The Impact of an Abortion Ban on Socio-Economic Outcomes of Children: Evidence from Romania*

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October 2005

Abstract

This study examines educational and labor outcomes of children affected by a ban on abortions. I use evidence from Romania, where in 1966 dictator Nicolae Ceausescu declared abortion and family planning illegal. Birth rates doubled in 1967 because formerly abortion had been the primary method of birth control. Children born after the abortion ban attained more years of schooling and greater labor market success. This is because urban, educated women were more likely to have abortions prior to the policy change, and the relative number of children born to this type of woman increased after the ban. However, controlling for composition using observable background variables, children born after the ban on abortions had worse educational and labor market achievements as adults. Additionally, I provide evidence of crowding in the schooling system and some suggestive evidence that cohorts born after the introduction of the abortion ban had higher infant mortality and increased criminal behavior later in life. While in the short-run the abortion ban differentially increased fertility of more educated women, in the long-run the ban differentially increased fertility among less educated women. This suggests that educated women changed their behavior more drastically as a result of the ban.

*I am especially grateful to my dissertation advisors Michael Kremer, Larry Katz, Caroline Hoxby and Andrei Shleifer for their guidance and support. I received helpful comments from two editors, two anonymous referees, Merriol Almond, Abhijit Banerjee, David Cutler, Rajeev Dehejia, Esther Duflo, Ed Glaeser, Claudia Goldin, Robin Greenwood, Ofer Malamud, Sarah Reber, Ben Olken, Emmanuel Saez, Tara Watson, and seminar participants at Boston University, Clemson, Columbia, Harvard, NBER Summer Institute, NEUDC, Princeton, Vanderbilt, and the World Bank. Any errors are solely mine. Financial support from the Social Science Research Council Program in Applied Economics, the Center for International Development and the Kokkalis Program at Harvard is gratefully acknowledged.

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1 Introduction

A number of recent studies have used the legalization of abortion in the US in the 1970's to analyze how the change in access to abortion affects child outcomes later in life. These studies find that the cohorts of children resulting from pregnancies that could have been legally terminated display better socio-economic outcomes along a wide range of indicators: they are less likely to live in a single household and less likely to live in poverty and in a household receiving welfare (Gruber, Levine, and Staiger, 1999), they consume fewer controlled substances (Charles and Stephens, 2002), have lower teen childbearing rates (Donohue, Grogger and Levitt, 2002) and are less likely to commit crimes (Donohue and Levitt, 2001).

This paper is also an effort to understand the link between access to abortion and socio-economic outcomes of children, but using a major policy change in the *opposite direction*. In 1966 Romania abruptly shifted 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. This policy was maintained, with only minor modifications, until December 1989, when following the fall of communism, Romania reverted back to a liberal policy regarding abortion and modern contraceptives. The short-run impact of the 1966 change in policy was an immediate and enormous increase in births: the total fertility rate increased from 1.9 to 3.7 children per woman between 1966 and 1967.

On average, children born in 1967 just after abortion became illegal display *significantly better* educational and labor market achievements than children born just prior to the change. This seemingly paradoxical result is the opposite of what one would expect in light of the findings from the US, but can be explained by a change in the composition of women having children: urban, educated women were more likely to have abortions prior to the policy change, so a higher proportion of children were born into urban, educated households after abortions became illegal. Controlling for this type of composition using observable background variables, children born after the abortion ban had *worse* schooling and labor market outcomes. This finding is consistent with the view that children who were *unwanted* during pregnancy had inferior socio-economic outcomes once they became adults. Additionally, I provide evidence that the increase in cohort size due to

the abortion ban resulted in a crowding effect in the schooling system.

The final part of the paper contains two extensions to the main analysis. First I show that while in the short-run the more educated women were mostly affected by the abortion ban, in the long-run the less educated women had the largest increases in fertility as a result of Romania's 23 year period (1967-1989) of continued pronatalist policies. This implies that educated women changed their behavior more drastically as a result of the ban and suggests that more educated women are more effective in reaching their desired fertility when access to birth control methods is difficult. Secondly, I offer some suggestive evidence that cohorts born after the introduction of the abortion ban had higher infant mortality and increased criminal behavior later in life.

Following is the plan of the paper. Section 2 provides an overview of the channels through which an unwanted birth might affect the socio-economic outcome of a child. Section 3 describes the unusual history of abortion legislation in Romania. In section 4, I describe the data and empirical strategy. Section 5 presents the results of the main analysis. Section 6 includes the two extensions and section 7 concludes.

2 The mechanisms by which an abortion ban affects socio-economic outcomes of children

Consider a woman's decision as to whether to use birth control: if the costs of using a certain birth control method increases substantially, she will likely use less of it. Instead, she will rely on abstinence, use alternative birth control technologies, and/or have more births. Thus, the children born under a restrictive birth control regime are more likely to be unplanned, unwanted or mistimed, relative to a world where a woman exercised costless control over her fertility. I will refer to children, whose births are a result of the increased cost of fertility control, as "unwanted." How might unwantedness affect adult outcomes?

A first way in which an unwanted birth might affect the quality of a child derives from the standard model of the child quality/quantity trade-off (Becker, 1981). Since it is assumed that parents desire equal levels of quality for each of their children, an increase in the number of children as a result of an unwanted pregnancy leads to a decrease in

child quality for all children in the household.

Secondly, optimal timing of birth might play an important role in the future development of a child. If access to birth control methods becomes difficult, women are less able to delay childbearing until conditions are more favorable for raising children. Unfavorable conditions might arise for a number of reasons. Childbearing can conflict with the longer term educational and labor market plans of a mother (Angrist and Evans, 1996), which can have a negative effect on the child. In addition a mother, who gives birth to an unwanted child prior to marriage, might either enter an undesired marriage or face single parenthood. Finally, a whole range of additional factors, broadly related to a mother's (and father's) physical and emotional well-being resulting from involuntary parenthood might affect the development of children within a family.

Finally, in the presence of selection in terms of pregnancy resolution, a change in access to birth control methods can affect the average quality of children. A number of studies (Grossman and Jacobowitz 1981; Joyce 1987; Grossman and Joyce 1990) show that increased access to abortion increased the weight of children at birth and decreased neonatal mortality, suggesting positive selection on fetal health.

The different theoretical channels just reviewed all predict that making access to abortions harder will have a negative effect on a child's development. Thus, for the purposes of this paper, I will call the combined effect of the three channels the effect of *unwantedness* on child outcomes. In addition to the mentioned US based research, the papers by Myhrman (1988) for Finland, Bloomberg (1980) for Sweden and Dytrych et al. (1975), David and Matejcek (1981) and David (1986) for the Czech Republic have studied outcomes of children born to mothers who have been denied access to abortion. Unwanted children display a number of negative outcomes, ranging from poorer health, lower school performance, more neurotic and psychosomatic problems, a higher likelihood of receiving child welfare, to more contentious relationships with parents and higher teen sexual activity. The major drawback of these studies is their inability to convincingly account for the self-selection of a certain type of mothers into the treatment group.[1]

[1]The Heckman bivariate selection model (Heckman, 1979) is the standard approach to control for non-random selection into the treatment group. Without making strong structural form assumptions, this estimator generally needs an exclusion restriction; in this case there are no plausible exclusion restrictions across the selection into treatment and child outcome equations.

There are two additional ways through which a change in abortion legislation could affect the average socio-economic outcome of children. First, one has to understand how the change in policy influences the composition of women who carry pregnancies to term. The direction of the effect is theoretically ambiguous and ultimately requires an empirical analysis of which types of women are most affected by the change in policy. While the evidence from the US (Gruber, Levine and Staiger, 1999) suggests that women from disadvantaged backgrounds are more likely to use abortion and thus are more affected by a change in abortion regime, the present analysis shows that in the case of Romania, abortion was used primarily by urban, educated women.

Finally, if the fertility impact of the ban on abortions is large, one could imagine a negative crowding effect resulting from a larger cohort competing for scarce resources.[2] The importance of possible crowding effects is an interesting question of its own and will be addressed in a later section.

3 Abortion and birth control policy regimes in Romania

Prior to 1966, Romania had one the most liberal abortion policies in Europe, since abortions were legal in the first trimester and provided at no cost by the state health care system. Abortion was the most widely used method of birth control (World Bank, 1992) and in 1965, there were four abortions for every live birth (Berelson, 1979). Worried by a rapid decrease in fertility,[3] Romania's communist dictator, Nicolae Ceausescu, issued an unexpected decree in the fall of 1966: abortion and family planning were declared illegal and the immediate cessation of abortions was ordered. Legal abortions were allowed only for women over the age of 45, women with more than four children, women with health

[2]Apart from the direct crowding effect caused, for example, by having more children in the school system, there could also be an additional compositional effect resulting from having proportionally more difficult peers in school as a result of the abortion ban.

[3]The rapid decrease in fertility in Romania in this period is atributed to the country's rapid economic and social development and the availability of access to abortion as a method of birth control. Beginning with the 1950s, Romania enjoyed two decades of continued economic growth as well as large increases in educational achievements and labor force participation for both men and women.

problems, and women with pregnancies resulting from rape or incest.

The immediate impact of this change in policy was a dramatic increase in births: the birth rate[4] increased from 14.3 to 27.4 between 1966 and 1967 and the total fertility rate[5] increased from 1.9 to 3.7 children per woman (Legge, 1985). As can be seen in Figure 1, the large number of births continued for about 3-4 years, after which the fertility rate stabilized for almost 20 years, albeit at a higher level than the average fertility rates in Hungary, Bulgaria, and Russia. Abortions remained illegal and the law was strictly enforced without major modifications until December 1989, when the communist government was overthrown.[6] Following the liberalization of access to abortion and modern contraceptives in 1989, the reversal in trend was immediate, with a decline in the fertility rate and a sharp increase in the number of abortions. In 1990 alone, there were 1 million abortions in a country of only 22 million people (World Bank, 1992).

This legislative history suggests a simple difference strategy to estimate the effects of changes in access to abortion on educational and labor market outcomes of children. The basic idea is to compare outcomes of children born just after the policy change and just before the change. Figure 2 plots the fertility impact of the policy by month of birth of the children. The decree came into effect in December of 1966 and the sharp increase in fertility was observed about six months later beginning in June 1967.[7] Therefore most of the women who gave birth immediately after June of 1967 were already pregnant at the time the law change happened.[8] From July to October of 1967 the average monthly birth rate was about three times higher than during January to May of 1967. A substantial fraction of these children would not have been born in the presence of access to abortion: this is the identification assumption of my study.

[4]The birth rate is the number of births per 1,000 population in a given year.

[5]The total fertility rate is the average total number of births that would be born per woman in her lifetime, assuming no mortality in the childbearing ages, calculated from the age distribution and age-specific fertility rates of a specified group in a given reference period.

[6]I discuss the fertility impact of the policy in detail in Pop-Eleches (2005).

[7]The six month lag between policy announcement and the fertility response results from the fact that a pregnancy lasts about nine months and abortions under the liberal policy were legal within the first three months of pregnancy.

[8]In fact a rough calculation of the number of pregnancies, abortions, and births around the time of the policy suggests that at least in the first couple of months following the ban basically all pregnancies were carried to term.

4 Data and empirical strategy

4.1 Data

The primary data for this analysis come from a 15% sample of the Romanian 1992 census. This dataset provides basic socio-economic information, such as gender, region of birth, educational attainment and labor market outcomes, for about 50,000 individuals for each year of birth. In addition the census provides not only the year but also the month of birth for each person, an important variable that will be used to identify the effect of the abortion ban within a narrow time window.

I mainly rely on the sample consisting of all children born between January and October 1967, producing more than 55,000 observations. The period between January and October is chosen primarily because it will allow me to separate the *crowding effect* from the other two effects of the abortion ban (*unwantedness effect* and *composition effect*). Although the spike in births (see Figure 2) occurred from July to October 1967, all children born from January to May had, by law, to enroll in school in the same year with the much larger group born in the later months. Therefore the entire group was exposed to the same crowding effect in school and later upon entry into the labor market. Secondly, the short time period will also minimizes the effect of other unobserved time trends and pre-conception behavioral responses to the policy. However, in order to control for possible cohort of birth effects and to examine potential effects of crowding on child outcomes, one of the specifications adds to the analysis children born in similar periods of 1965 and 1966, the two years prior to the policy change.

The cohort of interest for the present analysis (those born in 1967) was about 25 years old at the time of the 1992 census. At that age the vast majority of people in the cohort had finished school. Census information on current school enrollment is used to correct for expected educational achievement. But a shortcoming of the data is that labor market outcomes can be observed only early in the cohort's career and also just three years after the fall of communism. Because the large majority of individuals still in school at the time of the census were enrolled in universities, I exclude from the labor market regressions all those currently enrolled in university, with a university degree or with a postgraduate degree. Since most university graduates are likely to have good labor market

outcomes, their exclusion from the labor market regressions will unfortunately decrease the variability in labor outcomes.[9]

I focus on two measures of socio-economic outcomes for children: educational achievement and labor market activity. The educational variables are a range of dummies for school achievement[10]: apprentice (vocational) school, high school or more, and university or postgraduate.[11] The labor market outcomes are three skill specialization dummies based on ISCO occupational codes:[12] (1) elementary-skill (which includes individuals working in elementary occupations), (2) intermediate-skill (for workers employed as clerks, service and sales workers, skilled agriculture, craft workers, plant operators and assemblers, and (3) high-skill (which contains employees who are technicians, associate professionals and professionals).[13]

The census, however, contains socio-economic background variables of parents only for children who still live with their parents.[14] These parental background variables are needed in order to control for the changes in the *composition* of the cohort of children born to parents of differing socio-economic status within a given cohort. The proportion of children born in the first ten months of 1967 who still live with their mother is large (about 50%) and somewhat lower (about 40%) for those who live with both parents. Table 1, which presents the summary statistics for the main sample, shows that children born in the first ten months of 1967 who lived with their parents in 1992 were more educated, worked in higher skill jobs, were more likely to be born in an urban area and were less likely to be female than children who were not living with their parents. These results are consistent with the common Romanian custom whereby children live with their parents

[9]The variables used in this analysis are further defined in Appendix A.

[10]The omitted educational categories below apprentice school are elementary school and junior high school. Only about 2% in the sample only finish elementary school.

[11]Henceforth I will refer to post graduates and university students and graduates under the rubric "university" and to those with at least a high school degree as "high school".

[12]The ISCO (International Standard Classification of Occupations) codes classify jobs with respect to the type of work performed and the skill level required to carry out the tasks and duties of the occupations. ISCO is the standard classification of the International Labor Organization (ILO).

[13]The high skill dummy combines ISCO skill levels 3 and 4 because of the small number of professionals in the sample (corresponding to ISCO skill level 4). See appendix A for more information on the definition of variables.

[14]The sample does not capture the large number of unwanted children born as a result of the abortion ban who were abandoned by their parents. Thus the results provide arguably only a lower bound of the true effects caused by the abortion ban.

until they get married. Thus, children who marry later, such as males and those who get more education, are more likely to still live with their parents at the time of the census.[15] While the usable sample is unrepresentative of the total population, Figure 2 confirms that the proportion of individuals born in a given month within this sample tracks the birth records from Romania's vital statistics.

4.2 Empirical strategy:

I estimate a simple difference equation to capture the overall impact of the change in abortion policy:

(1) $OUTCOME_i = \alpha_0 + \alpha_1 \cdot after_i + \varepsilon_i$,

where $OUTCOME_i$ is one of the measures of educational or labor market outcomes for an individual born between January and October of 1967; $after_i$ is a dummy taking value 1 if an individual was born after the policy came into effect (between June-October), 0 otherwise. Within this framework, the overall impact of the change in abortion legislation on the socio-economic outcomes of the children is captured by the coefficient α_1.

The next equation incorporates controls for other observable characteristics of a child's parents:

(2) $OUTCOME_i = \beta_0 + \beta_1 \cdot after_i + \beta_2 \cdot X_i + \varepsilon_i$,

where $OUTCOME_i$ and $after_i$ are the same as in the basic framework, X_i contains two sets of control variables. The first group contains family background variables: 2 indicator variables for mother's education, 2 indicator variables for father's education, an urban dummy for place of birth of the child, a dummy for the sex of the child and 46 region of birth dummies. These background variables are likely to be fairly exogenous to the policy change.[16] The second group includes household specific variables: home ownership, rooms per occupant, square feet per occupant, availability of toilet, bath,

[15] Therefore, Romanian children who are 25 and still live with their parents are very different from children from the US of the same age who live at home. In the US, children leave their parents' home much earlier, so the small fraction of children who still live at home in their mid twenties are probably a lot less representative of their birth cohort than it is the case in Romania.

[16] One potential worry is the endogeneity of the mother's education, given that the birth of a child may have a negative effect on a woman's educational achievement (Goldin and Katz, 2002). I believe that in the case of Romania this is not likely to be a significant problem, since the fraction of women with tertiary education is very small (about 3%) and in Romania's traditional society the vast majority of individuals finish their education before getting married and most children are born to married couples.

kitchen, gas, sewage, heating and water. The household controls are potentially more endogenous, because they refer to household variables at the time of the census in 1992. By including these variables in the regression, I can partially control for composition into the sample that results from the differential policy response across groups.[17] Assuming that I have controlled for changes in the composition of families having children using the available socio-economic variables and that any unobservable factors that influence education and labor outcomes are constant across individuals, the coefficient β_1 can be interpreted as the negative unwantedness effect.

The basic framework does not allow one to test for crowding effects in the schooling and labor market due to sharp increases in cohort sizes, which is one of the potential channels through which a change in access to abortion affects child outcomes. In addition, the basic framework just outlined does not account for potential period of birth effects.

I will estimate an extended regression model to shed light on these issues. In this model children born in 1965 and 1966, the two years prior to the policy change, are also included in the sample and I use a slightly different range of months. First, children born after September 15th are dropped from the sample, because this is the government cut-off date for school enrollment and this ensures that all the children born in a given year in the sample enrolled in the same grade. Secondly, since the group of children born in May of 1967 might already contain some children born as a result of the policy change (see Figure 2), I drop children born in May from this specification in order to differentiate better between unwantedness and crowding effects.

The extended framework is described by the following equation:

(3)$OUTCOME_i = \gamma_0 + \gamma_1 \cdot after_i + \gamma_2 \cdot born(June - September)_i + \gamma_3 \cdot yearofbirth_i + \gamma_4 \cdot X_i + \varepsilon_i$,

where $OUTCOME_i$ and X_i are the same as in the basic framework, $after_i$ is a dummy taking value 1 if a person was born after the policy came into effect (between June-September 15th of 1967), 0 otherwise; $born(June - September)_i$ is a dummy taking value 1 if a person was born between June-September 15th, 0 otherwise; and $yearofbirth_i$ is a dummy taking value 1 if a person was born in 1967, 0 otherwise. I interpret the coefficient

[17] Urban and educated families used abortions more frequently prior to the policy change and therefore the fraction of children born into such families is likely to have risen once abortion was made available.

γ_1 as the combined negative unwantedness effect once I have controlled for period of birth, crowding and composition effects, while the coefficient γ_3 measures possible crowding effects.

5 Results

5.1 Graphical analysis

The overall impact of the 1966 abortion ban in Romania on average education outcomes of children can be easily captured in graphs. Figure 3 shows the percentage of persons in a particular education or labor market category who were born in a given month between January 1966 and December 1968. The pattern of educational and labor market achievement is consistent with the view that children born after the restrictive policy change came into effect have better outcomes: they are more likely to have finished high school and university and they are less likely to work in a job requiring only elementary skills and more likely to work in a job requiring high skills.

This apparently surprising result of superior educational and labor market outcomes of children born after the abortion ban can be explained by changes in the composition of women having children: urban, educated women working in good jobs were more likely to have abortions prior to the policy change, so a higher proportion of children were born into urban, educated households afterwards. Table 2 presents evidence of the size and statistical significance of these compositional changes using a simple comparison of means of parents' background variables that had children in the period January - October 1967. The percentage of urban women who gave birth between January and May was 35%, whereas the percentage for the period June to October was 42.2%. In terms of the educational level, the proportion of mothers who gave birth after the abortion ban came into effect and had only primary education decreased from 49.4% to 44.6%. For women with secondary education the proportion increased from 47.6 % to 52.1%. Similar differences can be observed in the educational level of fathers who had a child born during this ten-month period in 1967.[18]

[18]Table 2 also presents evidence that the average age at which women gave birth changed after the introduction of the policy, suggesting that the ban on abortions affected the optimal timing of children.

Figure 4 presents the same educational and labor market outcomes as Figure 3, but takes into account the composition changes. This figure plots average residuals from regressions after controlling for parental background. A visual inspection reveals that children born after June of 1967 are less likely to have attended high school or university and more likely to have graduated only from an apprentice school, which is considered a less desirable alternative to high school. The results are also reversed for labor market outcomes, with fewer children born after June of 1967 employed in jobs requiring high skills.

5.2 Regression results

Results of the children's educational achievement for the basic equation (1) are in columns (1) and (2) of Table 3. Column (1) presents estimates of α_1, the coefficient for the treatment dummy, using all children in the census sample born between January and October 1967. Column (2) also presents estimates of α_1, but only children for whom I have parental educational variables and household information are included. As mentioned earlier, I have parental information only for those children who are still living at home and thus could be matched to their parents.

Two main conclusions can be drawn from an analysis of columns (1) and (2) of Table 3. First, the overall impact of the abortion ban on children's subsequent educational outcomes is large and positive. During the ten-month period of study, children born after June were more likely to have finished high school and university. The size of this impact (see column 1) is large, the discrete change in the probability of finishing high school is 4% (from a mean of 46%) and the change in probability of going to university is .6% (from a mean of 9.1%). These results suggest that overall children born immediately after the abortion ban have better educational outcomes than those born immediately prior to the ban, indicating that the positive effect due to changes in the composition of mothers having children more than outweighs all the other negative effects that such a restriction might have had.

Secondly, a comparison of columns (1) and (2) shows that the size and significance

Interestingly, the average age at birth increased for women with primary and secondary education and decreased for women with tertiary education.

of the treatment effects for the full and restricted sample are similar. Children still living with their parents (and for whom I can recover parent background variables) are on average not affected very differently by the policy compared to the whole population of children. Thus, I feel comfortable proceeding to the next step of the analysis using this sub-group to control for the composition of children born into families with different socio-economic characteristics.

Columns (3) and (4) of Table 3 present the estimates of β_1, the coefficient on the treatment dummy after controlling for only the more exogenous background variables (column 3) and both background and household variables from the reduced form equation (2). This coefficient can be interpreted as the negative unwantedness effect after controlling for composition effects. As mentioned earlier, this combined unwantedness effect could be caused by a variety of different theoretically plausible channels, and the present analysis cannot distinguish between them.

The results in column (4) confirm the existence of a large and significant negative unwantedness effect. After controlling for family composition, the effect of the abortion ban on the probability of attending high school or university becomes negative.[19] The results are statistically significant and substantively large. The change in the probability of finishing high school is -1.7% (from a mean of 51.2%) and the change in probability of finishing university is -1.5% (from a mean of 13.2%). At the same time, the probability of going to an apprentice school - considered in Romania the default and a less desirable alternative to high-school - increases by 2.1% (from a mean of 23.2%). Thus, it appears that, controlling for family background, children born after the introduction of the abortion ban have worse educational outcomes. As mentioned earlier, I assume that any unobservable factors that might affect outcomes of children are constant across individuals. Given the rough control variables available and the fact that composition and unwantedness have opposite effects in the Romanian case, I believe that if anything the estimates on the effect of unwantedness are lower bound estimates of the true effect.

As mentioned earlier, one concern with the specifications used in columns (4) is that some of the controls for the children's socio-economic background might have been affected

[19]The reversal of the direction of the association between the abortion ban and child outcomes after controlling for family background is an example of Simpson's paradox (Simpson, 1951).

by the policy change. In particular, the unexpected birth of a child might affect the household variables (such as square feet per occupant). The regressions in columns (3) try to correct for this potential source of bias by using only control variables largely determined at the time of birth: region of birth dummies, urban/rural dummy of birth for the child, and parents' education.[20] Since the results in column (3), which the more exogenous background variables are generally qualitatively and quantitatively similar to those in column (4), the discussion of the results will focus primarily on results in column (4) which include both set of controls.

Table 4 presents the results when conducting the same tests but using labor market variables instead of educational achievement as outcomes. In the first column I present the reduced form estimates of equation (1) using the full sample. Similar to the educational outcomes, the overall effect of the abortion ban on type of employment is positive and large. The children affected by the policy change were, as adults, less likely to work in elementary occupations (by -0.6% from a mean of 6.4%) and more likely to work in jobs requiring a high level of skill (by 0.7% from a mean of 8.6%).

The second column of Table 4 shows estimates from the same regression as in column (1) but uses the restricted sample. The coefficients are similar to those in the previous column, although as in the case of the educational outcomes, children living with their parents have somewhat better outcomes. In columns (3) and (4) I present results from the estimation of reduced form regression (2), which includes different sets of controls. The results in column (4) suggest the existence of a negative unwantedness effect in the labor market. After controlling for family background, the effect of the abortion ban reduces the probability of working in a high-skill jobs from 9.1% to 8.4% and the change in probability of working in a job requiring intermediate-skill 1.2% (from a mean of 85.3%).[21] The effect is potentially greater since the census data records employment patterns very early in the career of the people I study, when there is less variability in outcomes across individuals. The labor market effect is potentially a lower bound also due to reduced variability in

[20]Furthermore, the inclusion of different sets of control variables does not affect the basic results. In all specifications the mother's education seems to be the most powerful control for family background.

[21]Additional results not shown here used an alternative definition to create five broad occupational dummy variables, which are broadly reflecting increasing skill in employment: (1) elementary occupations, (2) skilled agriculture, (3) clerical or sales, (4) production, and (5) managers and professionals. The size and significance of these results are similar to those found in the high skill/intermediate skill regressions.

employment outcomes resulting from the exclusion of university graduates from the labor outcome regressions. The use of a later dataset would provide a much better setting for looking at labor market effects. In particular the currently unreleased 2002 Romanian census would be a good data source, but by this time we expect very few individuals to live with their parents.[22]

5.3 Crowding effects and robustness checks

Table 5 presents the results from the extended framework for schooling outcomes, including children born in 1965 and 1966, the two years preceding the policy change. Column (4) of Table 5 confirms the existence of large crowding effects in the educational market. Children born in 1967, who went to school with a cohort that was more than twice as large as the cohort of the previous year, experience lower educational achievements: the probability of finishing high-school and university decreases by 3.9% and 1.3% respectively, while the probability of finishing only apprentice school increased by 1.7% (from a mean of 23%). Table 6 suggests that crowding effects in the labor market are small at best. While the coefficients point in the right direction, they are small and statistically not significant.[23] The larger crowding effects in schooling outcomes compared to labor market outcomes are not surprising. The structure of the school system entails that each age cohort is in a separate grade, so the crowding effects are potentially very large. On the other hand, the labor market does not have such a tight alignment of jobs to cohorts, so the crowding effect is spread over the entire labor market in Romania.

The extended framework can also be used to check the robustness of my main findings. The estimates of γ_1, the coefficient for the treatment dummy, are broadly similar to the results from the basic model. If we control for family background, we see that children

[22] One question of interest concerns the effects in educational and labor market outcomes differ depending on the sex of the child, the urban/rural place of birth, the region of birth of the child and the education levels of the parents. In regressions (not reported in the paper), the interaction of these variables with the treatment dummy were generally small and insignificant. The only exception was the interaction between treatment and a female dummy which is positive and significant in the education regressions. In other words, female children were less likely than male children to suffer the adverse consequences of the law.

[23] The interpretation of the crowding effect in the labor market should be treated with care, since age effects might play a significant role especially at the beginning of the labor market career of individuals. Age effects should be less of a concern for educational outcomes since most people in Romania have finished getting an education by age 25.

born after the policy change experience lower educational achievements. While the size of the magnitude of the probability of finishing apprentice school, high school and university are very similar to those in Table 3, in this specification the estimate of the high-school variable is no longer statistically different from 0 at the 5% level. The labor market outcomes reported in Table 6 are somewhat smaller than my previous finding. However, they generally confirm that, once I control for possible compositional and crowding effects, children born after the ban are less likely to work in high-skill jobs and more likely to work in intermediate-skill jobs.

Tables 5 and 6 also confirm that the effects of being born in the period June 1st to September 15th are generally very small. Finally, the results of the analysis are not sensitive to the length of the cohort of birth intervals used, to the inclusion of monthly time trends or to clustering the standard errors on the treatment dummy.

6 Extensions

6.1 The long-term fertility impact of the policy

This section uses census data from Romania and Hungary to measure the long-term effect of Romania's restrictive policies towards abortion and modern contraceptive methods on fertility levels in general, as well as the differential impact across educational groups. The magnitude of the long-term fertility impact of this policy is important because my analysis so far has provided evidence that excess fertility can negatively affect children's outcomes. Understanding the long-term effect of the policy across educational groups is of interest, given that the change in the composition of women who gave birth had a significant effect on average child outcomes.

The 1992 Romanian census asked women about the number of children ever born and thus for women who were over 40 in 1992 (or born prior to 1952) this variable is a good proxy for lifetime fertility. In Figure 5, I display the average number of children by year of birth for women born between 1900 and 1955. For women born between 1900 and 1930 I see a gradual and significant decline in fertility, which is broadly consistent with the timing of Romania's rapid demographic transition after World War II. The fertility impact of the restrictive policy can be observed for women born after 1930. Women born

around 1930 were in the their late thirties in 1967 and thus towards the end of their reproductive years at the time of the policy change. In contrast, the cohorts born around 1950 were in their late teens in 1967 and thus spent basically all their fertile years under the restrictive regime. The difference in fertility between these two cohorts is large (about 0.4 children or a 25% increase) and is probably a lower bound of the supply side impact since Romania's rapid economic development in this period probably decreased demand for children. Figure 5 also plots the mean number of children born to Hungarians living in Romania (from the 1992 Romanian census) and to the population in Hungary (from the 1990 Hungarian census). Hungary and the Hungarian population in Romania provide good comparison groups, since Hungary did not restrict access to birth control methods. Figure 5 shows the similar trend in fertility for Hungarians in both countries for women born prior to 1930 and the divergence in fertility levels afterwards.

Figure 6 presents evidence of increases in the fertility differential between educated and uneducated women over time. The fertility differential between educated and uneducated women experienced a gradual decline over time for cohorts born prior to 1930 followed by a gradual increase for cohorts born afterwards. The differential almost doubled when cohorts born around 1930 and 1950 are compared.[24] Thus the short-run and long-run impacts of the policy were very different between educational groups since educated women had the largest fertility increases immediately after the introduction of the ban but experienced the smallest fertility increases during Romania's 23 year long restrictive policy.[25] In a related paper (Pop-Eleches, 2005), I use detailed reproductive microdata[26] to provide an extensive analysis of the fertility impact of the Romanian pronatalist policy. My results suggest the significant importance that birth control methods play in influencing fertility levels and the effect of education on fertility.

[24]The relatively small number of uneducated Hungarians in the Romanian census sample and the inability to properly match educational levels between the Romanian and Hungarian data prevented an analysis of fertility differentials over time for the Hungarian population.

[25]This result is complementary to the findings of de Walque (2004), who shows the substantial evolution in the HIV/education gradient during an HIV/AIDS information campaign in Uganda.

[26]The main dataset used in that paper is the 1993 Romanian Reproductive Health Survey. I am also using the 1997 Moldovan Reproductive Health Survey as a control.

6.2 Early child outcomes and crime behavior

In this section I explore the effect of the abortion ban on two other socio-economic variables: early infant outcomes and crime behavior. Figure 7 plots the infant mortality rate and the late fetal death rate in Romania over the period 1955-1995. The data clearly suggest that the introduction of the restrictive policy caused large short-term increases in stillbirths and in infant deaths. Between 1966 and 1968, the infant mortality rate increased by 27% (from 46.6 to 59.5) and the late fetal death rate increased in the year following the introduction of the restrictive policy by 22% (from 14.7 to 17.9). Another indication of the negative impact of the policy change is the similarly large increase in low birth weights during this period. The percentage of low birth weight children increased between 1966 and 1967 from 8.1% to 10.6%. These results are consistent with the view that unwantedness at conception negatively affects early child outcomes. However, these results could also be explained by reduced access to pre and post-natal care due to possible crowding in hospitals and health clinics.

Next, following the work of Donohue and Levitt (2001) for the United States, I turn to the effects of the change in abortion regime on crime behavior later in life. The crime data[27]contain all the penal cases in the period 1991-2000 prepared by the regional tribunal of Sibiu county[28] for the regional courts.[29] For each of the over 1900 penal cases, I have basic information about the type of crime committed and most importantly for my purpose, the year of birth of the persons. I use this information to construct year-age cells for cohorts born between 1931 and 1985, dividing the number of crimes by the birth cohort population recorded at the 1992 census. The empirical strategy uses the following regression framework:

$$(5) \quad crime_{it} = \theta_0 + \theta_1 \cdot age_i + \theta_2 \cdot year_t + \theta_3 \cdot born\_67\_69_i + \theta_4 \cdot born\_after70_i + \varepsilon_i,$$

where $crime_{it}$ is a year-age crime rate, age_i and $year_t$ are a set of age and year

[27]Since no government agency collects crime statistics at the individual level for the whole country, the best alternative was to manually collect data from original archival documents in one region.

[28]Sibiu, one of Romania's 42 counties, is located in the center of the country. With a population of roughly half a million inhabitants, Sibiu is a medium sized county with an above average level of socio-economic development.

[29]In Romania, the regional tribunals with the help of the regional police prepare a detailed report for every penal crime comitted. This report is then sent to the regional courts who use this evidence to decide the cases.

dummies, $born\_67\_69_i$ is an indicator if a cohort was born between 1967 and 1969, the three years of high fertility. Finally $born\_after70_i$ takes value 1 for cohorts born after 1970.

The basic idea is to look at the crime behavior of cohorts born after the policy change after accounting for possible age effects and year effects. The cohort of birth indicator for the period immediately following the introduction of the policy (1967-1969) should account for the strong compositional changes described earlier, in addition to the negative unwantedness effect. The effect of the policy change on crime is potentially better measured for the cohorts born after 1970, a group that is less influenced by changes in the composition of families having children. Column 1 of Table 7 provides regression results for the total crime rate, which are consistent with my earlier findings. The cohort 1967-1969 had an average crime rate[30] that was 0.12 lower than the average crime rate of 0.89 for cohorts born prior to 1967. However, cohorts born after 1970 had a 0.3 increase in their crime rate compared to the cohorts born prior to the policy change. The negative coefficient for the cohort 1967-1969 suggests that the compositional changes have the strongest effect on crime behavior, just as in the education and labor regressions. The positive and significant coefficient for the cohorts born under the restrictive policy after 1970 provides some suggestive evidence that cohorts born in a period without access to abortion might experience higher crime rates during adulthood. Since in the medium and long-run the policy disproportionately affected disadvantaged women (Pop-Eleches, 2002), the increased criminality of cohorts born after 1970 could be explained not just by changes in the proportion of unwanted children but also by compositional factors.[31] However, the present framework cannot control for other time specific factors that might also have affected the criminal behavior of cohorts born after 1970. As an example, these results could also be explained by increased criminal behavior of young people during the transition process.[32]

[30]The crime rate equals the number of crimes per 1000 residents in a given birth cohort.

[31]Thus the compositional effect of the ban on abortion for cohorts born after 1970 might have a negative effect on crime rates, just like in the US after Roe v. Wade (Donohue and Levitt, 2001).

[32]The results in Table 7 are weakened and lose their statistical significance in specifications that include age-specific trends.

7 Conclusion

This paper has used Romania's unusual history of abortion legislation to assess the impact of a change in abortion regime on the socio-economic outcomes of children. On average, children born after abortion became illegal display better educational and labor market achievements, and this outcome can be explained by a change in the composition of families having children: urban, educated women working in good jobs were more likely to have abortions prior to the policy change, so a higher proportion of children were born into urban, educated households. Moreover, the analysis shows that after controlling for this type of compositional changes, the children born after the abortion ban had significantly worse schooling and labor market outcomes. I interpret this result as evidence of the existence of a negative unwantedness effect. The analysis also shows that crowding in schools, due to the large increase in fertility immediately following the abortion ban, lowered educational achievements of the cohorts affected. Finally, I have provided some suggestive evidence consistent with the view that cohorts born after the introduction of the abortion ban had inferior infant outcomes and increased criminal behavior later in life.

While the present study has shown evidence of negative developmental effects caused by a change in abortion policy, the relevance of these findings could be of a broader nature and does not have to refer strictly to abortion legislation. The findings of this study may be relevant in many settings where social, political or economic factors cause excess fertility, due to lack of access to birth control methods.

References

Angrist, J. and Evans, W. (1999), "Schooling and Labor Market Consequences of the 1970 State Abortion Reforms", Research in Labor Economics, 18, 75-114 .

Becker, G., A Treatise on the Family. Cambridge, MA: Harvard University Press, 1981.

Becker, G. and Lewis, H., "On the Interaction between the Quantity and Quality of Children". Journal of Political Economy, 81(2, pt. 2), S279-S288.

Berelson, B. (1979), "Romania's 1966 Anti-Abortion Decree: The Demographic Experience of the First Decade", Population Studies, 33,2, 209-222.

Bloomberg, S (1980), "Influence of maternal distress during pregnancy on postnatal development," Acta Psychiatrica Scandinavica, 62, 405-417.

Charles, K. and Stephens, M. (2002), "Abortion Legalization and Adolescent Substance Use", NBER working paper, no. 9193, Cambrige, MA.

Corman, H. and Grossman, M. (1985), "Determinants of Neonatal Mortality Rates in the US: A Reduced Form Model," Journal of Health Economics, 4, 213-236.

David H. P. eds (1999), From Abortion to Contraception, London: Greenwood Press.

David H.P. and Z. Matejcek (1981), "Children Born to Women Denied Abortion: An Update," Family Planning Perspectives, 13, 32-34.

David H. P. (1986), "Unwanted Children: A Follow Up from Prague", Family Planning Perspectives, 18, 143-144.

de Walque, D. (2004), "How Does the Impact of an HIV/AIDS Information Campaign Vary with Educational Attainment? Evidence from Rural Uganda", World Bank Policy Research Working Paper No. 3289.

Donohue J. J., Grogger, J. and S. D. Levitt (2002), "The Impact of Legalized Abortion on Teen Childbearing", University of Chicago mimeo

Donohue J. J. and S. D. Levitt (2001), "The Impact of Legalized Abortion on Crime.", Quarterly Journal of Economics, 116(2), 379-420.

Dytrych et al.(1975), "Children Born to Women Denied Abortion", Family Planning Perspectives, 7, 165-171.

Grossman, M. and Jacobowitz. (1981), "Variations in Infant Mortality Rates Among Counties of the United States: The Roles of Public Policies and Programs," Demography, 18(4), 695-713.

Goldin, C. and Katz, L. (2002), "The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions," , Journal of Political Economy, 110(4), 730-770.

Grossman, M. and Joyce, T. (1990), "Unobservables, Pregnancy Resolutions, and Birth Weight Production Functions in New York City," Journal of Political Economy, 98(5), 983-1007.

Gruber, J. Levine, P.B. and Staiger, D. (1999), "Abortion Legalization and Child Living Circumstances: Who is the 'Marginal Child?", Quarterly Journal of Economics, 114(1): 263-291.

Heckman, J. J. (1979), "Sample Selection Bias as a Specification Error", Econometrica, 47(1): 153-161.

Joyce, Th.(1985), "The Impact of Induced Abortion on Birth Outcomes in the United States." NBER working paper, no. 1757, Cambrige, MA.

Legge, J. (1985), Abortion Policy: An Evaluation of the Consequences for Maternal and Infant Health, Albany: State University of New York Press.

Levine, P.B. Staiger, G. Kane, T.J. and Zimmerman, D.J. (1999), "Roe v. Wade and American Fertility," American Journal of Public Health, 89(2), 199-203

Pop-Eleches, C. (2005), "The Supply of Birth Control Methods, Education and Fertility: Evidence from Romania," Columbia University mimeo

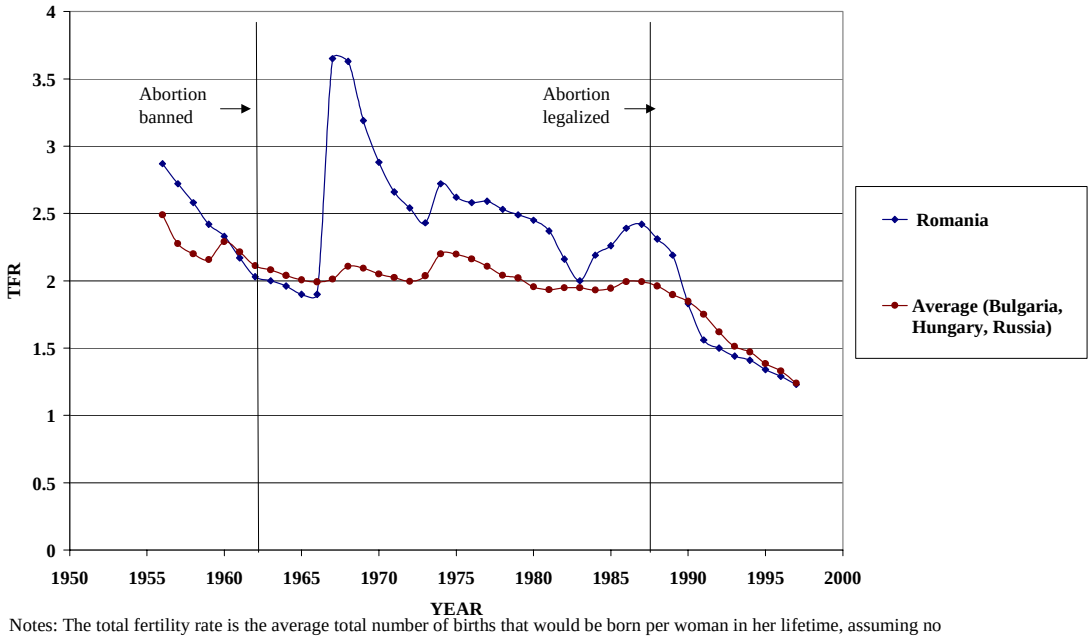
Roy, A. (1951), "Some Thoughts on the Distribution of Earnings," Oxford Economic Papers, 3,135-146.

Simpson, E.H. (1951), "The Interpretation of Interaction in Contingency Tables", Journal of the Royal Statistical Society, Series B, 13: 238-241.

World Bank Country Study. (1992), Romania: Human Resources and the Transition to a Market Economy. Washington, DC.

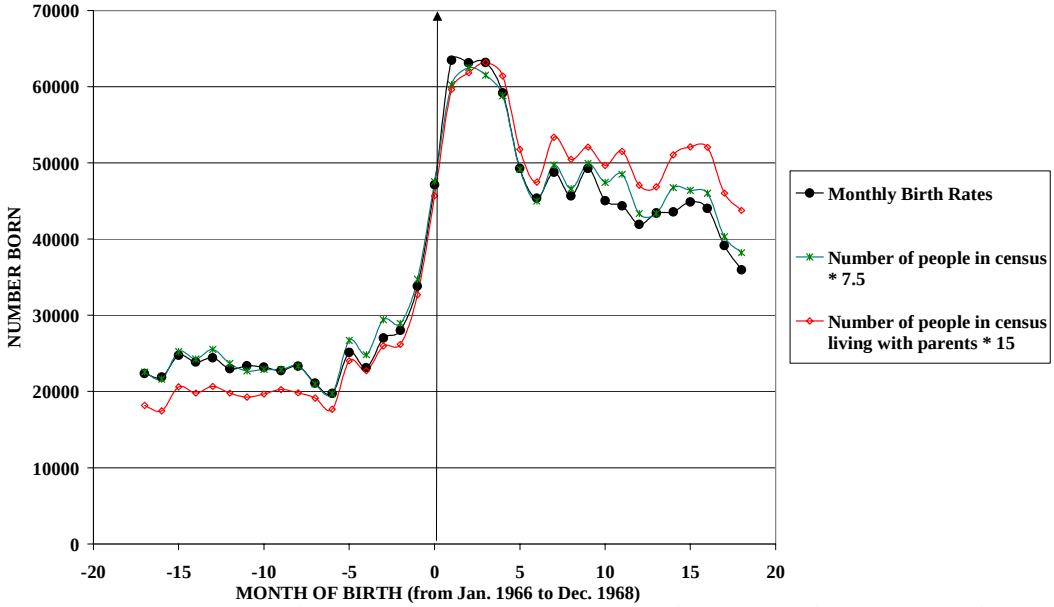
World Bank. (1978-1998) World Development Report. New York: Oxford University Press for the World.

FIGURE 1: TOTAL FERTILITY RATES



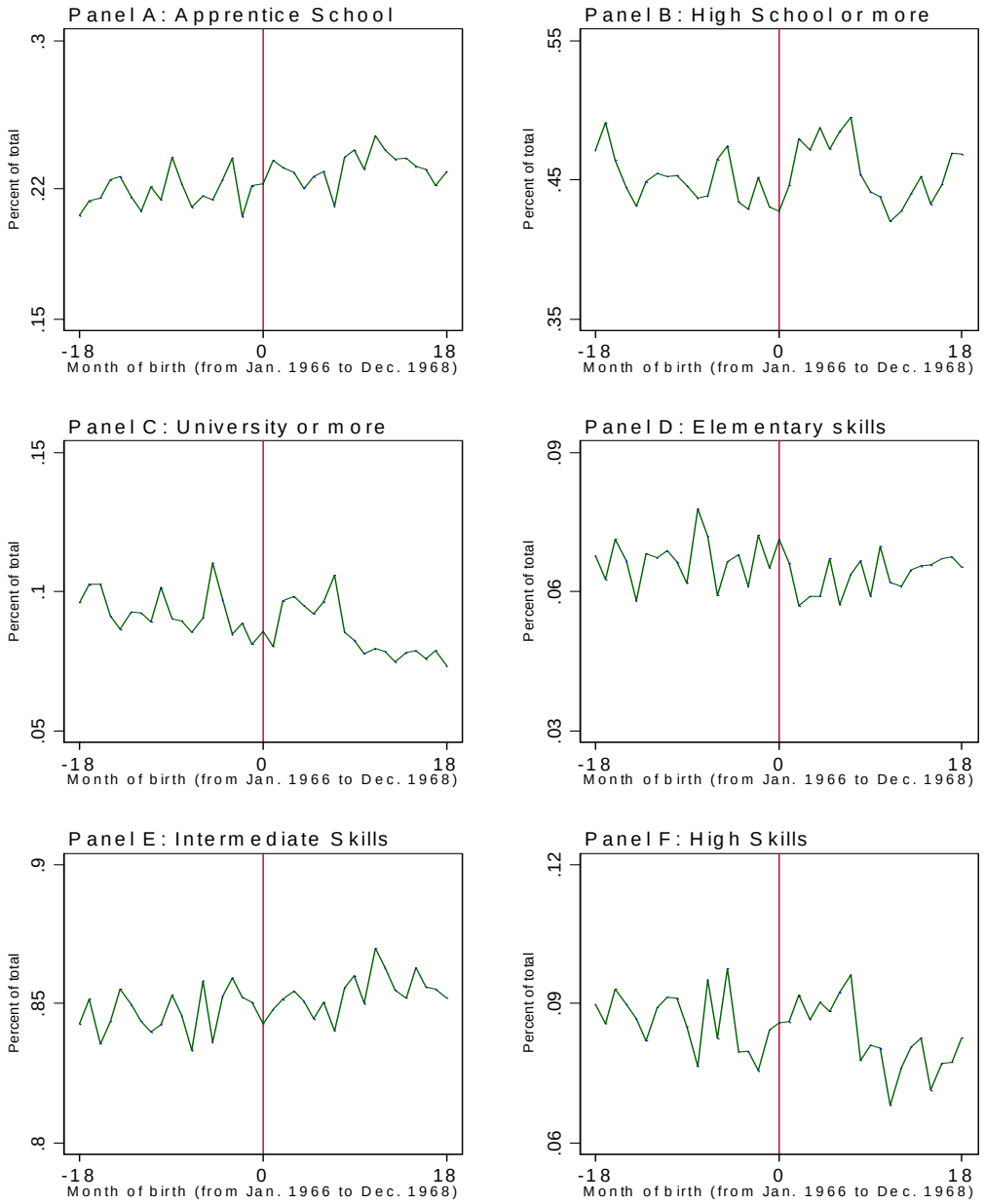
Notes: The total fertility rate is the average total number of births that would be born per woman in her lifetime, assuming no mortality in the childbearing ages, calculated from the age distribution and age-specific fertility rates of a specified group in a given reference period. Source: UN (2002).

FIGURE 2: MONTHLY BIRTH RATES - VITAL STATISTICS AND REPRESENTATION INTHE 1992 CENSUS SAMPLE



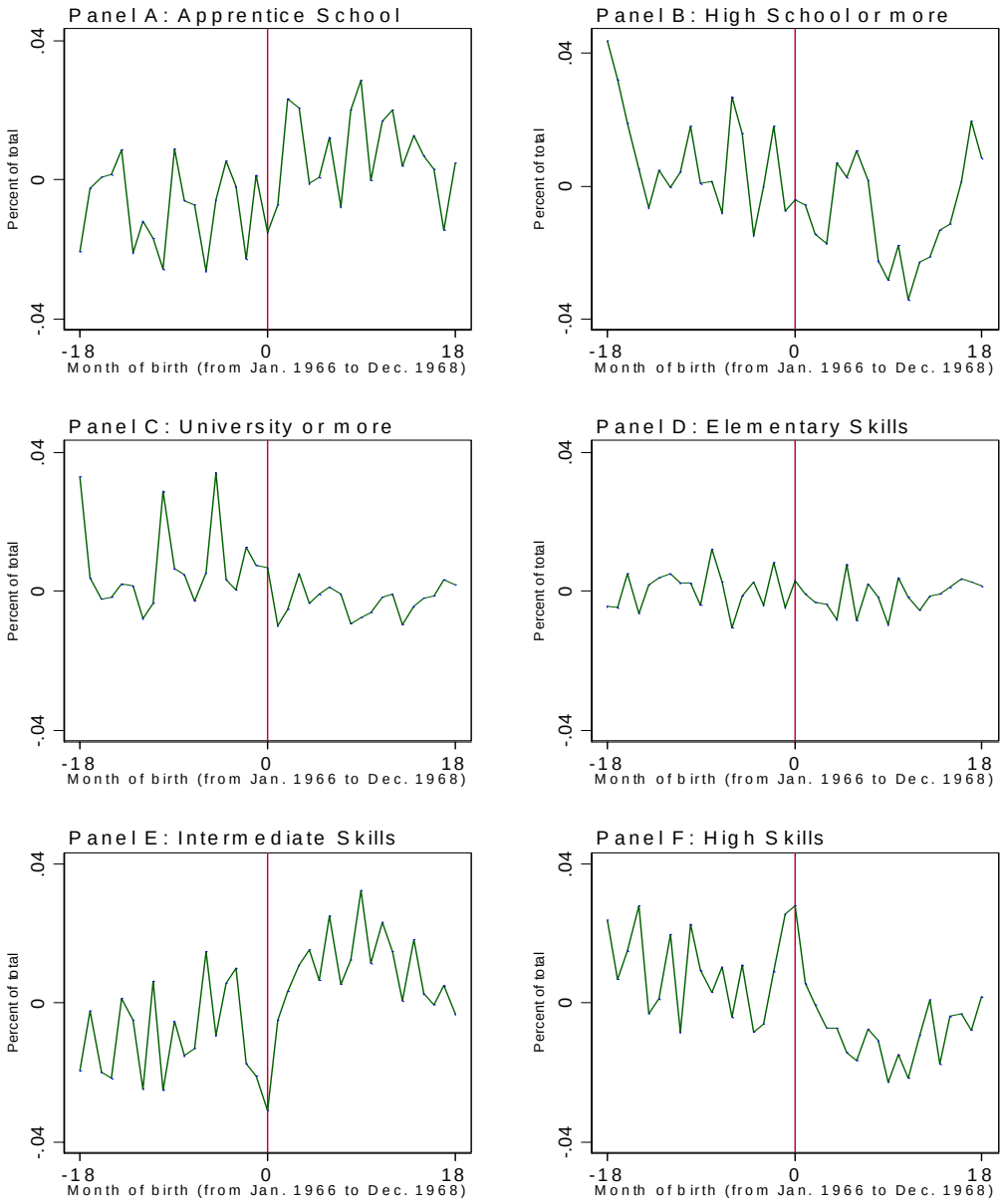
Notes: This graph plots the number of persons born between 1966 and 1968 by month of birth. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Also plotted are the number of persons born in the same period included in the census sample (scaled 1:7.5) and those in the census sample who still lives with their parents (scaled 1:15). Source: 1992 Romanian

FIGURE 3: EDUCATIONAL AND LABOR MARKET ACHIEVEMENTS - RAW DATA



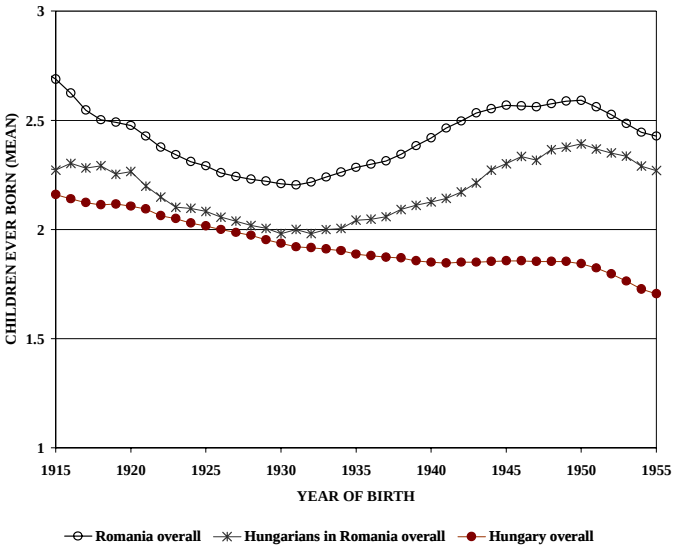
Notes: This graph plots average educational and labor market achievements by month of birth for persons born between 1966 and 1968. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Variables are further defined in Appendix A. Source: 1992 Romanian Census.

FIGURE 4: EDUCATIONAL AND LABOR MARKET ACHIEVEMENTS - RESIDUALS AFTER CONTROLLING FOR PARENTAL BACKGROUND



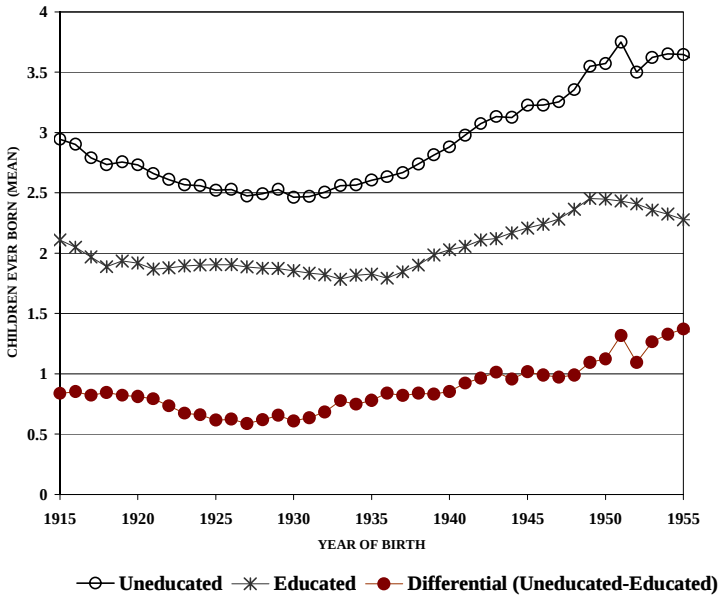
Notes: This graph plots average residuals from educational and labor marker outcome regressions after controlling for parental background by month of birth for persons born between 1966 and 1968. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Variables are further defined in Appendix A. Source: 1992 Romanian Census.

FIGURE 5: FERTILITY LEVELS OF WOMEN BORN BETWEEN 1900-1955



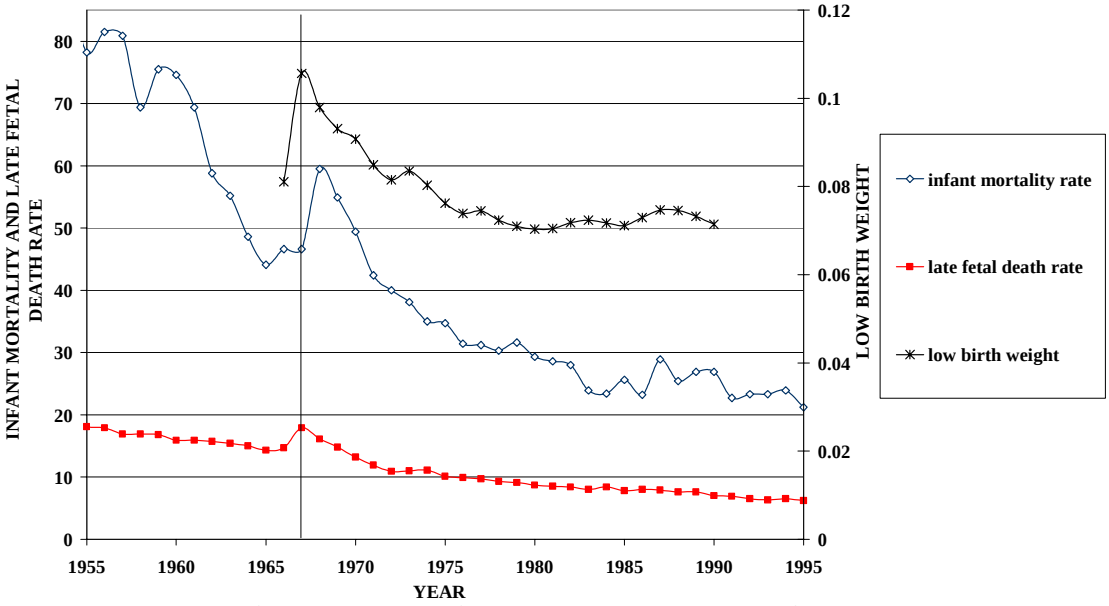
Notes: This graph plots the average number of children born in Romania by year of birth of the mother. Similar data is shown for the Hungarian minority in Romania and for Hungary. Hungary did not implement a similar restriction during this time period. Source: 1992 Romanian Census, 1990 Hungarian Census.

FIGURE 6: FERTILITY LEVELS IN ROMANIA BY EDUCATION



Notes: This graph plots the average number of children born by year of birth of the mother and educational level. Source: 1992 Romanian Census.

FIGURE 7: INFANT MORTASLITY RATE, LATE FETAL DEATH RATE, AND LOW BIRTH WEIGHT RATE IN ROMANIA (1955-1995)



Notes: This graph plots the infant mortality rate, the late fetal death rate and the low birth weight rate for Romania in the period 1955-1995.
Source: Government of Romania, Statistical Office.

Table 1: Summary statistics

Dependent Variables	*Full Sample (Jan.-Oct. 1967)*	*Do not live with either parent*	*Restricted sample (Live with both parents)*	*Diff.*	*Full Sample Controls (Jan.-May 1967)*	*Full Sample Treatments (June-Oct.1967)*	*Diff.*	*Restricted Sample Controls (Jan.-May 1967)*	*Restricted Sample Treatments (June-Oct.1967)*	*Diff.*
Gender of Child										
Female	**0.481**	**0.626**	**0.331**	**-0.295*** **	**0.474**	**0.484**	**0.009** **	**0.313**	**0.339**	**0.026*** **
Place of Birth										
Urban	**0.397**	**0.347**	**0.436**	**0.089*** **	**0.350**	**0.421**	**0.072*** **	**0.374**	**0.464**	**0.089*** **
Child's Education										
Apprentice School	**0.226**	**0.222**	**0.232**	**0.001*** **	**0.222**	**0.228**	**0.006***	**0.231**	**0.233**	**0.002**
High School or more	**0.460**	**0.420**	**0.512**	**0.092*** **	**0.435**	**0.472**	**0.038*** **	**0.484**	**0.525**	**0.041*** **
University or more	**0.091**	**0.058**	**0.132**	**0.074*** **	**0.087**	**0.093**	**0.006** **	**0.127**	**0.133**	**0.006**
Child's Job Type										
Elementary Skills	**0.064**	**0.068**	**0.056**	**-0.012*** **	**0.068**	**0.061**	**-0.006** **	**0.060**	**0.054**	**-0.006***
Intermediate Skills	**0.850**	**0.849**	**0.853**	**0.004**	**0.851**	**0.850**	**-0.001**	**0.852**	**0.854**	**0.002**
High Skills	**0.086**	**0.083**	**0.091**	**0.008*** **	**0.081**	**0.089**	**0.007*** **	**0.088**	**0.092**	**0.004**
Observations	**55337**	**27417**	**22847**		**18339**	**36998**		**7147**	**15700**	
Obs. for Job Type	**41898**	**20648**	**17335**		**13840**	**28058**		**5416**	**11919**	

Notes: The full sample contains people born between January and October of 1967. The restricted sample contains children living with both their parents at the time of the census in 1992, for whom I could obtain basic socio-economic variables of their parents. The persons born between January and May of 1967 are in the control group, while those born between June and October are in the treatment group. * indicates statistical significance at the 10% level, ** at 5% and *** at 1% for the difference in means.Variables are further defined in Appendix A.

Table 2: Selection effects of the change in abortion legislation: comparison of means

	Control Group (Jan.-May 1967)	*Treatment Group (June-October 1967)*	*Difference*
Place of Birth of Child			
Urban	**0.350**	**0.422**	**0.071*** **
Observations	19156	38494	
Mother's Highest Educational Level			
Primary	**0.494**	**0.446**	**-0.048*** **
Secondary	**0.476**	**0.521**	**0.045*** **
Tertiary	**0.030**	**0.033**	**0.003**
Observations	8453	18732	
Father's Highest Educational Level			
Primary	**0.370**	**0.323**	**-0.047*** **
Secondary	**0.576**	**0.613**	**0.038*** **
Tertiary	**0.055**	**0.064**	**0.009*** **
Observations	7574	16601	
Mother's Age at Birth by Education			
Primary	**29.188**	**29.497**	**0.309*** **
Secondary	**25.874**	**26.452**	**0.578*** **
Tertiary	**28.743**	**27.969**	**-0.774** **
Observations	8453	18732	

Notes: The sample contains parents who had children born between January and October of 1967and living at home at the time of the census in 1992. The Control Group contains people born between January and May 1967. The Treatment Group contains people born between June - October 1967. * indicates statistical significance at the 10% level, ** at 5% and *** at 1% for the difference in means. Variables are further defined in Appendix A.

Table 3 : Educational achievements for cohorts born between January and October 1967

Dependent Variables	*Full Sample (1)*	*Restricted Sample (2)*	*Restricted Sample (3)*	*Restricted Sample (4)*
Apprentice School				
Treatment dummy	**0.00643***	**0.00199**	**0.01960*****	**0.02134*****
	(0.00376)	(0.00602)	(0.00560)	(0.00556)
Observed probability	**.226**	**.232**	**.232**	**.232**
High School or more				
Treatment dummy	**0.03789*****	**0.04145*****	**-0.00565**	**-0.01713****
	(0.00449)	(0.00713)	(0.00795)	(0.00816)
Observed probability	**.46**	**.512**	**.512**	**.512**
University or more				
Treatment dummy	**0.00573****	**0.00611**	**-0.01232*****	**-0.01470*****
	(0.00257)	(0.00479)	(0.00405)	(0.00392)
Observed probability	**.091**	**.132**	**.132**	**.132**
Observations	55337	22847	22847	22847
Background controls	NO	NO	YES	YES
Household controls	NO	NO	NO	YES

Notes: The table presents the results of probit regressions. For continuous variables, the coefficient estimates represent the marginal effect of variables evaluated at their mean; for dummy variables the coefficients capture the effect of switching the value from 0 to 1. The sample contains people born between January and October of 1967. The dependent variables are 4 educational achievement dummies. The treatment dummy is 1 for people born after June of 1967, 0 otherwise. The background controls included are: 2 educational dummies of mother, 2 educational dummies of father, urban dummy for place of birth of child, dummy for sex of child and 46 region of birth dummies. The household controls are: homeownership, rooms per occupant, surface area per occupant, availability of toilet, bath, kitchen, gas, sewage, heating, water.

The full sample refers to all individuals in a given cohort included in the census sample. The restricted sample refers to those individuals in the census sample who live with their parents at the time of the census. Robust standard errors are shown below the coefficients in parentheses. Variables are further defined in Appendix A. * indicates statistical significance at the 10% level, ** at 5% and *** at 1%.

Table 4 : Labor market outcomes for cohorts born between January and October 1967

Dependent Variables	*Full Sample (1)*	*Restricted Sample (2)*	*Restricted Sample (3)*	*Restricted Sample (4)*
Elementary Skills				
Treatment dummy	**-0.00644****	**-0.00608**	**-0.00287**	**-0.00167**
	(0.00257)	(0.00384)	(0.00356)	(0.00344)
Observed probability	**.064**	**.056**	**.056**	**.056**
Intermediate Skills				
Treatment dummy	**-0.00098**	**0.00186**	**0.01214****	**0.01241****
	(0.00370)	(0.00581)	(0.00582)	(0.00583)
Observed probability	**.850**	**.853**	**.853**	**.853**
High Skills				
Treatment dummy	**0.00742*****	**0.00422**	**-0.00639**	**-0.00729***
	(0.00288)	(0.00468)	(0.00412)	(0.00404)
Observed probability	**.086**	**.091**	**.091**	**.091**
Observations	41898	17335	17335	17335
Background controls	NO	NO	YES	YES
Household controls	NO	NO	NO	YES

Notes: The table presents the results of probit regressions. For continuous variables, the coefficient estimates represent the marginal effect of variables evaluated at their mean; for dummy variables the coefficients capture the effect of switching the value from 0 to 1. The sample contains people born between January and October of 1967. The dependent variables are 3 skill specialization dummies based ISCO 88 occupational codes. The treatment dummy is 1 for people born after June of 1967, 0 otherwise. The background controls included are: 2 educational dummies of mother, 2 educational dummies of father, urban dummy for place of birth of child, dummy for sex of child and 46 region of birth dummies. The household controls are: homeownership, rooms per occupant, surface area per occupant, availability of toilet, bath, kitchen, gas, sewage, heating, water.

The full sample refers to all individuals in a given cohort included in the census sample. The restricted sample refers to those individuals in the census sample who live with their parents at the time of the census. Robust standard errors are shown below the coefficients in parentheses. Variables are further defined in Appendix A. * indicates statistical significance at the 10% level, ** at 5% and *** at 1%.

Table 5 : Educational achievements for cohorts born in 1965-1967

Dependent Variables	*Full Sample (1)*	*Restricted Sample (2)*	*Restricted Sample (3)*	*Restricted Sample (4)*
Apprentice School				
Treatment dummy	**0.00595**	**0.00700**	**0.01772***	**0.01969****
	(0.00590)	(0.00997)	(0.00955)	(0.00952)
Crowding dummy	**0.00944****	**0.00961**	**0.01663****	**0.01675****
	(0.00442)	(0.00747)	(0.00704)	(0.00700)
June-September dummy	**0.00312**	**-0.00264**	**0.00448**	**0.00430**
	(0.00394)	(0.00703)	(0.00661)	(0.00656)
Observed probability	**.220**	**.230**	**.230**	**.230**
High School or more				
Treatment dummy	**0.02869*****	**0.02308****	**-0.01269**	**-0.02197***
	(0.00707)	(0.01177)	(0.01314)	(0.01351)
Crowding dummy	**-0.01831*****	**-0.01312**	**-0.03823*****	**-0.03855*****
	(0.00530)	(0.00888)	(0.00987)	(0.01016)
June-September dummy	**0.00471**	**0.01100**	**-0.00261**	**-0.00363**
	(0.00472)	(0.00829)	(0.00924)	(0.00948)
Observed probability	**.458**	**.506**	**.506**	**.506**
University or more				
Treatment dummy	**0.00374**	**-0.00131**	**-0.01408****	**-0.01758*****
	(0.00416)	(0.00805)	(0.00609)	(0.00565)
Crowding dummy	**-0.00437**	**-0.00751**	**-0.01511*****	**-0.01269*****
	(0.00310)	(0.00614)	(0.00488)	(0.00464)
June-September dummy	**0.00185**	**0.00781**	**0.00053**	**0.00223**
	(0.00273)	(0.00559)	(0.00441)	(0.00413)
Observed probability	**.092**	**.135**	**.135**	**.135**
Observations	84508	30657	30657	30657
Background controls	NO	NO	YES	YES
Household controls	NO	NO	NO	YES

Notes: The table presents the results of probit regressions. For continuous variables, the coefficient estimates represent the marginal effect of variables evaluated at their mean; for dummy variables the coefficients capture the effect of switching the value from 0 to 1. The sample contains people born between January-April and June-Sept.15th of 1965-1967. The dependent variables are 4 educational achievement dummies. The treatment dummy is 1 for people born after June of 1967, 0 otherwise. The crowding dummy is 1 for people born in 1967, 0 otherwise. The June-September dummy is 1 for people born between June and Sept. 15th, 0 otherwise. The background controls included are: 2 educational dummies of mother, 2 educational dummies of father, urban dummy for place of birth of child, dummy for sex of child and 46 region of birth dummies. The household controls are: homeownership, rooms per occupant, surface area per occupant, availability of toilet, bath, kitchen, gas, sewage, heating, water.

The full sample refers to all individuals in a given cohort included in the census sample. The restricted sample refers to those individuals in the census sample who live with their parents at the time of the census. Robust standard errors are shown below the coefficients in parentheses. Variables are further defined in Appendix A. * indicates statistical significance at the 10% level, ** at 5% and *** at 1%.

Table 6 : Labor market outcomes for cohorts born in 1965-1967

Dependent Variables	*Full Sample (1)*	*Restricted Sample (2)*	*Restricted Sample (3)*	*Restricted Sample (4)*
Elementary Skills				
Treatment dummy	**-0.00615**	**-0.00478**	**-0.00330**	**-0.00297**
	(0.00385)	(0.00609)	(0.00582)	(0.00564)
Crowding dummy	**0.00145**	**0.00022**	**0.00142**	**0.00128**
	(0.00296)	(0.00464)	(0.00439)	(0.00424)
June-September dummy	**-0.00014**	**-0.00161**	**-0.00115**	**-0.00083**
	(0.00265)	(0.00438)	(0.00416)	(0.00401)
Observed probability	**.064**	**.057**	**.057**	**.057**
Intermediate Skills				
Treatment dummy	**-0.00603**	**-0.00057**	**0.00810**	**0.00811**
	(0.00591)	(0.00950)	(0.00913)	(0.00913)
Crowding dummy	**0.00956****	**-0.00074**	**0.00214**	**0.00255**
	(0.00438)	(0.00714)	(0.00694)	(0.00694)
June-September dummy	**0.00361**	**0.00145**	**0.00286**	**0.00295**
	(0.00389)	(0.00670)	(0.00652)	(0.00651)
Observed probability	**.849**	**.856**	**.856**	**.856**
High Skills				
Treatment dummy	**0.01268*****	**0.00529**	**-0.00368**	**-0.00413**
	(0.00482)	(0.00776)	(0.00627)	(0.00603)
Crowding dummy	**-0.01123*****	**0.00052**	**-0.00392**	**-0.00401**
	(0.00348)	(0.00578)	(0.00480)	(0.00464)
June-September dummy	**-0.00346**	**0.00020**	**-0.00036**	**-0.00015**
	(0.00307)	(0.00541)	(0.00450)	(0.00432)
Observed probability	**.087**	**.087**	**.087**	**.087**
Observations	64002	23223	23223	23223
Background controls	NO	NO	YES	YES
Household controls	NO	NO	NO	YES

Notes: The table presents the results of probit regressions. For continuous variables, the coefficient estimates represent the marginal effect of variables evaluated at their mean; for dummy variables the coefficients capture the effect of switching the value from 0 to 1. The sample contains people born between January-April and June-Sept.15th of 1965-1967. The dependent variables are 3 skill specialization dummies based ISCO 88 occupational codes. The treatment dummy is 1 for people born after June of 1967, 0 otherwise. The crowding dummy is 1 for people born in 1967, 0 otherwise. The June-September dummy is 1 for people born between June and Sept. 15th, 0 otherwise. The background controls included are: 2 educational dummies of mother, 2 educational dummies of father, urban dummy for place of birth of child, dummy for sex of child and 46 region of birth dummies. The household controls are: homeownership, rooms per occupant, surface area per occupant, availability of toilet, bath, kitchen, gas, sewage, heating, water.

The full sample refers to all individuals in a given cohort included in the census sample. The restricted sample refers to those individuals in the census sample who live with their parents at the time of the census. Robust standard errors are shown below the coefficients in parentheses. Variables are further defined in Appendix A. * indicates statistical significance at the 10% level, ** at 5% and *** at 1%.

Table 7 : Crime behavior in Sibiu, Romania

Dependent Variables	*Total crime* *(1)*	*Crime against persons* *(2)*	*Property crime* *(3)*	*Other crimes* *(4)*
dummy for birth(1967-1969)	**-0.116**	**-0.095**	**0.059**	**0.001**
	(0.102)	(0.065)	(0.053)	(0.056)
dummy for birth(after 1970)	**0.301****	**0.088**	**0.232*****	**0.221*****
	(0.124)	(0.095)	(0.081)	(0.071)
Age dummies included	yes	yes	yes	yes
Time controls included	year dummies	year dummies	year dummies	year dummies
Avg. crime rate for 1967-69 cohort	0.77	0.36	0.26	0.28
Observations	550	550	550	550
R-squared	0.64	0.52	0.54	0.48

Notes: The dataset contains all the penal cases judged by the Sibiu tribunal in the period 1991-2000. Year-birth cohort cells were constructed for all cohorts born between 1931-1985. The crime rate equals the number of crimes per 1000 residents in a given birth cohort, based on data from the 1992 census. The restrictive abortion policy came into effect in May 1967 and experienced three years of unusually large fertility (1967-1969). Standard errors are clustered at the year of birth level and shown below the coefficients in parentheses. * indicates statistical significance at the 10% level, ** at 5% and *** at 1%.

Appendix A: Definition of the variables

This table describes the variables from the 1992 Romanian census used in this study.

1. Dependent variables:

Educational achievements:

Romania's educational system is organized as follows: after 8 years of primary school, which virtually all children attend, a student has the choice to go to high-school for four years or to go to an apprentice school. The apprentice schools, which resemble the vocational schools in other European countries, are also 4 years long and they combine formal schooling with on job practical training but do not allow a student to apply for a university degree. Only graduates of high-schools are allowed to apply to universities.

Definition of education variables:

Apprentice School – this variable takes value 1 if an individual has graduated from an apprentice school, 0 otherwise

High School or more– this variable takes value 1 if an individual has graduated from high school, 0 otherwise. Thus, this variable includes those individuals who received tertiary education

University or more – this variable takes value 1 if an individual has graduated from university or a postgraduate school or is currently enrolled in university, 0 otherwise. Current enrollment in university is defined as having a high school degree and being currently in enrolled in school.

Labor market outcomes:

The labor market outcomes refer to those individuals currently employed in one of the four major ISCO skill Groups. The ISCO (International Standard Classification of Occupations) codes classify jobs with respect to the type of work performed and the skill level required to carry out the tasks and duties of the occupations. The ISCO is the standard classification of the International Labor Organization (ILO). Since a sizeable fraction of individuals were still enrolled in university at the time of the survey, individuals with a university degree or those currently enrolled in university were dropped from the labor market regressions.

Definition of labor market variables:

Elementary skills– this variable takes value 1 if an individual is employed at the time of the census in an ISCO skill level 1 occupation, 0 if employed in a different skill level occupation.

Intermediate skills– this variable takes value 1 if an individual is employed at the time of the census in an ISCO skill level 2 occupation, 0 if employed in a different skill level occupation.

High skills– this variable takes value 1 if an individual is employed at the time of the census in an ISCO skill level 3 or 4 occupation, 0 if employed in a different skill level occupation.

2. Independent variables:

Educational achievements of parents:

Secondary Education – this variable takes value 1 if an individual has graduated from secondary school (either high school or apprentice school), 0 otherwise.

Tertiary Education – this variable takes value 1 if an individual has tertiary education , 0 otherwise.

Household variables (refer to endowment of household at the time of the census in 1992):

Homeownership – this variable takes value 1 if a household owns the home where it lives at the time of the census, 0 otherwise.

Rooms per occupant– this variable measures the number of rooms in the household per number of household members at the time of the census.

Surface area per occupant– this variable measures the surface area (measured in square meters) in the household per number of household members at the time of the census.

Toilet – this variable takes value 2 if a household has a toilet inside the dwelling unit, 1 if a household has a toilet outside the dwelling unit, 0 if a household has no toilet

Bath– this variable takes value 2 if a household has a bath inside the dwelling unit, 1 if a household has a bath outside the dwelling unit, 0 if a household has no bath.

Kitchen– this variable takes value 2 if a household has a kitchen inside the dwelling unit, 1 if a household has a kitchen outside the dwelling unit, 0 if a household has no kitchen.

Gas– this variable takes value 1 if a household has access to gas for cooking in the household, 0 otherwise

Sewage– this variable takes value 1 if a household is connected to a sewerage system, 0 otherwise

Heating– this variable takes value 1 if a household has central heating in the household, 0 otherwise

Water– this variable takes value 1 if a household has access to hot water in the household, 0 otherwise

Other variables:

Urban – this variable takes value 1 if an individual was born in a urban area, 0 otherwise.

Sex– this variable takes value 1 if an individual is female, 0 otherwise.

Region of birth– these are a set of 47 region of birth dummies.

Fertility – the number of live births born to a female respondent at the time of the 1992 census