

The Effect of Computer Use on Child Outcomes

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Abstract

This paper examines the impact of having access to a home computer on child and adolescent outcomes. To avoid the bias due to non-random access to home computers, we exploit a unique government program which provided vouchers towards the purchase of a personal computer for low-income children enrolled in Romanian public schools. Since the fixed number of vouchers were allocated based on a simple ranking of family income, this program affords a stark regression discontinuity which allows comparisons across students very similar in family income and other respects, but who experienced markedly different access to a computer at home. In 2007, we conducted a household survey of children who participated in the program in 2005. Using these data, we show that children who received a voucher were 50 percent more likely to own a computer. Next, we show that receipt of a voucher had a large impact on time spent in front of the computer and decreased the amount of time spent watching TV and doing homework. Children in household that won a voucher also report having lower school grades and lower educational aspirations. There is also suggestive evidence that winning a voucher is associated with negative behavior outcomes. Nevertheless, we find that having a stay-at-home mom and the presence of rules regarding computer use do mitigate some of the negative effects of winning a computer voucher, indicating that parental monitoring and supervision may be important mediating factors.

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1 Introduction

The development of the personal computer in the late 1970s enabled households to purchase a computer for the home, and children to gain access to an important new technology. At present, over three-quarters of all American children aged 3 to 17 years live in a household with a computer. (U.S. Census Bureau, 2005) However, large disparities in computer ownership by race and family income remain. Data from the 2003 Current Population Survey (CPS) indicate that less than half of children with family incomes under \$25,000 lived in a household with a computer, compared to 92 percent of those with family incomes over \$100,000. Furthermore, access to computer technology is far less common among children in developing countries, and the disparities between the rich and poor are often much greater. Estimates from the OECD's 2003 Programme for International Student Assessment (PISA) show that most 15 year old students in developed countries have access to a computer at home (91 percent in the United States). In contrast, only about half of 15 year olds enrolled in school have access to a home computer in emerging Eastern European countries such as Poland, Latvia and Serbia.¹ Among 15 year olds in the bottom SES quartile within these countries, fewer than a quarter have access to a home computer.² (OECD, 2005)

Many government and non-governmental organizations are trying to bridge this "digital divide" across nations and between households. For example, Brazil embarked on some of the earliest government-run initiatives to bring inexpensive computers to its citizens. In 2003, the government announced a new plan to encourage domestic manufacturers to develop inexpensive consumer PCs for Brazilians with incomes between \$140 and \$1,400 USD. (Rebelo, 2005) Most recently, the One Laptop per Child (OLPC) program has received substantial publicity in its efforts to develop a cheap laptop computer suitable for children

¹This is probably an understatement of cross-country disparities in access since 15 year olds who remain enrolled in school in developing countries are more likely to come from advantaged family backgrounds.

²This fraction is substantially lower for less-developed countries such as Thailand, Tunisia, and Turkey, and essentially zero for countries in sub-Saharan Africa and parts of south Asia.

in developing countries. Peru and Uruguay have already placed orders for thousands of computers while others, such as Ethiopia, Thailand, and Nigeria have made preliminary commitments. (eWeek, 2007) Even in cases where these computers are provided for school use, they are also intended to serve as home computers.³ However, these major efforts to increase computer access among children are happening despite relatively little credible evidence regarding the effect of home computers on children's educational and behavioral outcomes.

The risks and benefits of increased computers use among children have been a matter of substantial public debate. As with concerns about television, many have expressed the worry that children might become "addicted" to interactive computer products.⁴ Some negative physical consequences are clearly associated with long periods of computer use, such as repetitive strain injuries, eye strain, and increased risk of obesity. Excessive computer use is also hypothesized to lead to decreased social involvement and isolation. If computers are used for playing games or for accessing the Internet, children may be exposed to adult content that can have detrimental effects on social and behavioral outcomes. More generally, it is possible that time spent on computers displaces other activities more valuable from a developmental perspective. On the other hand, computers may help introduce children to an important new technology. This may foster the development of computer skills which lead to better labor market outcomes as adult.⁵ Computers may also facilitate learning through the use of educational software. Indeed, in contrast to television, the interactive nature of

³The chairman of OPLC, Nicholas Negroponete, explains that "mobility is important, especially with regard to taking the computer home at night....bringing the laptop home engages the family." http://laptop.org/faq.en_US.html

⁴Nevertheless, recent evidence on the effect of early exposure to television on test scores suggests that (1950s) television did not lead to lower cognitive achievement. (Gentzkow and Shapiro, 2007) In related studies, Olken (2007) finds that television and radio reduces social participation in Indonesia while Jensen and Oster (2007) show that access to cable TV improves women's status in India.

⁵Krueger (1993) estimated a large wage premium among Americans who use a computer at work. However, DiNardo and Pishke (1997) have cast some doubt on whether these represent causal estimates for the effect of computer use by taking advantage of more detailed information on work activities from Germany.

computer technology has often been viewed with great promise.⁶ Since computers represent such a versatile technology, the potential risks and benefits are highly dependent on the availability of different types of software and the patterns of actual use.⁷

Moreover, in considering the effect of computers at home, parental involvement and monitoring may be especially important mediating factors for the effect of home computers on child and adolescent outcomes. In their qualitative study of home computer use, Giacquinta et. al. (1993) find that children engaged in educational computing only if parents took a very active role in selecting software and spending time with the children at the computer. When left on their own, most of the children in their sample only used home computers for games and regarded educational program as boring. If parental involvement and monitoring are positively correlated with parental education and income, the risks of home computer use may be more likely among disadvantaged populations.⁸

This paper seeks to provide a credible estimate for the effect of home computer access on educational and behavioral outcomes for children and adolescents. We analyze a government program administered by the Romanian Ministry of Education which subsidized the purchase of home computers for low-income children. The program offered about 27,000 vouchers worth 200 Euros (about \$240) in 2005 towards the purchase of a personal computer for students enrolled in Romania's public schools. Similar to programs in other countries, the Euro 200 program was intended to increase home computer use among low-income families and promote computer skills for school-aged children. Since the fixed number of vouchers were allocated based on a simple ranking of family income, we employ a regression discontinuity design that allows comparisons across students very similar in family income and other respects, but markedly different in their access to a computer at home. With data that we

⁶See Wartella and Jennings (2000) for comparisons between computers and more traditional media.

⁷Evidence from the 2003 CPS indicate that 83 percent of American children aged 3 to 17 with a computer at home used it to play games, the most common single use. (U.S. Census Bureau, 2005)

⁸Schneider and Coleman (1993) highlight the importance of parental involvement in children's schooling and document that higher SES parents exhibit higher levels of involvement.

collected through in-person household interviews, we estimate the impact of winning a program voucher on computer ownership and computer use, as well as academic and behavioral outcomes.

We find that winning a 200 Euro voucher increased the likelihood of households owning a home computer by 25 percentage points, or approximately 50 percent higher compared to households that had incomes above the program threshold. As might be expected, higher rates of computer ownership also led to increased computer use. Computers were turned on for almost 1 hour longer each day in households that were just under the threshold for winning, and children in households who won a voucher used computer significantly more than their counterparts who did not win a voucher. In terms of time-use, we estimate that children who won a program voucher reduced the time spent watching television and the time spent doing homework, each by about 3 hours a week. Children in household who won a voucher also had lower school grades and a lower likelihood of planning to go to college. The effect of winning a computer voucher on behavioral outcomes is somewhat less conclusive, with voucher winners receiving lower behavior grades in school but no significant effect on drinking behavior, weight and two behavior indices: Behavioral Problem Index (BPI) and Rosenberg Self-esteem Index. In sum, providing home computers for low-income children in Romania did not appear to improve educational and behavioral outcomes. This may not be surprising given that relatively few parents report having educational software installed on their computer, and few children report using the computer for educational purposes. Interestingly, we find evidence that having a stay-at-home mom and the presence of rules about computer use do mitigate some of the negative effects of winning a computer voucher, and suggests that parental supervision may be an important mediating factor.

The paper is organized as follows: Section 2 discusses the related literature regarding the effect of home (and school) computers on child and adolescent outcomes. Section 3 provides background on the Euro 200 program. Section 4 describes the data collection effort and

the resulting data. Section 5 explains the empirical strategy which underlies the analysis. Section 6 presents the results and Section 7 concludes.

2 Related Literature

There is a small but growing literature examining the effect of home computer use on educational outcomes using readily available survey data. Attewell and Battle (1999) use the 1988 National Educational Longitudinal Survey (NELS) to show that having a home computer is associated with higher test scores in both mathematics and reading. After controlling for differences in demographic and individual characteristics, they find that students with home computers score 3 to 5 percent higher on these tests than those students without home computers. Interestingly, they find that these positive effects are significant only for high SES households and, therefore, speculate that more affluent and higher educated parents are better able to provide a conducive environment for children to engage in learning with computers.

Using data from the Computer and Internet Use Supplement to the 2001 Current Population Survey (CPS), Fairlie (2005) shows that having access to a home computer is associated with a higher likelihood of being enrolled in school. He finds that teenagers with home computers are over 10 percentage points more likely to be enrolled in school than their counterparts without home computers. Controlling for family income, parental education, parental occupation and other background characteristics, this differential declines to only 1.4 percentage points. These findings indicate that selection on observable characteristics is quite substantial in this setting, and suggests that selection on unobserved characteristics may be the source of even further bias. Beltran, Das, and Fairlie (2006) extend this work using the 2000-2003 CPS Supplements and National Longitudinal Survey of Youth (NLYS) 1997. They find that teenagers with access to home computers are 6 to 8 percentage points

more likely to graduate from high school after controlling for various individual, parental, and family characteristics.⁹ Although they attempt to address the possibility of omitted variables by using parental use of the Internet at work and the presence of another teenager in the household as instruments, the resulting estimates are statistically insignificant and the exclusion restrictions are not entirely credible.

In contrast to these findings, Fuchs and Woessmann (2004) estimate a negative relationship between home computers and student achievement using PISA data. They observe that the bivariate relationship between the availability of home computers and student performance on math and reading tests is positive, similar to the findings from other studies. However, once they control for detailed student, family and school characteristics, they find that the relationship between availability of home computer use and test scores becomes negative and significant. Students with home computers score about 5 achievement points (approximately.05 of a standard deviation) lower on both math and reading tests. While they recognize that this analysis remains “descriptive rather than causal,” they maintain that these estimates should be closer to the true causal effect from an exogenous variation in computer availability.

Evidence concerning the effect of computer use in school on educational attainment is also quite mixed. Angrist and Lavy (2002) find that the quasi-random installation of computers in Israeli schools did not lead to improvements in math test scores. In related work, Goolsbee and Guryan (2006) show that Internet and communications subsidies in US schools (through the E-rate program) led to increased Internet investment but did not lead to improved student test scores. Rouse and Krueger (2004) present evidence from a randomized experiment showing that an instructional reading computer program improved certain limited aspects

⁹Schmitt and Wadsworth (2004) also provide evidence of a positive relationship between home computer ownership and subsequent academic achievement in Britain. Using the British Household Panel Survey, they find that access to a home computer is associated with higher rates of completion of British school examinations (GCSEs and A-levels) after including individual, household and geographical controls, as well as proxies for household wealth and prior educational attainment

of students language skills but did not improve broader language abilities. However, a recent study by Barrow, Markman and Rouse (2007) evaluated a randomized experiment which provided computer instruction in algebra and found significant effects on mathematics achievement. Finally, Banerjee et. al. (2007) examine the effect of an computer-assisted learning program in India which offered children two hours of computer time per week to play games that involve solving math problems. They find a positive effect of computer use on math test scores, suggesting that closely targeted computer instruction may be beneficial.

Closely related to research on educational outcomes, the psychological literature has explored the effect of computer and internet use on children's time-use, as well as cognitive and behavioral outcomes. Subrahmanyam et. al. (2000, 2001) review some findings from recent US-based studies: children with a computer at home spend more time using it and substitute away from watching television (Kraut et al., 2001; Stanger, 1998); children playing computer based games display higher levels of spatial ability (Subrahmanyam and Greenfield, 1994); effects on social and behavioral outcomes are quite mixed. Again, the possibility of omitted variables implies that these findings are merely suggestive. However, these cognitive and non-cognitive (social and behavioral) outcomes may play an important role in enhancing educational outcomes.

3 The Euro 200 Program

The voucher program, widely known as the Euro 200 program in Romania, was proposed by the Prime Minister's office and adopted by unanimous vote in Parliament in June 2004 as Law 269/2004. According to the law, the official purpose of the program was to establish a mechanism to increase the purchase of computers through financial incentives based on social criteria, in order to promote competence in computing knowledge. Although the incumbent party suffered a narrow electoral defeat in the November-December 2004 elections, the new

governing coalition actually expanded the resources allocated to the voucher program: thus, whereas 25,051 families received vouchers in 2004, the number of awards increased to 27,555 in 2005, 28,005 in 2006 and over 38,379 in 2007.¹⁰ The law also specified that the computers bought through the program had to be new and had to meet the following minimum specifications: 1.6 GHz processor, 128 MB RAM memory, 40 GB hard-disk with a keyboard, mouse and monitor, as well as some preinstalled software.

The 200 Euro (\$240) subsidy covered a substantial part of the cost of a new computer that met the minimum specifications. Nevertheless, households did need to “top up” the vouchers with their own income. For example, the voucher covered about 75 percent of the price of a system at Romania’s largest computer retailer, who sold almost 40 percent of the program computers in 2005.¹¹ (Comunicatii Mobile, 2005) According to data from the Ministry of Education, 94 percent (25,908 of 27,555) of the issued vouchers were converted into computer purchases by the recipients. Overall, the Euro 200 program was sizable by national standards and accounted for about 4.4% of total new computer sales in Romania in 2005.¹²

The program was targeted towards children from low income families. To be eligible to apply for the program, a household was required to have at least one child under the age of 26 enrolled in grades 1 to 12 of a private or public school or attending university. At the same time only households with monthly family income per household member of less than 1,500,000 lei (around \$50) were eligible to apply. The calculation of income included all permanent sources of income of family members in the month prior to the application,

¹⁰Along with the total number of vouchers, the proportion of applicants who received computers also increased dramatically from about 20% in 2004 to 53% in 2005, 96% in 2006 and 100% in 2007. As a result, the most recent two rounds of the program cannot be used for the current research design, since they do not provide meaningful control groups against which to evaluate treatment effects.

¹¹Comunicatii Mobile (http://www.comunic.ro/article.php/Aproape_jum%C4%83tate_din_sistemele_v%C3%A2ndute_%C3%AEn_programul_guvernamental_quotEuro_200quot_au_fost_oferite_de_Flamingo/1459/)

¹²The market for computers in Romania is extremely competitive so it does not appear that computer retailers were able to extract the value of the voucher subsidy from consumers.

with the exception of unemployment benefits, state support for children, merit scholarships and social scholarships.¹³ In 2005, 51,748 households applied for the program and met the threshold. Following the application deadline, all the applicants were ranked based on their family income per household member. Since the government had a limited budget, it restricted the number of vouchers to 27,555 in the 2005 program round, which corresponded to a maximum income of 506,250 lei (\$17).¹⁴ Neither the number of winners nor the income threshold was known to the applicants in advance. This feature of the program is essential for implementing the regression discontinuity design which enables us to compare students with incomes close to the 506,250 lei threshold who experienced a discontinuity in access to a home computer.

In order to encourage the use of these computers for educational purposes, the Ministry of Education also offered 530 multimedia educational lessons to voucher winners. These lessons were designed during 2001 to 2004 as part of a larger effort to introduce information technology into the education process. The lessons included subjects such as math, biology, physics, geography, computer science, history and chemistry for different grades and were developed under the guidelines of the Ministry of Education in accordance with the national teaching curriculum. Computer retailers who participated in the Euro 200 program were encouraged to install these lessons at no charge on the computers of program winners. However, as revealed by our household survey, relatively few parents report having educational software installed on their computer, and few children report using the computer for educational purposes.

¹³The application form included several explicit warnings against reporting false incomes and families needed to provide supporting documentation along with the application.

¹⁴Vouchers were issued in the name of the child, and therefore not transferable. Nevertheless, it is possible that families, in turn, sold their computer to other buyers. We show that this was not an important issue empirically.

4 Data

The primary data used in this paper are from a 2007 household survey we conducted with families who applied to the 2005 round of the Euro 200 program.¹⁵ In order to conduct this survey, we obtained the list of 1554 families who participated in this round of the Euro 200 program in the Romanian counties of Valcea and Covasna. This list contained the names of the parent and child who applied to the program, the place of residence and the name of the child's school. It also included information on the income per family member in the month prior to the application deadline, which is essential for implementing the regression discontinuity design. With the help of Gallup Romania, we then surveyed a target sample of 1317 families who lived in localities with at least four families that applied to the program.¹⁶ Of these remaining 1317 families, 858 were successfully interviewed for a response rate of 65%, which is in line with Gallup's interview rate for this population. While the remaining sample is not completely representative of the program applicant pool or the population of the two counties more generally, we found no evidence that response rates differed between households who won vouchers and their counterparts who did not receive vouchers.

The household survey had three separate components. First, we interviewed the family in order to obtain demographic information about each member of the household and basic household characteristics, including information about computer ownership. Then, as in other household surveys such as the NLSY, we collected information on child outcomes through parental reports and self-reports. In particular, we surveyed parents in order to elicit information on each child in the family and conducted a separate interview with each child present at home on the day of the survey. Both the parental and the child questionnaires included questions about our main variables of interest, such as computer ownership and

¹⁵The survey was conducted in the spring of 2007, between May and June, while most kids were still in school and preparing to take their end-of-year exams.

¹⁶This helped minimize the cost of surveying individuals in areas with few program participants.

use, child GPA and child behavioral problems. However, due to a limited budget, we were not able repeat all the questions (such as the time use questions or career plans) in both child-level surveys.

Table 1 presents summary statistics for the main variables in this part of the survey. Average monthly income per household member is about 525,000 Romanian lei, which translates into approximately \$20. Since the program was targeted towards low income families, it is not surprising that the sample population is predominantly rural and has comparatively low levels of educational attainment (almost half of the heads of household did not complete any form of secondary school). Compared to national averages, our sample contains an unusually large fraction of Hungarians reflecting the fact that one of the two counties in the study (Covasna) has a large Hungarian majority. Among our 858 applicant families, 49 percent received a voucher in the 2005 round of the Euro 200 program and 98 percent of the vouchers awarded were observed to have been cashed out. Computer ownership is quite high at around 75 percent, suggesting that about half of households who did not qualify for a voucher in the 2005 round had a computer by the spring of 2007. The high level of computer ownership at among these households is explained mostly by the fact that many received a similar voucher in the subsequent rounds of the Euro 200 program in 2006 and 2007. Interestingly, only about 30 percent of households had educational software installed on their home computer, despite the fact that educational software was available from the Ministry of Education at no cost. At the same time, access to the Internet among families in our sample is extremely limited, with only 6 percent of families having Internet access at home. When interpreting our results, it is important to keep in mind that the voucher program increased computer access for households with very limited access to the Internet. On average, computers were reported to be turned on for approximately 1.8 hours each day, or about 2.5 hours conditional on having a computer.

Panel A of Table 2 presents parental reports concerning some important time-use, acad-

emic, and behavioral outcomes for almost 1,800 children.¹⁷ In some regressions, we restrict our attention to the 1,351 children enrolled in grade school (grades 1 to 12). The sample is pretty evenly split between boys and girls and the children’s average age is 13.5 years. We elicited the frequency of home computer use on a scale of 1 (less than once a month) to 5 (every day use).¹⁸ Among the entire sample, almost a quarter used their home computer every day and another 18 percent used their home computer several times a week. Among those households with a home computer, over 80 percent of children used their computer more than once a week. On average, children watched about 2.1 hours of television per day. In order to get a more accurate measure, we also construct a weekly measure of TV viewing by multiplying the hours by the frequency of TV use over time.¹⁹ Given the high frequency of TV viewing, we determine that children watched almost 13 hours of television per week. Only about 30 percent of children were reported to read at least several times a week. In terms of academic outcomes, the average GPA reported by the head of household during 2005-06 is 8.36 out of a possible 10. About three-quarters of children are said to have plans to go to college, and approximately 10 percent have plans for a career related to computer work. In terms of behavioral outcomes, the average grade for school behavior during 2005-06 was extremely high at 9.93 out of a possible 10. We also asked household heads if their children had exhibited various behavior problems during the past three months. We created an index for the fraction of the problems that were reported to be “sometimes” or “often” true of the child, as opposed to “not true” to the following behaviors: trouble getting along with teachers, disobedience at home, disobedience at school, hanging around with troublemakers, bullying others, inability to sit still, and whether the child prefers to be alone.²⁰

¹⁷We allowed the head of household to report on up to 5 children. This sample censoring applied to only two families who had 7 and 9 children respectively.

¹⁸In addition, we recorded 2 (once or twice a month), 3(once a week), and 4 (several times a week).

¹⁹The frequency of TV viewing was reported in a similar fashion to the frequency of computer use.

²⁰The questions are based on items used in the National Health Interview Survey and the National Longitudinal Survey of Youth Children’s Supplement (NLSY-CS). As in recent MTO evaluations (Katz, Kling, and Leibman, 2001), we focus on seven questions that asked about behaviors which the mothers could ob-

Panel B of Table 2 presents summary statistics based on over 1,100 child interviews. for various time-use, academic, and behavioral outcomes. As before, we sometimes restrict our attention to the 1,013 children enrolled in grade school (grades 1 to 12). Average age and child gender in this sample are broadly similar to those in the sample of parental reports. We also asked children about the frequency with which they used their computers for games, education, and other activities.²¹ Among those with computers, almost 70 percent of children report that they play games at several times a week. In contrast, only 20 percent of children report that they use educational software more than once a week (in part because only 40 percent of families with computers actually own educational software). On average, children reported doing about 1.9 hours of homework per day. Again, we also construct a weekly measure of homework hours by multiplying the hours by the frequency of homework over time. According to this measure, children spend about 12.5 hours a week doing homework assignments. Children also report spending about 8.8 hours a day sleeping. We also asked about several academic and behavior outcomes. Average GPA for 2005-2006 reported by the children was, at 8.35, almost identical to that reported by parents. In addition, we conducted the 10 item Rosenberg Self-Esteem Scale in order to provide a self-reported measure of non-cognitive skills.²² Finally, we also asked children about the frequency with which they drunk alcohol in recent months.

serve directly, as opposed to generic questions about behavior or questions requiring intuition about how their child was feeling.

²¹The tables report average frequency (as with time-use variables) unconditioned on computer ownership.

²²The Rosenberg test consists of 10 statements related to overall feelings of self-worth or self-acceptance. The items are answered on a four-point scale which ranges from “strongly agree” (1) to “strongly disagree” (4). Summing the ratings after reverse scoring the negatively worded items, scores range from 10 to 40, with higher scores indicating lower self-esteem.

5 Empirical strategy

As mentioned above, the Romanian Ministry of Education offered approximately 27,000 computer vouchers to low-income students enrolled in Romania’s public schools in 2005. Since these computer vouchers were allocated according to a simple income cutoff, we employ a regression discontinuity (RD) design to compare outcomes across families with similar income and other characteristics but experienced different levels of program entitlements. This enables us to address the possibility of omitted variable bias between recipients of government benefits and their counterparts who were ineligible. The basic regression model used through the analysis is as follows:

$$outcome_i = \beta' \mathbf{X}_i + \delta winner_i + f(income_i) + \varepsilon_i \quad (1)$$

where $outcome_i$ represents a particular child outcome such as computer use, hours doing homework, or GPA, by child i . \mathbf{X}_i includes a set of control variables, such as age, ethnicity, gender, and educational attainment. In practice, these control variables have very little effect on our estimates of the discontinuity and serve mainly to increase precision. $winner_i$ is an indicator variable equal to 1 if monthly household income per capita is less than the minimum cut-off for the voucher program of 506,250 lei, and 0 otherwise. The coefficient δ , our main coefficient of interest, indicates the effect of receiving a 200 euro computer voucher on the relevant outcome. Finally, $f(income_i)$ is a smooth function of income, which is the forcing variable in the context of this regression discontinuity design. As in many recent studies employing this technique, we specify a linear model of this forcing variable, but allow it to vary on either side of the discontinuity.²³ While our primary specification uses a linear spline

²³See Dinardo and Lee (2004) for use of parametric functions in regression discontinuity design. Estimating this equation using non-parametric methods, along the lines of Hahn, Todd, and van der Klaauw (2001) and Porter (2003), also leads to similar results.

in income, we also estimate regressions with alternative polynomial functions for robustness.

Note that we restrict our analysis to the reduced-form effects of winning a voucher on various child outcomes. Since many families who did not win a voucher in 2005 successfully reapplied during the next two rounds (summers of 2006 and 2007), computer ownership at the time of the survey in 2007 underestimates the difference in access between households who won and did not win vouchers for the period from 2005 to 2007. In other words, we have variation in the exposure to computer ownership that isn't captured by observed ownership in 2007. Therefore, instrumenting for computer ownership with having received a voucher would not "scale up" our estimates in the appropriate fashion. Instead, we describe some rough calculations that enable us to translate the effect of winning a voucher into the impact of computer ownership on outcomes.

The central assumption underlying the RD design is that we have correctly specified the function of income (the forcing variable) which determines assignment of the computer voucher. Another important assumption is that households were not able to manipulate the forcing variable, by reporting a lower income. While it is possible that individual families underreported their income, such cheating probably doesn't represent a serious concern.²⁴ The minimum cut-off of 506,250 lei for the voucher program was not known ex-ante; it was determined by the amount of funds available and by the number of households who applied and their corresponding income, none of which were known prior to the start of the program. Indeed, in later rounds, almost all household who applied ended up receiving vouchers. Underreporting would only be a problem for our identification strategy if it varied differentially on either side of the income cut-off. Still, we did test for manipulation of the forcing variable by examining the density of reported income around the cutoff and found no evidence of cheating. (McCrary, 2007)

²⁴As mentioned previously, the Euro 200 application form included stern warnings against any attempt to falsify information on income.

6 Results

6.1 Effect on Computer Ownership and Computer Use

The 2005 round of the Euro 200 program provided vouchers for the purchase of a computer to all families with monthly incomes per family member below the cutoff of 506,250 lei. We begin by showing the dramatic effect of winning a voucher on computer ownership in these households. In Panel A of Figure 1, we normalize the household income per family member for the families in our sample to be 0 at the 506,250 lei cutoff. The sharp discontinuity at the cutoff mark is clearly visible and illustrates the empirical strategy which underlies our regression discontinuity design. Panel B documents that the proportion of awarded vouchers actually cashed in to buy computers was extremely high. Column 3 of Table 3 indicates that households who won a voucher were about 25 percentage points more likely to have a computer at home, a 50 percent increase over the likelihood of owning a computer among those who did not win a voucher. Panel D of Figure 1, which plots the probability of owning a computer based on residuals from a regression of computer ownership on our standard set of controls, reveals a similar discontinuity and confirms that families around the cutoff with very similar family incomes experienced a very different likelihood of owning a computer at home.

As explained earlier, the rates of computer ownership reported at the time of the 2007 survey will underestimate the differences in exposure to computers during the entire period from 2005 to 2007 (since households who did not win a voucher in 2005 may have won one in the summers of 2006 or 2007). Hence, we use administrative data on 2006 and 2007 program winners to define computer ownership in our sample at the end of the 2005-2006 academic year. Using this alternative definition, columns 1 and 2 of Table 3 indicate that the difference in the probability of computer ownership for households who won a 2005 voucher is over 50 percentage points. Panel C of Figure 1 illustrates the dramatic increase in the

magnitude of the discontinuity. These results highlight the difficulty of translating the effect of winning a voucher into the impact of computer ownership on outcomes. The 25 percentage point difference in computer ownership at the time of the 2007 survey would suggest that the effects of owning a computer are four times the effects of winning a voucher (4δ).²⁵ In contrast, since the difference in computer ownership at the end of the 2005-2006 academic year is closer to 50 percentage points, a more accurate rescaling for the impact of computer ownership on outcomes, such as 2005-2006 GPA, is actually only twice the effect of winning a voucher (2δ).

Given that winning a voucher does indeed lead to increased computer ownership, we examine whether it also affects the numbers of hours the computer is turned on and actual computer use among children. Panel E of Figure 1 shows the discontinuity in hours that the computer is turned on. Column (5) of Table 3 estimates that households who won a voucher had their computer turned on by 0.8 additional hours each day as compared to those household who did not receive a voucher.²⁶ Estimating this same result at the child level yields a slightly lower magnitude, at 0.78 hours, but still significant. We also estimate the probability that households who won a voucher had a computer installed with educational software, since this may have some influence on whether the computer is used in activities that enhance academic outcomes. The effect of winning on having a computer with educational software is not significant at the household level (column 7) but statistically significant at the child level (column 8). Finally, we consider the frequency of computer use for each child in the family as reported by parents and the children themselves. Columns 9 and 10 of Table 3 and Panel F of Figure 1 confirm that children in households who won a voucher use a home computer significantly more frequently.

²⁵Note that this resembles the standard calculation used in moving from an intention-to-treat (ITT) estimator to a treatment-on-the-treated (TOT) estimator. Such scaling of the reduced form estimate by the proportion of individuals that actually received the treatment was introduced by Bloom (1984)

²⁶If we rescale the coefficients as suggested above, getting access to a home computer increases the time that a computer is on by about 3.2 hours a day.

6.2 Effect on Time-Use

Having established the large impact of the Euro 200 program on computer ownership and computer use, Table 4 presents estimates for the effect of winning a voucher on children's time-use. Column 1 shows that children just below the income cut-off were spending about 0.3 hours less doing homework at each sitting. In column 2, we combine the frequency of homework and the typical time spent doing homework into a variable which measures the total hours of homework a week. Children in households who won a computer voucher spent approximately 2.3 fewer hours doing homework as compared to those who did not win a voucher. Panels A and B of Figure 2 show the discontinuities in homework hours per session and homework hours per week respectively. In addition to homework, ownership of a computer also seems to crowd out time spent watching TV. In column 4 of Table 4 we observe that winning a computer voucher decreases the time spent watching TV by about 0.4 hours a day. When we combine TV hours with the frequency of TV use, this translates into a reduction of approximately 3.5 hours of TV watching per week (see column 5 of Table 4). Panels C and D of Figure 2 show the discontinuities in TV hours per day and TV hours per week respectively.

Table 4 also presents results for two additional outcomes of interest. Children in households that won a computer voucher are 8 percent less likely to read at least once a week and appear to sleep about 27 minutes less per day. These results, though sizable, need to be interpreted with care since they are rather imprecisely measured and are not statistically significant at conventional levels. Similarly, the discontinuities for reading and sleep in Panels E and F of Figure 2 are not as stark. But overall, these findings provide strong evidence that the increase in time spent in front of a computer among winners of the Euro 200 program led to large reductions in hours spent watching TV and doing homework, as well as some indication that children spent less time reading and sleeping.

6.3 Effect on Academic and Behavioral Outcomes

In Table 5, we explore the impact of winning a computer voucher on a range of academic and behavioral outcomes. In light of the large decrease in time spent doing homework, we first examine the effect of winning a voucher on measures of school performance. We elicited information about average school grades for the 2005-2006 academic year, the first year following the distribution of the computers. Both columns 1 and 2 of Panel A indicate a negative effect of winning a voucher on GPA as reported by parents and the children themselves. The effect is statistically significant for the child reports, at 0.36 grade points or about one third of a standard deviation.²⁷ The decrease in GPA based on parental reports is smaller and not statistically significant at conventional levels. Similarly, parents in households who won a voucher are 13 percentage points less likely to report that their child intends to attend college. Panels A and B of Figure 3 each display a visible discontinuity around the income cut-off for GPA and the intention to attend college. Interestingly, winning a voucher does not increase the intention to major in computer science in college.

Panel B investigates the impact of winning a voucher on various behavioral outcomes. Children in households who received a voucher show a large reduction in their school behavior grade during the 2005-2006 school-year. This result is large and statistically significant, and the discontinuity clearly visible in Panel D of Figure 3. We also explore the effect of computer ownership on the Rosenberg Self-Esteem index, the Behavioral Problem Index (BPI), as well as child weight and drinking behavior. However, we find no significant impacts on these variables. To summarize, the evidence on GPA, college plans and the school behavior grade presented in Table 5 suggests that, if anything, computer ownership has a negative impact on child academic and behavioral outcomes.

²⁷Again, scaling these coefficients using computer ownership in 2006, these regression results suggest that computer ownership decreases GPA by about 0.6 of a standard deviation. Note that, although large, this effect is not very precisely measured.

6.4 Heterogeneous Effects

In order to delve deeper and try to understand our findings thus far, we explore how the effects of winning a computer voucher vary by both family and individual characteristics. Given that parental supervision and monitoring may be important mediating factors for the effect of home computers on child and adolescent outcomes, we begin by focusing on several proxies for parental involvement. First, we introduce an indicator variable for whether the mother is a stay-at-home mom. Approximately 60 percent of the mothers in our sample were reported to be stay-at-home moms.²⁸ Second, we include a variable based on a survey question in which we asked parents whether they had rules to regulate computer use for each child. About one third of parents in homes with computers indicated the existence of such rules.²⁹ Finally, we also examine the effect of having a less educated mother to check whether there are differences associated with parental education. We proceed to estimate equations in which the variable for winning a Euro 200 voucher is interacted with these various parental characteristics.³⁰

Table 6 presents results from estimating this equation for six of our main outcome variables (hours computer on, homework hours per week, TV hours per week, GPA, school behavior grade and college plans). Panel A reveals significant differences among program winners who have stay-at-home mothers. For five out of our six outcome variables, the interaction between *winner* and having a mother at home is large and with the opposite sign of the main effect. Moreover, these interactions are statistically significant for homework hours per week, GPA and the behavior grade. In other words, the presence of a stay-at-home mom substantially mitigates the negative effects of winning a computer voucher on

²⁸We do not include women who are unemployed in this definition of stay-at-home moms.

²⁹Note that these variables are potentially endogenous since they are measured after receipt of a computer.

³⁰Specifically we estimate the equation: $outcome_i = \beta' \mathbf{X}_i + \delta winner_i + \pi parent_chars_i + \lambda winner_i * parent_chars_i + f(income_i) + \varepsilon_i$ where *parent_chars_i* is an indicator for whether the mother stays at home, parents have rules about computer use, or the mother only has a primary education.

these outcomes.³¹ Similar but weaker results can be seen in Panel B for the interaction of winning a voucher and the presence of rules for computer use in the household. Column 1 of Panel B indicates that this interaction is negative and statistically significant for the hours computers are turned on, implying that the largest increase in computer use occur in families where parents do not restrict access to the computer.³² While the remaining columns also suggest differential effects on time spent watching TV and GPA, these estimates are not very precise. Panel C shows that the effects of winning a computer voucher do not vary significantly with the education level of the mother. This is consistent with the view that the role of stay-at-home mothers in explaining the heterogeneity of outcomes is driven by their ability to better monitor the activities of children in the home.

Appendix Table 1 explores the impact of child characteristics on the effect of winning a computer voucher. We focus on interactions with child age, gender, and the number of siblings.³³ Using the same six outcomes in Panels A to C, we do not find evidence that the effects of winning a computer voucher vary significantly with respect to these characteristics.

6.5 Robustness Checks

For robustness, we examine whether our main controls vary continuously around the income cutoff. Appendix Table 2 presents evidence showing that the discontinuities for age, gender and education of the primary caregiver as well as age, gender and ethnicity of the child are almost always small and statistically insignificant. In only one case (probability of being Roma) do we reject the null hypothesis. The smoothness of these controls around the discontinuity can also be observed in Appendix Figure 2, which shows plots corresponding

³¹Using F-tests for joint significance we still reject a zero effect of vouchers for the subsample of kids with stay-at-home moms. If we actually limit to the sample of stay-at-home moms, the coefficients are not significant but this is mostly due to lack of power.

³²This is striking insofar as having rules is associated with higher levels of computer use in the cross-section.

³³Specifically we estimate the equation: $outcome_i = \beta' \mathbf{X}_i + \delta winner_i + \pi child_chars_i + \lambda winner_i * child_chars_i + f(income_i) + \varepsilon_i$ where $child_chars_i$ includes age, gender and number of siblings.

to a number of background variables included in the table.

All of our main results thus far were estimated using a linear spline specification for the income function. Panel A of Appendix Table 3 present results for six of our main outcome variables of interest (hours computer on, homework hours per week, TV hours per week, GPA, behavior grade and college plans) using alternative specifications for the income function. These include linear, quadratic and cubic trends in income as well as a quadratic and cubic spline. In Panel B, we consider two alternative samples which restrict the windows around the cutoffs to 500,000 and 300000 lei. Obviously, the precision of our estimates are bound to be lower in these narrow windows. Finally, Panel C shows results using two alternative sets of possible control variables. One specification drops all the control variables while the other includes additional household characteristics such as availability of sewage, hot water and toilet. Most of our estimates remain significant across different specifications. However, even in cases where we lose some precision, the magnitude of these estimates remains quite similar.

7 Conclusion

This paper examines the effect of access to a home computer on educational and behavioral outcomes among low-income children and adolescents. Using data that we collected through in-depth household interviews during 2007, we implement a regression discontinuity design and estimate the impact of winning a government-funded voucher worth 200 Euros towards the purchase of personal computer in 2005. We find that winning such a voucher significantly increases the likelihood that households own a home computer by about 50 percent. Since the voucher only covered about 75 percent of the cost of a new computer, this result indicates that households expended further resources to acquire this technology. As expected, higher rates of computer ownership among winners also led to increased computer use. Computers

were turned on for almost 1 hour longer each day in households that were received a voucher and children in these households were significantly more likely to use computers than their counterparts who did not win a voucher. We find that children who won a voucher spent significantly less time watching television and doing homework. Moreover, the effect on homework appears to have had real consequences for school performance. We find evidence indicating that children who won a voucher had lower school grades. Parents reported that these children had a significantly lower expectation of going to college. Finally, we also find suggestive evidence that winning a voucher is associated with negative behavioral outcomes.

These findings indicate that providing home computers to low-income children in Romania led them to experience worse outcomes. How do we interpret these findings? It does not appear that these results are driven by the poor implementation of the Romania's voucher program. In fact, the program seems to have been successful in increasing home computer ownership and use among low-income children. However, despite the efforts of the Romanian Ministry of Education to encourage the use of these computers for educational purposes through the provision of educational lessons, relatively few children have educational software installed on their computer, and fewer still report using the educational software on a regular basis. Instead, our analysis brings out the important role of parents in shaping the impact of home computer use on child and adolescent outcomes. We find that in families where mothers stay at home and where parents have rules regarding computer use, the negative effects of winning a voucher are greatly reduced. Thus, our findings suggest caution regarding the broader impact of home computers on child outcomes. They also raise questions about the usefulness of recent large-scale efforts to increase computer access for disadvantaged children around the world without paying sufficient attention to how parental oversight affects a child's computer use.

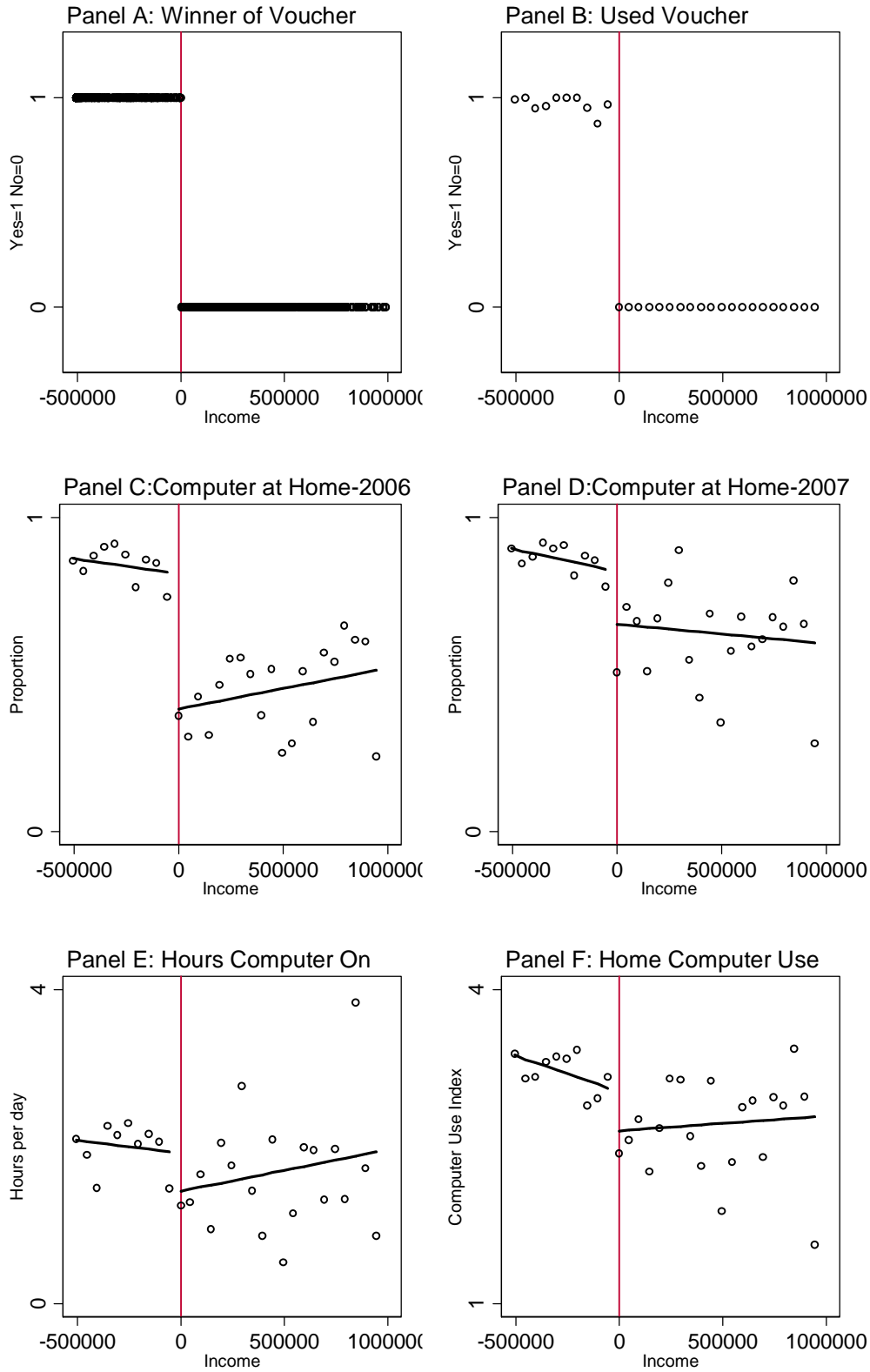
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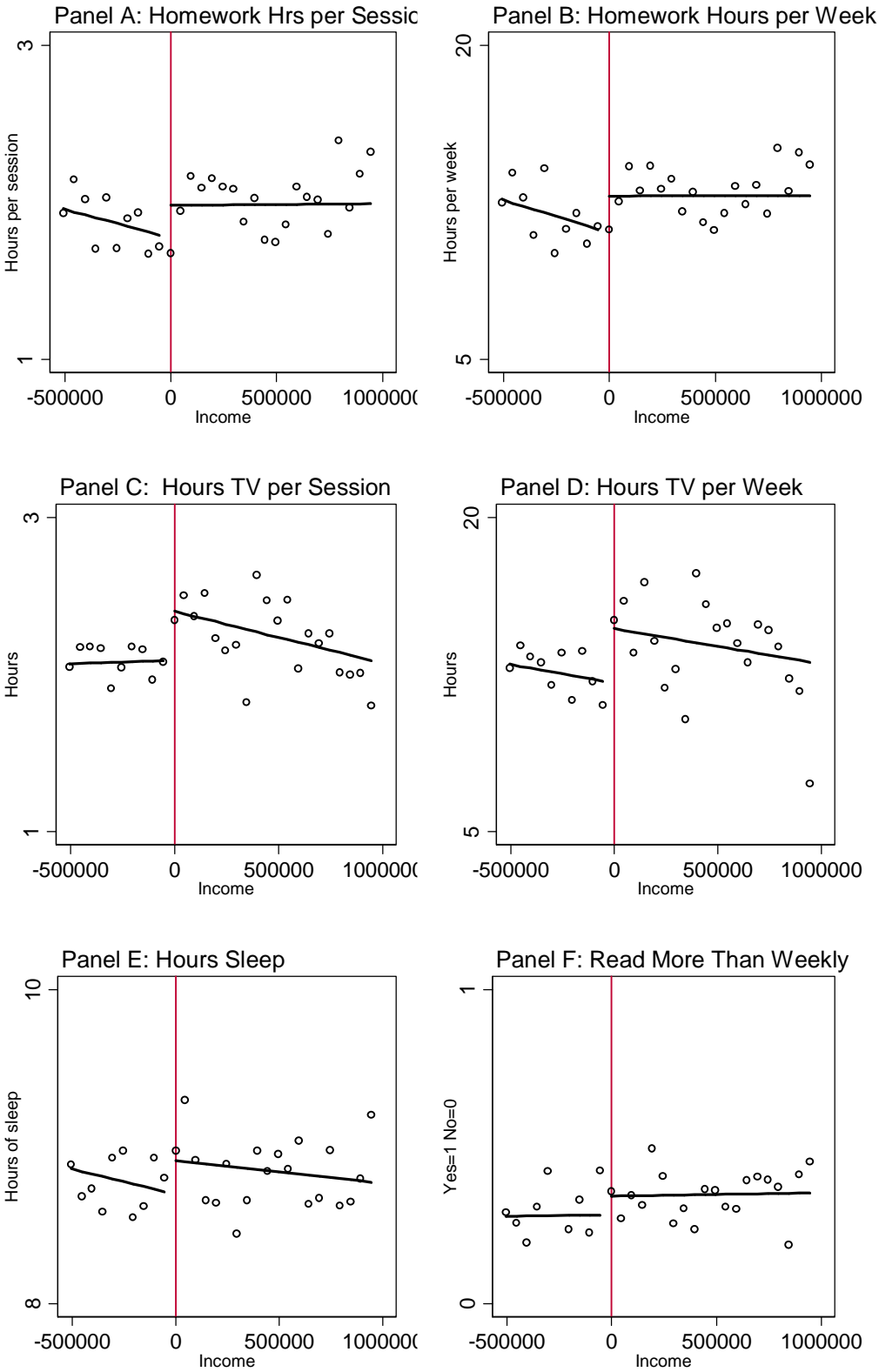
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Figure 1 - Computer Ownership and Use



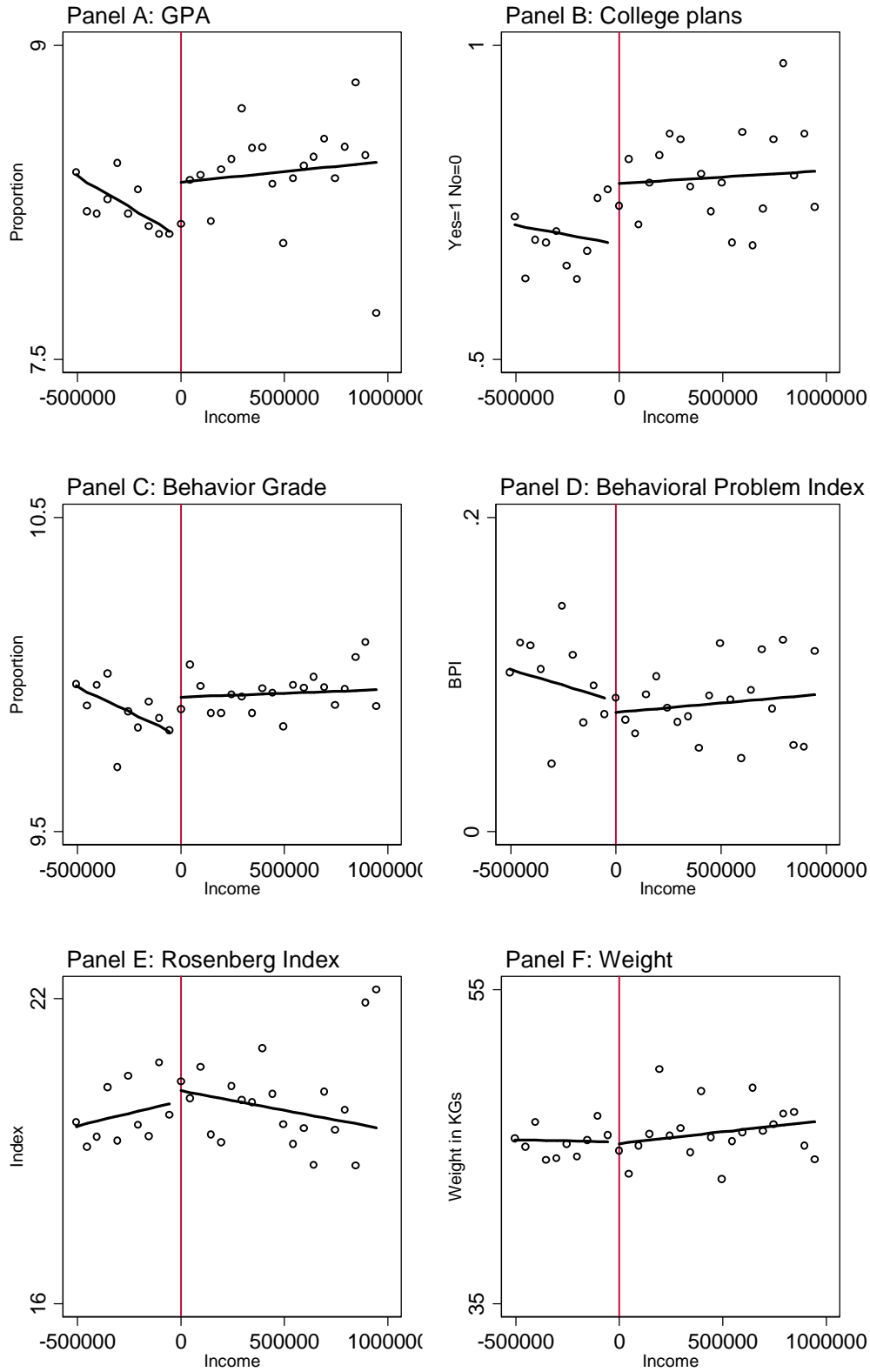
Notes: The dependent variables are defined in Table 2. In Panels C-F, the open circles plot residuals from regressions of the dependent variables on a number of parental and child background variables. The solid lines are fitted values to residuals from regressions of the dependent variable on a linear spline. The income variable is the monthly household income per family member used by the Euro 200 program and is normalized to be 0 at the 506,000 lei (\$17) cutoff. Source: 2007 Euro 200 Survey.

Figure 2 - Time Use



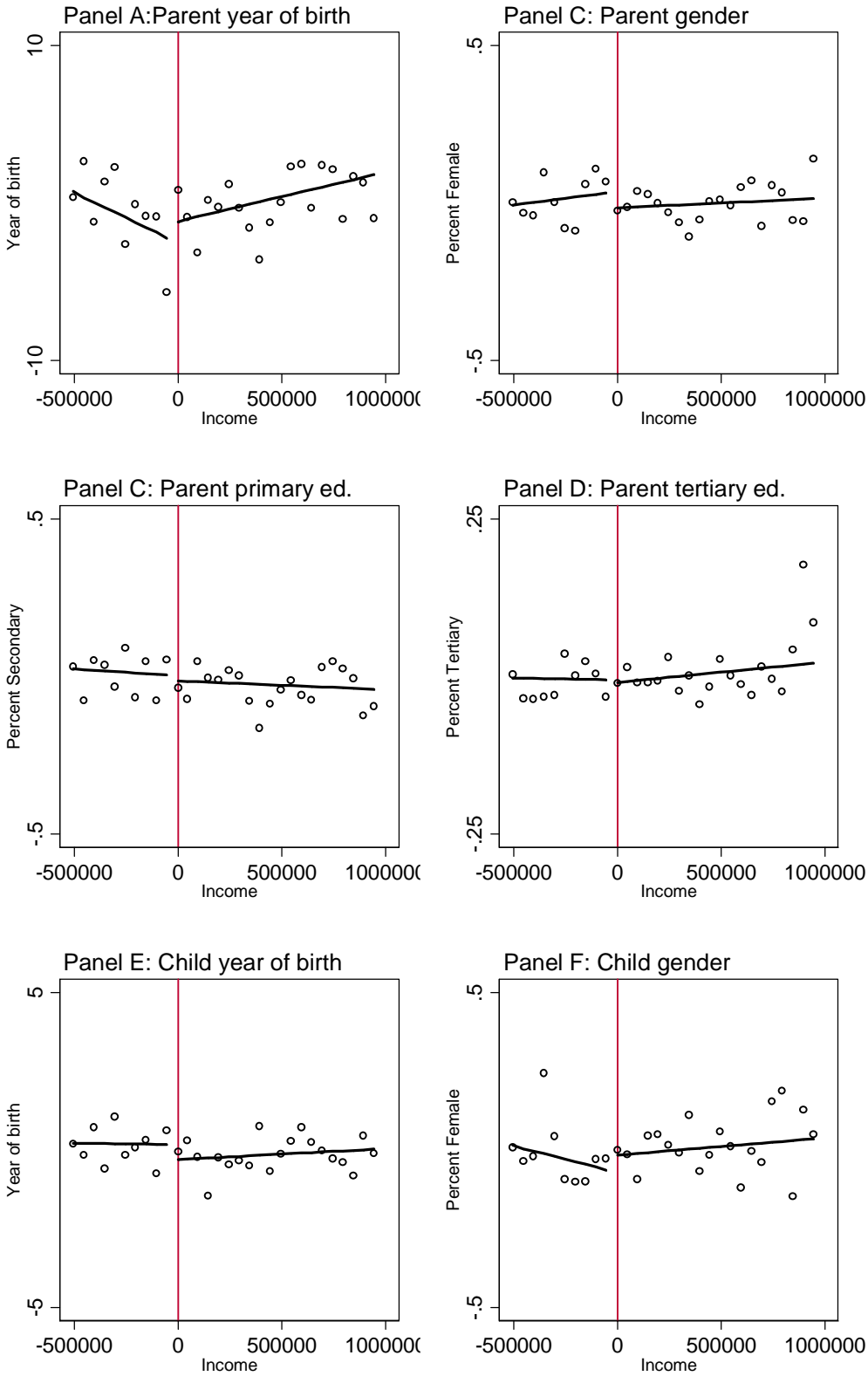
Notes: The dependent variables are defined in Table 2. The open circles plot residuals from regressions of the dependent variables on a number of parental and child background variables. The solid lines are fitted values to residuals from regressions of the dependent variable on a linear spline. The income variable is the monthly household income per family member used by the Euro 200 program and is normalized to be 0 at the 506,000 lei (\$17) cutoff. Source: 2007 Euro 200 Survey.

Figure 3 - Academic and Behavioral Outcomes



Notes: The dependent variables are defined in Table 2. The open circles plot residuals from regressions of the dependent variables on a number of parental and child background variables. The solid lines are fitted values to residuals from regressions of the dependent variable on a linear spline. The income variable is the monthly household income per family member used by the Euro 200 program and is normalized to be 0 at the 506,000 lei (\$17) cutoff. Source: 2007 Euro 200 Survey.

Appendix Figure 1 - Specification Tests



Notes: The dependent variables are defined in Table 2. The open circles plot residuals from regressions of the dependent variables on the remaining background variables. The solid lines are fitted values to residuals from regressions of the dependent variable on a linear spline. The income variable is the monthly household income per family member used by the Euro 200 program and is normalized to be 0 at the 506,000 lei (\$17) cutoff. Source: 2007 Euro 200 Survey.

Table 1: Summary Statistics at the Household Level

	Mean	SD	N
Winner	0.490	0.500	858
Income (ven)	524,979	450,898	852
Used Coupon	0.480	0.500	858
Number of children	2.104	0.929	858
Female HoH	0.119	0.324	858
Age of HoH	43.009	8.057	855
<i>Ethnicity of HoH</i>			
Romanian	0.532	0.499	857
Hungarian	0.408	0.492	857
Gypsy	0.060	0.237	857
<i>Education of HoH</i>			
Primary	0.226	0.418	846
Secondary	0.748	0.434	846
Tertiary	0.026	0.159	846
<i>Computer ownership</i>			
Have a computer	0.749	0.434	856
Have a computer in 2006	0.648	0.478	856
Have a computer w/ educ software	0.303	0.460	769
Have internet	0.053	0.223	855
Hours computer is on	1.785	1.967	844
Stay_at_home mother	0.598	0.491	850
Mother has Primary Education	0.186	0.389	838
Locality	58.81	33.45	858

Notes: SD is the standard deviation and N is the sample size. All summary statistics are based on the head of household. Source: 2007 Euro 200 survey.

Table 2: Summary Statistics at the Child level

	Mean	SD	N
Panel A: Parental survey reports			
Gender	0.478	0.500	1,794
Age	13.487	5.138	1,790
<i>Time use</i>			
Home computer use (frequency)	2.781	1.696	1,732
Hours TV per day	2.141	1.371	1,513
Hours TV per week	12.935	9.660	1,505
Read (every day)	0.271	0.445	1,698
<i>Educational and Behavioral outcomes</i>			
GPA 2005-2006	8.355	1.025	789
Behavior grade 2005-2006	9.931	0.391	934
Plan to attend high school	0.941	0.235	903
Plan to attend college	0.749	0.434	1,195
Career in computers	0.096	0.295	1,247
BPI Index	0.091	0.163	1,616
Weight (kilos)	45.331	17.106	1,726
Parents have rules for computers	0.263	0.440	1,713
Panel B: Child survey reports			
Gender	0.499	0.500	1,161
Age	14.133	4.307	1,161
<i>Ethnicity</i>			
Romanian	0.531	0.499	1,164
Hungarian	0.398	0.490	1,164
Roma	0.068	0.252	1,164
<i>Computer use (more than once a week)</i>			
for games	0.475	0.500	1,159
for education	0.152	0.359	1,161
for other activities	0.413	0.493	1,151
<i>Time use</i>			
Home computer use (frequency)	2.475	1.933	1,131
Hours homework per day	1.944	1.124	1,091
Hours homework per week	12.400	8.437	1,086
Hours sleep	8.806	1.254	1,095
<i>Educational and Behavioral outcomes</i>			
GPA 2005-2006	8.347	1.047	693
Rosenberg index	19.710	3.834	1,055
Drunk	1.266	0.572	1,157

Notes: SD is the standard deviation and N is the sample size. Source: 2007 Euro 200 survey.

Table 3: Effect of the Euro200 program on Computer Ownership and Use

<i>dependent variable</i>	Computer at home '06		Computer at home '07		Hours computer on		Computer with educational software		Home Computer use	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Winner	0.544*** [0.067]	0.525*** [0.069]	0.245*** [0.065]	0.276*** [0.070]	0.851** [0.339]	0.772** [0.375]	0.122 [0.089]	0.174** [0.086]	0.529** [0.244]	0.975*** [0.341]
Sample Size	834	1741	830	1729	818	1704	745	1555	1677	995
R ²	0.53	0.54	0.44	0.45	0.25	0.26	0.3	0.33	0.35	0.36
Mean of dep. var.	0.648	0.653	0.749	0.751	1.785	2.021	0.303	0.466	2.781	2.475
Survey	household	household	household	household	household	household	household	household	household	child
Unit	household	child	household	child	household	child	household	child	child	child

Notes: Robust standard errors in brackets. In regressions where the unit of observation is the child, the standard errors are clustered at the household level. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. In the household level regressions, the controls include age, gender, ethnicity and education of the head of household as well as locality controls. In the child level regressions, we additionally also control for age, gender and ethnicity of the child. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Table 4: Effect of the Euro200 program on Time Use

<i>dependent variable</i>	Homework hours	Homework hours per week	Reading every week	TV hours	TV hours per week	Hours sleep
	(1)	(2)	(3)	(4)	(5)	(6)
Winner	-0.284* [0.169]	-2.341* [1.306]	-0.081 [0.067]	-0.408* [0.225]	-3.461** [1.714]	-0.269 [0.188]
Sample Size	997	994	1301	1157	1154	965
R ²	0.27	0.31	0.29	0.25	0.25	0.30
Mean of dep. var.	1.944	12.400	0.271	2.141	12.935	8.806
Survey	child	child	household	household	household	child
Unit	child	child	child	child	child	child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. All regressions include controls for age, gender, ethnicity and education of the head of household, age, gender and ethnicity of the child and locality controls. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Table 5: Effect of the Euro200 program on Academic and Behavioral Outcomes

Panel A: Academic Outcomes					
<i>dependent variable</i>	GPA (child report)	GPA (parent report)	College plans	HS plans	Career w/ computers
	(1)	(2)	(3)	(4)	(5)
Winner	-0.358* [0.213]	-0.169 [0.212]	-0.132* [0.077]	-0.063 [0.044]	-0.026 [0.050]
Sample Size	665	756	1163	876	1105
R ²	0.37	0.33	0.30	0.25	0.22
Mean of dep. var.	8.347	8.355	0.749	0.941	0.096
Survey	child	household	household	household	household
Unit	child	child	child	child	child
Panel B: Behavioral Outcomes					
<i>dependent variable</i>	Behavior grade	BPI Index	Rosenberg Index	Weight	Drinking
	(1)	(2)	(3)	(4)	(5)
Winner	-0.174** [0.077]	0.009 [0.027]	-0.258 [0.622]	0.067 [1.261]	0.077 [0.088]
Sample Size	906	1277	932	1291	1017
R ²	0.25	0.28	0.33	0.63	0.31
Mean of dep. var.	9.931	0.091	19.710	45.331	1.266
Survey	household	household	child	household	child
Unit	child	child	child	child	child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. All regressions include controls for age, gender, ethnicity and education of the head of household, age, gender and ethnicity of the child and locality controls. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Table 6: Interactions with Parental Monitoring, Rules, and Education

<i>dependent variable</i>	Computer on (hrs per day)	Homework (hrs per week)	TV (hrs per week)	GPA (child report)	Behavior grade	College plans
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Winner	0.988** [0.470]	-3.809** [1.549]	-2.514 [1.805]	-0.661*** [0.246]	-0.282*** [0.102]	-0.194** [0.084]
Mother_at_home	-0.06 [0.228]	-0.368 [0.807]	-0.405 [1.029]	-0.191 [0.122]	-0.060** [0.030]	-0.044 [0.043]
Winner*Mother_at_home	-0.332 [0.339]	2.071* [1.140]	-0.215 [1.449]	0.397** [0.191]	0.153** [0.071]	0.079 [0.062]
Panel B						
Winner	0.993*** [0.364]	-2.356* [1.362]	-2.982* [1.526]	-0.376* [0.219]	-0.162** [0.077]	-0.128 [0.080]
Parent Has Rules for Computer	2.011*** [0.274]	-0.646 [0.985]	-1.978 [1.373]	0.127 [0.148]	0.008 [0.029]	0.054 [0.047]
Winner*Rules	-1.435*** [0.336]	-0.308 [1.233]	1.898 [1.613]	0.129 [0.199]	-0.031 [0.064]	-0.014 [0.064]
Panel C						
Winner	0.707* [0.386]	-2.651* [1.395]	-2.605 [1.600]	-0.233 [0.227]	-0.173** [0.082]	-0.074 [0.080]
Mother_Primary_Education	0.169 [0.329]	-0.328 [1.077]	-1.299 [1.457]	-0.084 [0.200]	0.004 [0.039]	0.04 [0.069]
Winner*Mother_Primary_Education	-0.098 [0.385]	1.658 [1.401]	0.949 [1.755]	-0.274 [0.261]	-0.01 [0.065]	-0.177** [0.081]
Survey Unit	household child	child child	household child	child child	household child	household child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. All regressions include controls for age, gender, and education of the head of household, age, gender and ethnicity of the child and locality controls. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Appendix Table 1: Heterogenous Effects

<i>dependent variable</i>	Computer on (hrs per day)	Homework (hrs per week)	TV (hrs per week)	GPA (child report)	Behavior grade	College plans
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Winner	0.791** [0.394]	-3.097** [1.374]	-2.824* [1.581]	-0.345 [0.235]	-0.178** [0.077]	-0.153* [0.081]
Female	-0.165 [0.124]	1.531** [0.721]	-0.538 [0.683]	0.577*** [0.106]	0.037 [0.028]	0.136*** [0.032]
Winner*Female	0.02 [0.171]	1.581 [1.034]	0.531 [0.910]	-0.027 [0.170]	0.01 [0.053]	0.05 [0.048]
Panel B						
Winner	1.074** [0.466]	-5.818** [2.396]	-0.539 [2.044]	-0.372 [0.570]	-0.099 [0.194]	-0.03 [0.135]
Age	-0.041 [0.026]	-0.491*** [0.185]	-0.163 [0.142]	-0.063 [0.049]	-0.014 [0.017]	-0.022 [0.015]
Winner*Age	-0.02 [0.020]	0.244* [0.138]	-0.147 [0.105]	0.001 [0.032]	-0.005 [0.011]	-0.007 [0.009]
Panel 3						
Winner	1.724** [0.720]	-4.001** [1.988]	-1.925 [2.514]	-0.139 [0.293]	-0.115 [0.095]	-0.124 [0.116]
Number_of_siblings	0.307 [0.190]	-0.711* [0.403]	0.12 [0.589]	-0.062 [0.082]	0.035** [0.018]	-0.045 [0.030]
Winner*Number_of_siblings	-0.329 [0.234]	0.683 [0.529]	-0.23 [0.694]	-0.063 [0.093]	-0.025 [0.021]	0.006 [0.036]
Survey	household	child	household	child	household	household
Unit	child	child	child	child	child	child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. All regressions include controls for age, gender, and education of the head of household, age, gender and ethnicity of the child and locality controls. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Appendix Table 2: Specification Tests (Effect of the Euro200 program on covariates)**Panel A: HH Characteristics**

<i>dependent variable</i>	Age	Gender	Primary	Secondary	Tertiary
	(1)	(2)	(3)	(4)	(5)
Winner	1.128 [1.545]	0.104 [0.072]	0.028 [0.062]	-0.033 [0.067]	0.005 [0.027]
Sample Size	837	837	837	837	837
R ²	0.20	0.17	0.40	0.37	0.23
Mean of dep. var.	43.009	0.119	0.226	0.748	0.026
Survey	household	household	household	household	household
Unit	household	household	household	household	household

Panel B: Child Characteristics

<i>dependent variable</i>	Age	Gender	Romanian	Hungarian	Roma
	(1)	(2)	(3)	(4)	(5)
Winner	-0.122 [0.476]	-0.041 [0.086]	-0.037 [0.029]	-0.028 [0.037]	0.065** [0.033]
Sample Size	1023	1023	1023	1023	1023
R ²	0.30	0.10	0.90	0.82	0.51
Mean of dep. var.	14.133	0.499	0.531	0.398	0.068
Survey	child	child	child	child	child
Unit	child	child	child	child	child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. All regressions include a linear spline in income. Source: 2007 Euro 200 survey.

Appendix Table 3: Robustness checks

Panel A: Academic Outcomes

<i>dependent variable</i>	Computer on (hrs per day)	Homework (hrs per week)	TV (hrs per week)	GPA (child report)	Behavior grade	College plans
	(1)	(2)	(3)	(4)	(5)	(6)
Alternative Trends						
Linear	0.937*** [0.311]	-1.416 [1.168]	-3.358* [1.821]	-0.184 [0.192]	-0.083 [0.061]	-0.113* [0.065]
Quadratic	0.810** [0.342]	-2.604* [1.332]	-3.298* [1.782]	-0.334 [0.221]	-0.204** [0.081]	-0.140* [0.080]
Cubic	0.692* [0.368]	-3.150** [1.421]	-2.726 [2.057]	-0.182 [0.242]	-0.204*** [0.076]	-0.126 [0.089]
Linear spline	0.851** [0.339]	-2.340* [1.306]	-3.461** [1.714]	-0.357* [0.214]	-0.174** [0.077]	-0.132* [0.077]
Quadratic spline	0.578 [0.438]	-3.252* [1.969]	-4.418** [2.243]	-0.204 [0.350]	-0.186* [0.101]	-0.013 [0.119]
Cubic Spline	0.104 [0.555]	-1.722 [2.499]	-7.174** [3.281]	-0.253 [0.474]	-0.249** [0.116]	0.055 [0.153]
Alternate Windows						
full window	0.851** [0.339]	-2.341* [1.305]	-3.461** [1.714]	-0.356* [0.213]	-0.173** [0.077]	-0.132* [0.077]
500,000 lei window	0.574 [0.362]	-2.580* [1.528]	-3.513* [2.105]	-0.233 [0.262]	-0.165** [0.074]	-0.193** [0.095]
300,000 lei window	0.51 [0.540]	-2.313 [2.186]	-5.635** [2.223]	-0.058 [0.436]	-0.107 [0.079]	-0.086 [0.140]
Alternative control						
No controls	1.082*** [0.298]	-0.905 [1.217]	-3.607** [1.607]	-0.31 [0.200]	-0.137 [0.099]	-0.072 [0.075]
Main controls	0.851** [0.339]	-2.340* [1.307]	-3.461** [1.714]	-0.357* [0.213]	-0.174** [0.077]	-0.132* [0.077]
Additional controls	0.926*** [0.344]	-3.311** [1.399]	-2.862* [1.575]	-0.424** [0.213]	-0.185** [0.083]	-0.123 [0.079]

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. "Winner" is defined as 1 for individuals with an income above the program cutoff of 506,000 lei (\$17), 0 otherwise. Source: 2007 Euro 200 survey.

Appendix Table 4: OLS Results for Selected Variables**Panel A: Time Use**

<i>dependent variable</i>	TV Hours per week	Homework hours per week	Read every day	Sleep
	(1)	(2)	(3)	(4)
Computer	-0.983 [1.530]	1.17 [0.956]	-0.021 [0.055]	-0.05 [0.138]
Sample Size	619	519	664	511
R ²	0.29	0.34	0.35	0.38
Mean of dep. var.	12.935	12.400	0.271	8.806
Survey	household	child	household	child
Unit	child	child	child	child

Panel B: Academic and Behavioral Outcomes

<i>dependent variable</i>	GPA 05-06	College plans	Behavior grade	Rosen Index
	(1)	(2)	(3)	(4)
Computer	0.386*** [0.134]	0.146*** [0.047]	0.037 [0.036]	-0.818* [0.445]
Sample Size	413	600	473	495
R ²	0.43	0.37	0.43	0.41
Mean of dep. var.	8.347	0.749	9.931	19.710
Survey	household	household	household	child
Unit	child	child	child	child

Notes: Robust standard errors clustered at the household level are in brackets. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Tables 1 and 2. All regressions include controls for age, gender, ethnicity and education of the head of household, age, gender and ethnicity of the child and locality controls. All OLS regressions are restricted to the households that did not win a voucher in the 2005 round of the Euro 200 program. Source: 2007 Euro 200 survey.