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

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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 abortion was 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.

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1 Introduction

This paper is an effort to understand how a ban on abortions affects socio-economic outcomes of children. I am able to make progress on this question by using a major change in Romania's abortion regime as a natural experiment. In 1966 Romania 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. This policy was sustained, 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 abortions became illegal display better educational and labor market achievements than children born just prior to the change. This outcome 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. 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. Additionally, I provide evidence of crowding in the schooling system.

The final part of the paper contains three extensions to the main analysis. First I

show that while in the short-run the more educated women were mostly affected by the ban on abortions, 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 suggests that educated women changed their behavior more drastically as a result of the ban. Secondly, I provide some suggestive evidence that part of the negative effect on educational outcomes may be explained by the trade-off between child quality and quantity (Becker and Lewis, 1973, Becker, 1981). Finally, 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.

The plan of the paper is as follows. Section 2 provides a simple conceptual framework that outlines the channels through which a ban on abortions might affect the average socio-economic outcomes of the cohort affected by this policy change and briefly summarizes previous research on this topic. 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 three extensions. The last section summarizes the findings and suggests some directions for further work.

2 The conceptual framework and literature review

2.1 The conceptual framework

In this section, I develop a simple application of a self-selection model (Roy, 1951) to explain how a ban on access to abortion can affect average child outcomes. The key idea is that access to abortion provides individuals with a more effective way to plan the number and timing of children. However, those individuals that choose to take advantage of this method may be different from those who are not and this creates an important selection effect that needs to be more carefully considered. To be more precise, the socio-economic outcomes of children born to mothers who had the option to get an abortion might be different from the outcomes of children if all pregnant women had to carry to term (Joyce, 1985).

Consider two groups of women (or families), who I denote as urban and rural. In period 1, assume that abortion clinics are available only in cities, so urban women have access to abortion at price c_u and rural women have access to abortion at price c_r, where $c_u \leq c_r$, because of travel cost. Abortion is the only method of birth control and the probability of getting pregnant is constant across groups and over time. Thus, this model assumes that in the short-run women cannot change the probability of getting pregnant either through abstinence or the adoption of alternative methods of birth control.[1] In each period, if a woman gets pregnant she knows with certainty the value (μ_i) that an extra child would bring her and her family.

[1] The long run behavioral changes in pregnancy outcomes are studied in Pop-Eleches (2002).

The value of an extra child depends on a number of factors. If a family has already reached the desired number of children, an extra birth would give parents a lower value. This result is derived from the standard model of the child quality/quantity trade-off (Becker, 1981). Secondly, optimal timing of birth might play an important role in the value of a child. Childbearing can conflict with the longer term educational and labor market plans of a woman (Angrist and Evans, 1999, Goldin and Katz, 2002), or with the decision of a woman to get married. In addition, a whole range of additional factors, broadly related to a mother's (and father's) physical and emotional well-being can effect the value of a child at a particular time. Third, parents might have a higher value from a child that displays good fetal health during pregnancy (Grossman and Jacobowitz 1981; Joyce 1985; Grossman and Joyce 1990).

I assume that each period of a woman's life is associated with a value of having an extra child in that period, and the distribution of these utilities is given by $f(\mu)$, which is identical for women of both groups (figures 1 & 2).

Once pregnant, the two groups make the following decision: Urban women give birth if $\mu_i + c_u \geq 0$, and abort otherwise, while rural women give birth if $\mu_i + c_r \geq 0$, and abort otherwise. Given the distribution of value $f(\mu)$ and the cost of abortion (c_u, c_r), the probability of giving birth if pregnant (p_u, p_r) for each group is:

$$p_u = prob(\mu \geq c_u) = \int_{c_u}^{\infty} f(\mu) d\mu.$$
$$p_r = prob(\mu \geq c_r) = \int_{c_r}^{\infty} f(\mu) d\mu.$$

A pregnancy carried to term will yield on average a value of E_u, E_r for the two

groups, where

$$E_u = E(\mu|\mu \geq c_u) = \int_{c_u}^{\infty} \mu f(\mu) d\mu$$

$$E_r = E(\mu|\mu \geq c_r) = \int_{c_r}^{\infty} \mu f(\mu) d\mu$$

Given the identical distribution of value across groups and the differential cost of abortion ($c_u \leq c_r$), it follows that $p_u \leq p_r$ and $E_u \geq E_r$.

In period 2, the government declares abortion illegal, thus making the cost of abortion approach infinity.[2] Then both groups will carry to term all their pregnancies. The probability of birth if pregnant (p_0) is 1 for both groups, and the average expected value of a birth for both groups (E_0) is equal to the average value of μ. Therefore, $p_u \leq p_r \leq p_0$ and $E_u \geq E_r \geq E_0$.

Finally, assume that average child outcome (α) is a linear function of the average parental value of a child that is born (E)[3], a measure of the parents' wealth that differs across the two groups ($w_u \geq w_r$), and a measure of social investment per child (Θ) that is inversely related to the total number of children born in a given year (due to crowding in schools and the labor market for example) and similar across the two groups. In period 1, the average outcome for the two groups is

$$\alpha_{1u} = \pi_0 + \pi_1 * E_u + \pi_2 * w_u + \pi_3 * \Theta(n_1)$$

$$\alpha_{1r} = \pi_0 + \pi_1 * E_r + \pi_2 * w_r + \pi_3 * \Theta(n_1)$$

[2] As mentioned earlier, this model studies the short-run impact of the policy and therefore the assumptions that the cost of abortion is close to infinity and that women cannot change their pregnancy behavior immediately after the introduction of the ban on abortions seem reasonable.

[3] It seem reasonable to assume that parents who value their children at birth more, will also invest more in them and this will positively affect their outcomes later in life. Investment is defined very broadly, and it includes things like love, attention, care etc.

where $\pi_1 > 0, \pi_2 > 0, \pi_3 > 0$. The cohort size in period 1 is $n_1 = \theta * p_u + (1-\theta) * p_r$ and θ is the proportion of urban residents in the population.

In period 2, the average outcome for the two groups is:

$$\alpha_{2u} = \pi_0 + \pi_1 * E_0 + \pi_2 * w_u + \pi_3 * \Theta(n_2)$$

$$\alpha_{2r} = \pi_0 + \pi_1 * E_0 + \pi_2 * w_r + \pi_3 * \Theta(n_2),$$

where $\pi_1 > 0, \pi_2 > 0, \pi_3 > 0$ and the cohort size in period 2 is $n_2 = p_0 = 1$

The average outcome for the whole population for the two periods is:

$$Outcome_1 = \theta * p_u * \alpha_{1u} + (1-\theta) * p_r * \alpha_{1r}$$

$$Outcome_2 = \theta * p_0 * \alpha_{2u} + (1-\theta) * p_0 * \alpha_{2r}$$

The effect of the ban on abortions on average children outcomes in a given cohort is threefold:

(1) *Within family selection effect:* within any given family, average child outcome is decreased because the average value from an extra child decreases from E_u to E_0 for urban women and from E_r to E_0 for rural women. This selection effect within the family is also known in the literature (David et al. 1988) as the effect of unwantedness.[4]

(2) *Between group composition effect:* within a cohort of birth, the composition of families born to the two groups changes. The compositional changes across families had a positive effect on average child outcomes, because a larger proportion of children

[4]In addition, note that although the model does not predict it, the quantity/quality trade-off implies that the birth of an extra child will not affect just the newborn but also the other children within the family.

were born to urban families which were wealthier and had higher child investment ($\frac{p_u}{p_u+p_r} \leq \frac{1}{2}$). The effect of changes in the composition of women who carry pregnancies to term on child outcomes does not have to refer just to urban and rural women, but could also be applied, for example, to women with more or less education. More generally, one expects similar effects for any two groups that have different wealth levels and abortion costs prior to the ban.

(3) *Crowding effect:* the ban on abortions increases the number of children in both groups. To the extent that social investment per child (Θ) is negatively associated with cohort size (due to school and labor market crowding), this should negatively affect children outcomes ($n_2 = p_0 = 1 \geq \theta_1 * p_u + (1 - \theta_1) * p_r \geq n_1$, since $p_u \leq p_r \leq p_0$).

2.2 Literature review

One line of research studies the outcomes of children born to mothers who have been denied access to abortion. The three most important longitudinal studies come from Sweden, Finland and the Czech Republic and share similar methodological approaches and findings.[5] These studies all find negative outcomes for children whose mothers could not get an abortion, 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.

[5] The most important studies are Myhrman (1988) for Finland, Bloomberg (1980) for Sweden and Dytrych et al. (1975), David and Matejcek (1981) and David (1986) for the Czech Republic. David et al. (1988) is a great review of all existing studies in this literature.

The major drawback of these studies is the absence of good control groups. The Czech study, which is considered the best designed and most comprehensive of all (David et al., 1988), selected women who had an undesired pregnancy from a very unrepresentative group of women: only 2% of all women who applied for abortion in this period were rejected. Given these methodological drawbacks, it is possible that the inferior development of the children studied is driven by self-selection of a certain type of mothers into the treatment group.[6]

A second line of research has focussed on the changes in abortion legislation in the US in the late 1960's and early 1970's. In 1970 abortions became widely available in five states and became legal in all states as a result of the 1973 Supreme Court decision in Roe v. Wade (Levine, Staiger, Kane and Zimmerman, 1999). The differential timing of the liberalization of access to abortion between these five states and the other states, provides a useful way to analyze the impact of changes in abortion legislation by employing a "difference-in-differences" strategy. In a recent paper, Gruber, Levine and Staiger (1999) use this empirical strategy to look at the effect of access to abortions on the living circumstances of subsequent cohorts of children. They estimate that the "marginal" children who were not born because abortions were legalized would have been 70% more likely to live in a single parent household, 40% more likely to live

[6] David et al. (1988, p.123) admit that in the Czech study they could not match the treatment and the control groups on observable characteristics: "notwithstanding the scrupulous observation of the matching criteria, the UP [unwanted pregnancy] mothers as a group appeared socially less competent at the very beginning of the Prague study ... some applied for abortions too late... others had had abortions before the birth of the UP [unwanted pregnancy] child...; they were more often unable to find a reliable partner for marriage and divorced and remarried more frequently so that more of the UP [unwanted pregnancy] than AP [accepted pregnancy] children had stepfathers".

in poverty and 50% more likely to be in a household collecting welfare. This study measures the composition effect resulting from changes in access to abortion by trying to assess how abortion influences the composition of women who carry pregnancies to term. This type of approach does not try to measure the impact of additional channels through which children born after changes in abortion legislation might have different social and economic outcomes. Along the same line, recent research concludes that cohorts born after the legalization of abortion in the US in the early 1970's are less likely to commit crimes (Donohue and Levitt, 2001), consume fewer controlled substances (Charles and Stephens, 2002) and have smaller teen childbearing rates (Donohue, Grogger and Levitt, 2002). The studies based in the US rely on state-to-state comparisons and therefore have to assume that the timing of abortion legalization at the state level was exogenous. These studies face the additional problem that people could cross state borders to get abortions in other states where abortion was legal.

3 Abortion and birth control policy regimes in Romania

Prior to 1966, Romania had one the most liberal abortion policies in Europe and abortion was the most widely used method of birth control (World Bank, 1992). In 1965, there were four abortions for every live birth (Berelson, 1979). Worried about a

rapid decrease in fertility,[7] Romania's communist dictator, Nicolae Ceausescu, issued an unexpected decree in October 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 problems, and women with pregnancies resulting from rape or incest.

The immediate impact of this change in policy was a dramatic increase in births: crude birth rates[8] increased from 14.3 to 27.4 between 1966 and 1967 and the total fertility rate[9] increased from 1.9 to 3.7 children per woman (Legge, 1985). After three years of high fertility (1967-1969), the fertility rate declined significantly but stabilized at a level that was higher compared to the years prior to the ban.[10] Abortions remained illegal and the law was strictly enforced without major modifications until December 1989, when the communist government was overthrown. The reversal in trend was immediate following the liberalization of access to abortion and modern contraceptives in 1989, 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

[7] 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 1950's, 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.

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

[9] 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.

[10] I discuss the fertility impact of the policy in detail in Pop-Eleches (2002).

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 prior to the change. Figure 3 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. 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 Data and empirical strategy

4.1 Data

The primary data for this empirical exercise is a 15% sample of the Romanian 1992 census. This dataset has a number of important advantages for my purposes. It is a very rich dataset that provides information for about 50,000 individuals for each year of birth. In addition to basic questions about family background and educational and labor market outcomes, the census provides not only the year but also the month of birth for each person, an important variable in the identification strategy.

The census, however, contains socio-economic background variables of parents only for children who still live with their parents. 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 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 practice whereby children live with their parents 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.[11] While the usable sample is unrepresentative of the total population, Figure 3 confirms that the proportion of individuals born in a given month within this sample tracks the birth records from Romania's vital statistics.

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 achievements. But a drawback 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 or with a university degree.

[11] 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.

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.[12]

I mainly rely on the sample consisting of all children born between January and October 1967, producing more than 55,000 observations. The short time period (January to October) is chosen because it minimizes the effect of time trends and pre-conception behavioral responses to the policy. Even though the spike in births (see Figure 3) 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.

One of the specifications adds to the analysis children born in the same time period of 1965 and 1966, the two years prior to the policy change. This model allows me to control for possible cohort of birth effects and to examine potential effects of crowding on child outcomes.

I focus on two measures of children's socio-economic outcomes: educational achievements and labor market activity. The educational variables are a range of dummies for school achievements: apprentice (vocational) school, high-school, and university. The labor market outcomes are three skill specialization dummies based on ISCO occupational codes:[13] (1) elementary-skill (which includes individuals working in elementary

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

[13] 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), (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).[14]

4.2 Empirical strategy:

The main virtue of the Romanian example is the suddenness and extremeness of the change in abortion availability. Therefore, it is appropriate that I employ simple empirical methods that exploit the ban in as transparent a way as possible. This is not an instance of having to tease out the useful variation in an explanatory variable from other variation; I simply want to expose the effects clearly. Many of the results can be seen from the figures I present, but I estimate several equations in order to quantify the effect more precisely.

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-

occupations. ISCO is the standard classification of the International Labor Organization (ILO).

[14]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.

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 about 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.[15] The second group includes household specific variables: home-ownership, rooms per occupant, square feet per occupant, availability of toilet, bath, 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.

Assuming that I have controlled for changes in the composition of families having

[15] 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.

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 effect due to changes in the selection of children within a family. The inclusion of a set of background and household characteristics in this equation is necessary because I have good reasons to believe that the change in access to abortions differentially affected particular socio-economic groups. 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.

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 quarter 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 school 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 3), I drop children born in May from this specification

in order to better differentiate between the effect of changes in the selection of births within a family and crowding effects.

The extended framework is described by the following equation:

(3)$OUTCOME_i = \gamma_0 + \gamma_1 \cdot after_i + \gamma_2 \cdot quarterofbirth_i + \gamma_3 \cdot yearofbirth_i + \gamma_4 \cdot X_i + \varepsilon_i$,

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; $quarterofbirth_i$ 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 γ_1 as the combined negative effect due to the change in the selection of children within a family, once I have controlled for quarter of birth, crowding and composition effects. The coefficient γ_2 gives us the quarter of birth effect while the coefficient γ_3 measures possible crowding effects.

5 Results

5.1 Graphical analysis

The overall impact of the 1966 ban on abortions in Romania on average education outcomes of children can be easily captured in graphs. Figure 4 graphs the percentage of persons who have completed a certain educational level and were born in a given month of the period January 1966 and December 1968. The pattern of educational

achievements is consistent with the view that children born after the restrictive policy change came into effect have better educational outcomes: they are more likely to have finished high-school and university.

This apparently surprising result of superior educational and labor market outcomes of children born after the ban on abortions 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. Table 1.1 presents evidence of the size and the statistical significance of these compositional changes by 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 ban on abortions came into effect and had only primary education decreased from 49.4% to 44.6%. For women with secondary education the increase was from 47.6 % to 52.1%. Similar differences can be observed in terms of the educational level of the fathers who had a child born during this ten-month period in 1967.[16]

Figure 5 presents the same educational outcomes as figure 4, but taking into account the composition changes. This figure plots average residuals from educational

[16] Table 1.1 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. Interestingly, the average age at birth increased for women with primary and secondary education and decreased for women with tertiary education.

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.

5.2 Regression results

Results of the children's educational achievements for the basic equation (1) are in columns (1) and (2) of Table 2. 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 information for parents 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 analyzing column (1) and (2) of Table 2. First, the overall impact of the ban on abortions 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 ban of legal abortions have better educational outcomes

than those born immediately prior the ban, implying 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 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 that uses this sub-group to control for the composition of children born into families of different socio-economic characteristics.

Column (3) and (4) of Table 2 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 effect due to changes in the selection of children within a given family, after controlling for the composition of families having children. As mentioned earlier, this 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 effect attributed to changes in the selection of children within the family. After controlling for family composition, the effect of the ban on abortions on the probability of attending high-school or university turns from positive to negative. The results are sta-

tistically 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 desired 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 selection within the family have opposite effects in the Romanian case, I believe that if anything the estimates on the effect of changes in the selection of births within a family 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 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) tried 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.[17] Since the results in column (3) which include only background variables which are more exogenous are generally

[17] 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.

qualitatively and quantitatively similar to those in column (4), the discussion of the results will focus primarily on results in columns (4) which include both set of controls.

Table 3 presents the results when doing the same tests but using labor market variables instead of educational achievements 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 on type of employment of the ban on abortions 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 that require a high level of skill (by 0.7% from a mean of 8.6%).

The second column of Table 3 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 that changes in the selection of children born within a given family negatively affect labor market outcomes. After controlling for family background, the effect of the ban on abortions 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%).[18] The effect is potentially

[18] Appendix B repeats the labor market analysis of Table 3, but uses 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.

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 the reduced variability in employment outcomes that resulted from the exclusion of university graduates from the labor outcome regressions.[19]

5.3 Crowding effects and robustness checks

Table 4 presents the results from the extended framework for schooling outcomes, which includes children born in the two years prior to the policy change. Column (4) of Table 4 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 5 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.[20] The larger crowding effects in schooling outcomes compared to labor market outcomes are not surprising. The structure of the school

[19] The use of a later dataset would provide a much better setting to look 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.

[20] 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 carreer 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.

system implies that each age cohort is in a different 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: controlling for family background, children 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 2, in this specification the estimate on the high-school variable is no longer statistically different from 0 at the 5% level. The labor market outcomes, which are reported in Table 5, 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.[21]

Tables 4 and 5 also confirm that quarter-of-birth effects 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.

[21] The smaller coeficient on the labor outcomes is mainly due to the fact that these regressions use smaller time intervals.

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 policy 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 affect children outcomes both at the family level, through a change in the selection of children born to families, as well as at the society level, through possible crowding in schools. Understanding the long-term effect of the policy across educational groups is of interest, given that the change in 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 6, 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 6 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 6 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 7 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 comparing cohorts born around 1930 and 1950.[22] Thus the short-run and long-run impact of the policy was very different between educational groups since educated women had the largest fertility increases immediately after the introduction of the ban but they also experienced the smallest fertility increases during Romania's 23 year long restrictive policy. In a companion paper (Pop-Eleches, 2002), I use detailed

[22] 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.

reproductive microdata[23] 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]

6.2 The trade-off between child quantity and quality

My analysis so far does not distinguish between the possible mechanisms by which the changes in the selection of children born within a family affects a child's development. In this section I am trying to assess one possible channel: the trade-off between child quality and quantity within a family.[25] As discussed earlier, Figure 6 clearly indicates that the year of birth of a mother is a good possible indicator of "excess" fertility due to the introduction of the restrictive policy. The basic idea is to look at educational outcomes of the cohort of people who were born prior to the ban (those born between 1957 and 1966) and see how the age of the mother affects educational achievements. The age of the mother affects educational achievements through two channels: (1) a direct effect of mother's age on the education of a child and (2) an indirect effect because having a younger mother means that she will spend a larger fraction of her reproductive years under the restrictive policy, which increases

[23] 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.

[24] My results suggest that at least part of the reason why less educated women had the largest fertility increases in the long run can be attributed to higher failure rates of traditional methods of contraception.

[25] Empirical evidence on the child quantity/quality trade-off is presented in Rosenzweig and Wolpin (1980), who use the birth of twins as an exogenous increase in the quantity of children within a family.

expected lifetime fertility and thus could affect fertility through the quantity/quality trade-off. The secondary effect should have a larger effect on young mothers who gave birth towards the end of the time period considered (1957-1966).

Unfortunately, the available data has some serious drawbacks and therefore the results in this section should be interpreted only as suggestive evidence. The sample suffers from potential selection problems, since children can be matched to their mothers only in the case when they live together and the proportion of children living at home increases from 18%, for those born in 1957, to 40%, for those born in 1966. As an example, in figure 8 I plot average fertility residuals from regressions of lifetime fertility on a number of socio-economic controls, by year of birth of the mother. The results clearly indicate that the group of mothers who gave birth to children in the period 1957-1966 and who still have a child residing at home has different fertility levels from the overall population in the sample. Secondly, the period 1957-1966 was one of rapid social and economic changes for Romania, so any factor that might have differentially affected young or old women over time could bias my analysis. Ideally, an adequate dataset would contain parental information for all the children born in this period, or at the very least a similar census dataset from another Eastern European country that did not have a similar policy change should be used as a control case. With these reservations in mind, I run the following type of regression:

$$(4) \quad OUTCOME_{it} = \pi_0 + \pi_1 \cdot yearofbirth_t + \pi_2 \cdot youngmother_i + \pi_3 \cdot yearofbirth_t \cdot youngmother_i + \pi_4 \cdot controls_i + \pi_5 \cdot yearofbirth_t \cdot controls_i + \pi_6 \cdot regionofbirth_i + \varepsilon_i,$$

where $OUTCOME_{it}$ is a dummy for a particular educational outcome (university, high-school), $yearofbirth_t$ is an indicator of the year of birth of the child (between 1957 and 1966), *youngmother* is an indicator variable taking value 1 if the mother was less than 25 at birth. The $controls_i$ are: 2 indicator variables for mother's education, 2 urban dummies for place of birth of the child and the mother and the household controls used in previous specification. Finally, $regionofbirth_i$ are 2 sets of 47 region of birth dummies of the child and the mother.

For women born in 1932 (aged 25 in 1957), the restrictive policy had little effect on their lifetime fertility (see Figures 6 and 8). However by 1966, the women who gave birth under the age of 25 are born after 1940 and the lifetime fertility of these cohorts was already affected by the policy. The coefficients of interest (π_3) are those of the interaction between $yearofbirth_t$ and $youngmother_i$. The results are best captured in graphs. Figure 9 plots the coefficients of the interaction terms for two educational outcomes (university, high-school). The interactions refer to the most disadvantaged mothers (only primary education, living in rural area and in households without amenities), who were affected most by the policy. The negative effect of having a young mother on the probability of going to university is becoming more pronounced for cohorts born in later year. As mentioned earlier, the age of the mother for cohorts born in the 1960's should pick up not only the direct effect that the age of the mother might have on schooling of a child but also the indirect effect that goes through the increased lifetime fertility of mothers who were young when they gave birth to children in the 1960's. The size of the change is also very large, with the probability of finishing

university and high-school decreasing by about 2.3 and 4.3 percentage points respectively. Figure 10 plots the increase in fertility for the same group over this period. Between 1957 and 1966 the fertility differential between a young and an old mother increased by about 0.8 children. These changes in educational achievement and fertility imply that an extra sibling in a family reduces the probability of going to university and high-school by 1.8 and 3.4 percentage points respectively.

6.3 Early child outcomes and crime behavior

In this section I explore the effect of the ban on abortions on two other socio-economic variables: early infant outcomes and crime behavior. Figure 11 plots the infant mortality rate and the late fetal death rate in Romania over the period 1955-1995. The data clearly suggests 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 the abortion ban changed the selection of births within the family. 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 contains all the penal cases in the period 1991-2000 prepared by the regional tribunal of Sibiu county[26] for the regional courts.[27] 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 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 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 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

[26] 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.

[27] 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.

for the strong compositional changes described earlier, in addition to the possible negative effect due to changes in the selection of children within a given family. 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 6 provides regression results for the total crime rate, which are consistent with my earlier findings. The cohort 1967-1969 had an average crime rate[28] 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 positive coefficient for the cohort 1967-1969 suggests that the compositional changes have the strongest effect on crime behavior, just like in the education and labor regressions. The negative 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 selection of births within a family but also by compositional factors.[29] However, the present framework cannot control for other time specific factors that might have also 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

[28] The crime rate equals the number of crimes per 1000 residents.

[29] 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).

the transition process.

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 ban on abortions had significantly worse schooling and labor market outcomes. I interpret this result as evidence of the existence of a negative effect due to changes in the selection of children within a family. The analysis also shows that the crowding in schools, due to the large increase in fertility immediately following the ban on abortions, 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.

An intriguing question left open by this paper is the mechanism by which the changes in the selection of children born at the family level affects a child's development.

While I have provided some indication that one possible channel could be the child quantity-quality trade-off, the measurement of the relative importance of each channel is a major unanswered question in this literature.

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.

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FIGURE 1: URBAN WOMEN

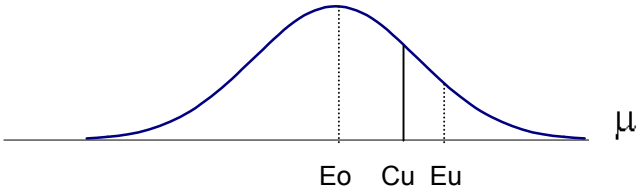


FIGURE 2: RURAL WOMEN

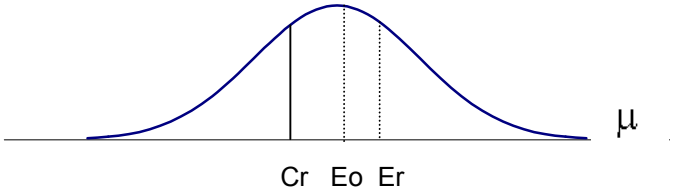
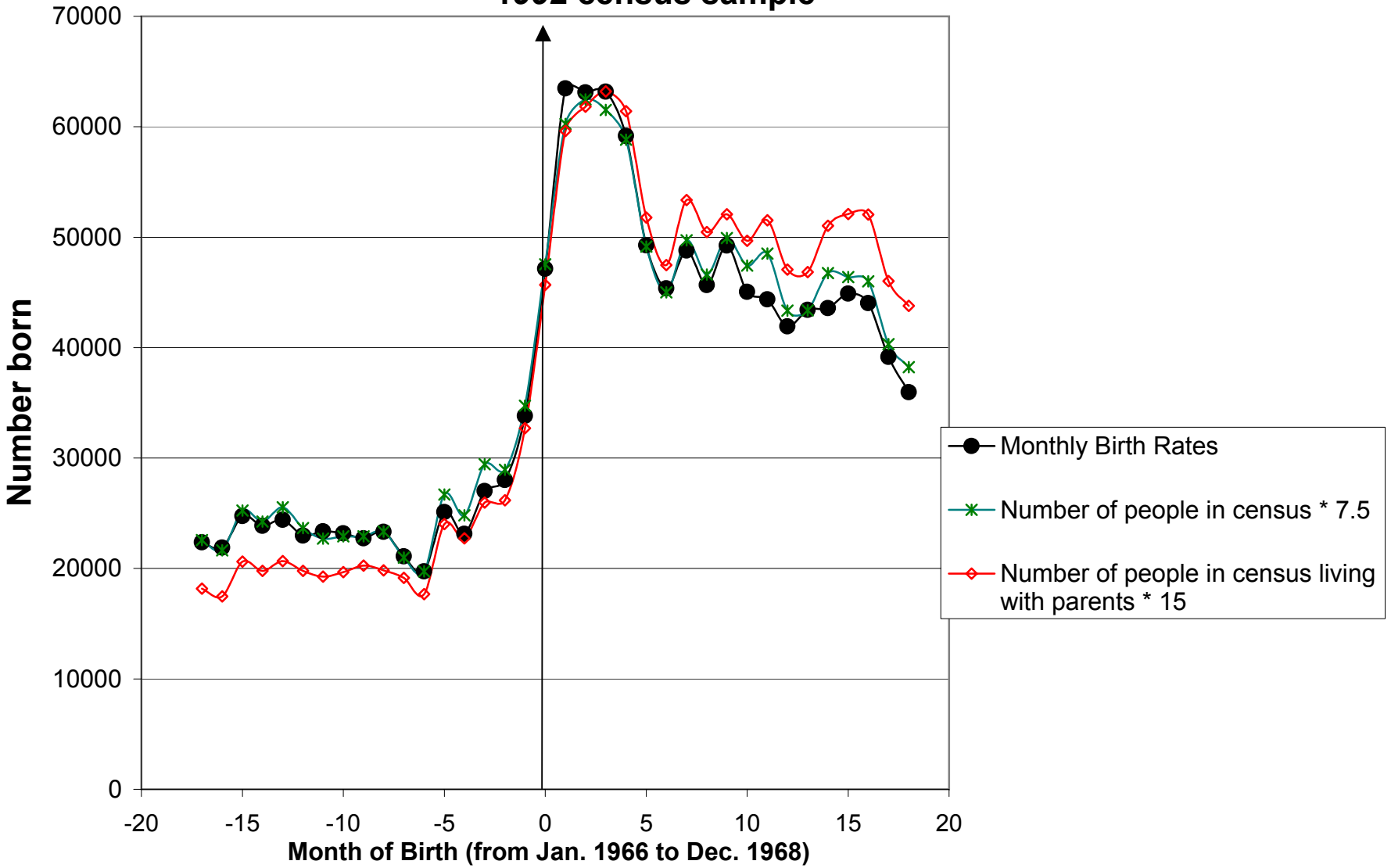
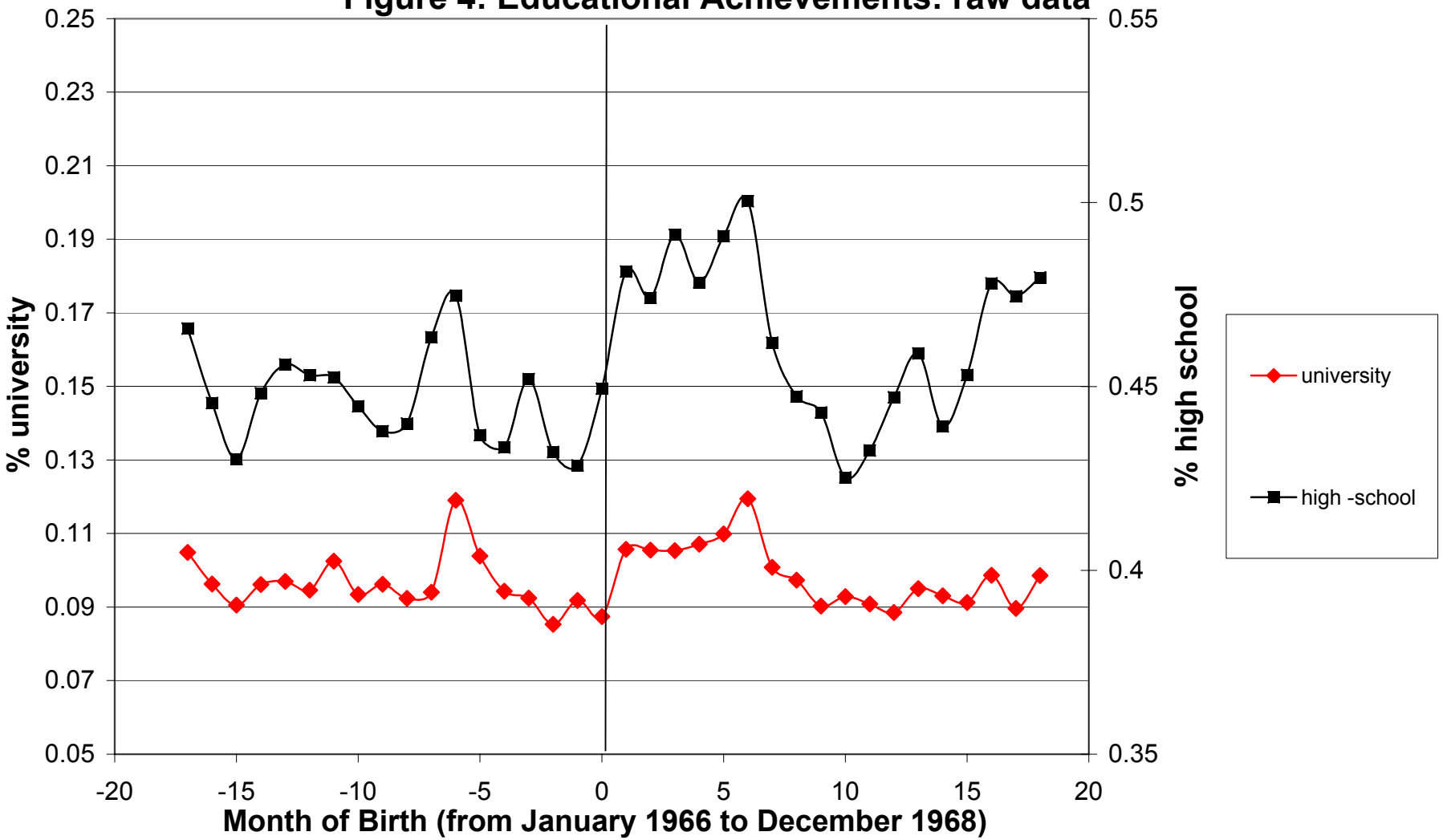


Figure 3: Monthly births rates: vital statistics and representation in the 1992 census sample



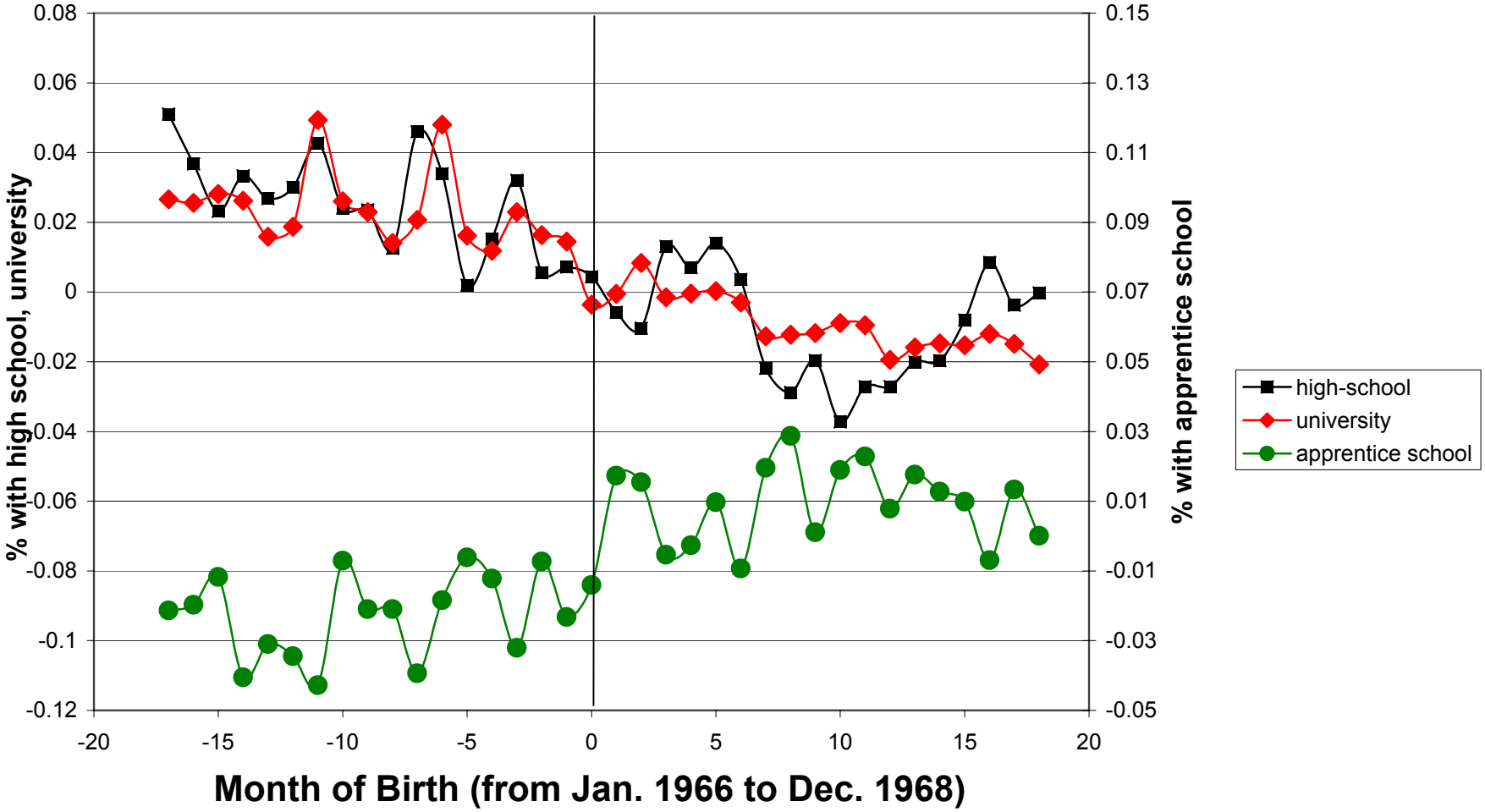
Notes: This graph plots the number of persons born between 1966 and 1968 by month of birth. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Also plotted are the number of persons born in the same period included in the 1992 census sample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

Figure 4: Educational Achievements: raw data



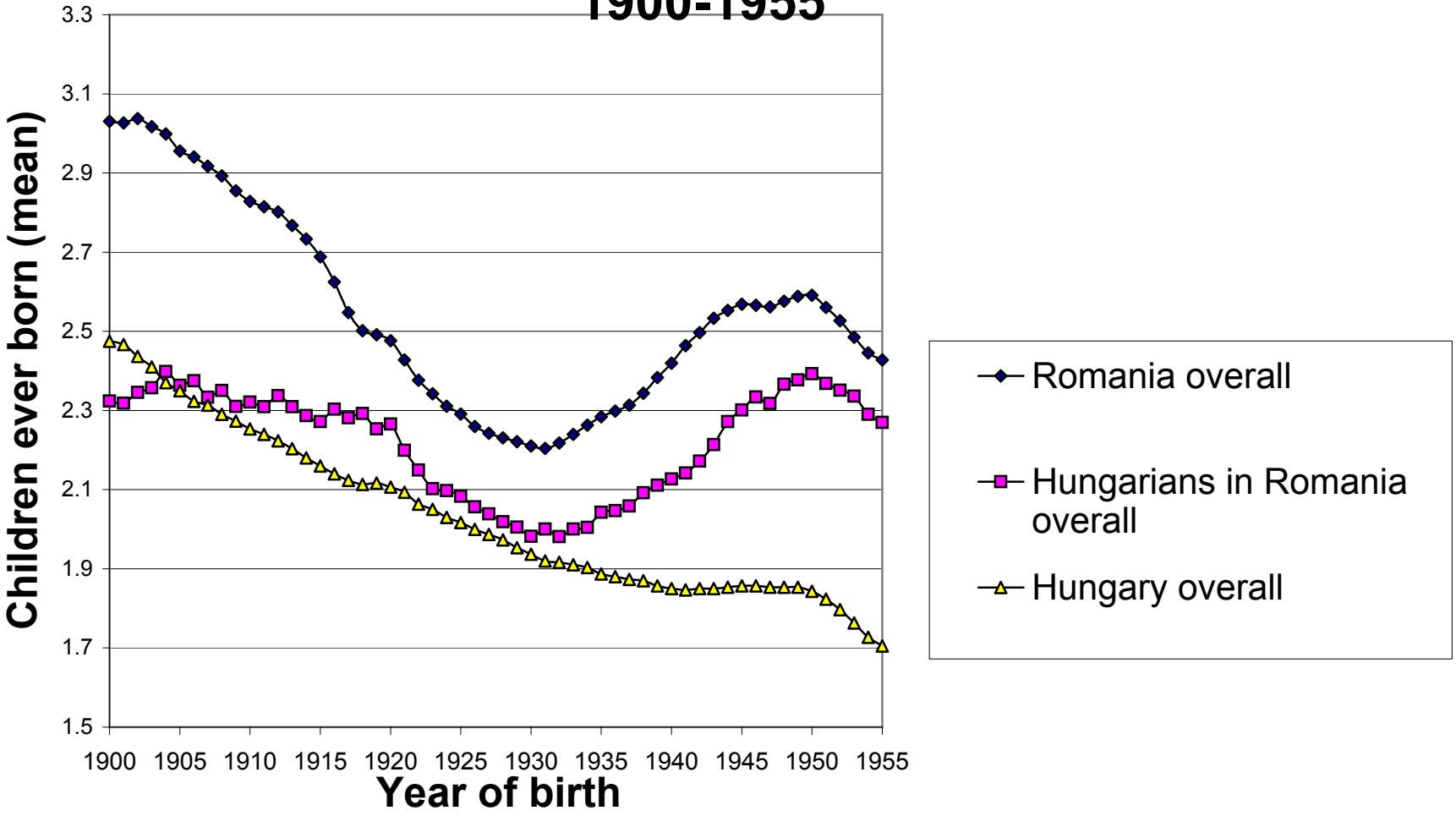
Notes: This graph plots average educational achievements by month of birth for persons born between 1966 and 1968. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Variables are further defined in Appendix A. Source: 1992 Romanian Census.

Figure 5: Residuals from educational regressions after controlling for parental background



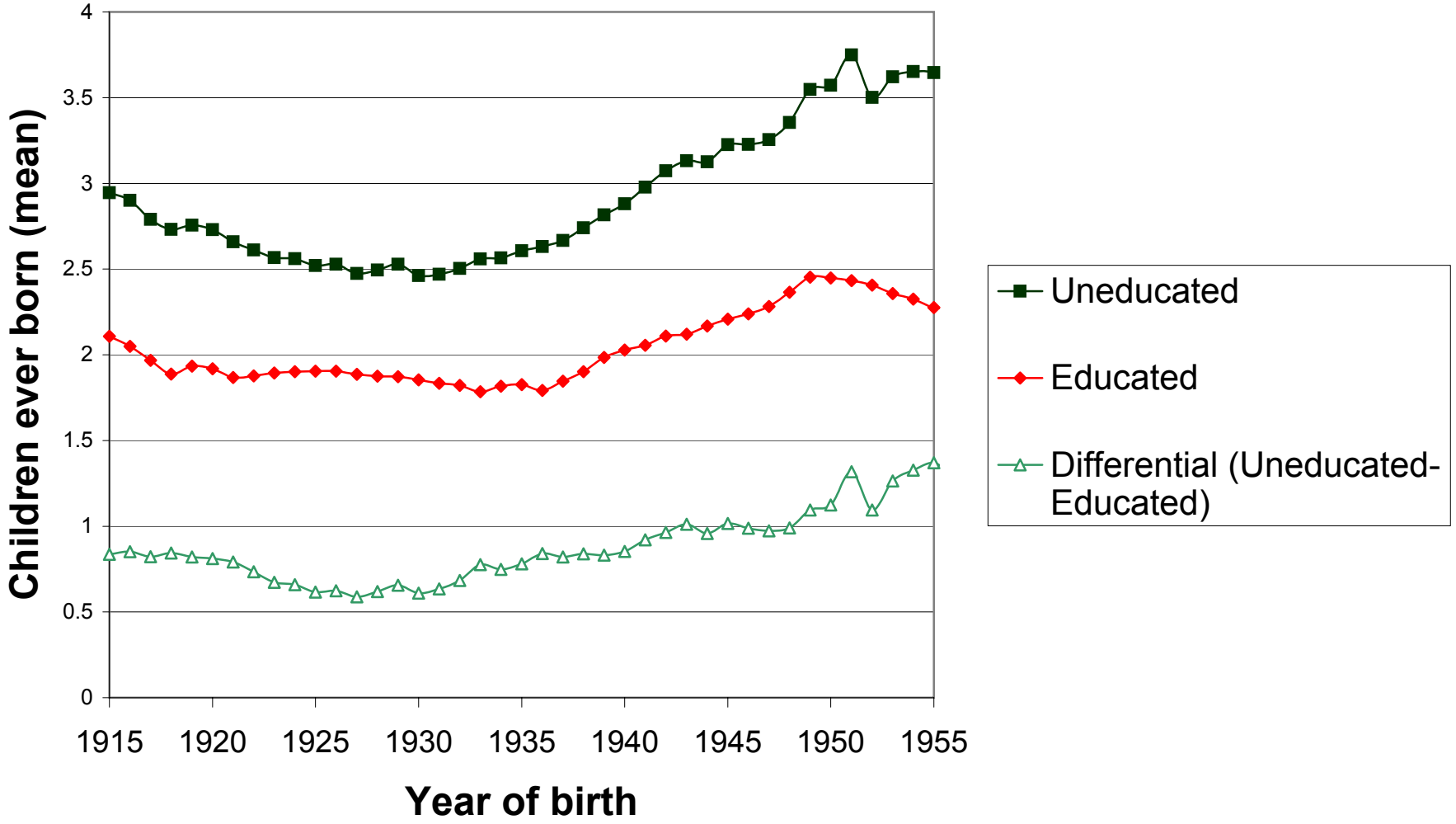
Notes: This graph plots average residuals from educational regressions after controlling for parental background by month of birth for persons born between 1966 and 1968. Month 0 refers to June 1967, the first month with large fertility increases due to the restrictive abortion policy. Variables are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

Figure 6: Fertility level of women born between 1900-1955



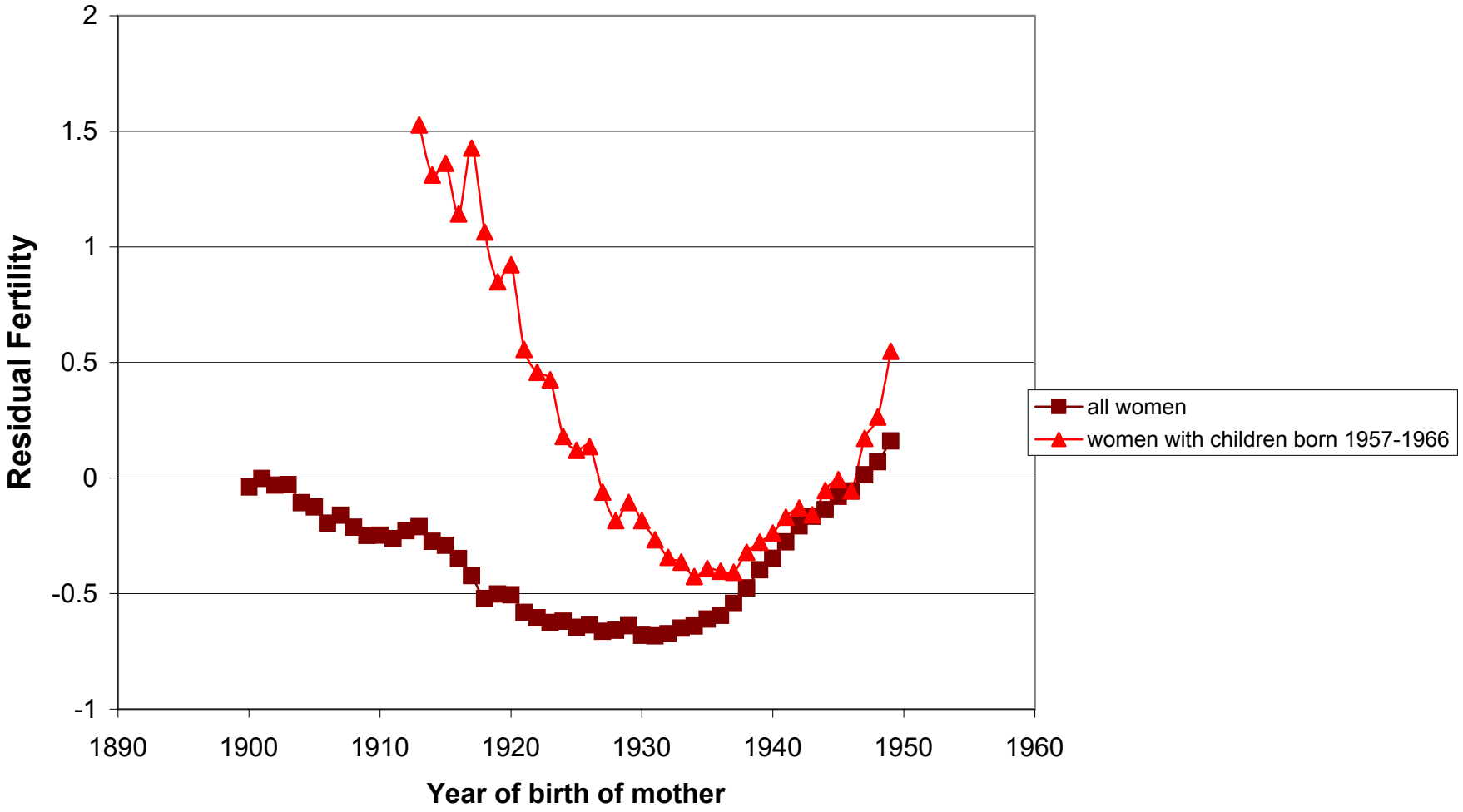
Notes: This graph plots the average number of children born by year of birth of the mother. Similar data is shown for the Hungarian minority in Romania and for Hungary. Hungary did not implement a similar restriction during this time period. Variables are further defined in Appendix A. Source: 1992 Romanian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

Figure 7: Fertility levels in Romania by education



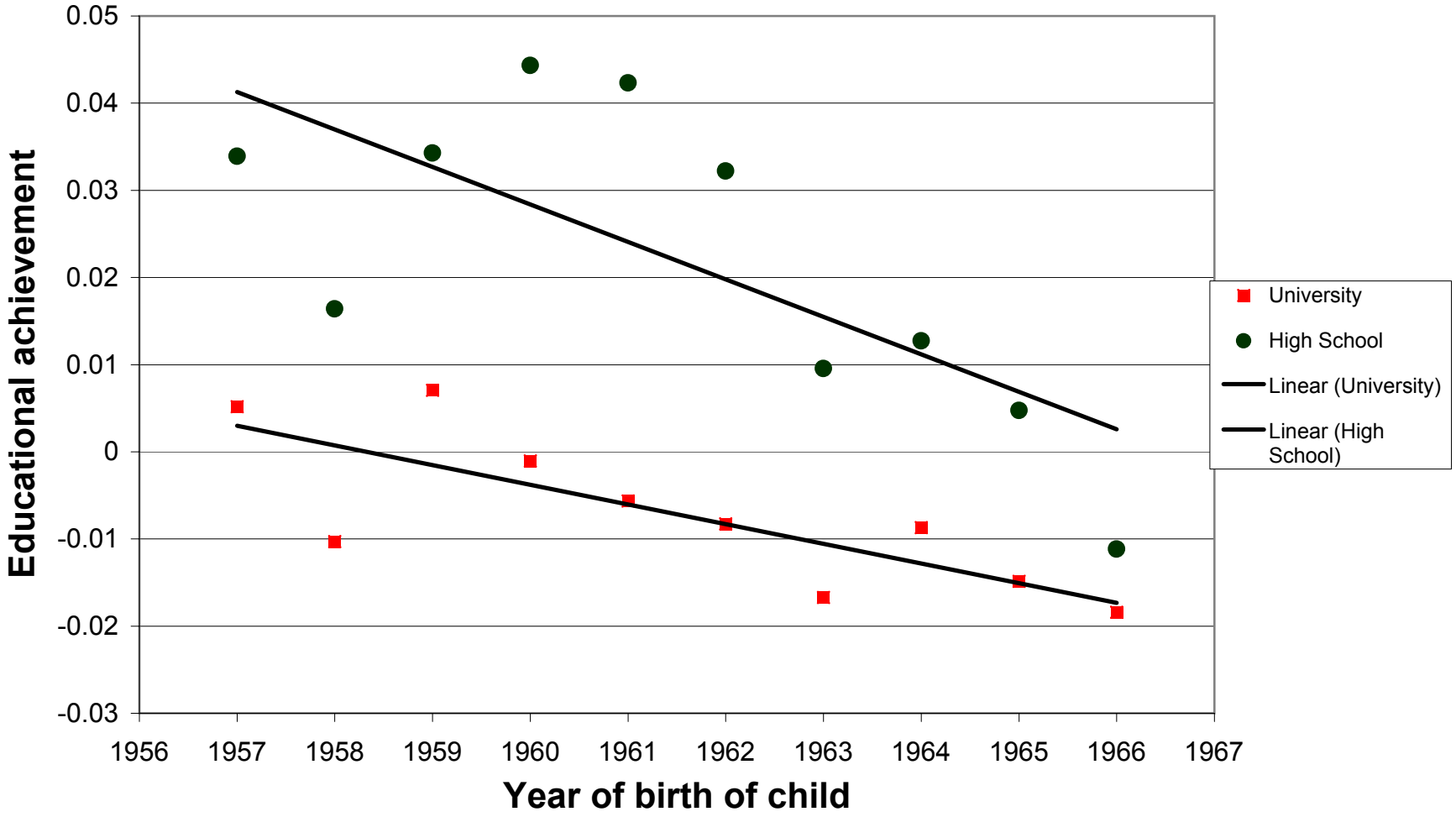
Notes: This graph plots the average number of children born by year of birth of the mother for uneducated (less or 8 years of schooling) and educated (more than 8 years of schooling) women. Source: 1992 Romanian Census

Figure 8: Fertility residuals for women born between 1915 and 1950



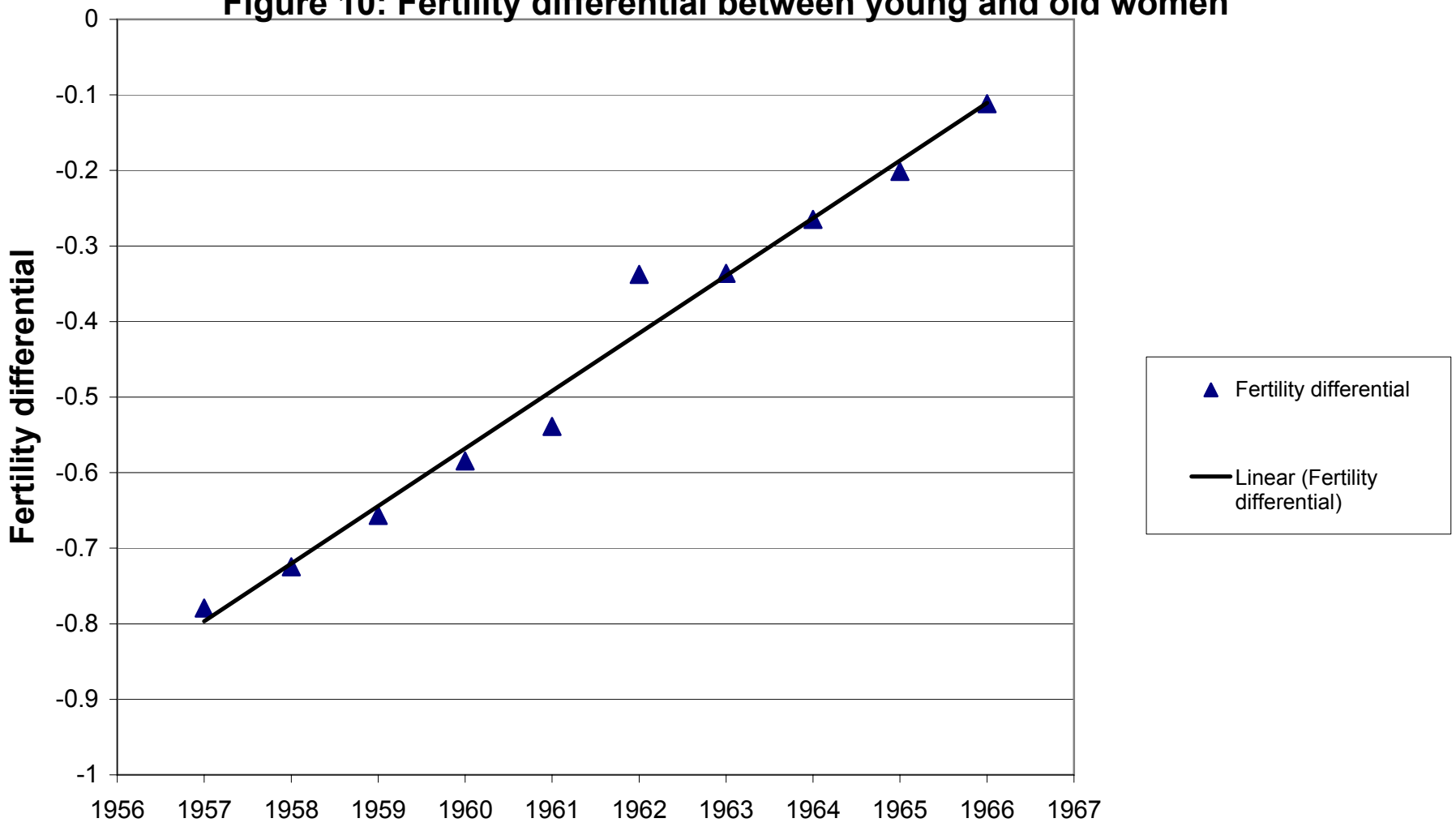
Notes: This graph plots the average residuals from regressions of lifetime fertility on a number of socio-economic controls, by year of birth of the mother. One regression includes all women who gave birth to at least one child, the other is restricted to those women who had a child born between 1957 and 1966 who was still living at home. Source: 1992 Romanian Census.

Figure 9 : Effect of mother's age at birth on the child's schooling outcome



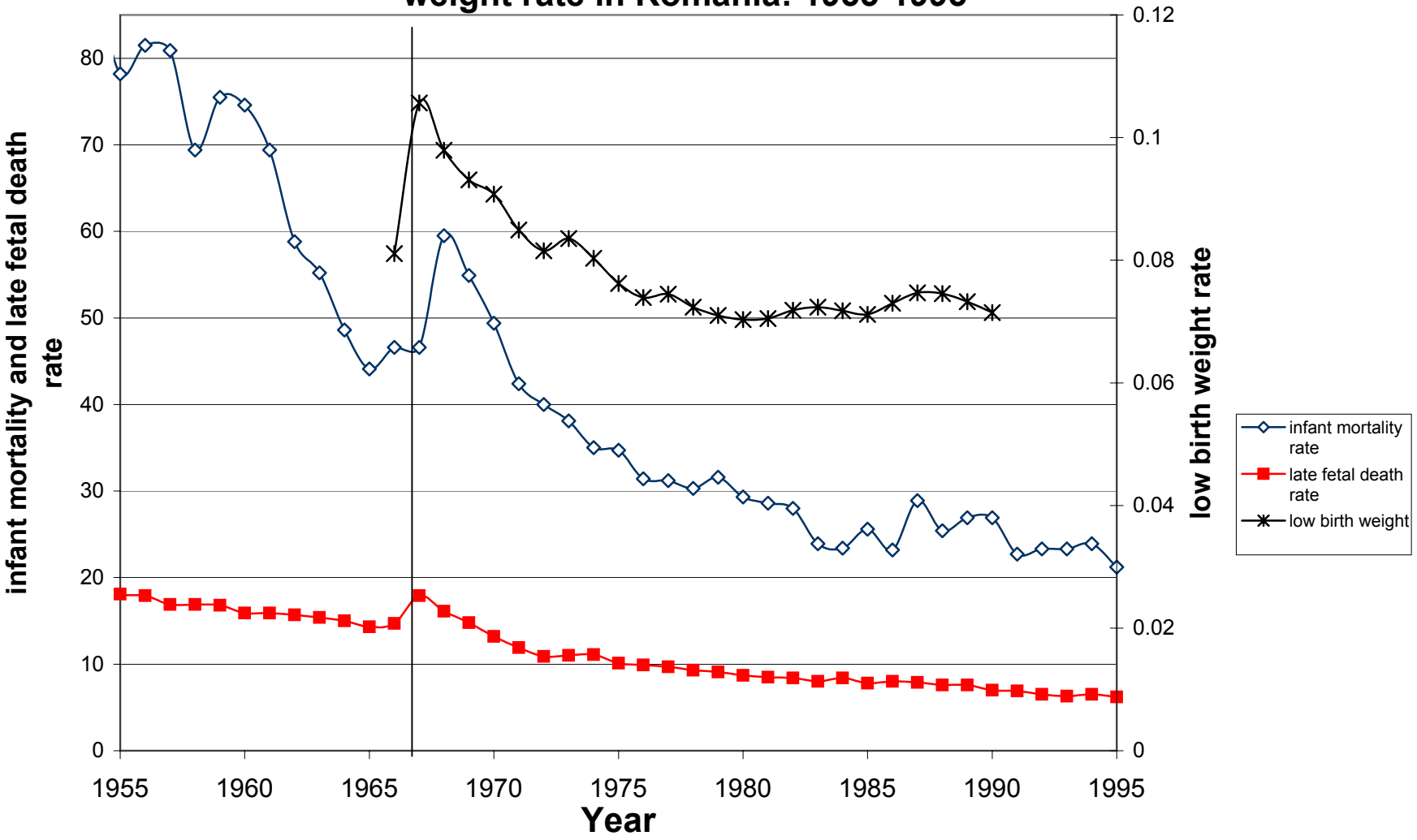
Notes: This graph plots the differential in educational achievement of children born to young and old mothers, who were born in the period 1957-1966. The results are based on equation (3) and they refer to the most disadvantaged women (uneducated, rural living in a household without amenities). The sample contains all the individuals born in the period 1957-1966 who still live with their mother at the time of the census. Source of data: 1992 Romanian census.

Figure 10: Fertility differential between young and old women



Notes: This graph plots the fertility differential between young and old mothers, who gave births in the period 1957-1966. The results are based on equation (3) and they refer to the most disadvantaged women (uneducated, rural living in a household without amenities). The sample contains all the women who had a child born in the period 1957-1966 who still living at home at the time of the census. Source of data: 1992 Romanian census.

Figure 11: Infant mortality 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: Difference between children who live and do not live with their parents: comparison of means

Dependent Variables	*Do not live with parent*	*Live with parents*	*Difference*	*P-values*
Gender of Child				
% Female	**0.587**	**0.331**	**-0.256**	**0.000**
Place of Birth of Child				
% Urban	**0.370**	**0.434**	**0.064**	**0.000**
Child's Educational Level				
High School	**0.423**	**0.512**	**0.089**	**0.000**
University	**0.063**	**0.132**	**0.069**	**0.000**
Child's Job Type				
Intermediate Skills	**0.852**	**0.854**	**0.002**	**0.564**
High Skills	**0.081**	**0.091**	**0.010**	**0.000**
Observations	22964	33999		
Observations for Job Type	17347	25268		

Notes: The sample contains people born between January and October of 1967. For children living with their parents at the time of the census in 1992, I could obtain basic socio-economic variables of their parents. Variables are further defined in Appendix A.

Table 1.1: Selection effects of the change in abortion legislation: comparison of means (with P-values for F-tests of difference in means)

	Control Group (Jan.-May 1967)	*Treatment Group (June-October 1967)*	*Difference*	*P-values*
Place of Birth of Child				
% Urban	**0.350**	**0.422**	**0.071**	**0.000**
Observations	19156	38494		
Mother's Highest Educational Level				
Primary	**0.494**	**0.446**	**-0.048**	**0.000**
Secondary	**0.476**	**0.521**	**0.045**	**0.000**
Tertiary	**0.030**	**0.033**	**0.003**	**0.192**
Observations	8453	18732		
Father's Highest Educational Level				
Primary	**0.370**	**0.323**	**-0.047**	**0.000**
Secondary	**0.576**	**0.613**	**0.038**	**0.000**
Tertiary	**0.055**	**0.064**	**0.009**	**0.008**
Observations	7574	16601		
Mother's Age at Birth by Education				
Primary	**29.188**	**29.497**	**0.309**	**0.007**
Secondary	**25.874**	**26.452**	**0.578**	**0.000**
Tertiary	**28.743**	**27.969**	**-0.774**	**0.032**

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. Variables are further defined in Appendix A.

Table 2 : 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				
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 5% level, ** at 5% and *** at 1%.

Table 3 : 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 5% level, ** at 5% and *** at 1%.

Table 4 : 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)
Quarter of birth 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)
Quarter of birth dummy	**0.00471**	**0.01100**	**-0.00261**	**-0.00363**
	(0.00472)	(0.00829)	(0.00924)	(0.00948)
Observed probability	**.458**	**.506**	**.506**	**.506**
University				
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)
Quarter of birth 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 quarter of birth 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 5% level, ** at 5% and *** at 1%.

Table 5 : 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)
Quarter of birth 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)
Quarter of birth 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)
Quarter of birth 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 quarter of birth 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 5% level, ** at 5% and *** at 1%.

Table 6 : 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, 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 5% 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 – 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 – this variable takes value 1 if an individual has graduated from university 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.

Elementary Occupations– this variable takes value 1 if an individual is employed at the time of the census in an elementary occupation as defined by the ISCO codes, 0 if employed in a different occupation.

Skilled Agriculture– this variable takes value 1 if an individual is employed at the time of the census in a skilled agriculture job as defined by the ISCO codes, 0 if employed in a different occupation.

Clerical or Sales– this variable takes value 1 if an individual is employed at the time of the census in a clerical or sales job as defined by the ISCO codes, 0 if employed in a different occupation.

Production– this variable takes value 1 if an individual is employed at the time of the census in a production job as defined by the ISCO codes, 0 if employed in a different occupation.

Managers or Professionals– this variable takes value 1 if an individual is employed at the time of the census in a managerial or professional job as defined by the ISCO codes, 0 if employed in a different 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

Appendix B : Labor market outcomes for cohorts born between Jan. and Oct. 1967

Dependent Variables	*Full Sample (1)*	*Restricted Sample (2)*	*Restricted Sample (3)*	*Restricted Sample (4)*
Elementary Occupations				
Treatment dummy	**-0.00644****	**-0.00608**	**-0.00287**	**-0.00167**
	(0.00257)	(0.00384)	(0.00356)	(0.00344)
Observed probability	**.064**	**.056**	**.056**	**.056**
Skilled Agriculture				
Treatment dummy	**-0.02874*****	**-0.03070*****	**-0.00794****	**-0.00522***
	(0.00351)	(0.00523)	(0.00350)	(0.00301)
Observed probability	**.122**	**.104**	**.104**	**.104**
Clerical or sales				
Treatment dummy	**0.01989*****	**0.01777*****	**0.00572**	**0.00415**
	(0.00341)	(0.00523)	(0.00494)	(0.00491)
Observed probability	**.13**	**.122**	**.122**	**.122**
Production				
Treatment dummy	**0.00787**	**0.01479***	**0.01766****	**0.01759****
	(0.00510)	(0.00795)	(0.00821)	(0.00823)
Observed probability	**.598**	**.627**	**.627**	**.627**
Managers or Professionals				
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 5 occupational dummies based on 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 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 5% level, ** at 5% and *** at 1%.