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ABSTRACT

The Effect of Access to Information and Communication Technology on Household Labor Income: Evidence from *One Laptop Per Child* in Uruguay*

This paper examines the effect of the *One Laptop Per Child* program in Uruguay [*Plan Ceibal*] on household labor income. Since 2007, the Uruguayan government has delivered one laptop to every child and every teacher in public primary schools. This program has considerably increased access to information technology within households since evidence shows that parents make use of the technology. Households in the department of Florida received laptops in 2007, while those in the department of Canelones received them in 2009. Therefore, using data from Household Surveys from the National Institute of Statistics in Uruguay, a *difference-in-difference* model is estimated to capture the effect of the plan of giving laptops on labor income [either total or hourly income]. The results indicate that there is a statistically significant *positive* effect of this plan on the labor income of those households *below* the median income. Such findings call for a plan that is more targeted to give laptops to *low-income* households, where parents possess less computer skills and the program has a greater potential.

JEL Classification: H41, H52, J31, O33

Keywords: technology, laptop, Uruguay, labor income, difference-in-difference, median income

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I. Introduction

This paper analyzes the effect of the recent increase in access to Information and Communication Technology (ICT, hereafter) on household labor income in Uruguay. Since 2007, under the name of *Plan Ceibal*, the Uruguayan government has delivered XO laptops[i], and eventually, Internet connections, to every child and every teacher in public primary schools. The program's objective is to close the prevailing digital divide that can potentially exacerbate the existing income inequality (Schiller, 1981).

Although children are the ones receiving the laptops, other household members make active use of the technology: 57% of the parents use the laptops to acquire computer skills, 45% to gather information and 31% to navigate the Internet (Plan Ceibal, 2012). Thus, economic theory and the literature suggest that a positive impact on household labor income can be expected. The aim of this paper is to explore the impact of the recent expansion of access to ICT over household labor income in Uruguay.

This study is timely for several reasons. *First*, it contributes to the limited literature on the impact of the access to ICT at home only. Most of the work in the field focuses on returns to computer skills and Internet use at the workplace. *Second*, it is the first one to explore the effect of the OLPC program on household labor income in Uruguay. *Third*, it is one of the few "*natural experiments*" in the field since increases in ICT access do not happen frequently on such a large scale. *Fourth*, it examines over-time changes as opposed to many other studies that only use cross-sectional data.

A *double difference model* is implemented to capture the outcome of the program on household labor income. The control group consists of households in the department[ii] of Canelones where the plan started in 2009. The treatment group includes households in Florida where households first received laptops in 2007. Using a Mincer equation and controlling for gender, ethnicity, civil status, rural location, access to other ICT devices and the number of XO laptops, results suggest no significant effect on all households, but a significant one on lower-income households. Those below the median income that have received at least one XO laptop have total and hourly labor incomes 37% and 33% higher than their counterparts, respectively. Therefore, these results call for the implementation of policies that target low-income families.

The literature on the impact of ICT access at home is limited since most studies explore the effects at the workplace. Some of them use cross-sectional data while others look at changes over time by using panel data. The following section develops on the economic literature of the impact of ICT access on income.

II. Background

One of the main issues associated with cross-sectional works is selectivity bias. Krueger (1993), considered the pioneering cross-sectional work in the field, uses the U.S. Current Population Survey (CPS) from 1984 to 1989 and finds that using a computer at home is associated with 9% higher earnings. Nevertheless, DiNardo and Pischke (1997) also find a wage differential associated with the use of pencils, telephones and calculators, and argue that Krueger's results suffer from selectivity bias. The authors sustain that even though a higher wage can result from using technology at work, it is also conceivable that higher-wage workers are the ones who use computers on their jobs (reverse causality). Different scenarios illustrate this phenomenon (Di Maggio and Bonikowski, 2008). First, employers may select more qualified workers to adopt new technologies (Entorf and Kramarz, 1997). Second, firms with better performance are more able to adopt new technologies and pay higher wages relative to firms that perform worse in the market (Domes, Dunne and Troske, 1997). Third, it is easier for firms with more skilled workers to adopt new technologies (Acemoglu, 2002).

Other cross-sectional studies for the United States find a positive impact of Internet use on earnings. Goss and Phillips (2002) and Freeman (2002) also use the CPS and conclude that the wage premium resulting from Internet use is approximately 13.5% and 14%, respectively. Navarro (2010) uses cross-sectional data from Brazil, Chile, Costa Rica, Honduras, Mexico and Paraguay and finds that returns from Internet use range from 18% to 30% for both salaried and self-employed workers. Additionally, Internet use for productive purposes yields positive returns for self-employed workers in Brazil and Chile.

In order to overcome selectivity bias, researchers have used panel data. Concerning the effect of ICT access at the workplace, Oosterbeek and Ponce (2009) conclude that unobserved worker characteristics, and not computer use, among Ecuadorian workers explain the wage premium associated with increases in productivity. Entorf and Kramarz (1997) and Haisken-DeNew and Schmidt (1999) reach similar conclusions using data sets from France and Germany, respectively. Other studies support the same results (Borghans and ter Weel, 2005; Sakellariou and Patrinos, 2003).

On the other hand, Dostie et al. (2009) use the Canadian Workplace and Employee Survey (1999-2001) and conclude that there is a positive impact of computer use after controlling for selectivity bias and unobservable characteristics. The authors implement a mixed effects model (individual fixed effects and matched employer-employee data) and find a 4% return to computer use at the workplace. Using the National Longitudinal Survey of Youth for the years 2000, 2002, 2004 and 2006, Danyal et al. (2011) implement a fixed-effects model and find that individuals possessing computer skills (defined as having a personal computer at home) earn a 4.8% wage premium. Arabsheibani et al. (2004) use data from the British Social Attitudes Survey for 1985 and 1990 and implement the Heckit technique to correct for selectivity bias. Their results show that two thirds of the wage differential between computer users and non-users is explained by computer use.

Pabilonia and Zoghi (2005) argue that using fixed-effects models to control for unobserved worker characteristics does not control for time-variant unobserved skills. Hence the authors use matched workplace-employee panel data from Canada and instrument computer possession in order to correct for selectivity bias. They find no statistically significant effect of computer use on wages but a significant one of computer experience on earnings. That is, a worker with average computer experience earns 13.5% more than a non-computer user. The authors conclude that computer experience as a proxy for computer skills, and not computer use independent of skills, generates a wage differential. Other studies follow the same direction (Borland, Hirschberg and Lye, 2004; Dickerson and Green, 2004).

Evidence of a positive return to Internet use is also found in the literature. Di Maggio and Bonikowsky (2008) observed that Internet users in the United States experienced a higher wage increase relative to non-users between 2000 and 2001 (Current Population Survey). The returns were significant for Internet use in both places (work and home) as well as only at home. In the same line and using the same database for 1997, Kim (2003) finds a positive return to information-seeking activities on the Internet.

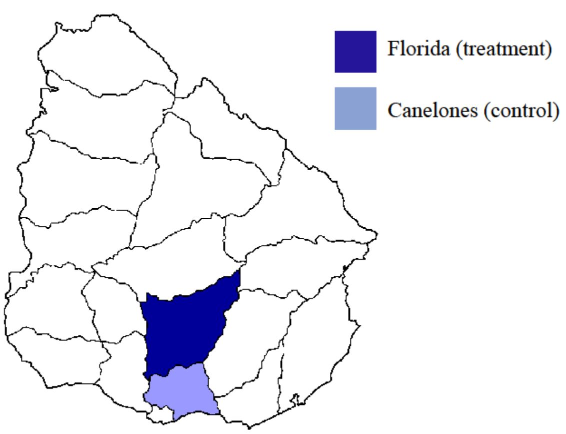
Hence the diverse literature on the effect of ICT on earnings indicates that two big challenges arise when estimating such effect: endogeneity of the treatment variable (selectivity bias) and controlling for unobserved (both time variant and invariant) individual characteristics.

III. Methodology and Empirical Analysis

Becker (1962) is the first work to compose a theory of human capital where factors other than physical capital help explain economic growth and income inequality. Such factors include intangible skills acquired from on-the-job training, schooling and gathering information, among others.

This paper intends to capture the return to investing in human capital by enjoying a greater access to technology and information at home. The evidence shows that around half of the parents whose children received laptops use the devices for information-seeking activities and computer skills acquisition. So an important theoretical expectation would be an increase in household labor income as a result of investing in human capital. The following empirical model attempts to capture these investment returns at the household level.

Figure 1: Map of Uruguay



The laptop delivery process suggests the existence of a natural experiment so a *double difference model* is estimated. The program started in the department of Florida in 2007 and reached the department of Canelones in 2009. Thus the treatment group consists of households in Florida that are eligible for the plan, while the control group contains households in Canelones with the same eligibility characteristics.[iii]

Since the survey does not follow the same collection of households, treatment and control groups contain different number of observations for each year. In 2006, the two groups consist of 245 and 687 households, respectively, while in 2009 they comprise 275 and 677 households, respectively.

Macro and micro evidence support that the common trend assumption is not violated. *Figure 2* and *Figure 3* confirm that GDP growth (1985-2006) and income per capita (1990-2012) have very similar trends for Canelones and Florida, which makes households in Canelones a strong control group for those in Florida.

Figure 2: GDP in current dollars (1985-2006)
Source: Office of Planning and Budget (Uruguay).

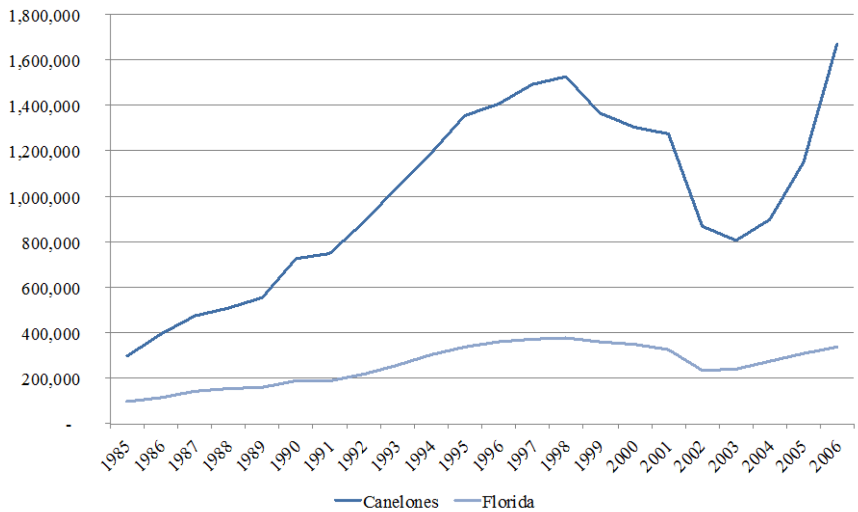
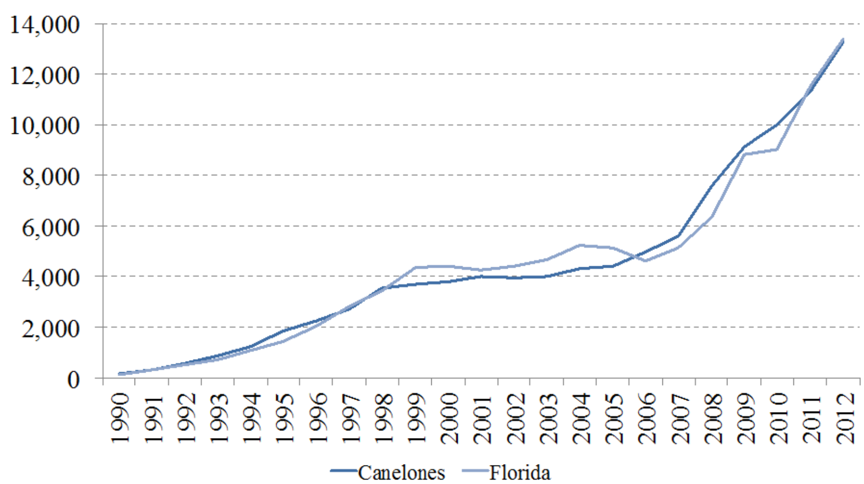


Figure 3: Per capita monthly average income in urban households in current pesos (1990-2012)
Source: National Institute of Statistics (Uruguay)



The basic specification consists of the following *Mincerian* equation:

$$\ln(LABINC_i) = \beta_0 + \beta_1 F_i + \beta_2 A_t + \beta_3(\boldsymbol{F_i} * \boldsymbol{A_t}) + \beta_4 educ_i + \beta_5 exp_i + \beta_6 exp_i^2 + \boldsymbol{HHhead\varphi} + \boldsymbol{HHICT\phi} + numlaptops_i + rural_i + \varepsilon_i$$

The binary variable $\boldsymbol{F_i}$ indicates that a household is located in Florida [i.e., ‘treatment’ group] and $\boldsymbol{A_t}$ that it was observed in 2009 [i.e., ‘after’ the program has been implemented]. The coefficient β_3 of the interaction term between these two variables $(F_i * A_t)$ is the *double* *difference estimator*, which in this model captures the effect of ICT access on household labor income. Education and experience refer to the household average schooling and potential experience. The vector $\boldsymbol{HHhead}$ contains head of the household dummies (white, male and married), while the vector $\boldsymbol{HHICT}$ includes dummies that indicate the possession of other ICT devices such as non-XO computers, cellphones, cable TV and radio. Controlling for access to other ICT devices does not attempt to establish any causal relationship but to isolate the effect of other channels whereby information can enter the household. Other control variables are the number of XO laptops in a household and a binary variable indicating that a household is located in a rural area.

This paper focuses mainly on the effect of the program on low-income households. For this, the sample is segmented to households below the natural log of median income. The segmentation is done separately for each of the four subgroups (treatment and control groups in 2006 and 2009) in order to preserve the sample proportionality.

Data come from the 2006 and 2009 Continuous Household Surveys from the National Institute of Statistics in Uruguay. *Table 1* contains the summary statistics [iv] of the households below the median income, and the relevant regression results are presented in *Table 2* (see *Appendix D* for overall sample regression results).

Table 1 [about here]

An average household from this data set earns 8,152 Uruguayan pesos per month, which is equivalent to 39 pesos per hour worked. This piece of information, together with the fact that all children attend public primary school, confirms that the sample consists mainly of low-income households. Treated households account for 28% of the observations, while those surveyed in 2009 are about half of the segmented sample. On average, fully employed members have attended school for approximately 7 years (less than completing middle school) and have an average potential experience of 28 years. There are on average 4 members and 2 children per household, and 15% of the households are located in rural areas. Around 73% of the heads of household are male, 98% white and 51% married. The numbers also show that 20% of the households own a non-XO computer, 37% have cable TV service, 93% possess a radio and 83% have at least one cellphone. The number of XO laptops is on overage 0.19 per household.

As expected for a cross-sectional data set, the χ^2 values from the Breusch-Pagan/Cook-Weisberg test confirm the presence of heteroskedasticity.[v] In order to cope with possible endogeneity in *average education*, the number of under-14 children in the household is used as an instrumental variable.[vi] Even though the t-tests from the first-stage regressions suggest this is a strong instrument, the Hausman test reveals that average education is not endogenous. That is, school attendance does not seem to depend strongly on household income for this segmented sample.

Table 2: **Regression** results based on sample below the median income

Dependent variable[s]:	**Total income** (1)	**Hourly income** (2)
Independent variables		
F [Treatment]	-0.0515	-0.085
	(0.0703)	(0.0703)
A [After]	0.1477***	0.0939*
	(0.0547)	(0.0501)
F * A	**0.3744*** **	**0.3258** **
	(0.1219)	**(0.1347)**
Average education	0.0405***	0.0639***
	(0.0079)	(0.0082)
Average experience	0.0426***	0.0273***
	(0.0082)	(0.0069)
Average experience squared	-0.0007***	-0.0003***
	(0.0001)	(0.0001)
Male head of household	0.1022*	0.0443
	(0.0607)	(0.0584)
White head of household	-0.0963	-0.0925
	(0.1235)	(0.1475)
Married head of household	0.0415	0.0589
	(0.0487)	(0.0473)
Non-XO computer	-0.0483	-0.081
	(0.0547)	(0.0573)
Cable TV	0.0984**	0.0855*
	(0.0434)	(0.0465)
Radio	0.2139*	0.0663
	(0.1189)	(0.0914)
Cellphone	-0.0747	-0.0689
	(0.0640)	(0.0580)
Number of XO laptops	-0.0905	-0.0677
	(0.0662)	(0.0730)
Rural	0.0517	0.0422
	(0.0585)	(0.0552)
_Constant	7.7481***	2.5034***
	(0.2289)	(0.2118)
No. of Obs.	940	940
R-Squared	0.16235	0.12136

* p<0.10, ** p<0.05, *** p<0.010
Note: robust standard errors ( ).

For those below the median income, the *double-difference estimator* indicates that the program has had a statistically positive significant effect on total labor income (*Table 2*). Families that received laptops in 2007 in Florida earn 37.4% more total income than their counterparts in Canelones. This result is significant at the 1% level. In terms of the Mincer-equation variables, both education and potential experience yield significant results at the 1%

level. The rate of return to education is 4% for every additional year of schooling, while the marginal effect of average experience at the mean is -11.4% for every year of experience. The total-income differential for a male head of household is 10.2%, whereas ethnicity and marital status do not yield significant results. In terms of access to ICT devices, possessing cable TV and radio is associated with 9.8% and 21.4% higher total income, respectively. Other devices and rural location do not generate significant coefficients.

The program has also had a statistically positive significant effect on hourly income for households below median income. Treated households in Florida earn on average 32.6% more per hour than non-recipients, which is statistically significant at the 5% level. Similarly, all Mincer-equation variables yield significant results at the 1% level. In relation to schooling, every additional year of average education is associated with a 6.4% increase in hourly labor income. A one-year increase in potential experience determines a 4.9% decrease in hourly income at the mean, while no head of household characteristic is statistically significant in the model. Only cable TV is significantly associated with hourly income, with an 8.5% differential, whereas rural location does not yield a significant coefficient.

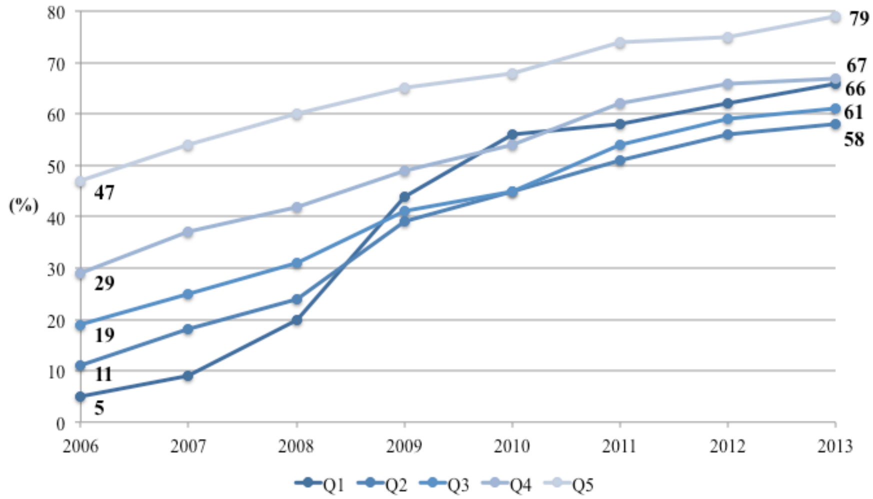
Even though the estimated return to computer and Internet use might seem unrealistically high for a 2-year period (37.4% and 32.6% for total and hourly income, correspondingly), the fact that the segmented sample contains mostly low-income households leads to the following considerations. First, an above 30% increase in wages for these households is not a significant amount in absolute terms. At the mean, the outcome on household labor income is 3,052 constant pesos (November 2009), which is equivalent to PPP USD 243.75. For hourly income, the increase is equal to PPP USD 1.02. A lower return might seem more realistic but not economically significant. Second, Uruguay is a developing economy so the return to information technology is expected to be greater than in developed countries. This is because skilled workers are scarcer in developing economies relative to non-skilled ones.

IV. Conclusions and Policy Implications

Those below the median income that received laptops in 2007 earn 37% and 34% more than non-recipients in total and hourly income, respectively. The *double difference model* captures no statistically significant effect in the overall sample (see *Appendix D Table 4*) and in those above median income.

Pre-existing differences in ICT access help explain such results. According to Ceibal Center, 47% of households in the highest quintile owned a computer in 2006 while in the lowest quintile only 5% had access to a computer at home (see *Figure 4*). By 2013, as a result of the program, these numbers had drastically increased to 79% and 66%, correspondingly. Thus higher-income households were more likely to already have access to ICT before the plan started, while only a small percentage of lower-income households enjoyed such access. This supports the idea that the program did not constitute a substantial change for households that already had computers at home prior to the treatment. Households where the program considerably increased access to the technology experienced an increase in income.

Figure 4: Access to home computer per income quintile
(percentage of households)
Source: Plan Ceibal



The potential impact of Ceibal in reducing inequality has not been maximized yet. The program currently provides parents with training on computer and Internet skills but 82% of them had not received any training in 2011. Only 21% of mothers from the lowest socioeconomic level[vii] used a computer at home, while 86% from the highest level reported to use one (for fathers, these figures are 9% and 71%, respectively). Additionally, 16% of those at the highest level did not know how to use the laptops against 44% at the lowest level (Plan Ceibal, 2012). These numbers show that if low-income household members seem to benefit more, but half of the parents from these households do not have the skills to use the laptops, then targeting these households would be highly beneficial in terms of diminishing income inequality.

Therefore, two options of policy recommendations follow from the results. The first one would be to reduce Ceibal spending by targeting only low-income households, while the second one would be an increase in the program's budget in order to pursue the same objective. The former gives priority to public spending efficiency by reducing the resources used in the program and possibly transferring the surplus to other programs that also prove to be beneficial. Assuming that the optimal income threshold is the median income (that is, there is no benefit above this limit), the welfare loss associated with the existing program equals 42.7% of Ceibal total budget or 1.3% of total spending in public education (see *Appendix E Table 5*).

Nevertheless, this option has several weaknesses. First, the optimal income threshold might be different from the one used in this cost saving calculation (i.e. median income). Second, given the nature of public education in Uruguay, selecting families based on household labor income would not enjoy much public support. Third, and probably the most important one, other potential benefits are totally ignored. For instance, Mane and Bishop (2006) find that children whose families made early investment in computer skills were later rewarded in the labor market. It is definitely too early to evaluate labor market outcomes among those pupils who received laptops.

On the other hand, a budget increase would pursue an equity objective by maintaining the program's universality. This option would certainly have greater public support than targeting only low-income households. The issue lies on the current government's inability to expand public spending. Official figures indicate that the local economy will grow 3% in 2014 and accumulate a fiscal deficit of 3.3% by the end of the year[viii]. Moreover, the Uruguayan economy is not expected to grow as fast as in the past decade, which will certainly have an impact on the public budget and on the upcoming government's spending decisions. Therefore, a rise in total Ceibal spending so as to target low-income households could encounter important budget limitations.

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Table 1: **Summary Statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Income and hours worked					
Real total labor income	940	8152.23	3886.90	104.10	17509.48
Hourly real labor income	940	39.19	29.96	0.62	457.81
Log of total real labor income	940	8.83	0.70	4.65	9.77
Log of hourly real labor income	940	3.46	0.66	-0.49	6.13
Hours worked (household)	940	56.77	27.59	1	254
Household characteristics					
Treatment (household in Florida)	940	0.28	0.45	0	1
After (year 2009)	940	0.51	0.50	0	1
Average education	940	7.37	2.98	0	17
Average age	940	41.00	12.85	14	84
Average potential experience	940	27.63	13.77	0	72
Households members	940	4.54	1.58	1	12
Children	940	1.91	1.14	0	7
Rural household	940	0.15	0.36	0	1
Head of household characteristics					
Male head of household	940	0.73	0.45	0	1
White head of household	940	0.98	0.15	0	1
Married head of household	940	0.51	0.50	0	1
ICT access					
Home computer	940	0.20	0.40	0	1
Cable TV	940	0.37	0.48	0	1
Radio	940	0.93	0.25	0	1
Cellphone	940	0.83	0.38	0	1
Number of XO laptops	940	0.19	0.52	0	4

Source: Continuous Households Survey, 2006 and 2009. National Institute of Statistics (Uruguay)

Appendix A: Variables definitions of key variables and data sources

Real total labor income = total labor income received by fully employed members the month prior to the interview. So the CPI from November 2009 is used as the base month for December 2009 earnings in order to convert from nominal to real labor income. Fully employed individuals are selected because their job condition is relatively more stable and thus so are their wages and working hours.

Real hourly labor income = real total labor income over the potential number of hours that fully employed household members worked. The potential number of hours is the number of weekly working hours reported times 4.29 (the number of weeks in a month).

Treatment = binary variable indicating that a household is located in Florida.

After = binary variable indicating that a household was observed in 2009.

Treatment * After = interaction term between *Treatment* and *After*. The coefficient of this term is the *double difference estimator*.

Average education = average years of schooling among household members who are fully employed.

Average experience = *Average age* – 6 – *Average education*. This specification suggests that individuals enter the labor market right after they finish education, assuming they started school at the age of 6. For this purpose, the variable on schooling excludes attendance to preschool education. Including potential labor experience allows controlling for the effect of both age and experience on earnings.

Male head of household = a binary variable indicating that the head of household is male.

White head of household = a binary variable indicating that the head of household is white.

Married head of household = a binary variable indicating that the head of household is married.

Children = number of children under the age of 14 in a household.

Home computer = a binary variable indicating that a household possesses a non-XO computer. Unfortunately, it is impossible to differentiate between the possession of a XO-computer and a non-XO computer in the 2009 survey. Thus Internet connection in 2009 is used as a proxy for having a non-XO device.

Cable TV = a binary variable indicating that a household has access to cable TV.

Radio = a binary variable indicating that a household has access to radio.

Cellphone = a binary variable indicating that there is at least one cellphone in the household.

Number of XO laptops = number of XO laptops a household received from Ceibal.

Data sources:
2009 Continuous Household Survey. National Institute of Statistics (Uruguay).
2006 Continuous Household Survey. National Institute of Statistics (Uruguay).
Link to website: http://www.ine.gub.uy/

Appendix B: Supplementary testing results

***Table 3*: Hypothesis testing**

Specification test	Overall sample		Segmented sample	
	Total income	*Hourly income*	*Total income*	*Hourly income*
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity (χ2-value)	50.59***	23.43***	96.66***	7.36***
T-test for the strength of the instrumental variable (t-value)	-4.08***		-2.85***	
Hausam test for the endogeneity of *Average education* (t-value)	0.01	1.32	-0.95	0.54

* p<0.10, ** p<0.05, *** p<0.010

Appendix C: Sample selection

The 2006 Continuous Household Survey does not include a question on XO-laptop possession. However, since laptops are delivered to all pupils and teachers in public primary schools, eligible households in 2006 are those in Florida and Canelones with at least one member that would attend or work in a public primary school the year after when the program began. These households can be identified as those with at least one primary school teacher, a 5-year old child not attending primary school yet or a child attending between the first and the fifth year of public primary school.

This identification makes a few assumptions. It assumes that primary school teachers will not quit their jobs in 2007, that every 5-year old child will start public primary school in 2007 and that every child attending public primary school will continue enrolled in 2007. The 2006 survey supports this approximation. The percentage of households in this survey with at least one primary school teacher, one 5-year old child and one child attending between the first and the fifth year of public primary school is 22.8%. The percentage of those with at least one primary school teacher and one child attending public primary school is 22.6%.

Moreover, the 2006 data set does not distinguish between public and private primary school teachers. Nonetheless, data from the Education Observatory of the National Administration of Primary Education indicate that a large majority of schools in these two departments are of public administration: 95% in Florida and 80% in Canelones. Therefore, selecting all primary school teachers (both public and private) should not lead to an important overestimation of the quantity of primary teachers that work in public schools.

The 2009 survey includes a question on XO-laptop possession. Thus the identification of households in Florida and Canelones for this particular year is done directly through this variable. As those in Canelones received the devices in 2009, we can assume that no income effect is observed yet and thus they constitute a strong control group.

Appendix D: Table 4 Overall sample regression results

Dependent variable[s]:	**Total income** (1)	**Hourly income** (3)
Independent variable		
***F* [Treatment]**	-0.0819	-0.0617
	(0.0628)	(0.0548)
***A* [After]**	0.0749	0.0649*
	(0.0461)	(0.0376)
F * A	**0.1667**	**0.114**
	(0.1097)	**(0.0959)**
Average education	0.0988***	0.1030***
	(0.0061)	(0.0052)
Average experience	0.0634***	0.0394***
	(0.0067)	(0.0054)
Average experience squared	-0.0010***	-0.0005***
	(0.0001)	(0.0001)
Male head of household	0.1583***	0.1119***
	(0.0494)	(0.0413)
White head of household	-0.0532	0.0147
	(0.1064)	(0.0937)
Married head of household	0.0926**	0.027
	(0.0394)	(0.0343)
Non-XO computer	0.1028**	0.0474
	(0.0407)	(0.0364)
Cable TV	0.1286***	0.0889***
	(0.0379)	(0.0336)
Radio	0.1245	0.0667
	(0.0899)	(0.0654)
Cellphone	-0.1223**	-0.0742*
	(0.0550)	(0.0441)
Number of XO laptops	-0.0097	0.0024
	(0.0625)	(0.0541)
Rural	0.0172	-0.0262
	(0.0500)	(0.0405)
_Constant	7.5541***	2.1514***
	(0.1854)	(0.1425)
No. of Obs.	1884	1884
R-Squared	0.26545	0.2497

* p<0.10, ** p<0.05, *** p<0.010; Robust SEs ( )

Appendix E: Table 5 Cost saving calculation

Cost per child (constant 2006 pesos)*	1,207
Number of laptops above median income (2013 Household Survey)**	298,502
Total spending in public education in 2011 (constant 2006 pesos)***	28,091,000,000
Ceibal spending in 2011 (constant 2006 pesos)***	844,000,000
Spending on laptops above median income (constant 2006 pesos)	360,270,080
Spending on laptops above median income (% Ceibal spending)	42.7%
Spending on laptops above median income (% total spending in public education)	1.3%

* The cost per child was 2,040 Uruguayan pesos per year in 2013, which is equivalent to 1,207 constant 2006 pesos.

** The median income comes from the sample used in this paper, which is equal to 14,043 constant 2006 pesos. This amount is assumed to be the optimal income threshold.

*** *Source:* National Institute of Statistics.

Endnotes

[i] Inexpensive laptop created by the MIT Media Lab.

[ii] "Department" refers to the administrative divisions of Uruguay. There are 19 departments in the country; Florida and Canelones are two of them.

[iii] See *Appendix C* for a detailed description of the sample selection.

[iv] See *Appendix A* for variables definitions of key variables.

[v] See *Appendix B* for supplementary testing results.

[vi] Various reasons support the selection of this instrument. First, the number of children is not highly correlated with household labor income (dependent variable). Second, it is not correlated with the error term that captures unobserved variables such as ability. Third, there is a strong correlation between the number of children and household average education since raising a child implies a decrease in the available resources individuals can devote to career investments.

[vii] The *socioeconomic level index* is constructed by the *Institute of Statistics* from the *Department of Economics and Administration* at *Universidad de la Republica* in Uruguay. The index considers the following variables: the mother's educational attainment, household overcrowding conditions and possession of appliances and technologies (Plan Ceibal, 2009).

[viii] Accountability and Balance of Budget Execution 2013 (2014).