in house	0.077	-0.092***	-0.068**	-	0.024	0.092***	0.068**
House owner	0.407	-0.262***	-0.137**	-0.283***	0.125*	-0.021	-0.146**
House occupant	0.352	-0.064	-0.183***	-0.029***	-0.119**	0.035	0.154***
General water access	0.003	-0.008	-	-	0.008	0.008	-

Notes. This table shows descriptive statistics and simple mean tests across regions for public-school students in Cohort 1. Individuals were classified as public school students if they are currently enrolled in public school or attended a public primary school in the past. Cohort 1 is a pre-interenvion cohort of individuals born between May 1993 and April 1994; for further information about this cohort refer to Table A1. Rest stands for "all other regions", i.e., Uruguay excluding Canelones, Montevideo, and Treinta y Tres. For consistency before and after 2005, the sample was restricted to urban areas with 5000+ inhabitants.
Source: ECH 2005–2006.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Descriptive statistics for cohort 1, temporal variation (2005–2006)

		Time variation (2005–2006)			
	Total	Florida	Rest	Canelones & Montevideo	Treinta y Tres
Age (years)	11.652	0.769***	1.174***	1.175***	0.688***
Male	0.512	0.319	0.007	-0.026	0.011
Lag behind	0.380	0.048	-0.048	-0.041	-0.246
Lives with parents	0.683	0.314	0.081*	0.071*	-0.058
Father HS graduate	0.212	0.296***	-0.037	-0.019	0.284***
Mother HS graduate	0.190	0.019	-0.026	0.017	0.272***
Father College grad	0.031	0.026	0.002	-0.003	0.090**
Mother College grad	0.047	0.043	0.012	0.017	0.129***
Household income	13807	3228	1844*	3287***	7572***
Household size	5.350	-0.813	-0.313*	-0.232*	-0.51
Car ownership	0.214	0.037	0.009	0.047	0.081
Heater ownership	0.505	-0.304***	0.133***	0.021	0.209
Fridge ownership	0.899	-0.077**	-0.009	0.03	-0.132***
PC in house	0.150	0.014	0.068**	0.085***	0.277***
Internet in house	0.077	0.175***	-0.025	0.018	0.088**
House owner	0.407	0.242	0.053	0.147***	0.123
House occupant	0.352	-0.068	-0.080*	-0.191***	-0.061
General water access	0.003	-	0.004	-0.003**	-

Notes. This table shows descriptive statistics and simple mean tests across the years 2005 and 2006 for public-school students in Cohort 1. Individuals were classified as public school students if they are currently enrolled in public school or attended a public primary school in the past. Cohort 1 is a pre-interenvion cohort of individuals born between May 1993 and April 1994; for further information about this cohort refer to Table A1. Rest stands for "all other regions", i.e., Uruguay excluding Canelones, Montevideo, and Treinta y Tres. For consistency before and after 2005, the sample was restricted to urban areas with 5000+ inhabitants.
Source: ECH 2005–2006.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Descriptive statistics for cohort 1, by school sector (2007 and 2012)

	Public school	Private school	Difference
2007			
Years of schooling	6.656	7.103	***
Lagging behind	0.527	0.224	***
Attends public primary school	0.998	0.000	***
Attends public secondary school	0.957	0.000	***
Age (years)	13.193	13.184	
Male	0.517	0.582	*
Household size	5.113	4.154	***
Resides in province of birth	0.878	0.874	
Father: highschool graduate	0.181	0.760	***
Household income	18882	58262	***
Home: automobile	0.262	0.720	***
Home: fridge	0.895	0.977	***
Home: TV	0.918	0.990	***
Home: Cell-phone	0.841	0.970	***
Home: PC	0.276	0.819	***
Home: Internet	0.099	0.616	***
2012			
Years of schooling	9.570	11.590	***
Lagging behind	0.842	0.406	***
Not moved since 2007	0.931	0.957	
Home: Internet	0.562	0.953	***
Home: PC	0.836	0.984	***
Home: Ceibal PC	0.492	0.128	***
Home: only Ceibal PC	0.214	0.015	***
Home: Ceibal | youngest in house	0.126	0.103	
Home: only Ceibal PC | youngest in house	0.031	0.000	***
Used PC in last month	0.804	0.987	***
Uses internet daily	0.500	0.928	***

Notes. This table presents descriptive statistics and simple mean tests across private and public school students in cohort 1. Individuals were classified as public school students if they attended either a public primary school or a public secondary school. Cohort 1 is a pre-interenvion cohort of individuals born between May 1993 and April 1994; for further information about this cohort refer to Table A1.

Source: ECH 2007 and 2012.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Robustness: Effect of the laptop program computer access in 2011

	Mean[A]	A. Complete sample			B. Doughnut sample		
		ITT	CI	N	ITT	CI	N
Robust SE	0.929	0.165*** (4.96)	[0.1, 0.231]	7,017	0.190*** (5.47)	[0.122, 0.258]	5,287
Province Cluster SE	0.929	0.165*** (6.46)	[0.115, 0.216]	7,017	0.190*** (7.58)	[0.141, 0.239]	5,287
Cohort Cluster SE	0.929	0.165** (3.22)	[0.065, 0.266]	7,017	0.190*** (3.58)	[0.086, 0.294]	5,287
Twoway Cluster SE	0.929	0.165*** (3.50)	[0.073, 0.258]	7,017	0.190*** (3.95)	[0.096, 0.284]	5,287
Permutation SE	0.929	0.165*** (4.96)	[-0.199, 0.112]	7,017	0.190** (5.47)	[-0.137, 0.205]	5,287
Collapsed Sample	0.921	0.207*** (3.06)	[0.073, 0.341]	152	0.237*** (3.19)	[0.09, 0.384]	114
No Controls	0.929	0.154*** (4.832)	[0.095, 0.279]	7,017	0.178*** (5.918)	[0.125, 0.297]	5,287
Province of Birth	0.927	0.165*** 5.808	[0.113, 0.274]	6,987	0.192*** 6.947	[0.139, 0.299]	5,269
Quadratic Trends	0.929	0.174*** (6.722)	[0.097, 0.246]	7,017	0.196*** (7.691)	[0.116, 0.267]	5,287
Single Linear Trend	0.929	0.171*** (6.481)	[0.092, 0.24]	7,017	0.196*** (7.527)	[0.116, 0.267]	5,287
Government Laptop	0.686	0.360*** (9.705)	[0.301, 0.504]	7,017	0.417*** (9.238)	[0.345, 0.588]	5,287
Province FE			✔			✔	
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate equation 1 and and show the estimate of θ. Controls include age, gender, and parental characteristics; outcome first generation excludes parental characteristics. Province refers to current province of residence and cohort is computed based on date of birth. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces).
Source: ECH 2011.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
[A] Mean among treatment cohorts.

Table A9: Alternative Specification —effect of intervention on educational attainment **by public/private school status**

	Sector trends	Computer access in 2011	Years of education	University	Post-secondary	High sch. graduate	High school
		(1)	(2)	(3)	(4)	(5)	(6)
A. Complete sample							
ITT	✘	0.273***	-0.104	-0.0625	-0.0711	-0.100**	0.0546*
Robust T-stat		(0.0423)	(0.185)	(0.0489)	(0.0484)	(0.0466)	(0.0322)
		[0.19, 0.356]	[-0.466, 0.258]	[-0.158, 0.033]	[-0.166, 0.024]	[-0.191, -0.009]	[-0.009, 0.118]
ITT	✔	0.280**	-0.0940	-0.210*	-0.181	-0.0734	-0.0609
Robust T-stat		(0.119)	(0.468)	(0.125)	(0.121)	(0.116)	(0.0907)
		[0.046, 0.513]	[-1.012, 0.824]	[-0.456, 0.035]	[-0.418, 0.056]	[-0.301, 0.154]	[-0.239, 0.117]
Observations		2,071	4,114	4,114	4,114	4,114	4,114
B. Doughnut sample							
ITT	✘	0.265***	-0.105	-0.0625	-0.0713	-0.100**	0.0544*
Robust T-stat		(0.0417)	(0.185)	(0.0489)	(0.0485)	(0.0466)	(0.0322)
		[0.183, 0.347]	[-0.467, 0.257]	[-0.158, 0.033]	[-0.166, 0.024]	[-0.191, -0.009]	[-0.009, 0.118]
ITT	✔	0.313**	-0.118	-0.206	-0.187	-0.0772	-0.0613
Robust T-stat		(0.122)	(0.476)	(0.126)	(0.122)	(0.117)	(0.0928)
		[0.074, 0.552]	[-1.051, 0.815]	[-0.453, 0.04]	[-0.426, 0.051]	[-0.307, 0.152]	[-0.243, 0.121]
Mean		0.917	9.899	0.15	0.178	0.233	0.569
Observations		1,640	3,253	3,253	3,253	3,253	3,253
Controls		✔	✔	✔	✔	✔	✔

Notes: Panels A–B estimate equation 2 and show estimates of θ. Controls include age, gender and race fixed effects as well as average household income and parental education measured in the last grade of primary school. The sample includes residents of Montevideo five years prior, except for past computer access where the sample is restricted to individuals residing in Montevideo in 2011. Regressions include seven cohorts, with three pre-intervention and two post-intervention cohorts. Past computer access measured in 2011. All other outcomes are measured around age 19. Robust standard errors in parentheses.
Source: ECH 2001–2018.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A10: Robustness —effect of the laptop program on educational outcomes [dependent variable: years of education]

	Mean[A]	A. Complete sample ITT	CI	N	B. Doughnut sample ITT	CI	N
Robust SE	10.289	-0.0793 (-0.51)	[-0.382, 0.223]	12,775	-0.134 (-0.80)	[-0.46, 0.193]	9,323
Province cluster SE	10.289	-0.0793 (-0.57)	[-0.351, 0.192]	12,775	-0.134 (-0.90)	[-0.427, 0.159]	9,323
Cohort cluster SE	10.289	-0.0793 (-0.77)	[-0.282, 0.123]	12,775	-0.134 (-1.17)	[-0.358, 0.09]	9,323
Twoway cluster SE	10.289	-0.0793 (-0.63)	[-0.328, 0.169]	12,775	-0.134 (-0.89)	[-0.429, 0.161]	9,323
Permutation SE	10.289	-0.0793 (-6.66)	[-0.914, 1.022]	12,775	-0.134 (0.4007)	[-0.899, 1.155]	9,323
Collapsed sample	10.136	-0.00529 (-0.02)	[-0.556, 0.545]	152	-0.0379 (-0.11)	[-0.732, 0.656]	114
No controls	10.289	-0.0351 (-0.26)	[-0.365, 0.395]	12,775	-0.0890 (-0.646)	[-0.408, 0.363]	9,323
Province of birth	10.289	-0.0962 (-0.691)	[-0.49, 0.225]	12,715	-0.149 (-0.950)	[-0.569, 0.222]	9289
Quadratic trends	10.289	-0.0706 (-0.518)	[-0.427, 0.3]	12,775	-0.119 -0.809	[-0.476, 0.248]	9,323
Single linear trend	10.289	-0.0688 (-0.495)	[-0.438, 0.294]	12,775	-0.110 -0.751	[-0.475, 0.276]	9,323
No younger siblings	10.591	0.0931 (0.624)	[-0.187, 0.513]	6,170	0.0631 0.420	[-0.245, 0.464]	4,528
Controls for: has children	10.289	-0.151 (-1.238)	[-0.473, 0.182]	12,775	-0.180 (-1.394)	[-0.506, 0.161]	9323
Controls for: current household income	10.289	-0.0323 (-0.227)	[-0.413, 0.35]	12,775	-0.0739 (-0.494)	[-0.426, 0.344]	9,323
Controls for: age-specific income trends	9.652	-0.00731 (-0.0435)	[-0.42, 0.37]	12,680	-0.127 (-0.684)	[-0.538, 0.303]	9,228
One post-intervention cohort	9.652	0.0698 (0.469)	[-0.308, 0.525]	9,916	0.0615 (0.354)	[-0.399, 0.564]	6,464
Years: completed	10.178	-0.0558 (-0.415)	[-0.413, 0.297]	12,775	-0.106 (-0.719)	[-0.459, 0.283]	9,323
Years: capped at 11	9.652	-0.0234 (-0.214)	[-0.307, 0.269]	12,775	-0.0631 (-0.524)	[-0.352, 0.259]	9,323
Years: observed at 17	9.404	0.188 (1.543)	[-0.081, 0.649]	15,187	0.250* (1.878)	[-0.039, 0.747]	11,337
Province FE			✔			✔	
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate equation 1 and and show the estimate of θ. Controls include age, gender, and parental characteristics; outcome first generation excludes parental characteristics. Province refers to province of residence five years prior and cohort is computed based on date of birth. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces).

Source: ECH 2009–2018.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[A] Mean among treatment cohorts.

Table A11: Effect of the laptop program on educational outcomes (2SLS specification)

		A. Complete sample			B. Doughnut sample		
	Mean[A]	TOT	CI	N	TOT	CI	N
Years of education	10.29	-0.880 (1.384)	[-3.192, 2.548]	12,775	-1.397 (1.345)	[-3.531, 1.737]	9,323
High school: enrolled	0.637	-0.298 (0.328)	[-0.881, 0.626]	12,775	-0.323 (0.313)	[-0.859, 0.531]	9,323
High school: graduate	0.349	-0.367 (0.269)	[-0.836, 0.268]	12,775	-0.469 (0.256)	[-0.888, 0.106]	9,323
Postsecondary: enrolled	0.271	-0.421 (0.240)	[-0.921, 0.118]	12,775	-0.504* (0.251)	[-0.941, 0.068]	9,323
University: enrolled	0.221	-0.0724 (0.199)	[-0.505, 0.323]	12,775	-0.120 (0.190)	[-0.495, 0.221]	9,323
Province FE			✔			✔	
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate a 2SLS regression similar to equation 1 but where the post-intervention and in-between binary variables are used as instruments for computer ownership in 2011. The TOT columns show the 2SLS estimates for the impact of computer access on educational outcomes. Controls include age, gender, and parental characteristics; outcome first generation excludes parental characteristics. Province refers to province of residence five years prior and cohort is computed based on date of birth. T-statistics from clustered standard errors and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces). P-values are based on the wild cluster bootstrap.

Source: ECH 2009–2018.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[A] Mean among treatment cohorts.

Table A12: Effect of intervention on enrollment in the public university system (2011–2018)

	Enrolled in public university system	
	Unconditional	Conditional on university enrollment
	(1)	(2)
A. Complete sample		
ITT	-0.00796	-0.0181
T-statistic	(-0.443)	(-0.950)
CI	[-0.064, 0.029]	[-0.074, 0.022]
Observations	12,680	9,228
B. Doughnut sample		
ITT	-0.00555	-0.0336
T-statistic	(-0.155)	(-0.864)
CI	[-0.123, 0.05]	[-0.157, 0.029]
Observations	2,657	1,934
Mean	0.193	0.193
Province FE	✔	✔
Controls	✘	✘

Notes: Panels A and B estimate equation 1 and show the estimate of θ. Controls include age, gender and race fixed effects as well as average household income and parental education for the cohort at the province of origin in the last grade of primary school. Province refers to province of residence five years prior. Regressions include seven cohorts in total, with one pre-intervention and two post-intervention cohorts in each province. The outcome is measured around age 19. The sample is restricted to 2011–2018 due to data constraints. Province-clustered standard errors are in parentheses.
Source: ECH 2001–2018.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A13: Effect of the program on computer access and postsecondary enrollment (alternative specification)
Variation across cohorts and school-type for a reweighed sample in Montevideo

	Weights computed at age 18			Weights computed at age 19		
	(1)	(2)	(3)	(4)	(5)	(6)
Past Computer Access						
Treatment	0.535***	0.557***	0.490***	0.579***	0.682***	0.587***
Robust SE	(0.0371)	(0.0446)	(0.0525)	(0.0317)	(0.0697)	(0.0610)
Clustered SE	(0.0586)	(0.0570)	(0.0686)	(0.0332)	(0.0563)	(0.0420)
Wild Bootstrap p-val	0.0001	0.0008	0.0019	0.000	0.0014	0.000
Mean(outcome)	0.664	0.666	0.666	0.519	0.473	0.473
R-square	0.629	0.772	0.766	0.651	0.748	0.744
N	497	378	378	521	390	390
Current College Enrollment						
Treatment	-0.152*	-0.133	-0.185*	-0.148**	-0.137	-0.137*
Robust SE	(0.0697)	(0.0709)	(0.0745)	(0.0483)	(0.0745)	(0.0594)
Clustered SE	(0.0834)	(0.119)	(0.103)	(0.0289)	(0.0602)	(0.0483)
Wild Bootstrap p-val	0.0824	0.294	0.0331	0.0155	0.135	0.0537
Mean(outcome)	0.200	0.238	0.238	0.247	0.271	0.271
R-square	0.349	0.554	0.498	0.470	0.720	0.716
N	525	380	380	553	391	391
Balance Test	0.001	-0.549**	-0.549**	0.001	-0.244	-0.244
	(0.083)	(0.223)	(0.223)	(0.107)	(0.150)	(0.150)
School type FE	✔	✔	✔	✔	✔	✔
Neighborhood FE	✘	✔	✔	✘	✔	✔
Cohort FE	✘	✔	✘	✘	✔	✘
Controls	✘	✔	✔	✘	✔	✔

Notes: The sample is limited to Montevideo and includes eight cohorts. Each observation is a cluster of gender–by–school-type–by–cohort–by–neighborhood, weighted by cell-size at first year of college and by a re-weighting procedure meant to balance treated private and public students on college enrollment post-intervention. Controls include gender fixed effects, average household income and parental education. Past computer access is the average of computer ownership by the household in a given cell, and is measured only at the survey year in which each cohort is expected to be enrolled in 8th grade (second year of middle school), which is when the program officially started in Montevideo. The first treated cohort in Montevideo is cohort 4. College enrollment is measured in the survey year in which each cohort is expected to be enrolled in the first year of college (age 18) or second year of college (age 19) as specified. The balance test reports whether the difference in trends differ between private and public school students before treatment. Robust and neighborhood-clustered standard errors in parentheses (Clusters: 62) .
Source: ECH 2001–2017.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A14: Heterogeneity —effect of the laptop program on years of education

		A. Complete sample			B. Doughnut sample		
	Mean[A]	ITT	CI	N	ITT	CI	N
Geography							
Montevideo	10.49	−0.0493 (−0.198)	[−0.552, 0.448]	4,185	−0.120 (−0.474)	[−0.63, 0.38]	3,045
Elsewhere	10.2	−0.0266 (−0.127)	[−0.452, 0.52]	8,590	−0.0725 (−0.340)	[−0.483, 0.484]	6,278
Gender							
Boys	9.91	0.16 (0.701)	[−0.479, 0.665]	6,412	0.140 (0.606)	[−0.51, 0.64]	4,676
Girls	10.65	−0.235 (−1.07)	[−0.632, 0.35]	6,363	−0.325 (−1.472)	[−0.721, 0.299]	4,647
Household Income							
High	10.91	0.0541 (0.23)	[−0.337, 0.773]	6,113	0.0691 (0.276)	[−0.332, 0.894]	4,242
Low	9.58	0.0286 (0.118)	[−0.597, 0.497]	5,363	−0.0381 (−0.155)	[−0.663, 0.449]	3,782
Parental Education							
High	11.81	−0.0561 (−0.295)	[−0.424, 0.554]	3,814	−0.0638 (−0.350)	[−0.422, 0.522]	2,775
Low	9.65	0.078 (0.414)	[−0.4, 0.563]	8,961	−0.0167 (−0.0904)	[−0.451, 0.538]	6,548
Province FE			✔				
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate equation 1 and show the estimate of θ. Controls include age, gender, and race fixed effects, as well as average household income and parental education for the cohort at the province of origin in the last grade of primary school. Province refers to province of residence five years prior. Regressions include ten cohorts in total, with three pre-intervention and three post-intervention cohorts in each province. Outcomes are measured around age 19 for every cohort. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces; 64 neighborhoods of Montevideo).
Source: ECH 2001–2018.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
[A] Mean among treatment cohorts.

Table A15: Interpretation —effect of the laptop program on determinants of schooling

		A. Complete sample		B. Doughnut sample	
	Mean[A]	ITT	CI	ITT	CI
Current computer access	0.777	−0.0126	[−0.081, 0.069]	−0.016	[−0.097, 0.061]
		(−0.476)		(-0.558)	
Internet use	0.828	0.0800**	[0.03, 0.136]	0.102***	[−0.048, 0.168]
		(4.013)		(4.311)	
Internet for Information and Communication	0.841	0.0242	[−0.057, 0.074]	0.002	[−0.078, 0.045]
		(1.119)		(0.105)	
Employed	0.388	−0.033	[−0.123, 0.032]	−0.048	[−0.145, 0.027]
		(−1)		(−1.277)	
Early parent	0.094	−0.0281	[−0.073, 0.018]	−0.018	[−0.065, 0.021]
		(−1.611)		(−1.105)	
Observations		12,775		9,323	
Province FE		✔		✔	
Province trends		✔		✔	
Controls		✔		✔	

Notes: Panels A and B estimate equation 1 and show the estimate of θ. Controls include age, gender, and race fixed effects, as well as average household income and parental education for the cohort at the province of origin in the last grade of primary school. Province refers to province of residence five years prior. Regressions include ten cohorts in total, with three pre-intervention and three post-intervention cohorts in each province. Outcomes are measured around age 19 for every cohort. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces).
Source: ECH 2001–2018.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
[A] Mean among treatment cohorts.

Table A16: Satisfaction, employment, and income among university graduates by area of study

		Area of study		
		Science and Technology	Social Sciences	Health
	Panel A: Graduate satisfaction survey (2010–2011)			
Work	Employed	96.3	95.9	94.9
	Unemployed	3.3	2.6	2.6
	Inactive	3.6	3.9	5.1
Salary	Not satisfied	83.4	88.5	80.7
	Satisfied	16.6	11.5	19.3
Regrets	No regrets	63.9	61.5	62.5
	University choice	10.5	9.6	6.6
	Major choice	14.9	15.6	18.4
	Both choices	7.3	9.3	9.9
	University degree	3.4	4.1	2.5
	Panel B: ECH (2012–2017)			
Income	All	47,317	39,580	35,804
	Males	54,012	48,893	45,607
	Females	36,126	34,376	32,329
Employed	All	0.958	0.951	0.973
	Males	0.976	0.968	0.990
	Females	0.928	0.941	0.967
Unemployed	All	0.025	0.020	0.008
	Males	0.019	0.022	0.005
	Females	0.034	0.019	0.010
N (%)	All	23.74	54	22.27
	Males	37.85	47.78	14.37
	Females	15.05	57.82	27.12

Notes. This table shows summary statistics for university graduates across areas of study. Panel A encompasses a representative sample of students that graduated from the public university system in 2010 and 2011. Panel B encompasses individuals aged 30–40 who completed a university degree between 2012 and 2017.
Source: Universidad de la Republica 2010–2011 and ECH 2012–2018.

Table A17: Effect of intervention on choice of major (breakdown by school/department)

		A.Complete sample		B.Doughnut sample	
	Mean	(1)	(2)	(3)	(4)
Agronomy	0.031	-0.016***	[-0.027, -0.005]	-0.020***	[-0.028, -0.012]
		(-2.898)		(-4.680)	
Architecture	0.062	-0.016**	[-0.029, -0.004]	-0.027***	[-0.042, -0.013]
		(-2.568)		(-3.645)	
Arts	0.016	0	[-0.006, 0.006]	0.004	[-0.002, 0.01]
		(0.114)		-1.31	
Science	0.055	-0.007	[-0.02, 0.005]	-0.002	[-0.013, 0.009]
		(-1.129)		(-0.330)	
Economic sciences	0.166	-0.008	[-0.039, 0.022]	-0.007	[-0.039, 0.026]
		(-0.537)		(-0.404)	
Social sciences	0.101	0.049***	[0.027, 0.071]	0.065***	[0.036, 0.094]
		(4.384)		(4.455)	
Law	0.115	0	[-0.018, 0.017]	-0.002	[-0.021, 0.017]
		(-0.052)		(-0.207)	
Nursing	0.064	-0.007	[-0.025, 0.011]	-0.002	[-0.023, 0.02]
		(-0.745)		(-0.171)	
Engineering	0.111	0.008	[-0.004, 0.021]	0.006	[-0.007, 0.018]
		(1.291)		(0.867)	
Medicine	0.179	-0.001	[-0.018, 0.016]	-0.009	[-0.03, 0.012]
		(-0.073)		(-0.848)	
Psychology	0.061	0.009*	[-0.001, 0.019]	0.009	[-0.003, 0.02]
		(-1.676)		(1.52)	
Veterinary	0.038	-0.011*	[-0.023, 0.001]	-0.015**	[-0.029, -0.001]
		(-1.756)		(-2.067)	
Observations		54,586		38,470	
Province trends		✔	✔	✔	✔
Controls		✘	✔	✘	✔

Notes: This table reports the marginal effects resulting from estimating equation 1 using a multinomial logit model. Each column is a separate regression. The largest category, economic sciences, is used as the baseline. Province refers to province of birth and cohort is computed based on date of birth. Controls include age, gender, and parental characteristics. Province-clustered standard errors are in parentheses (clusters: 19).
Source: Universidad de la Republica 2006–2016.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A18: Effect of intervention on university students **by public/ private school status**

	Sector trends	Technological major	Computer major	Enrollment across fields	Previous college	Scholarship application	First generation
		(1)	(2)	(3)	(4)	(5)	(6)
A. Complete sample							
ITT	✘	0.0147	-0.00127	-0.00780	0.00590	0.0138	0.0242*
Robust SE		(1.27)	(-0.19)	(-1.26)	(1.48)	(1.18)	(1.82)
CI		[-0.079, -0.003]	[-0.034, 0.01]	[-0.003, 0.036]	[-0.018, 0.007]	[-0.064, 0.007]	[-0.079, 0.007]
ITT	✔	0.0450	0.0170	-0.0437**	-0.0129	-0.0346	0.0127
Robust SE		(1.25)	(0.82)	(-2.33)	(-0.98)	(-1.01)	(0.31)
IC		[-0.112, -0.004]	[-0.053, 0.009]	[0.008, 0.064]	[-0.013, 0.023]	[-0.032, 0.027]	[-0.088, 0.029]
Observations		28,300	28,300	28,300	28,300	21,575	28,300
B. Doughnut sample							
ITT	✘	0.0150	-0.00126	-0.00785	0.00588	0.0139	0.0241*
Robust SE		(1.30)	(-0.19)	(-1.27)	(1.47)	(1.19)	(1.82)
CI		[-0.093, -0.011]	[-0.039, 0.009]	[-0.007, 0.034]	[-0.018, 0.009]	[-0.082, 0.013]	[-0.076, 0.017]
ITT	✔	0.0515	-0.00127	-0.0430**	-0.0197	-0.0486	0.0281
Robust SE		(1.32)	(-0.06)	(-2.18)	(-1.38)	(-1.08)	(0.64)
IC		[-0.131, -0.013]	[-0.05, 0.019]	[0.004, 0.062]	[-0.01, 0.03]	[-0.042, 0.039]	[-0.096, 0.033]
Observations		20,058	20,058	20,058	20,058	13,334	20,058
		0.156	0.043	0.049	0.02	0.319	0.628
Controls		✔	✔	✔	✔	✔	✔

Notes. Panels A–D estimate equation 2 and show the estimate of θ. Controls include age and gender fixed effects, as well as parental characteristics. Regressions include 9 cohorts in total. Robust standard errors in parentheses.
Source: Universidad de la Republica 2006–2016.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A19: Effect of intervention on area of study at university **by public/ private school status**

	Sector-specific trends	A. Whole Sample			B. Doughnut Sample		
		Social Sciences	Science and Technology	Health	Social Sciences	Science and Technology	Health
		(1)	(2)	(3)	(4)	(5)	(6)
1. Montevideo							
ITT	✘	0.007	-0.037**	0.029*	0.046**	-0.042**	-0.004
T-statistic		(0.407)	(-2.384)	(1.736)	(2.247)	(-2.340)	(-0.215)
		[-0.028, 0.042]	[-0.067, -0.006]	[-0.004, 0.062]	[0.006, 0.087]	[-0.078, -0.007]	[-0.039, 0.031]
ITT	✔	0.022	-0.044*	0.022	0.057*	-0.041*	-0.015
T-statistic		(0.725)	(-1.831)	(0.759)	(1.926)	(-1.658)	(-0.580)
		[-0.037, 0.08]	[-0.091, 0.003]	[-0.035, 0.08]	[-0.001, 0.114]	[-0.09, 0.008]	[-0.067, 0.036]
Observations		53,041	53,041	53,041	34,874	34,874	34,874
2. Whole Country							
ITT	✘	-0.005	-0.033**	0.038**	0.027	-0.047***	0.020
Robust SE		(-0.294)	(-2.427)	(2.487)	(1.395)	(-2.871)	(1.123)
CI		[-0.036, 0.027]	[-0.06, -0.006]	[0.008, .068]	[-0.011, 0.065]	[-0.08, -0.015]	[-0.015, 0.056]
ITT	✔	0.026	-0.037*	0.011	0.028	-0.055**	0.027
Robust SE		(0.942)	(-1.726)	(0.430)	(0.862)	(-2.105)	(0.831)
CI		[-0.028, 0.079]	[-0.079, 0.005]	[-0.041, 0.064]	[-0.036, 0.093]	[-0.107, -0.004]	[-0.037, 0.091]
Mean		0.401	0.26	0.339	0.401	0.26	0.339
Observations		63,455	63,455	63,455	37,497	37,497	37,497
Province FE		✔	✔	✔	✔	✔	✔
Controls		✔	✔	✔	✔	✔	✔

Notes: This table reports the marginal effects resulting from estimating equation 2 using a multinomial logistic model. The largest category, social sciences, is used as the baseline. Province refers to province of birth and cohort is computed based on date of birth. Controls include age, gender, and parental characteristics. Robust and province-clustered standard errors are in parentheses.
Source: Universidad de la Republica 2006–2016.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A20: Robustness —effect of the laptop program on scholarship applications

	Mean[A]	A. Complete sample			B. Doughnut sample		
		ITT	CI	N	ITT	CI	N
Robust SE	0.319	-0.0186 (-1.12)	[-0.051, .014]	39,908	-0.0238 (-1.09)	[-0.067, 0.019]	24,705
Province cluster SE	0.319	-0.0186 (-1.64)	[-0.041, .004]	39,908	-0.0238 (-1.47)	[-0.056, 0.008]	24,705
Cohort cluster SE	0.319	-0.0186** (-2.50)	[-0.033, -0.004]	39,908	-0.0238 (-1.88)	[-0.049, 0.001]	24,705
Two-way cluster SE	0.319	-0.0186** (-2.66)	[-0.032, -0.005]	39,908	-0.0238 (-1.49)	[-0.055, 0.008]	24,705
Permutation SE	0.319	-0.0186	[-0.043, 0.098]	39,908	-0.0238	[-0.112, 0.125]	24,705
Collapsed sample	0.493	-0.324*** (-4.37)	[-0.472, -0.177]	123	-0.436*** (-4.44)	[-0.633, -0.238]	85
No controls	0.319	-0.0295 (-2.33)	[-0.079, 0.01]	39,908	-0.0415* (-2.539)	[-0.106, 0.005]	24,705
Year of enrollment	0.311	0.0001 (0.003)	[-0.031, 0.073]	48,736	0.00829 (0.565)	[-0.031, 0.075]	29,354
Quadratic trends	0.319	-0.0294* (-2.49)	[-0.08, 0.001]	39,908	-0.0597*** (-2.58)	[-0.168, -0.03]	24,705
Single linear trend	0.319	-0.0183 (-1.6)	[-0.053, 0.027]	39,908	-0.0254 (-1.62)	[-0.077, 0.035]	24,705
No younger siblings	0.319	-0.0258 (-0.92)	[-0.106, 0.059]	15,667	-0.0190 (-0.52)	[-0.113, 0.096]	9,801
Long-term w/ quadratic trends	0.319	-0.0298** (-2.37)	[-0.085, 0.003]	39,931	-0.0539** (-2.44)	[-0.158, -0.024]	24,728
Born in Montevideo	0.319	-0.0205 (-1.10)	[-0.057, 0.016]	21,575	-0.0262 (-1.06)	[-0.075, 0.022]	13,334
Province FE			✔			✔	
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate equation 1 and and show the estimate of θ. Controls include age, gender, and parental characteristics; outcome first generation excludes parental characteristics. Province refers to province of birth and cohort is computed based on date of birth. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces).

Source: Universidad de la Republica del Uruguay, incoming student survey, 2006–2016.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[A] Mean among treatment cohorts.

Table A21: Robustness —effect of the laptop program on science and technology

		A. Complete sample			B. Doughnut sample		
	Mean[A]	ITT	CI	N	ITT	CI	N
Robust SE	0.257	-0.0302**	[-0.057, -0.003]	54,901	-0.0421***	[-0.072, -0.012]	38,680
		(-2.19)			(-2.78)		
Province cluster SE	0.257	-0.0302*	[-0.064, 0.004]	54,901	-0.0421**	[-0.078, -0.006]	38,680
		(-1.74)			(-2.27)		
Cohort cluster SE	0.257	-0.0302	[-0.065, 0.005]	54,901	-0.0421*	[-0.081, -0.003]	38,680
		(-1.67)			(-2.14)		
Two-way cluster SE	0.257	-0.0302	[-0.071, 0.01]	54,901	-0.0421	[-0.088, 0.003]	38,680
		(-1.46)			(-1.81)		
Permutation SE	0.257	-0.0302	[-0.045, 0.046]	54,901	-0.0421***	[-0.061, 0.047]	38,680
Collapsed sample	0.221	0.0120	[-0.032, 0.056]	133	0.0102	[-0.04, 0.061]	95
		(0.55)			(0.40)		
No controls	0.257	-0.0401	[-0.075, 0.04]	54,901	-0.0505	[-0.089, 0.039]	38,680
		(-1.661)			(-1.897)		
Year of enrollment	0.248	-0.0192	[-0.037, 0.034]	69,352	-0.0284	[-0.046, 0.026]	48,732
		(-1.48)			(-2.13)		
Quadratic trends	0.257	-0.0347	[-0.059, 0.03]	54,901	-0.0535	[-0.081, 0.02]	38,680
		(-1.995)			(-2.709)		
Single linear trend	0.257	-0.0290	[-0.054, 0.034]	54,901	-0.0406	[-0.067, 0.029]	38,680
		(-1.652)			(-2.149)		
No younger siblings	0.257	-0.0266	[-0.057, 0.038]	20,499	-0.0267	[-0.059, 0.044]	14,262
		(-1.353)			(-1.288)		
Long-term w/ quadratic trends	0.274	-0.0588**	[-0.075, -0.01]	67,246	-0.0750**	[-0.094, -0.012]	53,321
		(-5.42)			(-5.234)		
Born in Montevideo	0.257	-0.0565***	[-0.095, -0.018]	29,912	-0.0699***	[-0.112, -0.028]	21,075
		(-2.90)			(-3.28)		
Province FE			✔			✔	
Province trends			✔			✔	
Controls			✔			✔	

Notes: Panels A and B estimate equation 1 and and show the estimate of θ. Controls include age, gender, and parental characteristics; outcome first generation excludes parental characteristics. Province refers to province of birth and cohort is computed based on date of birth. T-statistics and confidence intervals from the wild cluster bootstrap are presented in brackets (clusters: 19 provinces).
Source: Universidad de la Republica del Uruguay, incoming student survey, 2006–2016.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
[A] Mean among treatment cohorts.

B Program Characteristics

Plan Ceibal distributed the XO-1, a small, durable, efficient, low-cost laptop that functions much like a normal PC.[1] As described by one reviewer: "[t]he XO-1 won't ramp up your digital productivity or amaze you with hi-def visuals," but "it celebrates its ability to communicate with people around the corner or around the world, access information, design programs and manipulate music, sound or pictures."[2] The laptop features 128MB of RAM, 1GB of NAND flash memory, wireless networking, and a video camera. It's also

[1] The display is the most expensive component in most laptops and the key area where the XO cut costs. For more details, see CL1 Hardware Design Specification (2008).
[2] OLPC XO-1 (One Laptop Per Child) review, January, 2008: https://www.cnet.com/uk/products/olpc-xo-1-one-laptop-per-child/review/2/.

designed to be operated by children and is therefore durable and rugged. In addition to a standard plug-in power supply, human power and solar power sources are available, allowing it to be operated far from a commercial power grid. The wireless technology supports both standard and mesh networking, which allows laptops to network peer-to-peer, without the need for a separate router. The XO-1 uses a GNU/Linux operating system, and all its software is free and open source. It comes with basic (educational) software installed. Plan Ceibal reported in 2009 that among schools with connectivity that used the laptops in class, 90% of students navigated the internet, 60% used the writing software, and 15% used the drawing software, with a smaller share using the calculator, chatting, reading a book, and memorizing concepts.[3] Pricing for the XO was set to start at US$188 in 2006, with the goal to reach the $100 mark in 2008. When the program launched, the typical laptop retailed for well north of $1,000.

As of December 2016, 1,681,830 laptops and tablets had been dispatched by the program.[4] At $188 per laptop, this would imply a direct cost of about $300 million. However, the overall operational costs of Plan Ceibal were higher, about $500 million by 2017. As a reference, this equates to an average of 3% of Uruguay's annual education budget and 0.4% of its annual federal budget since 2007.[5] The ultimate cost of the program added up to approximately $600 per student.[6] The program was financed mostly with taxpayer money, as Plan Ceibal got its own portion of the federal budget. There is no evidence that this implied a decrease in expenditures in other areas of education—in fact, the economy was growing and the overall education budget was rising. The Inter-American Development Bank helped finance the program through two loans: $5 million in 2010 and $30 million in 2017.

C Treatment Assignment and Identification

C.1 Cohort Assignment

The ideal way to classify individuals into cohorts would be to know exactly the *school grade* they were enrolled in when the program reached their province. This information would obviate the need for partially treated ("in-between") cohorts. Unfortunately, this information is not available in any of my data sources. I estimate students' date of exposure to the laptop problem based on their date of birth, assuming that children start primary school at the compulsory starting age to determine their grade at the time of

[3] https://www.ceibal.edu.uy

[4] Memoria Explicativa de los Estados Contables al 31 de Diciembre de 2016, Centro Ceibal.

[5] Official Ceibal Financial records 2010–2016; Institute of Statistics; Government Budget 2006 and 2008.

[6] With 429,016 students enrolled in public primary and middle school in 2007 and assuming the number of students would have exactly doubled by 2016.

the program. In Uruguay, children can begin primary school if they are at least six years old in March or turning six by the end of April. This regulation is respected: all students enrolled in the first grade of primary school in 2006 were at least six years old by April 30, and an estimate based on this age law is the best predictor of being enrolled in first grade conditional on primary school enrollment.[7] Because date of birth is not available in the ECH survey, in the first part of the paper I use information on age, month, and year of observation to determine a student's probability of turning six by April of a given year, under the assumption that births are uniformly distributed across the year.[8] For observations occurring in October, the probability of being in one cohort or the following one is exactly 50%. For this reason, I eliminate that month from my dataset when using this method and classify individuals in the cohort for which the probability surpasses 50%. This way, misclassification error stays well below 25%.

My methodology for classifying individuals into cohort works well: about 80% of students who I classified in second grade were indeed enrolled in second grade. However, only about 50% remained enrolled in the right grade for their cohort by the end of middle school, which suggests that repetition is a non-negligible concern. More generally, almost 20% of students repeat grade 1, and only 40% of students enrolled in grade 12 in 2011 were in the correct age for the grade. But, conditional on starting middle school, 75% of students reached grade 12 at the expected time. I address this concern by identifying an in-between group in the analysis. In-between cohorts are those that would have never been exposed to the intervention if it weren't for the fact that a fraction of them were enrolled one or two years behind their age in school in their respective province. My empirical approach treats these cohorts differently (and even drops them) to ensure that my estimate is not biased toward zero. Even with a perfect cohort assignment, there could be a bias toward zero for individuals with younger siblings (50% of students have younger siblings aged 5 to 18 at home). Because students are encouraged to take their laptops home, program participants could affect their relatives.[9] Even if this is not the case, younger siblings can be a problem when estimating the effect of the program on the presence of computers at home. To address this concern, I limit the sample to individuals with no younger siblings aged 5 to 18 in their household —in all regressions that document the treatment effect on computer access, and in the robustness section for the rest of the results.

[7] From the Ministry of Education of Uruguay. Refer to web Appendix Figure A4 for more details.

[8] This simplifying assumption is well supported by vital statistics data; births are evenly distributed across the months of the year and there are no clear patterns over time.

[9] De Melo et al. (2014) report that approximately 30% of sixth graders shared their government laptop with siblings in 2009.

C.2 Province Assignment

The ideal way to assign individuals into provinces would be to know the exact province in which everyone attended primary and middle school. Unfortunately, I have this information only for a limited number of years and only for the university microdata. For the other data, I must decide between province of birth, province of residence, and province of past residence. Misclassification error is likely to create a bias toward zero, but the bias could go either way if migration was differential by treatment. If, for example, treated cohorts from the least developed provinces were more likely to migrate to the richer provinces than the previous cohorts, the effects might be downward biased.

Migration could bias my estimates. Uruguay is a highly centralized country—more than 40% of the population and educational opportunities are concentrated in Montevideo. Hence, cross-province migration exists and is likely to be correlated with educational choices. Using household survey data, I find two clear trend breaks in migration patterns by age. The probability of moving out of the province of birth is high before primary school (ages 0 to 5), plummets during formal education (ages 6 to 17), and spikes again after high school (ages 18–20). By the time they start primary school, 6% of students have already moved outside their birth-province; this percentage rises to 11% during the last year of high school and almost 15% at age 19. This trend suggests that individuals move to study or work after completing their formal education. Since migration out of province of birth is already non-negligible by the start of primary school, my strategy for dealing with migration is to use the previous province of residence when measuring outcomes among adults and to use province of current residence when measuring outcomes among children. I also conduct robustness checks using province of birth (this information is available in all my datasets.) Cross-country migration is also a potential concern, but I will not be able to account for it in my data.[10]

Finally, in one of my robustness checks I limit my dataset to Montevideo neighborhoods. Here migration is less of a concern, because treatment status does not depend on the neighborhood of residence, and because migrating for school or work is less necessary.[11] In 2011 the ECH survey included questions about cross-neighborhood migration: 83% of 18-year-old students who had lived in Montevideo for the past five years were still living in the same neighborhood as five years prior. This share is a bit higher among private school students relative to public school students (92% vs 80%).

[10] Net entries to the Carrasco Airport were increasing up to 2013, after which the trend reverts (net emigration represented 0.4% of the population in 2015). Unfortunately, the migration office is not able to separate this by age groups.

[11] Montevideo is small enough that it can be crossed from side to side in 1 hour by car, and has good public transport.

D Choice of Major Robustness Checks (Details)

In this section I go over various exercises that evaluate the robustness of the results among university students along different dimensions. For this purpose I focus on the two main takeaways: (1) there is no evidence that the program affected scholarship applications (and if anything, the association appears to be negative), and (2) there is strong evidence that the program was associated with a decline in enrollment in the broadly-defined area of science and technology. The results from this analysis are presented in web Appendix Tables A20 and A21. Table A20 overall corroborates the conclusion that there is a negative, statistically insignificant association between the laptop program and the share of students who applied for scholarships. Besides the private to public school comparison outlined above, this finding is robust to how inference is handled (robust standard errors, standard errors clustered by province, by cohort, or two-ways, permutation tests), to the exclusion of control variables, to the exclusion of students who live with a younger sibling, to replacing the province-specific trends by a nationwide trend, and to limiting the sample to students born in Montevideo. There are three exceptions to this: The relationship remains negative and similar in magnitude but becomes statistically significant when collapsing the sample at the province and state level, and when including quadratic trends; on the other hand, the relationship remains statistically insignificant but becomes positive in magnitude (although economically closer to zero) when defining cohorts based on year of enrollment rather than year of birth. Table A21 overall corroborates the conclusion that the program was associated with a decline in enrollment in the broadly-defined area of science and technology. While the degree of statistical significance varies across the tests, the estimate switches sign to indicate a positive relationship when the sample is collapsed by province and cohort. Although this exercise is interesting I do not find it compelling: over 50% of the students in the sample were born in Montevideo and the majority of majors are offered only in that province, hence assigning the same weight to each province is likely to bias the estimate.

The findings in the second part of the paper have proven to be more complex than in the first part of the paper. The two main findings are that the program had no effect on scholarship applications and that it was associated to a lower probability of enrolling in science and technology, relative to the social sciences. In retrospect, the former is to be expected given that the program did not affect overall educational attainment in the population, that the scholarships available in Universidad de la Republica were widely popular even among the cohorts who were not exposed to the laptop program, and that even though students can fill the initial application form online, completing the process still requires bringing in documents in person. I found the latter result more puzzling given the fact that graduates from STEM majors in the public university system showed the highest level of satisfaction overall and the highest employment rates, not to mention higher salary satisfaction relative to graduates of the social sciences. However, it is also the case that the laptop program led to a growth in the supply and demand for quick technical degrees in computer and technology outside of the public university system, that the debate around the effects of this program and criticism to the lack of initial effects could have made technology less appealing, and that interest or knowledge in computers does not necessarily translate to an undergraduate degree in that area. Moreover, the effect of computers in major of choice could be very immediate (ex.: result from searching the internet short before deciding to enroll), and it was already established that at college-entry age the older cohorts of students had converged to the younger cohorts in terms of computer access. Finally, the the fact that these laptops used a rather obscure interface may have made it harder for students to learn how to use these laptops and to transfer their knowledge to other computers later on.

References

Gioia De Melo, Alina Machado, and Alfonso Miranda. The impact of a one laptop per child program on learning: Evidence from uruguay. 2014.