Abortion and Child Cognitive Outcomes[*]

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Abstract

In December 1989, following the fall of communism in Romania, the ban on access to abortion and birth controls methods was lifted. This paper attempts to analyze the educational achievements of children affected by the lift of this ban, using administrative data of secondary school admission exam scores and placement outcomes. We find robust evidence that children born after the liberalization of abortion have higher test scores and are more likely to place in a secondary school with an academic profile and with better peers. This finding is consistent with two possible channels through which a change in abortion legislation can affect child outcomes: (1) children born after the ban are more likely to live in families from more educated backgrounds and (2) they are less likely to have been unwanted at birth.

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1 Introduction

This paper presents evidence on the effect of changes in access to abortion on child cognitive outcomes. In order to understand this effect, it is crucial to know the mechanisms through which changes in an abortion regime affect the selection of women who give birth. First, average educational outcomes could be affected by changes in the *socio-economic composition* of women who carry pregnancies to term. The direction of the effect depends on which type of women are more likely to use abortion as supposed to other methods of birth control.[1] Second, changes in access to abortion can affect the number of children who are unplanned or unwanted at birth. This effect of being *unwanted* can arise for a number of reasons: (1) when childbearing does not occur at an optimal time it can affect educational, marriage and labor market decisions of a woman (Angrist and Evans, 1999, Goldin and Katz, 2002); (2) when an undesired additional birth affects lifetime fertility, child outcomes are negatively influenced through the standard child quality/quantity trade-off (Becker and Lewis,1973; Becker, 1981); and (3) lack of access to abortion does not allow parents to decide whether to carry a pregnancy to term based on fetal health (Grossman and Jacobowitz 1981; Joyce 1985; Grossman and Joyce 1990). Finally, any changes in cohort size caused by legislative changes regarding abortion can affect educational outcomes through changes in the *crowding* of educational resources.

The existing empirical literature on this topic has focussed mainly on the outcomes of children born around the legalization of abortion in US states in the early 1970s following Roe v. Wade and a number of similar state legislative changes. Given that in the US, the marginal user of abortion during this period was more likely to come from a more disadvantaged background, the effect of changes in the *composition* of women as well as the changes in fraction of *unwanted* births suggest that average outcomes of children should have increased following the liberalization of abortion.[2] This prediction is broadly confirmed in a number of studies that have analyzed different outcomes, ranging from poverty and educational attainment to drug use and crime (Gruber, Levine, and Staiger

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[1]Ananat et al. (2006) suggest the possibility of another source of selection given that changing the cost of abortion will also change pregnancy behavior. The present study assumes that at least in the short period studied immediately after the change in abortion regime there are no changes in marginal pregnancies.

[2]This literature does not address any crowding effect.

(1999), Ananat et al. (2006), Charles and Stephens (2006), Donohue, Grogger and Levitt (2002) and Donohue and Levitt (2001).[3][4]

In a recent paper Pop-Eleches (2006) has explored educational and labor market outcomes of children born as a result of a major change in Romania's abortion regime in 1966, when the country went from one of the most liberal abortion policies in the world to a very restrictive regime that made abortion and family planning illegal for most women. On average, children born in 1967 just after abortions became illegal displayed better educational and labor market achievements than children born just prior to the change, and this surprising finding can be explained by a change in the *composition* of women having children that is different from the US case. Women from more advantaged backgrounds were more likely to have abortions prior to the policy change, so the composition of children born into more advantaged families increased. However, after controlling for this type of composition using observable background variables, children born after the ban on abortions had significantly worse schooling and labor market outcomes, consistent with the existence of an *unwantedness effect*.[5]

Romania's restrictive ban was sustained, with only minor modifications, until December 1989, when following the fall of communism the country reverted back to a liberal policy regarding abortion and modern contraceptives. The present analysis uses the lift of the ban in December 1989, a ban that resulted in an immediate decrease in fertility, in order to examine child outcomes. The major advantage of the present setting is the availability of much better indicators of child cognitive outcomes, as measured by an admission score for the national placement exam into secondary education and a number of additional measures of educational achievement. Analyzing the 1989 change is of interest also because unlike the 1966 policy shift, the direction of the *compositional* effect reversed, because women from more disadvantaged educational background experienced the largest reductions in fertility. The outcomes of children born after the legalization of abortion should improve due to both *compositional* changes and reductions in the frac-

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[3]Another line of research looks at oucomes of children born to mothers who were denied an abortion (Myhrman (1988), Blomberg (1980), Dytrych et al. (1975), David and Matejcek (1981) and David (1986)). These studies find negative outcomes along many dimensions but their design cannot convincingly address the selection into treatment.

[4]Joyce (2004 and 2009) and Foote and Goetz (2008) have written critiques of the Donohue and Levitt (2001) paper. See also the reponses of Donohue and Levitt (2004, 2008) to these papers.

[5]Additionally, the analysis provides evidence of crowding in the schooling system.

tion of children who are *unwanted*, thus the direction of the effect should be similar to the liberalization in the US in the 1970s.

We start our analysis showing that the lift of the ban on abortions at the end of December 1989 led to a sharp and immediate reduction by one third in the number of births about six months later (after July of 1990).[6] This abrupt change allows for the implementation of a simple empirical strategy which compares outcomes of children born immediately before and after July of 1990 while also accounting for possible time trends and month of birth effects by using similar data from adjacent birth cohorts.

Using data from the Romanian Census of 2002, we first examine the change in the composition of women by educational attainment after July of 1990 and find that a smaller proportion of children are born to mothers with only primary education, consistent with the view that by 1990, women with less education were more likely to benefit from the liberalization of abortion. Additionally we show that the liberalization of the ban affected the age when women give birth as well as longer term fertility levels, indicating that women who gave birth before 1990 could not optimally chose the timing of their fertility decisions.

The main part of the analysis uses data on all the children who took the entrance exam into secondary schools in 2005 and 2006 in Romania, which according to Romania's school entry laws contains the cohorts born in 1990 and 1991. The dataset contains an excellent indicator of child cognitive achievement - the score on the national placement exam - as well as information on the quality of the school where the student was eventually admitted as a result of the centralized admission process. We find robust evidence that children born after the ban on abortions was lifted scored higher on the national entrance exam and were more likely to be placed in a school with higher scoring peers, were less likely to place into a vocational school and were more likely to be admitted into the most desirable academic high school track.

The paper is organized as follows. Section 2 provides a background of the Romanian history of legislative changes regarding access to abortion and other birth control methods. Section 3 describes the data and the relevant samples. The next section explains the empirical strategy used to identify the effect of the policy change on child outcomes.

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[6]Given that a pregnancy lasts about nine months and legal abortions under the liberal policy are allowed in the first three months of pregnancy, we expect a six month lag between policy announcement and the fertility response.

Section 5 presents the results, followed by the conclusion.

2   The liberalization of abortion and birth control in 1989

This section provides a brief description of Romania's unique history of access to abortion and birth control during communism.[7] After introducing liberalized access to abortion in the 1950's, abortion become the main birth control method until 1966[8], when the Romanian government abruptly outlawed abortion for most women of reproductive age[9] and severely restricted access to other modern methods of contraception. This policy was maintained with very minor modifications until the fall of communism in December of 1989.[10] The liberalization of access to abortion was equally abrupt and provides the discontinuity in fertility behavior that this paper tries to exploit to understand how changing access to abortion affects child development. Following the civil unrest that started in Timisoara in mid-December of 1989 and spread to other parts of the country, Romania's dictator was executed on December 25th. On December 26th, the interim leadership abolished the ban on access to abortions and in early January of 1990 the ban on import of modern contraceptives was lifted.[11] Figure 1A plots the fertility for Romania during the period 1960-1997 as well as the average for three other Eastern European countries (Hungary, Bulgaria, Russia) who did not have similar restrictions on the supply of birth control methods during this period. The initial increase in fertility was dramatic with the total fertility rate doubling between 1966 and 1967 to 3.7 children. Following the initial spike in fertility, the number of births did stabilize in the 1970s and 1980s but at a higher level. Following the lift of the ban, one can observe an immediate drop in fertility in 1990 but also a downward trend in fertility levels between 1992 and 1997 that is similar

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[7]For a more detailed discussion see Kligman (1998).

[8]In 1965, there were four abortions performed for every live birth (Berelson, 1979).

[9]Exceptions were made for women over 42, with more than four children as well as for some special circumstances (such as health problems, rape or incest).

[10]The increase in fertility after 1984 is due to further restrictions of the abortion regime. In addition to stricter monitoring of pregnant women, the minimum abortion age was increased from 42 to 45 years and the minimum number of births in order to be able to receive a legal abortion from 4 to 5.

[11]According to an account of a Romanian gynecologist, his hospital was stormed by over 300 women in need of an abortion on December 27 of 1989 (information based on a personal interview).

to fertility trends in Hungary, Bulgaria and Russia. The gradual decline in fertility in transition economies in the 1990s is the result of the social and economic transformations in these countries following the fall of communism.

In this paper, the focus is on the short run changes in fertility that happened in Romania in one year (1990). In a different paper, Pop-Eleches (2005) has argued that the sharp drop in fertility immediately after July of 1990 is driven by changes in access to abortion and not by changes in access to other methods of birth control[12] or by changes in the demand for children caused by the transition period. The most convincing evidence on the abortion induced change in fertility is presented in Figure 1B where data from the 1992 census is used to plot the number of children born in a particular months for the period 1989-1991. One can observe an abrupt one time drop in fertility starting six months after the lift of the ban (July of 1990) without any apparent trend in the birth rates during this period.

There are two alternative stories that might explain the drop in fertility after July of 1990 that are discussed in greater detail in Pop-Eleches (2005). First, the government introduced a number of pronatalist incentives in 1966 in addition to the ban of abortions and modern contraception in 1966. These incentives, although very small (one time paid medical leaves during pregnancy, one time maternity grant of about $85 and a $3 increase in the monthly child allowance[13]) might have changed the demand for children. The change in demand for children would be a worry for the present analysis only if the government also repealed these incentives in December of 1989 at the same time as the change in abortion legislation. According to a report by the World Bank (1992) no major changes in the provision of maternity and child benefits happened in this period.[14] The second alternative interpretation of the fertility pattern in 1990 is that the fall of the communist regime in Romania caused people to immediately update their expectations about the future as a results of the change from a repressive regime to a democratic society and to make immediate adjustments to their life-cycle behavior, such as fertility decisions.

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[12]The evidence presented in Pop-Eleches (2005) shows that between 1990 and 1992 there was no increase in the use of modern contraceptives in Romania.

[13]A monthly average wage in Romania during this period was just under $100.

[14]The level of social benefits during the transition period certainly changed in Romania as in most other transition countries as a result of budgetary cuts caused by the severe drop in GDP and might have been a contributing factor for the gradual decrease in fertility during the 1990's.

While this channel is intuitively possible, no such changes in fertility have been observed in other Eastern European countries following the fall of their communist regimes (David 1999). Instead, the consensus among demographers working in this area (David, 1999) is that the decline in fertility during transition was gradual in the region and reflected the continuous worsening of economic conditions.

In sum, this paper will use the lift of the ban of December 1989 to analyze educational outcomes of children born immediately before and after July of 1990, the time when the ban had an effect on fertility levels. Since the size of the monthly birth cohorts in Romania after July of 1990 declined from roughly 30,000 to 20,000 births, this implies that about 1/3 of children born in the months prior to 1990 were born as a result of the restrictions to abortions.

3   Data

The primary source of data for the present analysis is an administrative database containing all the children who have been allocated to a secondary level institution in the summer of 2005 and 2006. The allocation to schools is based on a centralized computerized process where each student has an *admission grade* and submits a form indicating her/his school preferences (up to a maximum of 200 schools).[15] All the students who want to attend secondary school need to be part of this allocation system. The *admission grade* is the average of the *national test,* a nationwide test taken once a year in three subjects (Romanian, math, history or geography),[16] and the average GPA during gymnasium (grades 5-8). All tests and grades use the same scale that ranges from 1 to 10, where 10 is the highest score and the passing grade is 5.[17] Our main variable for measuring child cognitive abilities is the *admission grade,* but we also use the outcomes of the computerized allocation process to create three additional variables about the quality of the school where the child was admitted. The first variable is the average admission grade

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[15]The allocation process assigns students based on the descending order of their *admission grade,* subject to the slot contraints that are published in advance. Schools do not have the ability to choose students and therefore there is no scope for gaming the system.

[16]Students enrolled in schools taught in the languages of ethnic minorities also take an additional language test.

[17]Students who do not score at least a 5 on the admission grade are not allowed to apply to a highschool, but they are allowed to enroll in a vocational school.

of a child's secondary school peers. The other two variables are an indicator variable for being admitted to a highschool (as opposed to a less prestigious vocational school) or to an academic highschool (the most selective and desirable secondary education track). Finally, the administrative dataset includes the exact date of birth, which is especially useful in identifying the discontinuity induced by the policy within a narrow window of time.

Our main cohort of interest is composed of children born in 1990, since the drop in fertility as a result of the lifting of the ban at the end of December of 1989 started roughly six months later, after July of 1990. The children born between January 1st and December 31st of 1990 were required by law to enroll in first grade in the fall of 1997 and scheduled to graduate from grade 8 in the spring of 2005. Panel A of Figure 2 shows the composition of children in the 2005 cohort born between October 1989 and March 1991. One can observe that the largest majority of students in the 2005 cohort are born in 1990. However, although there is a large drop off for children born before months 1 (born in January 1990) and after month 12 (born in December 1990), the overlap of students born in 1990 and present in the 2005 secondary admission cohort is not perfect. One reason is caused by the fact that some students are forced to repeat a grade in elementary school if their performance is unsatisfactory. Secondly, some parents manage to delay school entry for their children, especially for those children born closer to the cut-off.[18] In fact one can observe in Panel C of Figure 2 that the children in the 2005 admission cohort who are born prior to January of 1990 have much lower admission grades, consistent with the view that many of them have repeated a grade. Also, there is a dip in average grades for children born around December of 1990. This effect is likely caused by possible month of birth effects, as well as the fact that children who were sent to school earlier than required by the law might be very different from the average population.[19]

In sum, one can observe that despite the mandated allocation to school cohorts based on date of birth, one has to worry about the selection of children into a particular secondary school cohort. We propose to account for these selection effects by using similar administrative data from the 2006 admission process into secondary education as a control

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[18]Many parents in Romania believe that delaying school entry is useful even when their children do not suffer from any early developmental problems.

[19]The lower than average grades for those born in December of 1990 might be driven by differential rates of school delay by SES characteristics.

sample.[20] The size of the cohort and average admission scores by month of birth for those born between October 1990 and March 1992 who are present in the 2006 admission data are shown in Panels B and D of the same figure and it is quite similar to the corresponding data from 2005 shown in Panels A and C. The only visible difference is the preview of our main results: a comparison of the raw data of average admission grades in Panels C and D of Figure 2 shows an increase in average grades for those born immediately after July of 1990 (Month 7) for the 2005 cohort, while no similar increase can be observed for those born after July of 1991 (Month 7) for the 2006 cohort.[21]

A different source of selection bias could arise if the composition of children participating in the centralized secondary school allocation process is affected by the lift of the abortion ban. Remember that only those students who participate in this allocation process are included in the administrative data used in this study. The direction of the bias is likely to be downward if children born under the abortion ban have lower school performance in primary school and therefore a larger fraction do not take the exam for entry into secondary school due to higher dropout rates or grade repetition rates. We provide some evidence that this source of selection is unlikely to play a major role in this setting by looking at the proportion of children born in 1990, as recorded in the 1992 census, who are present in the 2005 highschool cohort and comparing them to children born in 1991 who are present in the 2006 highschool cohort. Appendix Figure 1A which plots these percentages by month of birth shows no clear selection patterns around July for these two cohorts and a similar pictures emerges in Appendix Figure 1B where similar data is presented using the 2002 census.

Since the administrative data does not contain any background variables for the children, we use data from the 2002 Romanian census to describe the effect of the lift of the abortion ban on the composition of children affected by the abortion ban. We use the education level of the mother as our main variable to understand how the lift of the ban of the abortion policy has changed the composition of families that have children. In addition we use the age of the mother at birth to understand how the change in the

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[20]Our research could not find any references indicating institutional changes at the secondary education level in Romania (both in terms of the structure of the school system or the rules of the admission process) between 2005 and 2006.

[21]The sharper decrease in the cohort size after Month 7 in Panel A compared to Panel B is also visible, but is harder to see because of the strong month of birth effects.

abortion policy affected the timing of births. Any change in the age of the mother after the repeal of the ban would be an indication that under the restrictive regime a share of the births were not optimally timed. We can recover maternal characteristics only for those children who still live with their mothers at the time of the census in 2002, however since children born in 1990 were only 12 years old at the time of the census, the matching rate was very high at 95 percent.[22]

Table 1 presents summary statistics for the main variables used in the study. The average admission grade for the 2005 secondary school admission cohort is 6.55 (on a scale from 1-10), about 63% of them get admitted to a high school and 36% to the most prestigious academic high schools. The means for the 2006 cohort are similar, although the average admission grades are somewhat higher (6.67). In the 2002 census, mothers who have given birth between 1988 and 1992 are on average less than 25 years old, they have given birth to 2.77 children by 2002 and have the following educational achievement: 44% have primary education or less (8 years of schooling or less), about 48% have secondary education and the remaining 7% hold a university degree.

4   Empirical strategy:

The first step of our analysis is to understand the impact of the 1989 repeal of the abortion ban in Romania on the composition of families having children. We estimate regressions of the form:

$$outcome\_mother_i = \beta_0 + \beta_1 Treatment_i + \beta_2{}'birth\_month_i + \beta_3{}'trend_i + \epsilon_i,\quad (1)$$

where $outcome\_mother_i$ is one of our indicators of educational achievement (primary education, secondary education, tertiary education), the age at birth or fertility level in 2002 of mother i and $Treatment_i$ is equal to 1 if individual i was born after July 1, 1990, which is six months after the lift of the ban and also the time where the decrease in fertility is observed in birth data. All regressions also include a set of calendar month of birth dummies ($birth\_month_i$) as well as $trend_i$, a quadratic polynomial of the month of

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[22]We have not found any evidence that the abortion ban has changed the probability to live with a parent in 2002.

birth of the child. The sample for the main specification includes all mothers who have a child living with them at the time of the census born between 1988 and 1992, i.e. all mothers who gave birth within 30 months of July of 1990.

The main part of the analysis is to measure how the abortion ban has affected educational outcomes of children. We consider the following regression model:

$$educational\_outcome_i = \theta_0 + \theta_1 Treatment_i + \theta_2' trend_i + \theta_3' cohort_i + \epsilon_i \,, \qquad (2)$$

where $educational\_outcome_i$ is our main measure of cognitive skills - the *admission grade* score - or one of our three measures of school quality (average grade of peers in school, indicator for being admitted to a high school or academic high school). $Treatment_i$ and $trend_i$ are defined as in equation (1), and $cohort_i$ is a dummy taking value 1 for children in the 2006 admission cohort and value 0 for those in the 2005 admission cohort. The overall impact of the change in abortion legislation on the socio-economic outcomes of the children is captured by the coefficient θ_1, which could be due to either of the two mechanisms discussed earlier (*unwantedness* and *composition* effect). Note that since we restrict ourselves to a particular school cohort, any existing crowding effects due to changes in the cohort size, resulting from change in access to abortion and birth control methods, should be constant within a particular cohort.

All specifications are restricted to those children who should be in their respective admission cohort based on their date of birth (children born in 1990 (1991) and present in the 2005 (2006) secondary school cohort). Some specifications only include the 2005 cohort, while in others we replace the $trend_i$ controls with a set of calendar month of birth dummies. Our estimation approach essentially compares the outcomes of children born six months before and after the discontinuity in fertility that resulted from the lift of the ban. We estimate the discontinuity using the parametric regression described above and assume that the $trend_i$ controls account for any effects that are associated with age which vary continuously. At the same time the 2006 cohort controls for possible month of birth effects as well as possible selection effects of a birth cohort into a corresponding secondary school admission cohort. Standard errors are clustered by age in months (Bertrand, Duflo and Mullainathan (2004), Card, Dobkin and Maestas (2008)).

5   Results

Regression results of the effect of the liberalization of abortion in Romania after 1989 on the composition of women who give birth is provided in Table 2. Column (1) of Tables 2 shows that children born after July of 1990 were 1.6% less likely to have a mother that only received a primary level of education. Columns (2) and (3) show an equally large increase in the proportion of mothers with secondary education and no change in the proportion mothers with tertiary education. These results are similar to those in Pop-Eleches (2005) the largest decrease in the level of fertility is found for women with less education as a result of the lift of the ban in 1989. These results imply that children born after the lift of the ban in 1989 were more likely to live in a more privileged household. As a result we expect the direction of the composition effect to go in the same direction as the unwantedness effect, implying that θ_1 should be, if anything, positive. Therefore, the direction of the liberalization of abortion in Romania on child outcomes should be similar to the case of the US after the liberalization of abortion following Roe v. Wade and different from the effects in Romania at the time of the introduction of the ban in 1966 (Pop-Eleches, 2006). Column 4 of Table 2 shows that the average age at birth decreased by almost half a year after July of 1990, suggesting that older women responded more to the lift of the ban, presumably because they were more likely to have reached or exceeded their ideal family size under the old abortion regime. The last column of Table 2 show that a birth under the ban had a lasting effect on fertility levels even more than 10 years later, implying that children born after the ban grew up in families with fewer siblings.[23] While the large decrease in fertility immediately after July of 1990 is the most direct evidence that many of the children born under the ban were not wanted by their parents, the changes in the age at birth and life-cycle fertility provide additional support for this claim.[24]

Next we turn to Table 3 which presents the main results of the paper.[25] Panels A, B

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[23]These results are robust to controlling for mothers education. They suggest that the observed effects are not just compositional.

[24]While in the case of Romania a decrease in the average age at birth after the lifting of the ban is consistent with the view that the restrictive ban lead to unwanted birth, this results might not be general to other settings. For example the legalization of abortion could decrease the percentage of teen pregnancies, therefore increasing the average age when women give birth.

[25]The results in the current version are slighly different and usually larger than those presented in an

and C present the coefficient on the *Treatment* dummy variable for the four indicators of educational achievement for three different specifications. Panel A is based on regressions restricted to children born in 1990 present in the 2005 cohort and includes quadratic monthly controls. In Panel B we also add the 2006 control cohort and include a cohort dummy as a control, while Panel C uses the same sample as Panel B but includes a set of calendar month of birth variables instead of the quadratic monthly controls.

All the coefficients of Table 3 are positive and almost all are statistically significant suggesting that the lift of the ban of abortions has improved educational outcomes of children. Our preferred specifications from Panel C of Table 3 show that children born after the ban score on average .106 (standard error .008) higher on the admission grade and this helps them be admitted to a school that has peers who on average have an admission grade that is .037 higher.[26] At the same time, children born after the ban are 2.2 percent more likely to be admitted to a highschool from a mean of 63% and they are also 2.1% more likely to attend an academic highschool (mean of 36%).

In Appendix Table 1 we performed a number of additional robustness checks. One potential criticism of the results in Table 3 is that our estimates rely to a large extend on how we control for trends and seasonal factors.[27] One approach that we take is to restrict our analysis to much narrower time windows. The simplest comparison is the difference in educational outcomes for children born in July and June of 1990 who are present in the 2005 administrative dataset. The difference in the average score between these two month is slightly smaller but still sizeable and statistically significant (.064 (standard error .023)). A similar picture emerges when one makes this simple narrow comparison for the other three outcome variables (average grade of peers, admission to highschool, admission to academic highschool).[28] In the first four columns of Panel B of the same

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earlier version. Due to a programming mistake, the *Treatment* dummy took value 1 for children born after June of 1990 instead of July of 1990. We have corrected this error in the current version.

[26]Since the average test score of the 2006 cohort is higher than the 2005 cohort one might worry that an equal point increase in performance might have a different impact across the two cohorts in terms of how far a student is moving in the ability distribution. In such a situation a more appropriate specification might be one that uses the log of the admission score. In regressions not reported in the paper we have checked that the results are robust when using a log specification.

[27]Unfortunately we were not able to have access to similar data from other years.

[28]The results that compare children born only one month apart (July versus June of 1990) provide the strongest evidence against the concern that other factors that change as a result of the transition process (such as prenatal care, income or family investments) might be driving our estimates.

table we find similar results if we use a sample that is also restricted just to children born in June and July but also includes children born in the same months of 1991 who are in the 2006 administrative dataset. The last four columns of Appendix Table 1 repeat the same analysis but use a somewhat larger window (April to September) and we find again robust evidence that children born after the ban have better educational outcomes.

Given that the gestation length varies across pregnancies and that legal abortions are probably more likely to happen for mothers in their third rather than their second month of pregnancy in December 1989, the decline in fertility after July of 1990 is not completely instantaneous. As can be seen in Table 1B, July of 1990 was the first month with a rapid decline in fertility but the month of August also saw very large further reductions in births. Therefore we also performed some robustness checks (not reported in the paper) that are similar to those in Appendix Table 1, but restricting the sample to those born in June and August only. The results are very similar to those using the comparison of June and July.

In Figure 3 we plot the residuals for the months January to December of 2005 which are based on regressions similar to those in Panel C of Table 3. The graphs for all four outcome variables show a break in the pattern of educational achievement after July of 1990 and they confirm that children born after the repeal of the abortion ban in Romania in 1989 have better educational outcomes, based on a cognitive admission score and the quality of their highschool admission placement.

Finally, we compare the evidence presented in this section on the effect of the lift of the abortion ban on educational outcomes with those from the introduction of the ban in 1967 presented in Pop-Eleches (2006). The lifting of the ban lead to a reduction in fertility by one third in the first six months and the resulting increase in high-school attendance compared to vocational school attendance of 2.1 percentage points is due to the combined composition and unwantedness effects. In 1967, the abortion ban resulted in a doubling of fertility in the short run and the decrease in highschool graduation due to the unwantedness effect was 1.7 percentage points. While the direct comparison of these effects is difficult given the differences in data sources and institutional settings, the magnitudes of the effects are remarkably similar. Finally it should be noted that although the Romanian evidence shows significant schooling effects any comparison with the US experience associated with *Roe v. Wade* should take into consideration that the fertility

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impact in Romania was much larger.

6   Conclusion

In this paper we exploit the sharp drop in fertility caused by the liberalization of abortion in Romania in December of 1989 in order to understand the effect that changes in access to abortion have on child outcomes. We find evidence that compared to children born immediately before the lift of the ban, average educational achievements improve as measured by test score data from the universe of children who are being admitted to secondary schools. The improved schooling performance is consistent with two of the mechanisms that can explain the impact of the liberalization on child outcomes: (1) children born after the ban are more likely to live in families from more educated backgrounds and (2) they are less likely to have been unwanted at birth. More broadly, the results suggest that access to birth control methods plays an important role in shaping fertility decisions in the family and that these effects have lasting impacts on socio-economic outcomes later in life.

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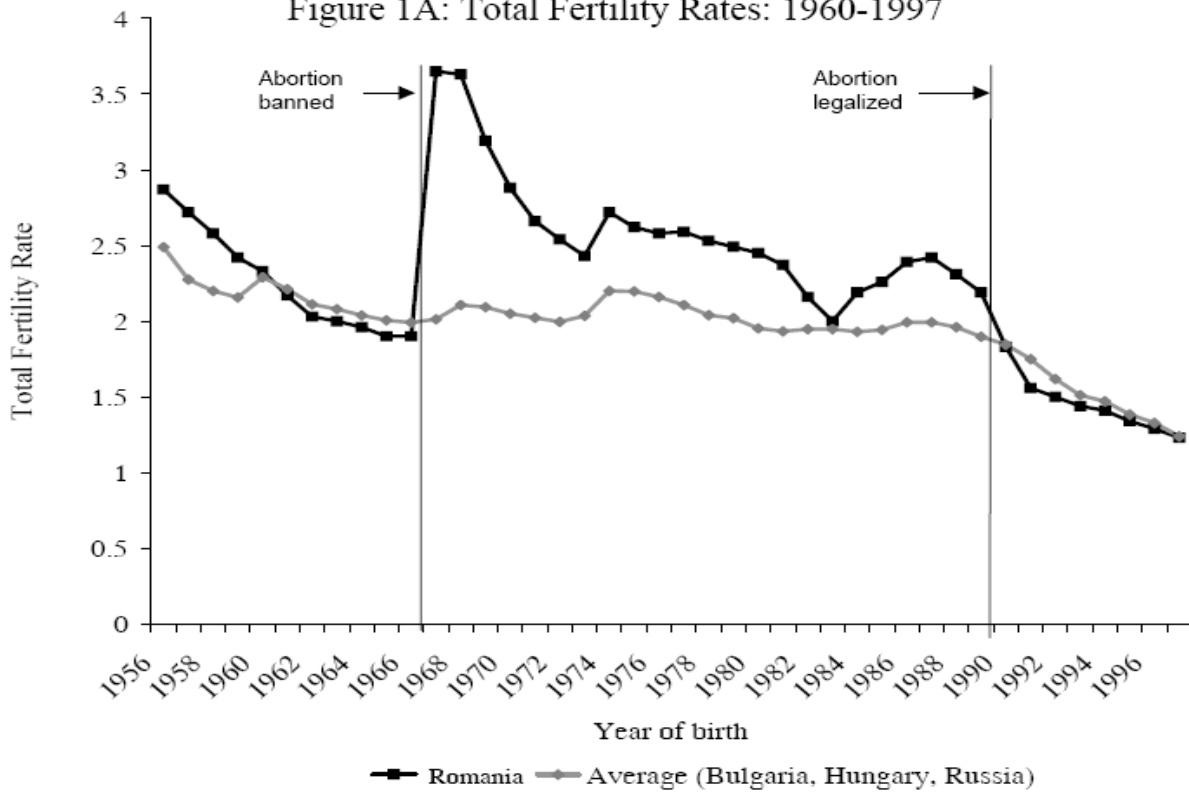
Figure 1A: Total Fertility Rates: 1960-1997

Abortion
banned →

Abortion
legalized →

Total Fertility Rate

Year of birth

■ Romania ◆ Average (Bulgaria, Hungary, Russia)

Figure 1B: Cohort Size for Children Born 1989-1991

Cohort Size based on 1992 Census

Month of birth (January 1990 = Month 1)
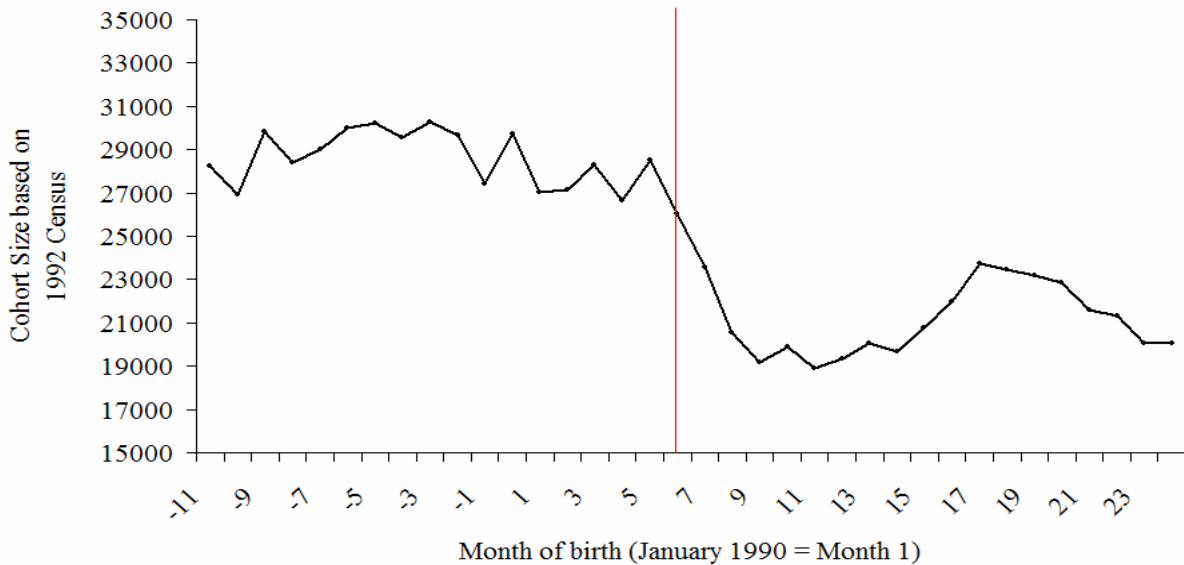
Notes: Figure 1A - The total fertility rates for Romania, Hungary, Russia and Bulgaria for the period 1969-1997 are based on UN (2002). Figure 1B - The monthly size of cohorts in Romania in the period 1989-1991 are based on the 1992 Romanian Census.

Figure 2: Size and Average Grades for 2005 and 2006 Cohort
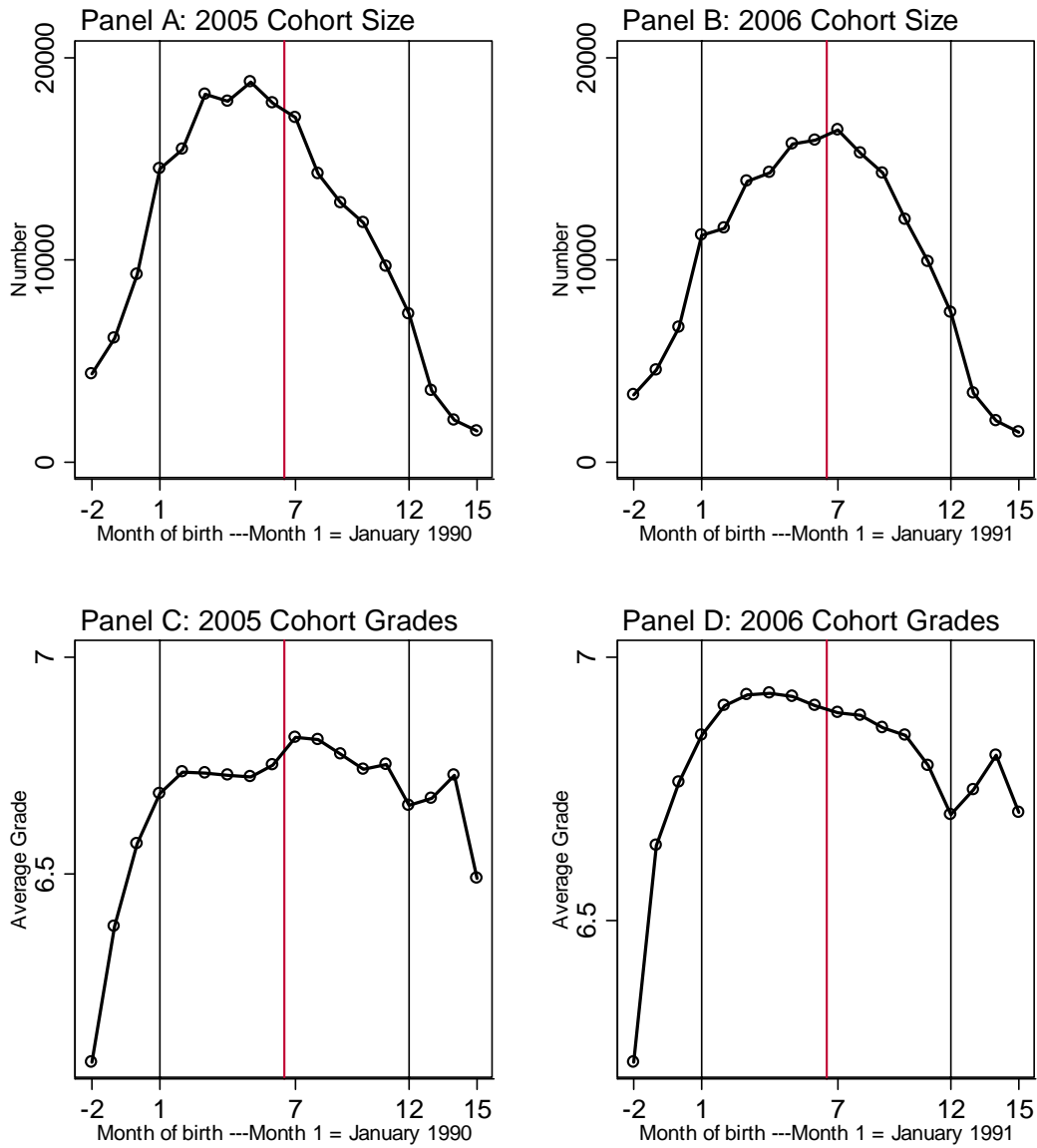
Notes: Panels A and C contain all students in the 2005 secondary school entry cohort born between October 1989 and March 1991. Panels B and D contain all students in the 2006 secondary school entry cohort born between October 1990 and March 1992. Panels A and B plot average cohort sizes by month of birth. Panels C and D plot average entry grades by month of birth. The fertility decrease as a result of the abortion legalization started with cohorts born after July (Month 7) of 1990. Source: Romanian Ministry of Education

Figure 3: Abortion Access and Educational Outcomes (1990 cohort - Month 0 =June 1990)
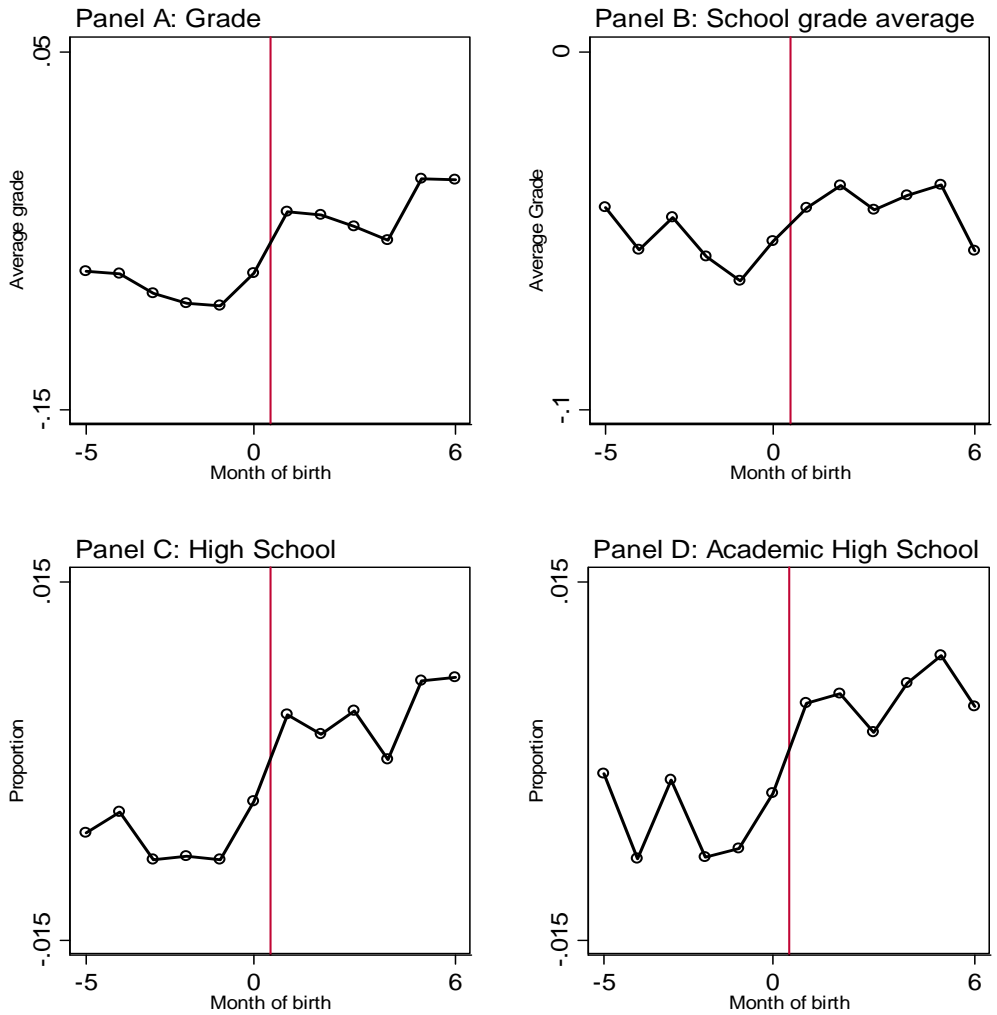
Notes: All panels plot residuals from regressions similar to those of Panel C in Table 3. They represent residuals of educational attainment by month of birth for children born in 1990 and present in the 2005 secondary school cohort. Children born in 1991 and present in the 2006 cohort are used in these regressions to account for month of birth effects. The fertility decrease as a result of the abortion legalization started with cohorts born after July (Month 0 in graph) of 1990. Source: Romanian Ministry of Education

Appendix Figure 1A: Selection into administrative data - 1992 Census

— Percent born in 1990 present in 2005 cohort — Percent born in 1991 present in 2006 cohort
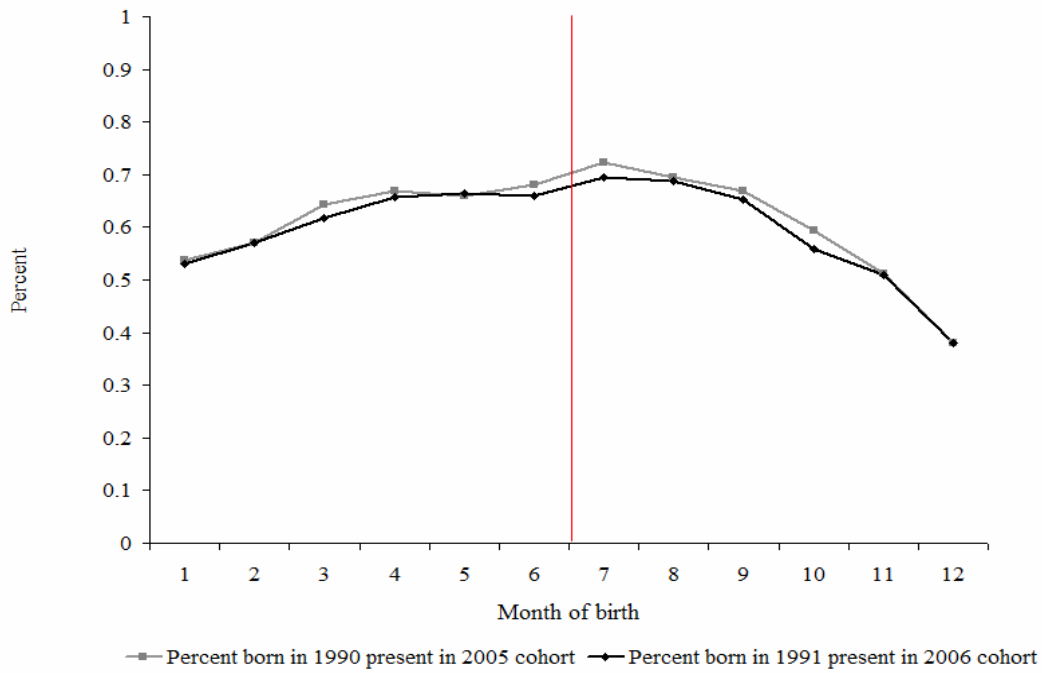
Appendix Figure 1B: Selection into administrative data - 2002 Census

— Percent born in 1990 present in 2005 cohort — Percent born in 1991 present in 2006 cohort
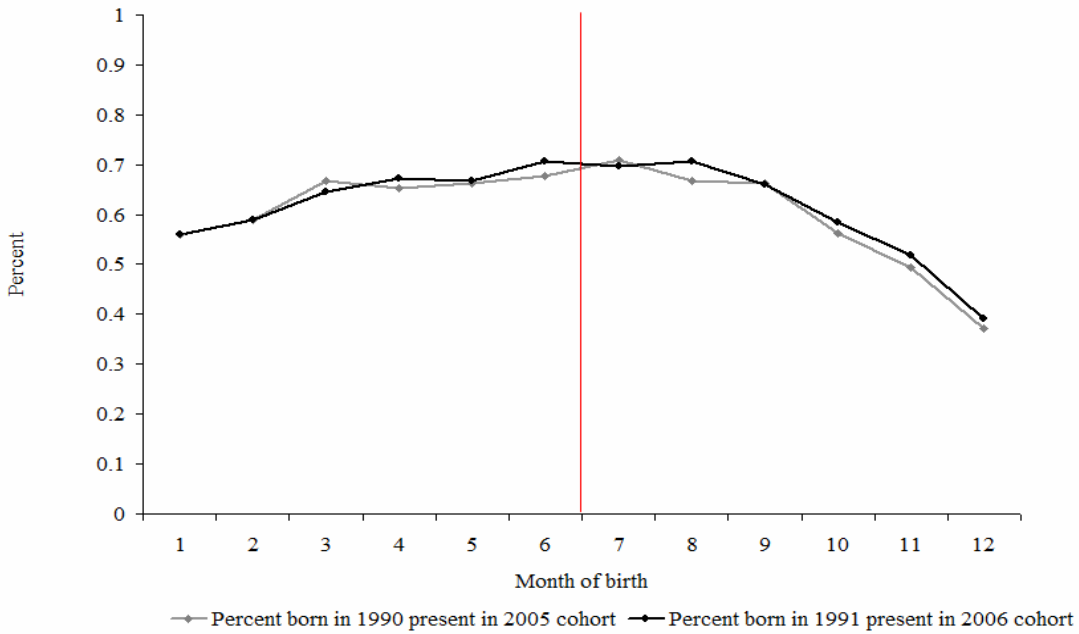
Notes: Appendix Figure 1A plots the proportion of children born in 1990 by month of birth, as recorded in the 1992 census, who are present in the 2005 highschool cohort and comparing them to children born in 1991 who are present in the 2006 highschool cohort. Appendix Figure 1B plots a similar graph using the 2002 census.

Table 1: Descriptive Statistics

	Mean	SD	N
Characteristics of Mothers			
Primary Education	0.44	0.50	139,126
Secondary Education	0.48	0.50	139,126
Tertiary Education	0.07	0.26	139,126
Mother's Age at Birth	24.72	5.67	139,511
Live Births in 2002	2.77	1.89	135,790
Characteristics of Children			
2005 cohort			
Admission Grade	6.55	2.20	222,863
Average Grade of Peers	6.55	1.60	222,863
Attend Highschool	0.63	0.48	222,863
Attend Academic Highschool	0.36	0.48	222,863
2006 cohort			
Admission Grade	6.67	2.26	198,958
Average Grade of Peers	6.67	1.47	198,959
Attend Highschool	0.63	0.48	198,959
Attend Academic Highschool	0.36	0.48	198,959

Notes: SD is the standard deviation and N is the sample size. Mother's characterstics are based on the 2002 Romanian census and contain women who gave birth between 1988 and 1992 (within 2.5 years of July, 1990). Schooling outcomes of children are based on all children who where allocated to a secondary school in the years 2005 and 2006. Source: Romanian Ministry of Education (www.edu.ro)

Table 2: The effect of the 1989 abortion legalization on mother's characteristics

	Primary Education	Secondary Education	Tertiary Education	Mother's Age at Birth	Live Births in 2002
	(1)	(2)	(3)	(4)	(5)
Treatment dummy	-0.016** [0.006]	0.017*** [0.005]	-0.001 [0.003]	-0.469*** [0.071]	-0.034** [0.015]
Linear monthly trend	Y	Y	Y	Y	Y
Cal. month dummies	Y	Y	Y	Y	Y
Sample Size	139,126	139,126	139,126	139,511	135,790
Mean of dep. variable	0.44	0.48	0.07	24.72	2.77

Notes: Standard errors are provided in brackets and are clustered by age of child in months.***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. Samples include cohorts born between January 1, 1988 and December 31, 1992. The dependent variables are defined in Table 1. AFTER is defined as 1 for individuals born on or after July 1, 1990 and 0 for individuals born on or before June 30, 1990.

Table 3: The effect of the 1989 abortion legalization on educational outcomes of children

	Admission Grade	Average Grade of Peers	Attend Highschool	Attend Academic Highschool
	(1)	(2)	(3)	(4)
Panel A				
	0.091***	0.057***	0.018***	0.017***
Treatment dummy	[0.014]	[0.012]	[0.004]	[0.002]
Monthly trend	Y	Y	Y	Y
Cal. month dummies	N	N	N	N
Cohort dummy	N	N	N	N
Samples	2005	2005	2005	2005
Sample Size	175506	175506	175506	175506
Panel B				
	0.103***	0.043***	0.021***	0.020***
Treatment dummy	[0.011]	[0.008]	[0.003]	[0.002]
Monthly trend	Y	Y	Y	Y
Cal. month dummies	N	N	N	N
Cohort dummy	Y	Y	Y	Y
Samples	2005/2006	2005/2006	2005/2006	2005/2006
Sample Size	333501	333501	333502	333502
Panel C				
	0.106***	0.037***	0.022***	0.021***
Treatment dummy	[0.008]	[0.005]	[0.002]	[0.002]
Monthly trend	N	N	N	N
Cal. month dummies	Y	Y	Y	Y
Cohort dummy	Y	Y	Y	Y
Samples	2005/2006	2005/2006	2005/2006	2005/2006
Sample Size	333501	333501	333502	333502
Mean of dependent variable (2005 cohort only)	6.55	6.55	0.63	0.36

Notes: Standard errors are provided in brackets and are clustered by age in months. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Table 1. The Treatment dummy is defined as 1 for individuals born on or after July 1, 1990 and 0 for individuals born on or before June 30, 1990. Panel A is based on children born in 1990 and present in the 2005 secondary school cohort. Panels B and C also include children born in 1991 and present in the 2006 cohort as controls.

Appendix Table 1: The effect of the 1989 abortion legalization on educational outcomes of children

	Monthly Intervals: June-July				Monthly Intervals: April-September			
	Admission Grade	Average Grade of Peers	Attend Highschool	Attend Academic Highschool	Admission Grade	Average Grade of Peers	Attend Highschool	Attend Academic Highschool
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A								
	0.064***	0.038**	0.011**	0.014***	0.068***	0.032*	0.015***	0.015***
Treatment dummy	[0.023]	[0.017]	[0.005]	[0.005]	[0.013]	[0.013]	[0.003]	[0.003]
Monthly trend	Y	Y	Y	Y	Y	Y	Y	Y
Cal. month dummies	N	N	N	N	N	N	N	N
Cohort dummy	N	N	N	N	N	N	N	N
Samples	2005	2005	2005	2005	2005	2005	2005	2005
Sample Size	34792	34792	34792	34792	98519	98519	98519	98519
Panel B								
	0.076**	0.023	0.015**	0.016**	0.098***	0.053***	0.020***	0.021***
Treatment dummy	[0.033]	[0.024]	[0.007]	[0.008]	[0.016]	[0.014]	[0.005]	[0.003]
Monthly trend	Y	Y	Y	Y	Y	Y	Y	Y
Cal. month dummies	N	N	N	N	N	N	N	N
Cohort dummy	Y	Y	Y	Y	Y	Y	Y	Y
Samples	2005/2006	2005/2006	2005/2006	2005/2006	2005/2006	2005/2006	2005/2006	2005/2006
Sample Size	67139	67139	67139	67139	190499	190499	190499	190499

Notes: Robust standard errors are provided in brackets. Standard errors in Panel B are also clustered by age in months. ***, ** and * indicate statistical significance at the 1, 5 and 10 percent level respectively. The dependent variables are defined in Table 1. The Treatment dummy is defined as 1 for individuals born on or after July 1, 1990 and 0 for individuals born on or before June 30, 1990. Panel A is based on children born in 1990 and present in the 2005 secondary school cohort. Panels B and C also include children born in 1991 and present in the 2006 cohort as controls. The first four columns only contains children born in June and July, while the last four columns contains children born between April and September.