To My Family

INTERGENERATIONAL TRANSMISSION OF EDUCATION: A CASE STUDY OF COVID -19

The Graduate School of Economics and Social Sciences of
İhsan Doğramacı Bilkent

University

by

DOLUNAY GÜLŞAH ARICI

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INTERGENERATIONAL TRANSMISSION OF EDUCATION: A CASE STUDY OF COVID-19
By Dolunay Gülşah Arıcı

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Economics.

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ABSTRACT

INTERGENERATIONAL TRANSMISSION OF EDUCATION
A CASE STUDY OF COVID-19 ERA

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The intergenerational transmission of education is a well-established idea theoretically and empirically for developed countries. Yet, we must still understand this phenomenon in a developing country context. In this study, we utilize the exogenous variation induced by the 1997 Compulsory Schooling Law of Turkey to estimate the causal link between mothers' education and their children's online education experience during COVID-19 Online Education Era by using the 2021 Survey on Information and Communication Technology (ICT) Usage in Households and by Individuals. We find that the education reform did not significantly affect the information and communication technologies the children have access to, the probability of participating in online classes at least once, and the total and educational hours spent on the computer or the internet. However, we find that the reform positively and significantly affected using the Internet to do homework. These results indicate that the mother's reform status does not affect the "quantity" of online education, but it affects the "quality" of online education.

Keywords: Compulsory Schooling Law, Intergenerational Transmission, Online Education

ÖZET

Eğitimin Kuşaklararası Aktarımı
COVID-19 Dönemi Üzerine Bir Vaka Çalışması

Arıcı, Dolunay Gülşah
Yüksek Lisans, İktisat Bölümü
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Haziran 2023

Eğitimin nesiller arası aktarımı, gelişmiş ülkeler için teorik ve ampirik olarak iyi anlaşılmış bir konudur. Ancak, bu olguyu gelişmekte olan ülkeler bağlamında anlamamız gerekiyor. Bu çalışmada, 2021 Hanehalkı Bilişim Teknolojileri Kullanım Araştırması'nı kullanarak, COVID-19 Çevrimiçi Eğitim Döneminde annelerin eğitimi ile çocuklarının çevrimiçi eğitim deneyimi arasındaki nedensel bağlantıyı tahmin etmek için 1997 Türkiye Zorunlu Eğitim Kanunu'nun neden olduğu dışsal varyasyonu kullanıyoruz. Çalışmamızın sonucunda, eğitim reformunun çocukların erişebildiği bilgi ve iletişim teknolojileri, çocuğun çevrimiçi derslere en az bir kez katılma olasılığı, bilgisayar veya internette geçirilen toplam ve eğitim amaçlı süresi üzerinde istatistiksel olarak anlamlı bir etkisinin olmadığını buluyoruz. Ancak, reformun interneti ev ödevi yapmak için kullanma üzerinde olumlu ve istatistiksel olarak anlamlı bir etkisi olduğunu buluyoruz. Bu sonuçlar, annenin reform durumunun çevrimiçi eğitimin "niceliğini" etkilemediğini ancak çevrimiçi eğitimin "niteliğini" etkilediğini göstermektedir.

Anahtar Kelimeler: Zorunlu Eğitim, Eğitimin Kuşaklararası Aktarımı, Çevrimiçi Eğitim

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CHAPTER 1

PRELIMINARIES

1.1 INTRODUCTION

On March 11, 2020, WHO declared that the world is facing a pandemic, namely COVID-19. Following this announcement, many countries imposed certain measures, such as lockdowns and school closures, to alleviate the spread of the virus. During this period, about 1.725 billion children in over 95% of countries have been affected by school closures during the COVID-19 pandemic (Smith, 2021). As a developing country, Turkey has been no exception. Starting from March 16, 2020, all schools were closed in Turkey. Although face-to-face education was possible occasionally when the course of the pandemic was less severe, the primary method of instruction was remote education for almost 1.5 years. As a remedy, the Ministry of National Education (MoNE) broadcasted lessons on TRT EBA TV and provided the EBA Platform for all online education purposes. Despite all the efforts to continue education online, the pre-existing inequalities in Turkey became prominent during this period of 1.5 years of online education. First of all, whether the students had access to EBA TV and other online education methods is questionable. While some students had interactive education through video calls, tablets, and computers, some relied solely on TRT EBA TV. It is noteworthy to mention that 60% of the students did not log into EBA. Moreover, the

effectiveness of online education methods and education through EBA TV is ambiguous (TEDMEM, 2020).

Among the many problems COVID-19 has created, educational loss due to school closures stands out as a problem that can potentially have long-term effects. Learning is a cumulative process, and a learning loss at one point in a children's life can create a snowball effect. In the literature, the long-term adverse impact of school closures during crises such as wars, conflicts, and pandemics before the COVID-19 crisis is well established (Akresh, 2008; Ichino and Winter-Ebmer, 2004; Smith, 2021). Thus, we might expect that the educational loss of the affected cohorts can accumulate and potentially affect their future economic outcomes if the educational loss during COVID-19 is not compensated with effective policies (Agostinelli, Doepke, Sorrenti, Zilibotti, 2021).

During school closures and lockdowns, children were away from their schools and restricted to their own social circles. Thus, the quality and quantity of time spent with parents can have a stronger impact on their children's educational attainment and outcomes during the COVID-19 crisis. These arguments suggest that intergenerational transmission of education can be substantial during COVID-19. Therefore, the COVID-19 Crisis provides a good framework to study questions related to the intergenerational transmission of educational attainment. Moreover, considering that education is a major contributor to intergenerational income mobility, school closures due to COVID-19 threaten equality in society (TEDMEM 2020, Agostinelli et al. 2021, OECD 2007).

This research aims to quantify the disproportionate effect of the pandemic on educational attainment and analyze the intergenerational persistence of low educational attainment. We use the exogenous variation in middle school completion induced by the 1997 Compulsory Schooling Law (CSL97) in Turkey to estimate the intergenerational effects of education. We focus our analysis on the COVID-19 era because the school closures and lockdowns increased the interaction between parents and children, making

the intergenerational transmission channel stronger than before. The results of this research have implications for educational policy. First of all, these results are suggestive of a potential group that should be targeted by educational policies to mitigate the effects of COVID-19. Moreover, as suggested by Oreopoulos, Page, and Stevens (2006), this research allows us to quantify the spillovers of compulsory schooling laws and take into account the positive externalities associated with compulsory schooling laws when making public policy decisions. Additionally, the results of this research can shed light on the causal channels of intergenerational mobility in Turkey.

1.2. RELATED LITERATURE

This research contributes to two growing strands of literature. First of all, this research contributes to the extensive literature on the effect of COVID-19 on education. The widespread school closures during COVID-19, combined with the digital inequality that correlates with other types of inequalities in society, can substantially increase inequality in the long run (Champeaux, Mangiavacchi, Marchetta & Piccoli, 2022; Robinson et al., 2015). Following these concerns, there is a growing literature on the effectiveness of different online education methods and the differential effects of school closures on different groups during COVID-19. In the literature, many studies show that online education is not a perfect substitute for traditional face-to-face education, and there is significant learning loss in many dimensions, such as reading and math scores in the cohorts affected by the COVID-19 pandemic (Singh, Romero & Muralidharan 2022; Ardington, Wills & Kotze, 2021; Grewenig, Lergetporer, Werner & Woessman, 2021; Betthäuser, Bach-Mortensen & Engzell, 2023). Nonetheless, receiving online education was still beneficial compared to not receiving any online education during COVID-19 (Clark, Nong, Zhu & Zhu, 2021; Carlana and La Ferrara, 2021). Moreover, Angrist, Bergman and Matsheng (2020) show that even low-technology interventions such as SMS messages and phone calls could improve learning by 0.12 standard deviations.

COVID-19 was a period in which the pre-existing inequalities became more prominent. Following the onset of online education, having access to education was conditional on

having access to ICTs such as computers, tablets, mobile phones, and a fast and secure internet connection. Indeed, not everyone could benefit equally from online education during this period due to the prominent digital divide in many societies, including Turkey (Polat, 2012). The studies in the prior literature find that the parents' telework possibility, rurality, and gender are factors that result in being more severely affected by the pandemic (Clark et al., 2021; Contini et al., 2022; Fenoll, 2022). Clark et al.(2021) also show that even the device used for online education may be an important factor, as Chinese middle school students who used computers for online education performed better in centralized exams than those who used a smartphone for online education during COVID-19. In line with our research findings, many studies find that children from low-educated and low-income families were also more severely affected by school closures (Agostinelli et al., 2021; Engzell, Frey & Verhagen, 2021; Maldonado & De Witte, 2022; Neidhöfer, Lustig & Tommasi, 2021).

In addition to the studies that set forth the correlation between parental education and children's education in the context of COVID-19, prior literature shows a high degree of correlation between parents' and their children's education in different contexts (Holmlund, Lindahl & Plug, 2011; Dearden, Machin & Reed, 1997). However, these results do not show a clear causal link as there can be confounding factors such as genetic pool, social norms, and environment shared by parents and their children. As a result, another strand of literature focused on establishing a causal link between the education of parents and children. However, an important challenge to establish such causality is finding an increase in parents' overall level of schooling, which would leave the existing distribution of abilities and marital choices unchanged (Behrman and Rosenzweig, 2002). In the literature, there are three main approaches to achieving this goal. Some studies use sibling and twin pairs (Rosenzweig and Wolpin, 1994; Behrman and Rosenzweig, 2002, Behrman, Foster, Rosenzweig & Vashishtha, 1999). Evidence from these studies indicates mixed results. For example, Behrman and Rosenzweig (2002) find that increasing the schooling of females would not raise that of the next generation in the U.S. context. However, they highlight that their results can be context-

dependent, as Behrman et al. (1999) find a strong positive effect in the context of rural India. Another approach is using randomly assigned adoptees and adoptive parents (Sacerdote, 2007; Sacerdote, 2002). However, Oreopoulos et al. (2006) and Chevalier (2004) highlight that these methods have important shortcomings. First of all, neither entirely overcome the endogeneity problem caused by unobserved confounders, as they can not address other confounders, such as environment and social norms. Moreover, these studies use relatively small samples that are not nationally representative.

Using compulsory schooling laws as a natural experiment is another research method to find the causal link between parents' and children's education. Numerous studies use compulsory schooling laws in the context of developed countries such as the US, Britain, and Scandinavian countries (Chevalier, 2004; Oreopoulos et al., 2006; Black, Devereux, & Salvanes, 2003). The results from such studies also reveal mixed results. Holmlund et al. (2011) aim to understand the reason behind these mixed results when different identification strategies are used. They conclude that each method violates some internal and external validity assumptions; thus, the intergenerational effect estimates are biased or lack predictive power. They also find that causal parental schooling effects are minor. Still, they explain a large part of the differences in the resources parents allocate for their children's education; thus, parental schooling still matters from a policy perspective.

Nonetheless, the existing literature is focused mainly on developed countries, and empirical evidence for developing countries is scarce. A quick inspection of the history of public education would reveal that the developed countries, which the prior literature focuses on, started to raise public education as early as the 18th century. Besides, Hertz et al. (2007) find that the correlation between parental education and children's education differs a lot between nations, and developing countries are the ones that have the highest intergenerational persistence. Therefore, there is room for further research to find the causal effect of parents' education on children's education in a developing country context, where the links between parental education and children's education can be

stronger and intergenerational mobility is lower. The novelty of our research is that we combine the two distinct strands of literature, the effect of COVID-19 on education literature and the intergenerational causal effect of education literature, and use COVID-19 Online Education Era as a case study to show the causal link between parental education and children's education using 1997 Compulsory Schooling Law of Turkey as a natural experiment. Moreover, we study this question in a developing country context.

1.3. BACKGROUND

1.3.1. School Closures and Online Education in Turkey During COVID-19 Pandemic

Starting from March 16, 2020, schools were closed in Turkey. Following this decision, the Ministry of National Education (MoNE) took immediate action. Starting from March 23, 2020, K-12 lessons were broadcasted on TRT EBA TV, the educational television channel owned by the state broadcaster TRT. Later, the EBA platform was available online for all distant education purposes. This platform was already available since 2012. The platform included interactive and non-interactive content suitable for all grade levels and educational programs. Moreover, students and teachers could communicate through this platform, and teachers could assign homework and upload additional content. Starting from April 15, 2020, 8th and 12th-grade students could receive virtual live classes using the EBA platform. For the remaining students, teachers could use alternative platforms (TEDMEM, 2021). Later, the EBA Platform's capacity increased to 2 million virtual live classes daily. Moreover, students could receive online education through alternative open-source platforms. (T.C. Milli Eğitim Bakanlığı, 2020)

The 2019-2020 School Year ended on June 19, 2020. Between June 27 and August 28, summer school programs were broadcasted on TRT EBA TV. Moreover, MoNE announced that private schools could start compensatory education starting from August 15, 2020 (TEDMEM, 2020). Students started the 2020-2021 School Year with online education on August 31, 2020. Starting from September 21, 2020, partial face-to-face education started again, with gradual increases in the number of days the students had

face-to-face education and varying onset dates of partial face-to-face education at different school levels (TEDMEM, 2021). Starting from November 23, 2020, face-to-face education was suspended again, and education went back to online in all educational institutions and all school levels until the end of the semester on January 22, 2021.

In the second semester of the 2020-2021 School Year, mixed policies were applied. During the February 15 - March 2, 2021 period, the pre-schools with separate buildings[1] and schools located in villages started face-to-face education. All other schools continued online education. During March 2 – April 15, online or face-to-face education decision was based on the COVID-19 riskiness level of each city. Table 1 summarizes the method of education for different education levels in different regions (TEDMEM, 2022). During this period, online education was still the prevalent method of education, except for 8th grade and 12th grade. Most importantly, for the primary school children, the mode of education was 2 Days Online and 3 Days Face-to-face across all cities, regardless of the riskiness level. After this period of increased face-to-face education, during 15-30 April 2021, education continued online again. All students were subject to online education in this period except for pre-school, 8th-grade, and 12th-grade levels. From April 30 to May 17, 2021, education went entirely online for all students. Thus, during the survey period of our data source, April 2021, the predominant method of education was online education.

Education continued with mixed policies for different grades for the rest of the semester. However, through the end of the semester, all children were attending school face-to-face for at least some days. On July 2, 2021, the spring semester ended. During the July 5 – August 31 period, 2021 MoNE carried out a national program for compensation of educational loss during COVID-19. The 2021-2022 School Year started with full-time

[1] In Turkish education system, some preschools do not have a separate building. They are operating in a classrom as a part of a middle school or a primary school.

face-to-face education in all grade levels, and the education system returned to its normality.

1.3.2. 1997 Compulsory Schooling Law of Turkey

Before 1997, the compulsory education was five years of primary school in Turkey. At the end of five years, children were receiving primary school diploma. On August 16, 1997, compulsory schooling was increased from 5 to 8 with Basic Education Law Number 4306. Five years of primary school education and three years of lower-secondary education were combined as eight years of compulsory primary school education. All the children who completed 4^{th} grade or a lower grade at the end of the 1996-1997 School Year and children who did not have a 5-year primary school degree at the beginning of the 1997-1998 School Year were subject to this policy. At the time of the policy, children were required to begin school in the fall semester of the year when they turned 72 months old, which means the children born after 1987 were subject to the policy. It is important to note that non-compliance with the 1997 Compulsory Schooling Law was common because the rule on school start age was not strictly enforced. Thus, some degree of fuzziness is present around the 1986 birth year cutoff (Kırdar, Dayıoğlu & Koç, 2018; Akyol & Kırdar, 2022).

The timing of this policy was related to the political developments in Turkey in the late 1990s, and the policy did not stem from better-than-average economic conditions. Thus, the reform was independent of the general macroeconomic conditions and did not coincide with other policies that might affect schooling outcomes (Aydemir & Kırdar, 2017). To implement the 1997 CSL, the government increased public spending on education to a great extent to solve the problems regarding physical capacity and feasibility (Akyol & Kırdar, 2022). For example, the government built new schools, added new classrooms to existing schools, recruited new teachers, and provided free textbooks and school uniforms to children from low-income families (Güneş, 2015). Before the enactment of the policy, urban-rural and gender divide in lower secondary school attendance and differences in physical capacity for schooling in urban and rural regions were substantial. As a remedy for this, MoNE used two main instruments:

bussing the children who reside in rural areas to nearby schools and building free-of-charge boarding schools, which decreased the cost of attending school for rural children. In urban areas, the double-shift system was initiated in which part of the students attend school in the morning and some in the afternoon. This system allowed the capacity in the urban areas to be used more efficiently (Akyol & Kırdar, 2022; Kırdar Dayıoğlu & Koç, 2016).

Table 1: Method of Education by Region and Education Level During March 2- April 15, 2021 Period

	Low-Risk Regions	Medium-Risk Regions	High-Risk Regions
Pre-school	Face-to-Face	Face-to-Face	Face-to-Face
Schools in Low Population Density Regions	Face-to-Face	Face-to-Face	Face-to-Face
Primary School	2 Days Face-to-Face 3 Days Online	2 Days Face-to-Face 3 Days Online	2 Days Face-to-Face 3 Days Online
5. , 6. , 7. Grade	2 Days Face-to-Face 3 Days Online	2 Days Face-to-Face 3 Days Online	Full-Time Online Education
8. Grade	12-22 Hours of Face-to-Face Education with Shorter Instructional Time	12-22 Hours of Face-to-Face Education with Shorter Instructional Time	12-22 Hours of Face-to-Face Education with Shorter Instructional Time
9. , 10. , 11. Grades	2 Days Face-to-Face	2 Days Face-to-Face	Full-Time Online Education

Source: TEDMEM, 2022

CHAPTER 2

DATA AND EMPIRICAL STRATEGY

2.1. DATA

We use the data from the Survey on Information and Communication Technology (ICT) Usage in Households and by Individuals conducted by the Turkish Statistical Institute (TURKSTAT). This survey has been conducted each year in April starting from 2013. The scope of this survey is mainly individuals aged 16 to 74. Only in 2013 and 2021 the scope of this survey includes children aged 6 to 15 as well. The survey contains questions on whether individuals and children use ICTs, the purpose and frequency of use of ICTs, and the activities conducted on the internet or using computers and mobile phones. Moreover, the survey includes questions on the ICT equipment ownership of individuals and households.

In this study, we use the 2021 wave of this survey as our sample. The 2021 survey was conducted in April 2021, and online education was still the main form of education in Turkey during this period. Our sample contains responses from 13,662 households, 30,530 individuals aged between 16 to 74, and 7034 children aged between 6 to 15 on various questions to determine the ICT usage of individuals, including their background characteristics such as age, education level, employment status, and occupation. In the Individuals response part of the 2021 survey, individuals are asked i) their age and gender, ii) their highest level of education completed, iii) their relationship with the household lead, iv) the current region they reside in. In the Children response part of the

2021 survey, children are asked i)their age and gender, ii) their relationship with the household lead, iii) whether they continue their education and the education level that they continue, iv) their average time spent on the computer for educational and non-educational purposes, v) their average time spent on the internet for educational and non-educational purposes, vi) whether they used the computer to participate in online classes, vii) whether they used the internet to participate in online classes, viii) whether they used the computer to study, do homework, or prepare a presentation, ix) whether they used the internet to do homework or learn something, x) whether the child has a computer and a mobile phone dedicated only for their use. Using these responses, we define our outcome variables, which are dummy variables when necessary. Table 10 in the Appendix consists of a detailed explanation of each variable.

Our analyses mainly focus on the mothers' education as the 1997 Compulsory Schooling Law (97 CSL) disproportionately affected females' education more compared to men. Additionally, we focus our analyses on children aged between 6 to 10. There are three reasons for this choice of focus group. First of all, the 1986 cohort was 34 years old in 2021. In our analyses, we are mainly interested in the online educational engagement of the children of individuals whose age is in a bandwidth of 34. Thus, an older child with a very young mother implies a different socioeconomic group. For instance, let us assume we have a 15-year-old child in our sample whose mother is 33 years old. In such a scenario, the mother was subject to the 97 CSL, but she had her child when she was only 18, which is a fairly young age for motherhood. The second reason for this choice of focus group is the differential implementation of online education during the month of the survey, as we summarized in Table 1. During the month of the survey, the method of instruction was uniform across all riskiness levels of cities only for primary school kids, who are mostly aged between 6 to 10. This detail is important to achieve more clear identification. The third reason is related to the parental influence in different stages of child development. Children may act more rebellious during puberty and adolescence, and parental influence can be weak in these age groups. Thus, we focus our analysis on a group where parental influence can be more important. We make our estimations around

the 1986 birth year cutoff of the mothers. Our bandwidths range from 4 years to 10 years with 1-year increments. It is important to note that no major educational reform happened in Turkey within these bandwidths. In particular, the timing of Turkey's recent 4+4+4 Education Reform in 2012 does not coincide with our bandwidth selections.

The household I.D. number and the relationship with the household lead data allow us to match the children with their actual parents. Using this information, we matched 6398 out of 7034 children with their mothers. Two hundred forty-five kids did not have a female in their households. Therefore, we dropped these kids from our sample. The remaining 391 children are matched with the oldest female in their household, assuming that they will act as the maternal figure for the child. Using the age data for the mothers, we can trace back their birth years, which allows us to define the treatment status of the mothers. Table 2 presents summary statistics for mothers and children based on the mother's treatment status. The sample we used for these summary statistics includes the mothers who were born in six years bandwidth of the 1986 cohort and their children. On Panel A, one can observe that for both the treatment and control groups, almost %36 of the mothers have at least a middle school degree. Moreover, the mothers in the treatment group are approximately six years younger on average compared to the ones in the control group, which is expected as we define our treatment and control status based on age. Approximately 19% of the mothers in the treatment group worked in the reference week, whereas 28.5% of the mothers in the control group worked in the reference week. The household sizes of the mothers in the treatment group and the control group are very close, and there are 4.6-4.8 individuals in their household on average. It is important to note that these rough measures do not capture pre-policy and post-policy cohort effects, sampling weights, and regional disparities.

Panel B presents the summary statistics for the children of the mothers who were born in six years bandwidth of the 1986 cohort. Children whose mother is treated are, on average, 9.29 years old, whereas children whose mothers were not treated are, on average, 10.67 years old. In the treatment group, 93.1% of the children continue their education, and in the control group, 94.9% continue their education. In the treatment

group, 40.7% of the children have a computer dedicated only to their use. This figure is higher for the control group. 48% of the children in the control group have a computer of their own. There is a similar figure for having a computer in the house. 72.3% of the children in the control group have a computer in their house, whereas only 61.3% of the children in the treatment group have a computer in their house. In terms of internet access, both in the treatment and control groups, almost 98-99% of the children have internet access in their houses. In terms of having a mobile phone dedicated only to the child's use, there is a gap between the children in the treatment and the control group. 40.7% of the children in the control group have a mobile phone of their own, whereas only 28.7% of the children in the treatment group have a mobile phone of their own. Regarding the measures that give an idea about online education engagement, children in the control group seem to have higher engagement levels on average. Similar to the case in the mothers' summary statistics, these figures do not account for the child's age, cohort effects, regional disparities, and sampling weights.

Table 2: Summary Statistics Based on the Treatment Status of the Mother

	Treatment	Control
A) Summary Statistics for Mothers in Our Sample		
Has Middle School Degree	0.361	0.368
	(0.015)	(0.013)
Age	31.53	37.643
	(0.060)	(0.044)
Worked in the Reference Week	0.189	0.285
	(0.012)	(0.012)
Household Size	4.682	4.763
	(0.043)	(0.037)
Observations	1,054	1,441
B) Summary Statistics for Children in Our Sample		
Age	9.29	10.67
	(0.061)	(0.057)
Continues Education	0.931	0.949
	(0.006)	(0.004)
Has Own Computer	0.407	0.48
	(0.012)	(0.010)
Has a Computer in the House	0.613	0.723
	(0.012)	(0.009)
Has Own Mobile Phone	0.287	0.407
	(0.011)	(0.010)
Has Internet Access	0.987	0.984
	(0.003)	(0.002)
Participated in Online Class	0.736	0.79
	(0.010)	(0.008)
Total Time Spent on the Internet	13.411	16.333
	(0.373)	(0.351)
Total Time Spent on the Computer	7.605	9.644
	(0.305)	(0.297)
Used the Internet for Homework	0.641	0.688
	(0.011)	(0.009)
Observations	1,772	2,513

Notes: Detailed explanations of the variables can be found in Table 10 in the Appendix. The summary statistics presented in this table are for the sample of mothers and children that is in the6-year bandwidth of the 1986 birth year of the mother cutoff.

2.2 CONCEPTUAL FRAMEWORK

This section is dedicated to the discussion of potential channels through which parental education may affect their children's educational attainment, engagement, or outcomes. We use the models of Becker and Tomes(1979; 1986) to guide our empirical strategy. These models essentially analyze the intergenerational transmission of inequality and allocation of resources within the family. The model implies that parents can affect their children's future earnings by transferring some endowments and with expenditures made on their human capital. In the COVID-19 context, these expenditures can be the monetary expenditures made for ICT equipment for online education as well as spending time on the formation of their children's human capital.

An exogenous change in the mothers' education level can affect their children's educational attainment and outcomes through several channels. First of all, education can potentially increase mothers' labor market outcomes. More educated individuals tend to participate more in the labor force and have jobs with higher real wages. Moreover, more educated women tend to match with more educated spouses (positive assortative mating). These factors add up to a higher household income, allowing parents to allocate more resources to their children's education. In particular, during the COVID-19 school closures, ICTs such as laptops and tablets, a fast and secure internet connection, and a space dedicated to the children were necessary for the children to continue their education. Evidently, a household with a higher income can provide their children with more of these resources.

Another channel through which parental occupation can affect the children's educational attainment during COVID-19 is the parent's occupation type. During COVID-19 school closures, some parents whose occupations are suitable for working from home could stay at home. However, some occupations, such as healthcare professions or blue-collar workers, were unsuitable for working from home. A parent who could work from home can monitor better whether their children are attending to their distant learning. This channel may affect the children's educational attainment during school closures by

creating a substantial difference in the "quantity" of time parents spend with their children.

Another important channel in our context is the quality of parental time. An exogenous increase in the parents' education level can substantially increase the quality of the time spent with the children and therefore improve the educational outcomes of the children. In the absence of effective online education, parents may function as imperfect substitutes for a teacher. Whenever online education is available, parents can help with the implementation of online education by ensuring that their children are attending and paying attention to their online classes. In that sense, the presence of an educated parent or an adult in the house can be crucial for the children's educational attainment and outcomes during COVID-19. A more educated parent can function as a closer substitute for a teacher. Additionally, different from the societal culture, a parent can acquire cultural values that favor their offspring's education more; thus, they can be more attentive to their children's education.

2.3. EMPIRICAL STRATEGY

The 1997 Compulsory Schooling Law and the COVID-19 pandemic provide a unique opportunity to study the intergenerational transmission of education. As discussed in the previous sections, simple OLS estimation is not useful for identifying the intergenerational transmission of education due to confounding factors. Parents and their offsprings share similar environments, societal cultures, and genetic pools, all of which can affect parents' and children's education. Thus, we need an exogenous variation only in the years of schooling of the affected cohorts. Using the 1997 Compulsory Schooling Law as a natural experiment and comparing the online education experience of children whose mothers are affected by the policy (treatment group) and that of whose mothers are not affected by the policy (control group) allow us to identify the causal effect of parental education on their offsprings' education.

To estimate the effect of policy on children's educational attainment during COVID-19, we use a Regression Discontinuity Design (RDD) where the normalized birth year of the individuals is the running variable. Our estimates will not reflect the effect of the confounders as the policy was exogeneous and did not affect other covariates. Before we make our reduced form estimations, we conduct preliminary checks to verify the first-stage effect of the policy on the education of all females in the 2021 survey and mothers in our sample. Additionally, we checked if the policy affected the household size and whether the children continued education. For the preliminary checks, we use the following Sharp-RD specification,

$$y_i = \beta_0 + \beta_1 T_i + I(T_i = 0) f(a_i) + I(T_i = 1) g(a_i) + X_i \Gamma + \mathrm{u_i} \quad (1)$$

where y_i is a dummy variable that takes the value 1 if the female/mother has a middle school degree for first-stage estimations and household size, and a dummy variable that takes the value 1 if the child continues their education for other preliminary checks. Our running variable, a_i, is the normalized birth year, calculated as $a_i = -(age_i - 34)$, since the 1986 cohort was 34 years old in the survey year, 2021. T_i takes the value of 1 if the normalized birth year is bigger than or equal to zero. I(.) is the indicator function, and it takes the value of 1 if the statement inside the parentheses is true and 0; otherwise. f(.) and g(.) capture linear time trends in pre-policy and post-policy periods. X_i is the vector of control variables for individual i. In our estimations for these preliminary checks, we only have a set of dummy variables for the current NUTS-1 region of residence of individual i. In our estimations, we use sampling weights of the individuals and cluster our standard errors in the current NUTS-1 region and the mother's birth year level. β_1 shows the policy effect on the outcome variables for preliminary checks; thus, it is our coefficient of interest.

In our reduced form estimations, we use a specification analogous to the specification for preliminary checks. This time we are able to use a broader vector of control variables. Thus X_i includes the household size of the child and a set of dummy variables for the child's age and the current region of residence. Also, our dependent variables, y_i, are as follows: a set of dummy variables that takes the value of 1 if the child (i)has a

computer and internet access in their house, has a computer/mobile phone that is dedicated only for their use, (ii) participated in online classes, (iii) educational and non-educational hours spent on computer/internet, and (iv)used the internet to do homework. In our regressions, we use sampling weights of the children, and we cluster our standard errors in the current NUTS-1 region and the mother's birth year level.

CHAPTER 3

MAIN RESULTS

3.1. Preliminary Checks: Balanced Covariate Check and Policy Effect on Females' and Mothers' Education, Continuing Education, Household Size

An identifying assumption of RDD is that the distribution of covariates should not have a discontinuity at the threshold. The failure of this assumption implies that individuals were allocated to the left and right-hand sides of the cutoff in a non-random fashion. Therefore, before we begin our analyses, we check if the covariates we use for this section's estimations present a discontinuity at the threshold. Table 11 illustrates this analysis.

Before we present our main results, it is important to check if the policy had an impact on the mothers' education since it is our first stage assumption. Moreover, the policy can potentially alter whether the children continue education and the household size of the mothers. Thus, we also examine if the policy had an effect on children continuing their education and household size. RDD graphs for each of the variable is displayed in Appendix Figure 2. Table 2 presents the RDD estimates for these variables. These estimates control for the respondents' NUTS-1 current region of residence and account for sampling weights using analytical weights. Standard errors are clustered in the region of current residence and birth cohort of the female/mother level. Panel A in Table 2 shows that the policy increases middle school completion for all females in the 2021

survey by more than 8 ppt with medium and large bandwidths. For the mothers in our sample, one can observe on Panel B that the policy increases middle school completion by more than 9 ppt for most bandwidths. Panel C in Table 2 shows that the policy does not have a significant impact on household size and children continuing education. These results allow us to drop the 413 out of 7034 children who do not continue their education and add household size as a control variable in our estimations for the estimations for main outcome variables of this research.

Table 3: Policy Effect on Middle School Completion, Household Size, and Continuing Education

	Number of Years Around the Cutoff						
	4	5	6	7	8	9	10
A) Policy Effect on Middle School Completion of All Females							
Policy	0.052	0.071**	0.081**	0.093***	0.094***	0.084***	0.079***
	[0.035]	[0.032]	[0.032]	[0.031]	[0.029]	[0.026]	[0.025]
Observations	2,788	3,469	4,144	4,787	5,358	5,931	6,531
B) Policy Effect on Middle School Completion of Mothers in Our Sample							
Policy	0.079**	0.096***	0.089***	0.101***	0.094***	0.086***	0.096***
	[0.036]	[0.034]	[0.031]	[0.032]	[0.032]	[0.029]	[0.028]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370
C) Households Size of Mothers in Our Sample							
Policy	0.002	-0.075	-0.037	-0.076	-0.061	-0.064	-0.107
	[0.151]	[0.130]	[0.117]	[0.110]	[0.112]	[0.103]	[0.100]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370
D) Policy Effect on Children Continuing Their Education							
Policy	-0.011	-0.020	0.001	-0.003	0.006	-0.002	0.002
	[0.022]	[0.021]	[0.020]	[0.018]	[0.018]	[0.017]	[0.016]
Observations	3,083	3,712	4,285	4,730	5,088	5,381	5,608

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The sample in Panel A consists of all females surveyed in 2021. The dependent variables are Middle School Completion of Females and Mothers, and Children Continuing Their Education, which are dummies that take 1 if the individual has received at least a middle school diploma, and if the child continues their education, respectively. Policy is a dummy variable that takes 1 if the mother/female belongs to the treatment group, i.e., was born after 1986, respectively. The control variables include a set of dummy variables for NUTS-1 current region of residence. All regressions are weighed using sampling weights. Standard errors are clustered at the region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

3.2. Effect of Policy on Having Access to Internet, Computer, and Mobile Phone

As discussed in previous sections, during COVID-19 school closures, computers, mobile phones, and a fast and secure internet connection were essential to continue education. In this section, we check if having a mother who was subject to the 97 CSL had an impact on having access to these technologies in 2021. RDD graphs for each of the variable is displayed in Appendix Figure 3. Table 3 presents the RDD estimates for these variables. Panels A, B, and C in Table 3 depict positive but insignificant and very small coefficients. These results indicate that the policy had a positive but insignificant effect on having internet access and a computer in the house and children having a mobile phone only for their use. The policy effect on children having a computer only for their use is negative but insignificant with very small coefficients. These results indicate that in 2021 there was no significant difference between the children whose mother was subject to the policy and those whose mother was not subject to the policy in access to the internet, computers, and mobile phones. It is important to note that when the 2021 survey was conducted, it had been more than one year since the start of the pandemic, and it was the third semester of online education. Parents may have adjusted and provided their kids with the ICTs necessary for online education during the year, although they had problems with access initially.

Table 4: Policy Effect on Having Access to Internet, Computer, and Mobile Phone

	Number of Years Around the Cutoff						
	4	5	6	7	8	9	10
A) Policy Effect on Children Having Internet Access in their House							
Policy	0.007	0.007	0.015*	0.014*	0.007	0.008	0.010
	[0.010]	[0.008]	[0.008]	[0.007]	[0.009]	[0.008]	[0.007]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Policy Effect on Children Having a Computer in Their House							
Policy	0.006	0.034	0.033	0.021	0.018	0.012	0.010
	[0.043]	[0.039]	[0.038]	[0.035]	[0.034]	[0.032]	[0.032]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272
C) Policy Effect on Children Having a Mobile Phone Only for Their Use							
Policy	0.010	0.013	0.007	0.017	0.001	0.002	-0.012
	[0.038]	[0.034]	[0.035]	[0.032]	[0.032]	[0.031]	[0.029]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272
D) Policy Effect on Children Having a Computer Only for Their Use							
Policy	-0.076	-0.044	-0.020	-0.028	-0.012	-0.023	-0.029
	[0.050]	[0.043]	[0.040]	[0.038]	[0.036]	[0.035]	[0.034]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The sample in Panel A consists of all children surveyed in 2021. The dependent variables are Has Internet Access, Has a Computer in the House, Has Own Mobile Phone, Has Own Computer, which are dummies that take 1 if the child has the quoted ICT. Policy is a dummy variable that takes 1 if the child's mother belongs to the treatment group, i.e., was born after 1986, respectively. The control variables include a set of dummy variables for NUTS-1 current region of residence, a set of dummy variables for the age of the child, and the household size of the child. All regressions are weighed using sampling weights. Standard errors are clustered at the region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

3.3. Effect of Policy on Online Class Participation on Computer and the Internet

Although there seems to be no significant difference between the children of more educated and less educated mothers regarding access to necessary technologies, we can still expect a different online education experience for these children. The parenting styles and the environment provided by the mothers who were subject to the policy and who were not may be different, and it may alter the engagement level to online education. In order to address these concerns, we conducted analyses on the activities done by the children on the internet and using computers and mobile phones. Figure 4 in the Appendix presents RDD graphs for these variables. First of all, as a broad measure, we analyzed whether the children used the internet, computer, or mobile phone to participate in online classes at least once for the whole sample of children and children younger than ten years old. Table 4 Panel 1A and 1B summarizes these results. We observe positive but insignificant coefficients. When we restrict our sample to children younger than ten years old, we observe insignificant coefficients that are slightly bigger than those for the whole sample.

Then, considering the results of Clark et al.(2021), revealing that children who used computers performed better in exams compared to those who used mobile phones, we examined the effect of the policy separately for the internet, computers, and mobile phones. The coefficients in Table 4, Panel 3A, and 3B indicate no evidence to conclude that the policy affected children's online class participation behavior. However, one should approach the results from this measure of online education engagement with caution as this measure shows only one-shot participation of the children. Indeed, it is not surprising that 80% of the children in our sample participated in online classes using the internet, computer, or mobile phone at least once. In the following sections, we consider different measures that show the online education engagement of children.

3.4. Effect of Policy on Total Hours and Educational Hours on the Internet and Computer

We consider the average weekly hours spent using the internet and the computer as a more precise measure for online education engagement. We are mainly interested in the educational hours spent on computers. However, children with access to more resources, such as computers, mobile phones, and the internet, may prefer to allocate their screen time more for non-educational purposes. Thus, we also consider the total hours spent on the internet/computer for educational and non-educational purposes. Figure 5 presents the RDD Graphs, and Table 5 presents the RDD estimates for average hours spent on the internet and computer in a week. In Table 5, because our sample gets smaller and smaller when we change the sub-sample and the bandwidth, we also report bootstrap p-values for our coefficients.

Our estimates revealed that policy did not have a significant effect on the average educational hours spent on computers or the internet in a week for the total sample of children. Moreover, we observe a similar pattern for children younger than 10, a group subject to the same method of education during April 2021. Considering the results from this section and sections 3.2 and 3.3, we conclude that in April 2021, there was no significant difference in access to online education between the children of mothers in the treatment and the control group. Another interpretation of these results is that in terms of the "quantity" of online education, these children did not differ.

However, one should not conclude too hastily that there is no intergenerational transmission of education. We can still suspect that the quality of the education may have differed. More educated parents may be able to send their children to higher quality schools that provided an education that engages the children more by assigning homework and other activities. In the following section, we explore this issue. It is also important to note that the outcome variables we consider in this section are subject to

measurement error as the survey asks the average number of hours in a week, which is a rough measure, and younger children may not comprehend this question very well

Table 5: Policy Effect on Online Class Participation

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The control variables include a set of dummy variables for NUTS-1 current region of residence, and for the age of the child, and the household size of the child. All regressions are weighed using sampling weights. Standard errors are clustered at the region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

	Number of Years Around the Cutoff							Number of Years Around the Cutoff						
	4	5	6	7	8	9	10	4	5	6	7	8	9	10
	1) Using the Internet/Computer/Mobile Phone for Online Classes							3) Using Computers for Online Classes						
A) Total Sample														
Policy	-0.008	0.006	0.016	0.017	0.008	0.013	0.008	0.019	0.032	0.040	0.016	0.023	0.022	0.030
	[0.046]	[0.037]	[0.033]	[0.032]	[0.031]	[0.028]	[0.027]	[0.045]	[0.041]	[0.040]	[0.038]	[0.035]	[0.034]	[0.033]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Children Younger Than 10														
Policy	0.024	0.040	0.041	0.034	0.022	0.025	0.019	0.038	0.058	0.030	-0.012	0.007	0.008	0.014
	[0.052]	[0.044]	[0.039]	[0.037]	[0.035]	[0.033]	[0.032]	[0.052]	[0.049]	[0.046]	[0.045]	[0.041]	[0.038]	[0.037]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	1,595	1,920	2,203	2,436	2,598	2,728	2,812
	2) Using the Internet for Online Classes							4) Using Mobile Phones for Online Classes						
A) Total Sample														
Policy	-0.022	-0.022	-0.020	-0.016	-0.028	-0.024	-0.023	-0.046	-0.042	-0.035	-0.005	-0.022	-0.020	-0.021
	[0.039]	[0.032]	[0.029]	[0.028]	[0.027]	[0.025]	[0.024]	[0.052]	[0.046]	[0.043]	[0.040]	[0.041]	[0.037]	[0.035]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Children Younger Than 10														
Policy	0.022	0.017	0.014	0.003	-0.022	-0.024	-0.028	0.017	0.002	-0.004	0.039	0.021	0.013	0.014
	[0.045]	[0.038]	[0.037]	[0.036]	[0.035]	[0.033]	[0.032]	[0.055]	[0.051]	[0.052]	[0.047]	[0.044]	[0.041]	[0.039]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	1,595	1,920	2,203	2,436	2,598	2,728	2,812

Table 6: Policy Effect on Total Time and Educational Time Spent on Computer

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The control variables include a set of dummy variables for NUTS-1 current region of residence, a set of dummy variables for the child's age, and the child's household size. All regressions are weighed using sampling weights. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

	Number of Years Around the Cutoff							Number of Years Around the Cutoff						
	4	5	6	7	8	9	10	4	5	6	7	8	9	10
	1) Total Time Spent on the Internet							3) Educational Time Spent on the Internet						
A) Total Sample														
Policy	0.828	1.324	0.630	0.384	0.018	0.247	0.074	0.650	0.935	0.516	0.248	0.084	0.248	0.239
	[1.729]	[1.494]	[1.223]	[1.106]	[1.032]	[0.977]	[0.964]	[1.176]	[0.959]	[0.810]	[0.771]	[0.711]	[0.683]	[0.672]
Bootstrap p-value	0.673	0.445	0.622	0.734	0.986	0.804	0.941	0.631	0.390	0.542	0.756	0.912	0.730	0.733
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Children Younger Than 10														
Policy	2.208	2.995*	2.089	2.045	1.626	1.507	1.451	1.223	2.035*	1.531	1.461	1.060	1.012	1.111
	[2.186]	[1.660]	[1.450]	[1.313]	[1.235]	[1.211]	[1.175]	[1.426]	[1.125]	[0.994]	[0.933]	[0.876]	[0.860]	[0.838]
Bootstrap p-value	0.395	0.116	0.176	0.156	0.216	0.250	0.238	0.464	0.113	0.148	0.157	0.250	0.274	0.210
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	1,595	1,920	2,203	2,436	2,598	2,728	2,812
	2) Total Time Spent on the Computer							4) Educational Time Spent on the Computer						
A) Total Sample														
Policy	1.333	1.212	0.969	0.386	0.351	0.412	0.695	0.985	1.185	1.041	0.460	0.391	0.466	0.627
	[1.588]	[1.378]	[1.199]	[1.108]	[1.084]	[1.031]	[1.018]	[1.011]	[0.888]	[0.775]	[0.719]	[0.703]	[0.678]	[0.671]
Bootstrap p-value	0.464	0.435	0.456	0.743	0.769	0.709	0.501	0.394	0.228	0.205	0.551	0.601	0.515	0.360
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Children Younger Than 10														
Policy	1.792	2.094	1.415	0.383	0.749	0.793	0.873	1.208	1.709	1.426	0.729	0.824	0.971	1.076
	[1.950]	[1.599]	[1.431]	[1.306]	[1.245]	[1.207]	[1.156]	[1.245]	[1.077]	[0.956]	[0.875]	[0.834]	[0.819]	[0.783]
Bootstrap p-value	0.442	0.243	0.368	0.790	0.566	0.538	0.466	0.405	0.157	0.172	0.448	0.346	0.272	0.184
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	1,595	1,920	2,203	2,436	2,598	2,728	2,812

3.5. Effect of Policy on Homework Activity on Computer and the Internet

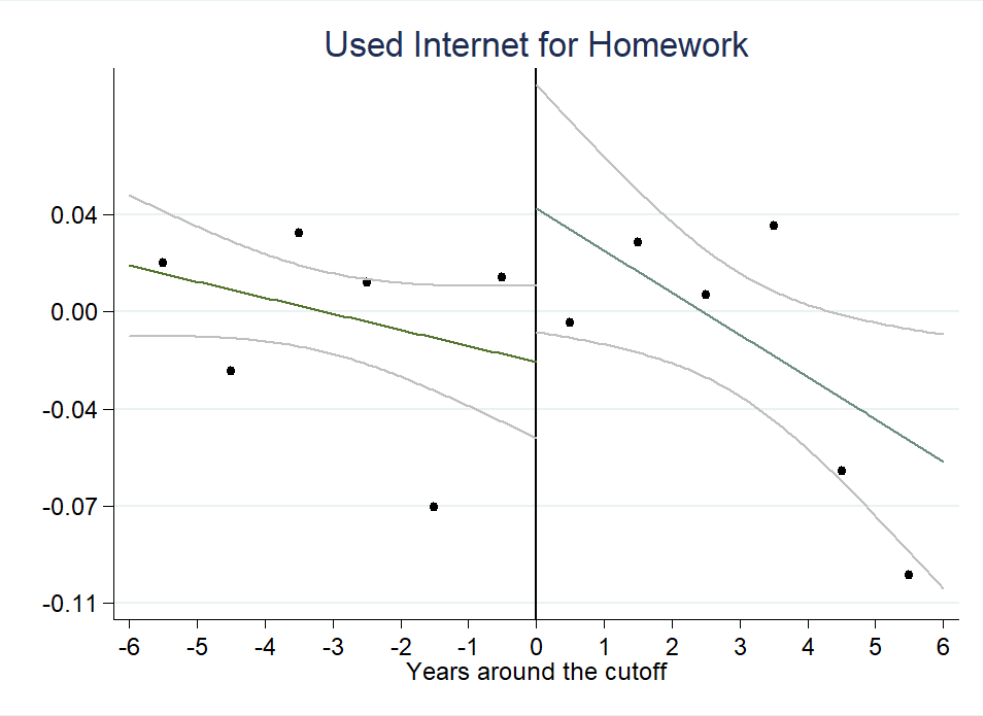

Figure 1: Policy Effect on Homework Activity on Computer and the Internet

In this section, we explore whether the children whose parents were subject to the policy used the internet more than their peers to do their homework or to learn something. Table 6 summarizes our findings. Our RDD estimates for the whole sample of children indicate that policy positively and significantly affected this behavior. This result is consistent across all bandwidths. For small to medium bandwidths, a child in the treatment group used the internet by more than 6 ppt, and for large bandwidths, more than 5 ppt for learning purposes compared to their peers in the control group. We observe a similar pattern for children younger than 10. For this subsample, we have positive and significant coefficients only for 5 out of 7 bandwidths that we consider. For this subsample of children younger than 10, we observe larger coefficients.

Considering the results from all sections from Section 3.2 to 3.5, our interpretation is as follows: In April 2021, access to online education and the "quantity" or duration of

online education was no longer a problem. This is expected because it already had been one year since the start of the pandemic, and it was the third semester of online education, which gives enough time for parents and schools to adjust and respond to the children's online education needs. Most probably, what differed was the quality of education that the children were subject to and the engagement level of the children. A possible explanation for this difference is that maybe more educated parents sent their kids to better schools or value their children's education more, which made them monitor their kids' online education engagement. Another possibility is that maybe more educated parents acted as role models for their kids because they were also using the internet or computer for educational purposes, or they were equipped with more digital skills that can help the child. Therefore, we also analyzed the policy effect on the digital skills of mothers. Table 3A in Appendix presents the RDD estimates for the digital skills of the parents. We find that although the policy had a positive and significant effect on the more basic digital skills, such as transferring a file, it did not affect other digital skills or the variety of digital skills that mothers have.

Table 7: Policy Effect on Using the Internet to Do Homework or Learn Something

	Number of Years Around the Cutoff						
	4	5	6	7	8	9	10
	1) Using the Internet to Do Homework						
A) Total Sample							
Policy	0.067*	0.071**	0.074**	0.061*	0.059*	0.053*	0.051*
	[0.038]	[0.033]	[0.032]	[0.032]	[0.030]	[0.029]	[0.028]
Observations	2,901	3,488	4,035	4,451	4,780	5,054	5,272
B) Children Younger Than 10							
Policy	0.103*	0.116**	0.124**	0.093*	0.075*	0.056	0.052
	[0.053]	[0.046]	[0.043]	[0.042]	[0.040]	[0.039]	[0.037]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The sample in Panel A consists of all children surveyed in 2021. The dependent variable is Using the Internet for Homework, a dummy that takes 1 if the child has used the internet for homework. The policy is a dummy variable that takes 1 if the child's mother belongs to the treatment group, i.e., born after 1986. The control variables include a set of dummy variables for NUTS-1 current region of residence and a set of dummy variables for the child's age and household size. All regressions are weighed using sampling weights. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

CHAPTER 4

ROBUSTNESS CHECKS

4.1. Fuzzy Regression Discontinuity Design

As we discussed in the previous sections, there is some degree of non-compliance with the 97 CSL because the rule regarding the school start age was not strictly enforced. Therefore, we also consider a Fuzzy Regression Discontinuity Design. We use the treatment status of the mother, defined according to the 1986 birth year cutoff, as an instrument to estimate the causal effect of the mother's middle school completion on the online education experience of the children.

Table 7 reports the results for Educational Time Spent on the Computer and the Internet and Using the Internet for Homework for the whole sample and the subsample of children younger than 10. One can see that these results are very similar to the findings in Tables 5 and 6. Thus, we can conclude that our findings are robust when we use a Fuzzy Regression Discontinuity Design.

Table 8: Fuzzy Regression Discontinuity Estimations – Effect of Middle School Completion on Selected Variables

	A) Children Younger Than 10 Number of Years Around the Cutoff							B) All Sample Number of Years Around the Cutoff						
	4	5	6	7	8	9	10	4	5	6	7	8	9	10
	1) Educational Time Spent on the Internet							1) Educational Time Spent on the Internet						
MSD	13.091	25.887*	29.952	21.512	14.531	17.879	18.264	8.732	12.023	7.098	3.556	1.205	3.888	3.949
	[13.399]	[15.722]	[24.378]	[14.912]	[11.987]	[16.251]	[14.046]	[12.277]	[10.032]	[9.448]	[8.242]	[8.570]	[9.253]	[8.052]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	2,901	3,488	4,035	4,451	4,780	5,054	5,272
F-Statistic	4.938	4.176	1.984	3.667	4.537	2.849	3.843	7.860	9.467	9.154	9.757	8.759	7.497	10.14
	2) Educational Time Spent on the Computer							2) Educational Time Spent on the Computer						
MSD	12.541	21.691	27.826	11.325	11.371	17.114	17.633	11.678	14.090	13.057	5.579	4.718	6.688	8.348
	[11.652]	[14.386]	[22.872]	[11.631]	[10.737]	[14.814]	[12.728]	[10.961]	[9.490]	[9.219]	[7.255]	[7.899]	[8.705]	[7.548]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	2,901	3,488	4,035	4,451	4,780	5,054	5,272
F-Statistic	4.938	4.176	1.984	3.667	4.537	2.849	3.843	7.860	9.467	9.154	9.757	8.759	7.497	10.14
	3) Using the Internet for Homework							3) Using the Internet for Homework						
MSD	1.056*	1.463*	2.412	1.364	1.018	0.982	0.857	0.789*	0.840**	0.913**	0.683*	0.691*	0.727*	0.653*
	[0.638]	[0.880]	[1.812]	[0.887]	[0.669]	[0.837]	[0.684]	[0.460]	[0.425]	[0.464]	[0.387]	[0.391]	[0.438]	[0.367]
Observations	1,595	1,920	2,203	2,436	2,598	2,728	2,812	2,901	3,488	4,035	4,451	4,780	5,054	5,272
F-Statistic	4.938	4.176	1.984	3.667	4.537	2.849	3.843	7.860	9.467	9.154	9.757	8.759	7.497	10.14

Notes: Each column reports the effect of the policy for different bandwidths around the cutoff. The sample in Panel A consists of all children younger than 10. Panel B reports the estimations for the whole sample of children. MSD is a dummy variable that takes the value of 1 if the child's mother has a middle school degree. The control variables include a set of dummy variables for NUTS-1 current region of residence and a set of dummy variables for the child's age and household size. All regressions are weighed using sampling weights. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

4.2. Placebo Check

In order to assess the robustness of our results, we also provide a placebo check by gradually shifting the cutoff year away from our original cutoff by three years in either direction and redefining the treatment variable accordingly. Such an analysis allows us to eliminate the possibility that a random trend between our outcome variables and the birth cohorts of the mothers in our sample drives our results. We provide a placebo test to assess the robustness of our main finding regarding the Using the Internet for Homework outcome variable.

Our estimations in Table 8 show the effect of the placebo reforms for different bandwidths around the placebo reform. One can observe that placebo reforms do not have a significant impact on the probability of using the Internet for homework. Thus, we can conclude that our results are robust

Table 9: Effect of Placebo Reforms on Using the Internet for Homework

	Year of Discontinuity						
	1983	1984	1985	1986 (Actual Cutoff)	1987	1988	1989
BW = 4							
Policy	-0.008	-0.030	-0.030	0.103*	0.029	0.021	-0.040
	[0.056]	[0.062]	[0.054]	[0.053]	[0.053]	[0.045]	[0.051]
Observations	1,637	1,653	1,646	1,595	1,548	1,491	1,372
BW = 5							
Policy	-0.032	-0.066	-0.012	0.116**	0.028	0.054	-0.017
	[0.051]	[0.054]	[0.050]	[0.046]	[0.045]	[0.044]	[0.046]
Observations	1,938	1,964	1,946	1,920	1,852	1,746	1,601
BW = 6							
Policy	-0.047	-0.075	-0.024	0.124***	0.051	0.040	0.004
	[0.049]	[0.048]	[0.049]	[0.043]	[0.042]	[0.040]	[0.043]
Observations	2,188	2,231	2,238	2,203	2,118	1,962	1,814
BW = 7							
Policy	-0.043	-0.072	-0.023	0.093**	0.061	0.045	0.002
	[0.045]	[0.046]	[0.046]	[0.042]	[0.040]	[0.038]	[0.040]
Observations	2,405	2,462	2,488	2,436	2,313	2,186	2,002
BW = 8							
Policy	-0.041	-0.057	-0.029	0.075*	0.034	0.054	0.013
	[0.042]	[0.043]	[0.044]	[0.040]	[0.038]	[0.037]	[0.038]
Observations	2,603	2,662	2,660	2,598	2,504	2,353	2,197
BW = 9							
Policy	-0.026	-0.056	-0.029	0.056	0.026	0.036	0.028
	[0.040]	[0.041]	[0.041]	[0.039]	[0.037]	[0.036]	[0.037]
Observations	2,771	2,801	2,772	2,728	2,638	2,515	2,362
BW = 10							
Policy	-0.023	-0.050	-0.037	0.052	0.013	0.031	0.014
	[0.038]	[0.039]	[0.040]	[0.037]	[0.036]	[0.035]	[0.035]
Observations	2,892	2,881	2,869	2,812	2,739	2,647	2,523

Notes: Policy is a dummy variable that takes 1 if the mother belongs to the treatment group. The control variables include a set of dummy variables for the NUTS-1 current region of residence, child age, and household size. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

4.3. Non-Linear Trends

The validity and robustness of our main results heavily depend on the functional form of the trend component. In this section, we aim to show that our main results are robust when we add a quadratic trend to our estimations. Table 9 presents the coefficients from our estimates with a quadratic trend. The coefficients for educational and total time spent on the internet/computer are still positive but insignificant in conventional significance levels, which implies no evidence for policy effect on these variables. The coefficients for using the internet to do homework are again positive and highly significant. Having observed these results consistent with our main findings, we can say that our results are robust to changing the trend assumption.

Table 10: Estimations with Quadratic Trends for Selected Variables for 6-10 Age Group

	Number of Years Around the Cutoff		
	8	9	10
	1) Educational Time Spent on the Internet		
Policy	2.554*	2.099	1.747
	[1.435]	[1.398]	[1.282]
Observations	2,598	2,728	2,812
	2) Educational Time Spent on the Computer		
Policy	1.841	1.278	1.116
	[1.357]	[1.313]	[1.181]
Observations	2,598	2,728	2,812
	3) Total Time Spent on the Internet		
Policy	3.629*	3.189	2.891
	[2.154]	[2.043]	[1.849]
Observations	2,598	2,728	2,812
	4) Total Time Spent on the Computer		
Policy	1.992	1.533	1.298
	[2.088]	[1.970]	[1.792]
Observations	2,598	2,728	2,812
	5) Using the Internet to Do Homework		
Policy	0.179***	0.178***	0.154***
	[0.063]	[0.060]	[0.056]
Observations	2,598	2,728	2,812

Notes: The control variables include a set of dummy variables for the NUTS-1 current region of residence, child age, and household size. Quadratic time trends are added as control variables, and we allow for differential quadratic time trends on the right-hand side and left-hand side of the cutoff. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

CHAPTER 5

CONCLUDING REMARKS

The prior empirical literature on intergenerational transmission of education is mainly focused on developed countries. This study investigates the intergenerational transmission of education in a developing country, Turkey. To do this, we use COVID-19 Online Education Era as a case study. We are mainly interested in establishing a causal link between mothers' education and children's online education experience during COVID-19 online education era. We assess the online education experience by the ICTs the child has access to, whether they participated in online classes at least once, total and educational hours spent on the computer or the internet in a week, and whether they used the internet to do homework. We use the exogenous variation in education created by the 1997 Compulsory Schooling Law of Turkey as a natural experiment for identification.

Our results suggest that the reform did not have a statistically significant effect on ICT access, online class participation, and total and educational hours spent on the internet or on the computer. However, the reform increased the probability of using the internet for homework by 5.1-7.4 ppt for the whole sample and 7.5-12.4 ppt for children younger than 10. Moreover, these results are robust after we conduct several robustness checks.

These results indicate that a mother's reform status does not have a significant effect on the "quantity" of online education, but it may have a significant effect on the "quality" of online education the children obtained during COVID-19. One possible explanation for this can be the differences in school quality. During the pandemic, higher-quality schools may have provided a more engaging education by giving more homework and follow-up on children. More educated mothers can self-select their children into higher-quality schools, which can substantially affect the online education experience of their children. Similarly, more educated mothers may have monitored their children's online education experience. Another explanation of this phenomenon can be the role model effect of the mothers. A more educated mother might use the Internet for learning purposes, which can inspire their children to do so.

Our analysis provides a case study focusing on the COVID-19 online education era. To understand intergenerational transmission in Turkey, one should also analyze it in other contexts. Our results also imply a potentially vulnerable group in terms of education: children from lower-educated families. The degree of educational loss during COVID-19 is still unknown in Turkey. A piece of empirical evidence that quantifies the educational loss during COVID-19 would be essential for policymakers to develop policies to compensate for the educational loss and prevent the snowball effect in terms of educational loss.

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APPENDIX

Table 10: Variable Descriptions

VARIABLE	DEFINITION
Normalized Birth Year(Birth)	-((Age of the Mother)-34)
Policy	A dummy variable that takes the value 1 if the Birth is bigger than or equal to zero; 0 otherwise
Has Middle School Degree (MSD)	A dummy variable that takes the value 1 if the mother/female has a middle school degree or a higher level of degree; 0 otherwise
NUTS-1	Set of dummy variables for NUTS-1 regions of Turkey.
Continuing the Education	A dummy variable that takes the value 1 if the child is continuing their education; 0 otherwise
Household Size(HHS)	Number of people living in the household of the person who is surveyed
Has Internet Access	A dummy variable that takes the value 1 if the child or any member of the household has internet access at their house
Has a Computer in the House	A dummy variable that takes the value 1 if there is a computer(desktop/laptop/tablet) in the household of the children (can be shared with others)
Has Own Mobile Phone	A dummy variable that takes the value 1 if the child has a mobile phone dedicated only for their own use
Has Own Computer	A dummy variable that takes the value 1 if the child has a computer(desktop/laptop/tablet) dedicated only for their own use
Using the Internet to Participate in Online Classes	A dummy variable that takes the value 1 if the child used the internet at least once to participate in online classes
Using Computers for Online Classes	A dummy variable that takes the value 1 if the child used a computer at least once to participate in online classes
Using Mobile Phones for Online Classes	A dummy variable that takes the value 1 if the child used a mobile phone at least once to participate in online classes

Table 10 (Cont'd)	
Using the Internet/Computer/Mobile Phone for Online Classes	A dummy variable that takes the value 1 if the child used a mobile phone or a computer or the internet at least once to participate in online classes
Total Time Spent on Computers	Average hours spent in a week on a computer for both educational and non-educational purposes
Total Time Spent on the Internet	Average hours spent in a week on the Internet for both educational and non-educational purposes
Educational Time Spent on Computers	Average hours spent in a week on a computer for educational purposes
Educational Time Spent on the Internet	Average hours spent in a week on the Internet for educational purposes
Using the Internet to do Homework	A dummy variable that takes the value 1 if the child used the internet at least once to do homework or learn something
Variety of Digital Skills	Total number of digital skills an individual has
Having any Digital Skill	A dummy variable that takes the value 1 if the individual has any one of the digital skills in the survey
Transferring File Digital Skill	A dummy variable that takes the value 1 if the individual can transfer files
Downloading Apps Digital Skill	A dummy variable that takes the value 1 if the individual can download applications

Table 11: Balanced Covariate Check

	R.D. Effect	p-value
NUTS1 Region -1	0.01	0.953
NUTS1 Region -2	0.009	0.814
NUTS1 Region -3	-0.007	0.961
NUTS1 Region -4	-0.029	0.799
NUTS1 Region -5	-0.011	0.928
NUTS1 Region -6	-0.039	0.8
NUTS1 Region -7	0.015	0.814
NUTS1 Region -8	0.005	0.937
NUTS1 Region -9	0.005	0.888
NUTS1 Region -10	-0.002	0.963
NUTS1 Region -11	-0.018	0.79
NUTS1 Region -12	0.061	0.672
Age of the Child -6	-0.019	0.296
Age of the Child -7	0	0.989
Age of the Child -8	-0.033	0.055
Age of the Child -9	0.045	0.004
Age of the Child -10	0.032	0.094
Age of the Child -11	0.005	0.746
Age of the Child -12	0.01	0.644
Age of the Child -13	-0.002	0.915
Age of the Child -14	-0.017	0.402
Age of the Child -15	-0.021	0.146

Notes: The estimations presented in this table are for the observations in the six years bandwidth of the cutoff

Table 12: Policy Effect on the Selected Digital Skills of the Mothers in Our Sample

	Number of Years Around the Cutoff						
	4	5	6	7	8	9	10
A) Policy Effect on Variety of Digital Skills							
Policy	0.153	0.270*	0.251*	0.163	0.164	0.182	0.167
	[0.165]	[0.156]	[0.135]	[0.135]	[0.134]	[0.119]	[0.114]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370
B) Policy Effect on Having Any Digital Skill							
Policy	0.000	0.013	0.020	0.022	0.024	0.033	0.028
	[0.039]	[0.038]	[0.036]	[0.035]	[0.036]	[0.034]	[0.033]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370
C) Policy Effect on Transferring File Digital Skill							
Policy	0.057	0.076**	0.080**	0.071**	0.065**	0.081**	0.073**
	[0.042]	[0.037]	[0.036]	[0.034]	[0.033]	[0.032]	[0.030]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370
D) Policy Effect on Downloading Apps Digital Skill							
Policy	0.030	0.048	0.048	0.054*	0.053*	0.049*	0.049*
	[0.038]	[0.035]	[0.032]	[0.031]	[0.031]	[0.029]	[0.028]
Observations	1,762	2,143	2,495	2,790	3,012	3,212	3,370

Notes: The control variables include a set of dummy variables for the NUTS-1 current region of residence, child age, and household size. Standard errors are clustered at the current region-by-birth-year level. *, **, *** denote significance levels of 10%, 5% and 1%, respectively. Standard errors are in parentheses. Source: 2021 ICT Usage Survey

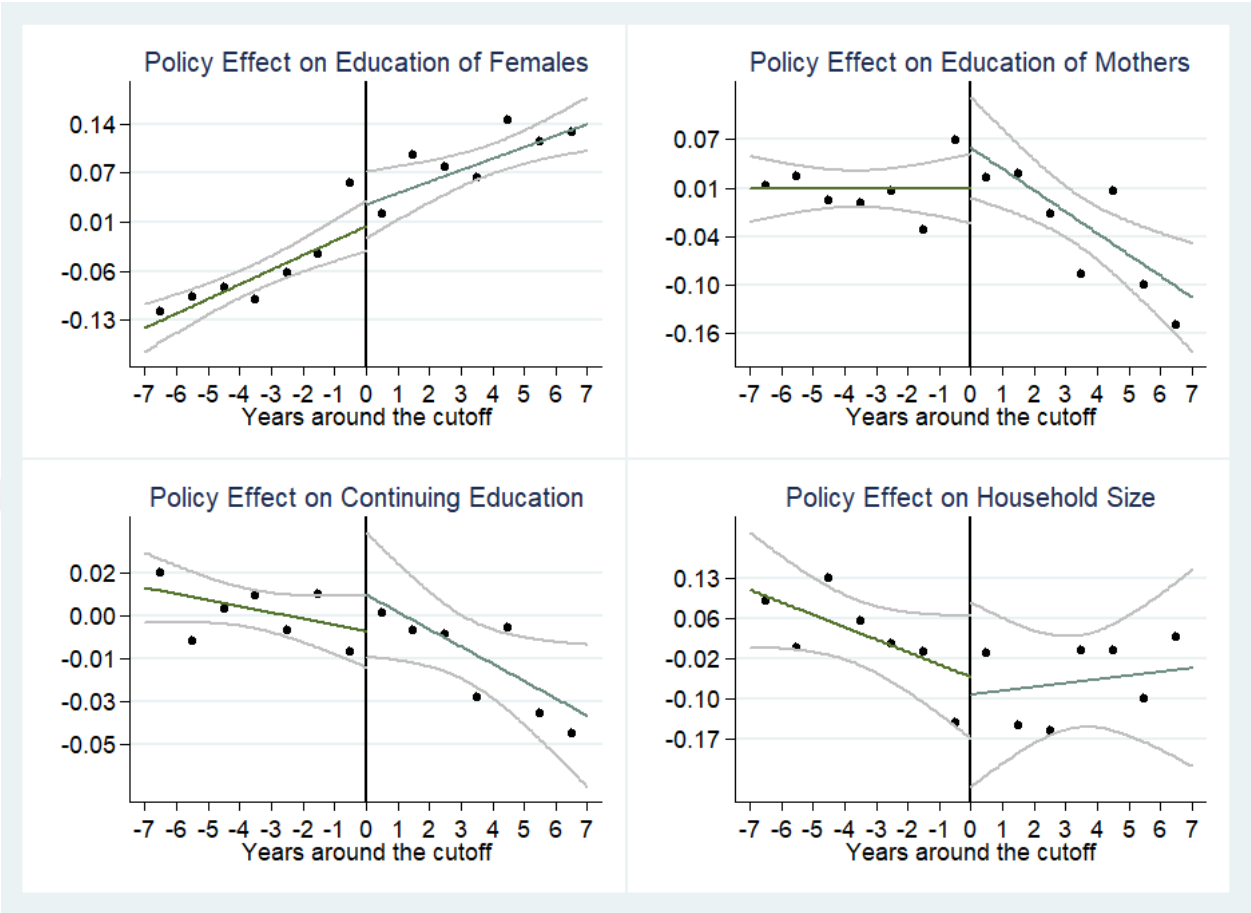

Figure 2: Policy Effect on and Mothers' Education, Continuing Education, Household Size

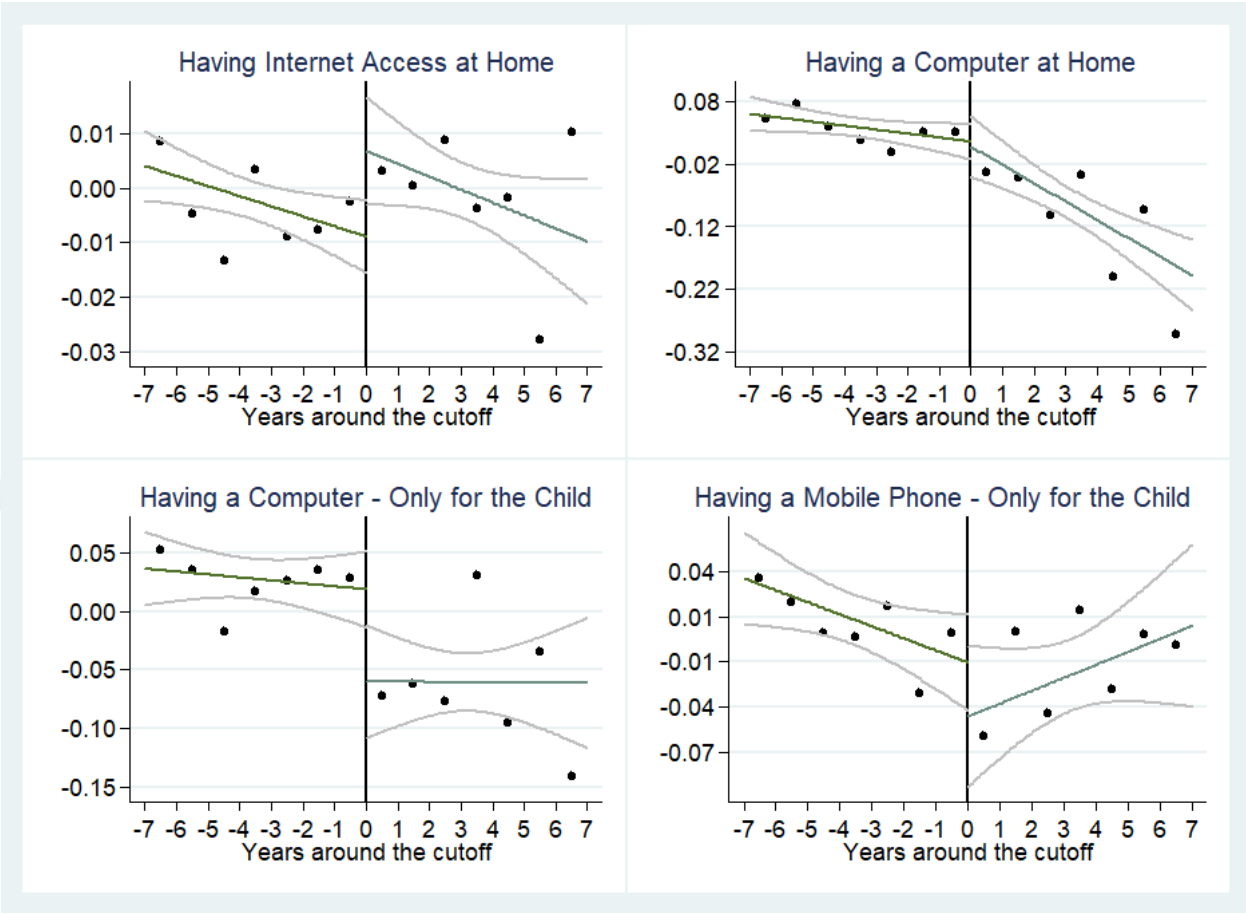

Figure 3: Policy Effect on Having Access to Internet, Computer, and Mobile Phone

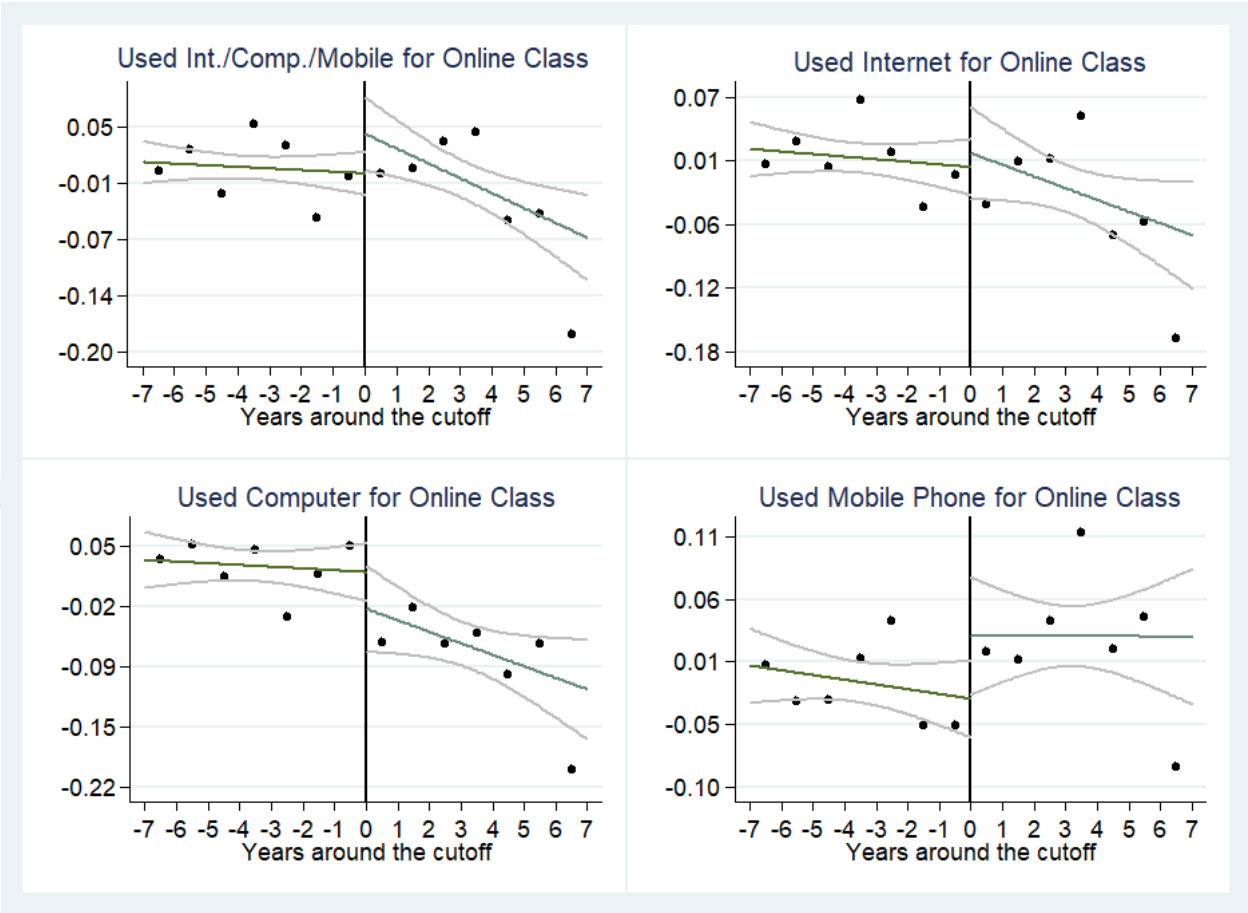

Figure 4: Policy Effect on Online Class Participation on Computer and the Internet

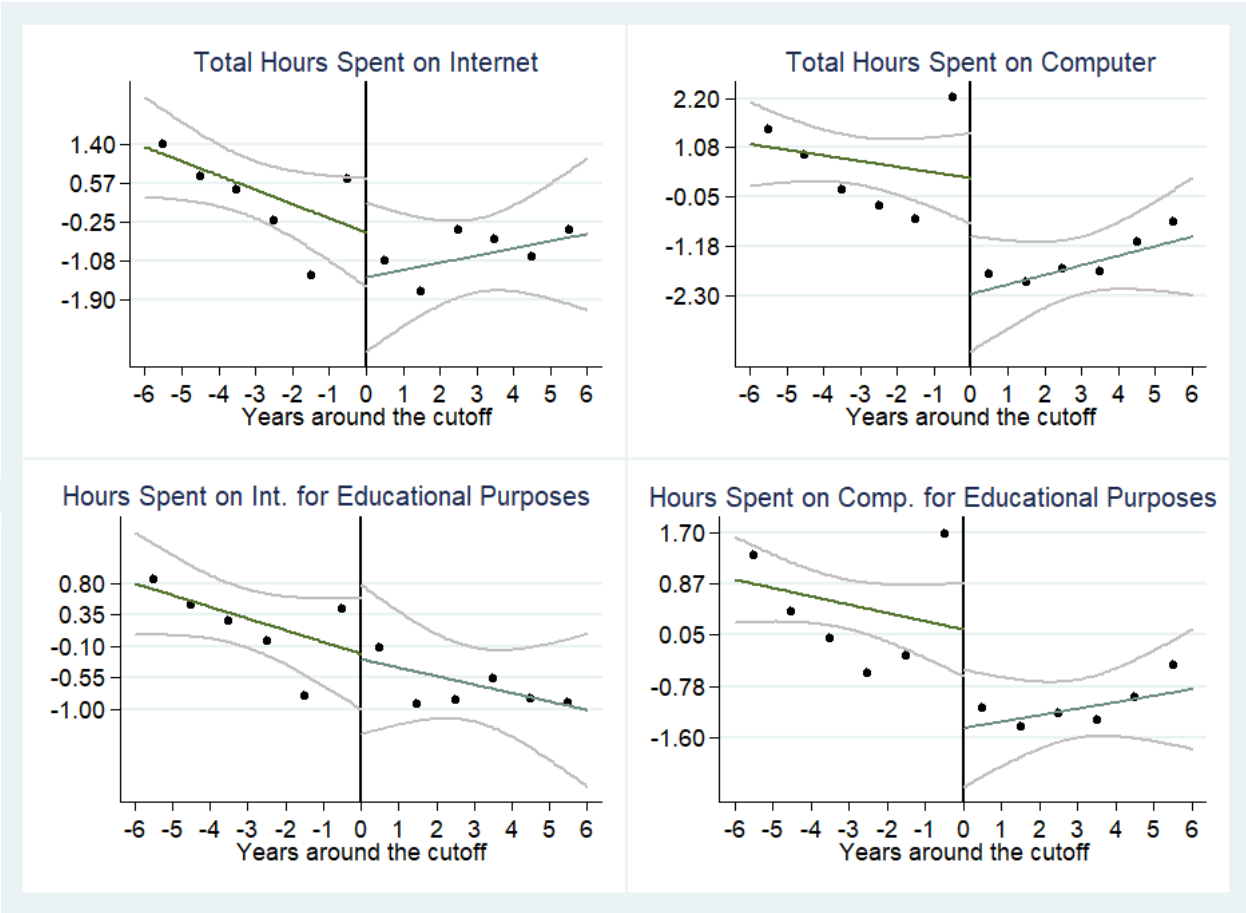

Figure 5: Policy Effect on Total Time and Educational Time Spent on Computer