Economic Uncertainty, Parental Selection, and Children's Educational Outcomes*

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Abstract: After the fall of the Berlin Wall, East Germany experienced an unprecedented temporary drop in fertility driven by economic uncertainty. We show that the children born during this transition period performed worse on a range of educational outcomes from an early age onwards. The mothers of these children exhibit personal characteristics and family structures consistent with negative parental selection. Investigating the underlying mechanisms reveals that parental educational input and emotional attachment were also lower for these children. Finally, our ability to compare siblings means that we can reject that our results stem from a time of birth effect.

Keywords: Economic uncertainty; Parental selection; Educational Attainment

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1. Introduction

This paper documents how the socioeconomic environment not only affects the size but also the composition of a cohort. Using a natural experiment, we show how cohorts born during a period of high economic turmoil perform worse on various dimensions of education. We subsequently study the possible mechanisms driving this phenomenon, focusing on family composition and certain parenting behavior that could lead to negative educational outcomes. The results confirm the large effect of parental selection. Further tests dismiss alternative explanations of the poorer educational attainment of the affected cohorts.

Becker (1960) and Ben Porah (1973) have long hypothesized that fertility is a pro-cyclical decision, see Lindo (2010) or Schaller (2015) for recent empirical evidence. Gronau's (1977) model suggests that an economic slump results in a negative income effect, which reduces the demand for children; moreover, since children require a large investment of time from parents, it also prompts a positive substitution effect that pushes the demand for children in the opposite direction. Which effect is stronger is ambiguous a priori, but since fertility is in general pro-cyclical, the income effect appears to dominate overall. However, the relative size of the income and substitution effects may differ across family types, thus rendering the economic environment an important factor affecting the size of a cohort as well as its composition. Using education as a proxy for earning potential, Perry (2004) argues that for completed fertility, the income effect dominates for high education women, while the substitution effect dominates for the less educated. If this were also true for short-run variations in income, then cohort composition would be pro-cyclical. Indeed, Dehejia and Lleras-Muney (2004) show that white mothers giving birth when unemployment is higher are less educated, resulting in worse health outcomes at birth. Currie, Duque and Garfinkel (2015) confirm that this same mechanism was also at play during the latest economic recession in the US. Del Bono, Weber and Winter-Ebmer (2014) also highlight that the fertility drop associated with another type of economic shock, namely plant closures, is solely driven by more skilled women postponing pregnancies.

This paper improves on the existing literature in three important dimensions. First, we rely on much larger, and mostly unexpected, variations in the economic environment. More precisely, following the fall of the Berlin Wall and the collapse of the collectivist socioeconomic system, East Germany went through a transition period characterized by high economic uncertainty. Concomitantly, the fertility rate in the former GDR was more than halved over a three-year period, starting exactly nine months after the fall of the Wall, before

eventually stabilizing[1]. Throughout the manuscript, we refer to the cohorts born in the Eastern Länder[2] during the period of economic and social transition, i.e., between August 1990 and December 1993 as the 'Children of the Wall' (*CoW*). The natural experiment that we exploit led to a very profound, yet short-lived exogenous fertility shock in the former East Germany which has created clear pre- and post-cohorts. Moreover, no drop in fertility was observed in the former West Germany, which generates a natural control group since those born on either side of the "border" were subject to increasingly similar socioeconomic environments growing up in re-unified Germany. Also, note that by the time these children entered schools, disruption to the school system stemming from the end of communism had largely subdued. Indeed, we reject that for the cohorts and outcomes of interest, trends in East and West Germany substantially differ. This natural control group enables us to credibly account for the potential effect of shared macro shocks, which leads us to employ a difference-in-differences estimator strategy throughout. Some of the analysis is also conducted within school cohorts amongst children conceived only a few months apart around the fall of the Wall as a way to ensure that the economic or school environment do not directly drive our results.

Second, this paper investigates the longer run consequences of parental selection. Recent research has highlighted the importance of endowment, early conditions and parental investments on the accumulation of human capital (see Cunha and Heckman, [2007] or Bjorklund and Salvanes [2010] for reviews). In particular, Cunha, Heckman, Lochner and Masterov (2006) show the high returns to early investment. As such, one may expect that changes in parental selection lead to differences in the accumulation of human capital between cohorts. Using four different datasets, we are able to document variations in educational attainment from age 10 to 17. Since the cohorts of interest are much smaller than usual, we can immediately reject any crowding out effect and, on the contrary, we expect these cohorts to have experienced higher level of public spending. Indeed, class size dropped by 10% for the affected cohorts (Kempkes, 2010). Consequently, if parental selection proves negative for these children, our results should be interpreted as lower bound estimates of the true effect of parental selection.

[1] Other Eastern European countries also experienced drops in fertility following the collapse of the communist regimes, although their magnitudes were substantially smaller than the one observed in East Germany (UNECE, [2000]).

[2] Throughout the paper, we will use "Land", "Bundesland" or "State" interchangeably to refer to the 16 constituent states of the Federal Republic of Germany—or mostly 15 as Berlin is often dropped from the analysis since it is not possible to know which individuals were from the East or West after unification. Note also that the plural of Land in German is Länder.

Third, the literature on parental selection has mostly been unable to comprehensively document the parental characteristics and behaviors that are likely to be associated with both fertility selection and children's outcomes. We fill this gap by exploiting very rich individual level datasets with information on the mother's and child's characteristics. We begin our analysis by considering the commonly used observable maternal characteristics (age, education and employment/income) to establish the direction of the selection into fertility. This data also enables us to expand on several mostly overlooked sets of characteristics: i) family structure[3]; ii) parental input in the child's education; and iii) maternal emotional attachment and parenting competence as expressed by the children themselves. As such, we more precisely document the parental selection and assess potential mechanisms by which it affects children's outcomes. We also provide the first direct micro-evidence that uncertainty about the economy affects a woman's fertility decisions differently by education level.

A remaining worry would be that children born during this very uncertain time suffered directly from the possible adverse economic environment that they and their mothers faced. For example, the fetal programing hypothesis (Barker, 1995) asserts that parental stress while the child is in the womb can lead to abnormal emotional control issues (see van den Bergh et al. [2005] for a review), which could in turn increase the chances of negative outcomes, even without parental selection (see Aizer, Stroud and Buka [2015], for example). Our first examination of this mechanism uses school test data comparing children from the same school cohort born nine months around the cut-off defined by the fall of the Berlin Wall. These children can be considered to have shared the same economic environment during their childhood and the same educational environment in the year of the test. As such, they only differ according to parental selection. Nonetheless, certain mothers may have experienced some level of stress while pregnant, albeit at different months of the pregnancy, or during the early months of childrearing. Since the timing of the stress might be important, we also conduct a second test that relies on comparing *CoW* outcomes with those of their older siblings born in the economically stable times of East Germany. These older siblings are mostly expected to display similar outcomes if the driver is parental selection, but not if our reduced form evidence is driven by being born in a particular environment.

Our main empirical analysis and the ensuing findings developed in the paper are as follows. We first clearly document the unprecedented drop in the birth rate observed in East Germany just after the fall of the Berlin Wall, especially the drop in in-wedlock birth. We

[3] Neal (2004) highlights family structure as an important long run selection mechanism that explains the large female black-white income gap in the US, albeit not in the specific context of an economic recession.

subsequently offer a number of explanations of this phenomenon by placing it in the context of the historical and institutional background; thus, the very high level of economic uncertainty in East Germany in the years of transition following German reunification emerges as the main reason for the fertility reduction. In the absence of any national test, we exploit German oversamples in two international tests (the Progress in International Reading Literacy Study or PIRLS and the Program for International Student Assessment or PISA) to objectively assess the performance of *CoW* at ages 10 and 15 compared to their schoolmates. Additionally, we use the "Deutsches Jugend Institut" Youth Survey (DJI) and the German Socio-Economic Panel (SOEP) to assess self-reported educational outcomes at ages 12 and 17. The results are consistent across datasets and highlight that the affected cohorts experienced worse educational outcomes at all ages. These findings are confirmed in a number of alternative specifications, and placebo checks enable us to reject the notion that the results are driven by time-specific unobservable characteristics.

Having documented the poorer outcomes of the *CoW*, we investigate the parental selection of the mothers of these children. Using our various data sources, we report strong evidence of the negative selection on observable characteristics of women who gave birth in East Germany just after the end of the communist regime. On average, these women were younger, had lower levels of education, were less likely to be economically active and were more often on welfare. From the SOEP and DJI, we also document that *CoW* grew up in environments with much less stable family structures. The effect is unlikely to be mainly driven by economic deprivation because families with children born in Eastern states during the transition period do not have strikingly lower net income levels, partly thanks to the relatively large social transfers available in Germany. The various datasets allow us to further explore the possible mechanisms stemming from substantial differences in parental behavior that could explain the poorer educational outcomes of *CoW*; for instance, these parents were less likely to read to their children and generally provided less educational inputs. Importantly, *CoW* self-report their relationship with their families as being of much lower quality. This lower emotional attachment is often put forward as an important factor in the child development literature on the long-term effect of early rearing conditions (see Brook-Gunn, Berlin and Fuligni [2010] or Conti and Heckman [2013] for a recent review).

We reject the hypothesis that these children have worse outcomes due to being born in bad economic times. First, such an explanation would not involve differences in parental characteristics and behavior. Second, the test score analysis involves comparing children in the same school born only a few months apart, thus rejecting environmental differences as the

explanation for the large differences in educational attainment. Third, while one could still argue that the timing of the stress while the child was in the womb matters, the *CoW*s' older siblings—who were born under stable conditions of the communist regime—also had worse educational outcomes and poor relationships with their mothers. Finally, as a test to confirm that the nature of the parental selection mechanism observed is driven by economic uncertainty is proposed, we combine individual information on a woman's education level, her beliefs about future economic conditions and her fertility in the years after the fall of the Berlin Wall. This enables us to prove that those who were more worried about the future were less likely to subsequently have children but, crucially, that this response was also much stronger for women with higher levels of education.

Our findings clearly show that the cohort of children born during the transitional period, which was characterized by substantial economic uncertainty, was negatively selected. This conclusion has potentially important policy implications. First, the provision of public services (e.g., school investment) should not only be based on the size of an incoming cohort; rather, more attention should be paid to its composition. Second, since remedial policies are most effective when employed at an early age (Cunha and Heckman [2007]), it is important to identify at-risk children as early as possible, and even perhaps before they are born. Through targeted policies such as home improvement programs, improving parental skills could also have a large impact on negatively selected cohorts (see reviews of evidence in Doyle et al. [2013]). However, our findings also suggest that it might be difficult to identify the right target group of parent/children since the selection is driven by characteristics such as parenting skills or emotional attachment, factors that are typically not observed.

The remainder of this paper is structured as follows. Section 2 details the institutional background surrounding the period of the fertility drop, which we exploit as a natural experiment, and considers various possible explanations on why the fertility dropped. Section 3 describes the various datasets used and specifies the difference-in-differences strategy that we adopt throughout. Section 4 presents evidence on the differences in educational outcomes for the CoW compared to other cohorts. Section 5 documents the extent of parental selection and the differences in parental behavior, and Section 6 offers concluding remarks.

2. Documenting the Fertility Drop

2.1 East Germany and the German reunification

Germany was split along the positions of the occupying armies in the aftermath of World War II, with the Federal Republic of Germany (FRG or West Germany) and the German Democratic Republic (GDR or East Germany) officially being founded in 1949. The GDR developed as one of the most orthodox of the former European communist regimes. As the two countries' economic and political performances diverged, increasingly more citizens from East Germany migrated by crossing the border into West Berlin. To stop this exodus, the Berlin Wall was built around the western part of the city in 1961, becoming the symbol of the forty-year physical and socio-economic separation of people who had previously shared a common destiny.

By the end of the 1980s, a series of sudden and radical political changes led to the rapid collapse of the communist regimes in most of Eastern Europe. In the GDR, large demonstrations against the regime started in September 1989 and emblematically culminated with the televised demolition of the Berlin Wall on the evening of November 9th, 1989, as the borders between East and West Germany were declared opened. There was strong political will to quickly re-unite the two countries, especially with the organization of an election as early as March 1990, when the communist party in East Germany was heavily defeated. Two months later, a common currency was announced and introduced in July of the same year. Unification was officially completed in October 1990, less than 11 months after the Berlin Wall had fallen (see for example, Judt [2005] for details). The very abrupt end of almost half a century of communist rule and the express reunification that followed was a huge unexpected shock, leading to a transitional period of great socioeconomic uncertainty for citizens of the new East German Länder[4]. This was perhaps best illustrated by the unprecedented decline in the number of births that occurred there in the years immediately after the fall of the Wall.

2.2 The Fertility Drop

The upper panel of Figure 1 documents the yearly crude fertility rate in East and West Germany from 1950 to 2008. The first thing to note is that despite the somewhat lower level in the East, the trends in fertility up to 1989 were very similar in both countries: a post-war baby boom until the mid-1960s, a rapid decrease (readjustment) in the following decade,

[4] We are not the first to use German re-unification as a natural experiment to investigate the occupational effect on precautionary (Fuchs-Schündeln and Schündeln [2005]) and household saving (Fuchs-Schündel [2008]), preference for redistribution (Alesina and Fuchs-Schündeln [2007]), consumption behavior (Bursztyn and Cantoni [2015]) or the economic impact of networks (Burchardi and Hassan [2013]). No study has however previously focused on the outcome of the children born during this transition period as we do in this paper.

before a relative stabilization between 1970 and 1990. The somewhat larger increase in fertility in East Germany starting in 1974 was the result of pro-natalist policies that provided a range of welfare benefits to parents (see Reinheckel et al. [1998] for details). However, these policies only had a temporary effect so that fertility trends in both countries were similar by the mid-1980s[5], which is the origin of the period we study. What stands out in Figure 1 is the massive and temporary collapse in birth rates in the East, but not in the West, following the fall of the Berlin Wall (vertical red line). It has been defined by demographers as the "most substantial fall in birth rates that ever occurred in peacetime" (Conrad, Lechner and Werner [1996], p. 331). Within a year, the birth rate dropped by 40 percent before reaching an all-time low in 1993, when it was less than half of its 1989 level. However, this fertility drop was relatively short-lived, and a recovery started in 1994.

[Figure 1 about here]

All family structure decisions were affected by the regime change. The lower panel of Figure 1 shows the yearly marriage rate (per 1,000 inhabitants) in East and West Germany over the same period. In the 1950s and 1960s, the rates are remarkably similar in the two countries, declining from 10/1,000 to 7.5/1,000. However, pro-natalist policies introduced in East Germany in the early-1970s (see Reinheckel et al. [1998] for details) temporarily pushed the marriage rate up, whereby the marriage rate in East Germany was constantly two points above that in West Germany[6]. Following the fall of the Wall in late 1989, the marriage rate dropped abruptly in East Germany in 1990 (-70 percent) before stabilizing at around 4/1,000, meaning that the rate was similar in both regions of re-unified Germany by the end of the period.

Combining the fertility and marriage decision information, Figure 2 displays the difference in the yearly change in crude birth rate (per 1,000 women) between 1950 and 2008 for in- and out-of-wedlock births between West and East Germany. For most of the period, these series do not diverge by more than ten percentage points. What stands out is that the collapse in birth rate is entirely driven by in-wedlock births (solid line), which dropped by more than 60 percent in 1990, while those out-of-wedlock (dotted line) increased very

[5] Note that the cohort of women coming to their peak fertility age after 1989 was relatively smaller, having been born during the fertility ebb of the early-1970s. This natural cohort size effect contributes at most to 10 percent of the drop in the number of birth observed (Eberstadt [1994]).

[6] Note that out-of-wedlock birth does not necessary imply single motherhood, as a large fraction of couples with children cohabit without being formally married.

slightly. This suggests that the cohorts born in East German states between 1990 and 1993 were not only dramatically smaller but also negatively selected in terms of family structure.

[Figure 2 about here]

Finally, to more precisely link the timing of the fertility drop to the regime change in East Germany, we focus on the monthly number of births for the two regions in Figure 3. While the data for Eastern Länder is only available from January 1990 onwards, this still enables us to observe that the number of births only started to sharply fall in August of that year—exactly nine months after the fall of the Wall—before stabilizing in early 1994. Throughout this period, the number of births in West Germany remains remarkably stable. The exact timing of the onset of the fall—August 1990—is the first indication that the collapse of the regime was not foreseen and that the drop was not driven by immediate use of abortion (more below). As such, it was a change in the decisions to conceive that drove the reduction in fertility. Note also that the drop in births in the East was not solely due to displacement of mothers-to-be to the West (more below) since the numbers of births in the West remained on a very constant trend.

[Figure 3 about here]

These figures clearly illustrate three important points that are relevant to our identification: i) pre-1990, fertility trends were consistently similar between East and West; ii) the fertility drop affecting East Germany after the fall of the Wall was short lived, and fertility started recovering within three and half years so that we define 'Children of the Wall' as the cohorts of individuals born in the transition period between August 1990 and December 1993 in an Eastern Bundesland; and iii) the marital status of parents suggests that the CoW originated from a very different type of family.

2.3 Explaining the Fertility Drop

We consider three potential reasons why fertility fell so sharply in East Germany after the fall of the Berlin Wall, namely, change in birth control provision, East to West migration and economic uncertainty. Although it is difficult to exactly measure the relative importance of these factors, we provide evidence here that the reduced number of births was mostly

driven by economic considerations. While the issue of whether women postponed or reduced their family size or whether more women remained childless is of interest, it is beyond the scope of this paper since our aim is to understand changes in the composition of the cohort of children born between August 1990 and December 1993[7].

2.3.1 Access to Birth Control Methods

A large number of studies on fertility decisions and child outcomes have exploited policies that changed access to birth control, and predominantly access to abortion, which has been shown to be broadly beneficial for subsequently born cohorts (see Bailey, Guldi and Hershbein [2013] for a brief review of this literature)[8]. Here, instead, we argue that access to birth control is unlikely to be an important factor in explaining the sudden drop in the number of births. First, access to birth control methods was very liberal in East Germany and the right to on-demand abortion was not modified before 1995, after which it became more restricted. Second, one could have expected that faced with the immediate uncertainty of a new environment, potential mothers would have terminated pregnancies in greater numbers. We have already argued that the exact timing of the fertility drop (Figure 3) does not appear to support this idea in the very short-run. Additionally, the number of terminations in the five East German Länder (excluding Berlin) dropped from 72,774 in 1988 to 26,207 in 1994 (-63 percent). This more than matches the drop in the number of births observed over this period (-57 percent) and translates into a small decrease in the abortion to birth ratio. We can thus safely say that the decline in fertility was mostly due to a fall in conceptions, which is important for two reasons. First, it implies that our 'pre-treatment' groups (of mothers and children) are not selected post-conception. Second, we can assume that the children eventually born must have been 'wanted' by their mothers at the time, which makes it a very different selection mechanism than when a drop in fertility is driven by the legalization of abortion along with the fewer 'unwanted' children in a cohort that it implies.

2.3.2 Internal Migration

[7] However, as these delayed fertility issues could have changed the composition of individuals born after 1993, when applicable (i.e., for analysis using SOEP data), we have tested and confirm that all our results are mostly unchanged by the exclusion of these post treatment cohorts.

[8] In particular, the US legalisation of abortion has been shown to reduce child poverty (Gruber, Levine and Staiger, 1999), teenage motherhood (Donohue, Grogger and Levitt, 2009), use of controlled substances (Charles and Stephens, 2006), crime (Donohue and Levitt, 2001) and improve education (Ananat, Gruber, Levine and Staiger, 2009), while Pop-Eleches (2006) demonstrates that an abortion ban led to positive parental selection in Romania.

One of the most important changes in the life of East Germans after the fall of the Berlin Wall was that the opportunity of direct migration to the more opulent West became possible again. A substantial number of individuals made use of this newfound freedom, with almost 800,000 individuals migrating from East to West, representing 5 percent of the pre-1990 population. This internal migration flow quickly died down, and by 1993 almost as many Germans were making the move in the opposite direction. Hunt (2006) demonstrates that improvements in relative wages were responsible for the ebbing of eastern migration. On average, movers were younger and more likely to be female (Fuchs-Schündeln and Schündeln [2009]), and thus internal migration had an impact on the reduced number of births in the East. Eberstadt (1994) estimates that internal migration accounted for about 10 percent of the total drop in birth numbers. However, this does not really cast doubt on the magnitude of the fertility drop since the crude birth rate used to illustrate it in Figures 1 and 2 uses the yearly number of women in the population of East or West Germany as a denominator.

However, migration remains a worry for the validity of our identification, even if it does not directly explain the drop in fertility, since it could still distort the composition of the (control) cohorts of individuals that we observe in West Germany. This would be the case if mothers of young children migrated in substantial numbers or if many of the women who moved to the West subsequently gave birth there, although this is not observed in the raw data presented as West Germany birth numbers remain on trend. Note that internal migration is not an issue for all of our micro-level analysis using SOEP data where we allocate the treatment status based on the mother's place of residence in 1989 rather than current location. Results from the different data sources point to the same mechanism; as such, internal migration is unlikely to be the driver of the observed selection effects. Additionally, to test how much internal migration may bias our results, we run regressions based on the SOEP data using current location rather than location of the mother in 1989 to allocate treatment. Results from these regressions are never statistically different from those presented. Therefore, we are confident that our results are not driven by internal migration.

2.3.3 Economic Uncertainty

During the half-century of communist rule, there was no uncertainty concerning employment and wages, and women were very integrated into the labor force. The costs of having children were kept low due to the public provision of childcare, health and educational services. In the months immediately following the fall of the Berlin Wall, full employment policies were abandoned; indeed, almost a third of the pre-unification jobs had been

eliminated by the end of 1994, and 65 percent of those unemployed were women. The generous and universal benefits linked to having a child were quickly curtailed to match Western levels, while the availability of childcare shrank and housing costs surged (Rheinheckel et al. [1998]). This negative economic picture was mitigated by the aforementioned rapid catch up of Eastern wages, which were negotiated to reach parity with the West by 1994, large financial transfers from the West and a generous one-to-one conversion of the OstMark to the DeutscheMark in July 1990. In fact, mean disposable income and consumption in the new Länder had recovered to their pre-1989 level as early as three years after the fall of the Wall (Dornbusch and Wolf [1992]). Therefore, there was very substantial and fast economic convergence between East and West Germany after the fall of the Berlin Wall, even though the East remained relatively poorer. Can we thus still claim that economic uncertainty drove the drastic fall in the number of births in those years? We use evidence from survey data collected at the time which links fertility decisions and uncertainty about the economic situation to answer this question.

[Figure 4 about here]

First, the 1992 Population Policy Acceptance Study (PPAS) allows us to link the perception of economic uncertainty to fertility decisions[9]. When asked in this survey what were the reasons for not wanting a(nother) child, the most common reason given by 78 percent of East Germans was poor economic circumstances. The next two most common answers were also related to the perception of the economic situation, namely the costs of raising children (60 percent) and fear of the future (49 percent). Additionally, the SOEP allows us to track the evolution of the perception of the economic situation and childcare provision over time. Figure 4 reports the difference between East and West Germany in terms of the fraction of individuals worried about the economic situation. Following reunification, East Germans were 20 percentage points more likely to be very worried about the economy. This difference increased up to 30 percentage points in 1991, before the views on the economy converged in 1993 and remain close thereafter. Amazingly, this is precisely when we start observing a rebound in birth rates in the East, which is consistent with our

[9] The Population Policy Acceptance Study (PPAS) is a comparative survey of European attitudes and opinions concerning demographic changes, demographic behaviors and population-related policies. In Germany, the first survey was conducted in 1992. About 10,000 men and women in East and West Germany between the ages of 20 and 39 years were asked about family policy, its impact and expectations on future family policies. For more on this survey, see: http://www.bib-demografie.de/EN/Research/Surveys/PPAS/ppas_node.html

assumption that economic uncertainty was one of the main factors behind the drop in fertility in the East[10]. Since the PPAS indicates that childcare was also an important concern, the SOEP also enables us to assess the differences in the perception of childcare availability between East and West over time. Again, we observe that East German parents were more worried about childcare availability, yet they rapidly converged towards the West's perception. These measures of uncertainty about the future thus validate the definition of the *CoW*, since the expectations about the economy and childcare of both East and West Germans had broadly converged by 1993.

3. Data Sources and Empirical Strategy

3.1 The Datasets

3.1.1 Cross Sectional Standardized Test Data: IGLU 2001 and PISA 2006

No administrative test score data is available across states in Germany due to the Länder's strong independence from the central government in terms of educational policies. However, we are able to identify two international testing exercises that were taken by large samples of German school children conceived just before and after the fall of the Berlin Wall at two stages of their educational careers: *aged 10* with the Progress in International Reading Literacy Study (PIRLS) in 2001 and *aged 15* with the Program for International Student Assessment (PISA) in 2006[11].

For our analysis, we actually use an over-sample of 10,000 students of PIRLS 2001 called IGLU 2001. The questionnaire and testing are identical, and the data provider (IQB) has identified for us children attending schools in the former East Germany[12]. The sampling includes 4th grade children in 2001. Limiting ourselves to children born in Germany between July 1989 and June 1991 leads to 20% of pupils being defined as *CoW*. The test took place in

[10] Additionally, in 1991, 45% of East German workers asked about the probability of losing their jobs within the next 12 months reported that they would definitely or probably lose it. For East Germans, this perceived probability of job loss fell to 21% and 16% by 1993 and 1996, respectively. Despite still being higher than in the West, which remained between 6 and 8% during the same period, this shows a very high level of economic uncertainty and a remarkable convergence of perceptions within the three years following re-unification.

[11] The PIRLS surveys are based on a two-stage sampling design whereby schools catering for 10 years old are sampled, and in the second stage, two classrooms per schools are randomly selected (see in particular Appendix B in Martin, Mullis and Kennedy (2003) for details on the German sample). The PISA sample is also based on a two stage sampling design whereby schools catering for 15 years old students are randomly selected, and a random selection of 35 students of the appropriate age is selected independently of their classroom (OECD, 2007).

[12] This representative sample is drawn from schools in six Landër: Baden-Württemberg, Bavaria, Bremen, Hessen and North Rhine-Westphalia in the West and Brandenburg in the East.

May 2001 in all schools and is designed to assess the reading competences of 4th graders in reading, comprehension and literacy[13]. In addition to test results, the survey collects information from parents, which is used to create an Index of Early Home Literacy Activities, an Index of Home Educational Resources, an Index of Parents' Attitudes toward Reading and a report on the number of books at home. We use these to assess the home environment of the pupils in terms of parental input.

Similarly, PISA 2006 is an international testing exercise of 15-year-old students (typically in grade 9) across the world. The PISA assesses the reading and math skills of students and collects survey information from pupils, parents and teachers. Typically, the testing lasts for about two hours per student with a combination of multiple choice questionnaires and open-ended questions. Germany over-sampled the 2006 PISA and once again IQB kindly identified for us pupils from schools located in the former East Germany, excluding Berlin. The dataset contains information on 34,516 children, but we only keep those born in 1990 in Germany (30,650), 12% of whom are defined as *CoW* (born in or after August 1990 and currently living in East Germany).

Note that for both PIRLS and PISA we know if pupils study in East or West Germany but do not know from which Bundesland they are exactly. As there is substantial heterogeneity between states within these two larger geographical units, we will rely on school level analysis to wipe out the state characteristics that may affect test results. A worry when using this method with PISA is that, by grade 9 in Germany, most students are tracked according to their academic performance, and school assignment could therefore be endogenous. Fortunately, in these two surveys, the sampling is at the school level not the classroom level, and German pupils often attend a multi-track school. This is especially true in East German Länder where the data reveals that 47 percent of sampled schools offer multiple-tracks and all students in the lowest track (Hauptschule) are from a multi-track school. As such, controlling for school fixed effects is not equivalent to controlling for tracking of pupils by ability level and enables us to capture Land specific characteristics.

3.1.2 Individual Survey Data: DJI and SOEP

The DJI Youth Survey is part of the continuous social reporting undertaken at the German Youth Institute. Here, we use the 2003 wave for youths born between 1989 and 1991,

[13] For each competency, five plausible values reflecting the child ability are recorded. We take the average from these fifteen plausible values as our measure of competence and normalize it to a mean of 0 and a standard deviation of 1.

which gives us a representative sample of 2,154 German youths. These individuals are observed when aged between 12 and 14 years and answer a battery of questions on various topics, including education and family life. It contains 7 percent of individuals who can be classified as 'Children of the Wall,' i.e., those identified as being born in an East German Bundesland between August 1990 and December 1993.

The German Socioeconomic Panel (SOEP) is a large annual longitudinal survey of private households first established in West Germany in 1984. Since 1990, it has also included individuals from the former East Germany. We use data from 1990 to 2011, comprising more than 50,000 unique individuals, a quarter of whom live in the East. The SOEP includes detailed personal characteristics and extensive questionnaires for all members of the household, including retrospective information when necessary. The main survey is augmented by topic-specific modules, and we make extensive use of those with questions focusing on mothers and young adults (aged 17) when children of the relevant cohorts are interviewed for the first time. Note that the SOEP asks adults their location in 1989. When using this survey, *CoW* is thus defined based on their 1989 location independently of future migration decisions.

In addition to basic socio-demographic characteristics, from the various questionnaires in DJI and SOEP, we extract self-reported measures of education and family composition as well as information on parenting behavior/relationships as reported by the children[14].

3.2 Empirical Strategy

For all outcomes, our empirical strategy relies on a difference-in-differences approach in which we first compare the characteristics or educational outcome of pupils born (conceived) before August 1990 (November 1989) to those born earlier. The counterfactual, or second difference, is provided by the non-treated individuals from West German Länder, which enables us to naturally control for common macro shocks and time trends. The basic specification used throughout is as follows:

$$Y_{is} = \beta CoW_{is} + \gamma East_s + \rho X_{is} + f(MoB, YoB) + \gamma_s + \varepsilon_{is} \qquad (1)$$

The subscript s denotes either a state or a school depending on the dataset being used. When available, a school or state fixed effect, γ, is introduced. $East$ is a dummy for living in East

[14] Detailed information on the DJI and the SOEP is available online at: http://www.dji.de/index.php?id=1&L=1 and http://panel.SOEP.de/

Germany, while *MoB* and *YoB* are indicators of the month and year of birth. *X* is a vector of individual level characteristics, which varies between datasets. ε_{is} is an error term assumed to be independent and normally distributed across individuals *i*. The coefficient of interest in all regressions is the estimate of β on *CoW*, which is a dummy equal to 1 when an individual is—or her mother had—a Child of the Wall (i.e., born or birth between August 1990 and December 1993 in an Eastern Land) and zero otherwise[15]. All regressions are re-weighted to account for survey design, and standard errors are clustered at the school level (IGLU and PISA) or by region and birth year (DJI and SOEP).

In a difference-in-differences framework, the identification assumption is that there is no difference in trends between the regions before the treatment occurs. Using SOEP, we are able to test this assumption at either the mother or child level. We never find any statistically different pre-trend differences between East and West for the cohorts born between 1982 and 1989 for any of the outcomes of interest.

4. Empirical Evidence on Educational Outcomes

4.1 Test Score Results

The PIRLS test assesses the reading ability of pupils in grade 4 when they are about 10 years old. We rely on the difference-in-differences framework explained above in which we compare test results for children born before and after August 1990 enrolled at a specific school in either East or West Germany. This allows us to implicitly control for any differences in the provision of education between states. Since all children are tested on the same day, it is important to control for age at test via month of birth dummies. We assume that any "month of birth" effect on test score is similar between West and East German schools and test this assumption below[16]. We additionally control for gender, number of

[15] In simple terms, our regression specifications are throughout roughly equivalent to defining a *transition* period for births between August 1990 to December 1993 and then regressing outcomes of interest for children and mothers on dummies for *transition*, *East*, and *"transition*East,"* which is the *CoW* term estimate we will focus on and interpret in our analysis.

[16] Threats to this assumption would be that school years are organized differently in East and West German States, leading to months of birth having a different effect on grades in the two regions. Another threat would be that variations in cohort composition across months (Buckels and Hungerman, 2013) differ between the two regions. In an alternative specification, we include interactions between months of birth and living in the East. The "month of birth" interactions become negative and significant from August onwards, and the point estimates do not significantly differ between August and December, highlighting that over this (short) period, the selection effect was constant.

children in the household and dummies for whether the parents were born abroad. The coefficient of interest is the interaction between being born after August 1990 and living in the East, which identifies any difference in performance for the cohort of East German children conceived in the transition period. The upper panel of Table 1 reports the estimate of the interaction term on three outcomes: normalized reading test score as well as an indicator of being in the top or bottom of the test score distribution, respectively. *CoW* score 0.15 of a standard deviation lower than their schoolmates conceived before the fall of the Wall. This is mostly driven by the distribution of test scores for the *CoW* having a larger tail of low achievers. Thus, there is no effect of *CoW* on the probability of being in the top decile of the distribution, although being a *CoW* increases the probability of being in the bottom 10 percent by two-thirds. An effect on test score at an early age is likely to have a large impact on educational attainment since Germany is characterized by an early tracking system whereby pupils are directed into different educational paths in grade 5 or 6 (depending on the state in which they reside).

[Table 1 around here]

We similarly analyze results of the PISA test, which assesses reading and math skills when pupils are about 15 years old. The identification is again a difference-in-differences strategy where we compare the test score of children born between January and July 1990 to those of children born after August 1990 in the same school in either East or West Germany. The base specification controls for month of birth, gender and whether the parents were born abroad. The mean normalized math test score is 0.064 of a standard deviation lower for *CoW*, and the effects for reading are similar but larger at -0.078 of a standard deviation[17]. Again, we find that the results are mostly driven by a worsening in the left tail of the test score distribution, leaving *CoW* 22 (28) percent more likely to be in the bottom decile in math (reading), while no effect is observed at the top end of the distribution[18].

To test the assumption that "month of birth" effects are similar in East and West Germany, we conduct a placebo regression using the PISA 2003 where we consider the

[17] The results are not sensitive to using a smaller window around the Fall of the Wall. The estimates using only children born between May and November 1990 are -0.073 (0.027) and -0.055 (0.027) for reading and math, respectively.

[18] We also obtained results for regressions that control for grade attended, track type, number of siblings, age of mother, marital status and maternal education, although these substantially reduce the sample size (from 28,008 to 23,393 observations) as not all parents responded to the survey. The results are not significantly different for these specifications and thus are not presented here to save space, but they are available upon request.

treated as pupils born from August 1987 to December 1987 in East Germany. Reassuringly, we do not find any effect of the placebo treatment, which assures us that our results are not driven by region-specific "month of birth" effects.

Finally, note that since our models include school level fixed effects, these results are not driven by changes to the curriculum or other institutional differences that would affect only children from certain East German states born after August 1990. If anything, these results are likely underestimating the true parental selection effect[19] as school choice might reflect parents' preferences for education, a question we explore below. To recap, when comparing the test performances of children in the same school, those conceived after the fall of the Wall performed substantially worse, which is consistent with parental selection.

4.2 Self-Reported Educational Attainment

In addition to the objective measures of educational performance explored above, the DJI and SOEP provide self-reported measures of educational attainment, with the results presented in Table 2. Focusing on the interaction between being born post-August 1990 and being educated in the East, we find that *CoW* are 6.5 percentage points more likely to have already repeated a grade. In terms of mean size impact, this effect is large and translates into a 45 percent increase in the probability of repeat. Similarly, they were also 40 percent less likely to report finding learning easy, and 19 percent more of them reported that they did not get along with their peers, which are two indicators of a lower taste for schooling.

[Table 2 around here]

Similarly, at age 17, using SOEP we find that *CoW* mostly display negative educational outcomes (results reported in the lower panel of Table 2). They are two percentage points more likely to have dropped out of education. Since this is a relatively rare outcome in Germany, this represents a very large mean size effect of a 53 percent increase in the probability of not being in school at that age. Conditional on not having dropped out, *CoW* are a third more likely to be in a lower track. No effect is found on repeating, although this outcome is only reported conditional on still being in education and is thus a lower bound effect.

[19] Indeed, using the restricted sample of schools offering multiple academic tracks, we can approximate by how much our main results under-estimate the overall effect of parental selection on test results. On this restricted sample, we estimate models including or excluding school fixed effects. The point estimates on COW on test score are indeed reduced by 10% when school fixed effects are included.

Overall, we have consistently found that the *CoW* display or report much lower educational outcomes from an early age onwards, which is mostly driven by a worsening of the tail end of the distribution. In terms of size, our effects are, for example, comparable by age 10 (-0.150 of a standard deviation in reading score) to the difference in test scores between children who attended the Head-Start pre-school program and those who did not (taking Deming [2009]'s 0.133 estimate). The almost fifty percent increase in drop-out rates by age 17 is very large but in line with the impact on female high school graduation from enrollment in the Perry Preschool compared to those who were not (taking Anderson [2008]'s .494 percentage points estimate). We now explore whether this is consistent with negative parental selection as the underlying mechanism using various measures of parental characteristics and behavior, such as the mother's and family's characteristics as well as the perceived quality of parenting and parent-child relationship as reported by the children themselves.

5. Who Gives Birth in Times of Economic Uncertainty?

5.1 Parental Selection

5.1.1 Mothers' Socioeconomic Characteristics

As already discussed, the large fertility drop that we study is certainly not random across women and is likely to be driven by parental selection. After reviewing the evidence on the educational attainment of the *CoW*, our above conclusion is that they were the product of important *negative* selection into motherhood. Faced with a high level of uncertainty about the future and a new set of (unknown) constraints regarding the costs of child rearing, women with lower parenting skills were relatively more likely to conceive and give birth in the years following the collapse of the communist regime. To test this hypothesis, we turn to the SOEP data and focus on the sub-sample of women who gave birth in East or West Germany between 1982 and 1995. Note that the SOEP provides retrospective information on location before the fall of the Berlin Wall, which we use to allocate the *CoW* status so that these estimates are not affected by subsequent internal migration decisions.

[Table 3 about here]

We compare the mothers of *CoW* to other mothers on a number of 'positive' socio-economic characteristics, reporting the results in Table 3. First, we note that East German mothers are, on average, quite different to their Western peers over this period, which is captured by the strongly significant coefficients on the 'Birth East' dummy (although the pre-1989 trends do not differ between regions). The mothers of *CoW* are over 7 months younger, almost 60 percent more likely to be teenage mothers, have nine months less education and are eight percentage points less likely to have completed high school. These mothers also had a lower employment probability at the time of survey.

5.1.2 Family Structure

We have already shown in Figure 2 that at the cohort level, the East German women who had children after the fall of the Belin Wall were much more likely to do so out of wedlock. The DJI and SOEP allow us to assess differences in longer run family formation much more thoroughly. As reported in Table 4, the results from the analysis of information from both surveys reveal that the *CoW* experienced much less stable family structures as they grew up. In particular, by age 12, they were 13 percent less likely to live with their natural father, a third more likely to have experienced a divorce and had a 60 percent higher probability of having experienced new partnerships during their childhood. A similar picture emerges when exploring the family structure of these children from birth until age 17, using the mother's relationship history in the SOEP. By the time the child is 17, *CoW* mothers were 11 percent less likely to live with the father of the child and had a relatively lower probability of being married. The most dramatic figure here is that they are 80 percent less likely to have ever been married since the child was born, which is a huge effect even in view of the relatively low 6 percent average baseline.

[Table 4 around here]

The results in this section clearly confirm that our prior conclusion was correct and that women who had children during the very uncertain times following the fall of the Berlin Wall were negatively selected on all of the standard observable socioeconomic characteristics which are associated with relatively lower educational attainment for children. While those differences are likely to be important for child outcomes, we now investigate the negative parental selection issue more directly, and arguably more objectively, by relying on

information on parental skills and the maternal-child relationship, as well as parental educational input.

5.2 Parental Input and Quality

5.2.1 Parental Inputs: Educational Inputs and Income

The various surveys allow us to investigate the variations in parental inputs that are related to education. Here, we rely on children's self-reporting in the IGLU (age 10), DJI (age 12/13) and PISA (age 15) to investigate differences in parental reading behavior and interest in the children's education. Moreover, we also assess whether the main driver of worse educational performance is economic deprivation.

As reported in Table 5, parents of *CoW* engaged in less reading activities before the child entered school, were reading less frequently with their children at the age of 10 and their houses had less reading material. The lesser engagement of parents in the schooling of their children is also found in the DJI at age 12/13. Based on the child's answers to three questions about whether their parents care about their educational achievements, are helpful in solving school problems and attend school meetings, we estimate that parents of *CoW* were 0.1 of a standard deviation less engaged in the schooling of their child. These children were also less involved in activities that could potentially compensate for the lack of educational inputs provided by their parents. At age 15, they spent 20 less minutes per week on their homework and were 20 percent less likely to be attending any out-of-school teaching. An overall index of educational resources at home confirms that they were significantly less endowed than their peers[20].

[Table 5 about here]

Are these differences mainly driven by differences in family income? The last row of the PISA panel in Table 5 suggests otherwise, revealing no significant difference in the average perceived wealth of *CoW* households as measured from children's reporting on a list of items available at home. This is admittedly a very noisy measure, and to explore this issue further, we also assess whether *CoW* households are poorer by computing the average gross and net

[20] Home educational resources is a score based on possessing the following items: a desk and quiet space to study, a computer, education software, books to help with work, technical reference books and a dictionary. The score is then standardized to a mean of 0 and a standard deviation of 1.

income (i.e., after accounting for social transfers) during childhood that mothers report in the SOEP[21]. Consistent with what we know about their human capital—the lower employment probability of mothers and their greater propensity to live in single-headed families—*CoW* households report significantly lower gross income. However, the generosity of welfare programs in Germany considerably reduces this gap in terms of net income (the *CoW* coefficient is still negative but half the size of raw income and no longer statistically significant).

Another possible test to show that our results are not primarily driven by income is to include it—or other associated observable characteristics—as an additional control when measuring the impact of being born in East Germany in the transition period. Using our largest survey (PISA), we find that the estimated *CoW* coefficients are slightly smaller but not statistically different when these additional controls are included[22]. While this is a further indication that the lower child outcomes we observe are unlikely to be mainly a result of the economic deprivation of *CoW* households, we should still interpret this finding with some caution for two reasons. First, because survey measures of wealth/income are notoriously noisy and, second, because the self-reported measures of current income used here are only crude proxies for permanent income, which is the concept of wealth that matters in the child development context.

5.2.2 Parenting Quality: Relationship and Support

The child development and psychology literature has highlighted the role of the parental relationship and parenting style in the production of cognitive skills (see Dornbusch et al., 1987 for example). The DJI and the SOEP provide a unique opportunity to test usually unobservable indicators of parental skill quality. In both surveys, children answer a series of questions about the quality of their relationship with their mothers, including how supportive they perceive them to be. Table 6 reports the estimated coefficients on being a *CoW* using our DiD approach on these self-reported measures of parental quality assessed by the child at age 12 (DJI) and 17 (SOEP). Note that we mostly focus here on the mother-to-child relationship and support as we have documented a large negative selectivity in the probability of these children living with their fathers.

[21] We create childhood measures of both gross and net household income. Gross household income is derived from the average income reported yearly by mothers between 1990 and 2010, and net income is the average for the same 20 year period after accounting for social transfers.

[22] Our PISA results are not sensitive to including maternal education, maternal employment and family status measures in the test regressions. The results are not reported but available on request.

The DJI allows us to build a score on parent-child relationship quality based on the sum of answers to the following questions: "How satisfied are you currently with your maternal/paternal relationship?"; "Do you have a good relationship with maternal figure?"; "Does your maternal figure support you when you need it?"; and "How important is your maternal figure?". This score is normalized to a mean of 0 and a standard deviation of 1 and is scaled so that a higher value means a better quality relationship. *CoW* rated their relationship with their mothers to be 0.1 of a standard deviation worse than their peers. The DJI also allows us to construct another measure of the child's perceived quality of life at home, as reported in the difficult family score. This score is composed from answers to questions on a four-point scale regarding "whether there are frictions in the family", "whether one can speak about anything", "whether we have fun together" and "whether we all go our own ways." A higher value of this normalized score reflects a less integrated family. Again, according to our results, *CoW* rated their family life much more poorly than their peers (0.2 of a standard deviation).

[Table 6 around here]

Similarly, at age 17, the SOEP includes a substantial number of questions on children's perceived quality of their maternal relationship and the support received. We focus on two concepts: "Mother Shows that she Loves You," from which we generate a dummy variable ("Mother Loves Me") that takes the value 1 for answering 'very often' and 0 otherwise; and "Supportive Parenting," which is derived from a multi-item scale of nine questions described and tested extensively in Weinhardt and Schupp (2011). A strong first indicator of maternal attachment is whether teenagers feel (very often) loved by their mothers. Our estimate in Table 6 indicates that *CoW* are 37% less likely to be in this category, suggesting a much lower level of maternal attachment. Finally, we use an overall measure of 'supportive parenting' to gauge maternal participation in the child's life and how much the parent involved the child in decision-making. This reveals that *CoW* report a much lower level of maternal support on average, at 0.3 of a standard deviation lower, compared with other children[23].

[23] The DJI and the SOEP also contain measures of conflict between the child and his/her mother, which were revealed to be much more frequent for *CoW*. However, as rightly pointed out by the editor, conflict is not a monotonic indicator of parenting quality, and a mother who does not monitor her son will often have few fights with him, while the reverse can also be true. Since monitoring children's behavior is mostly considered a

These very robust findings on poorer maternal relationship quality and the lower perceived support received by *CoW* at different points in their childhood are important for two reasons. First, they are perhaps surprising given that one might have assumed that women who had children during uncertain economic times may have wanted them relatively 'more' and would have been expected to be more attached to their child later in life. Second, they point to a potentially crucial, yet often unexplored channel by which selection into motherhood links to parental skills that drive the child's later outcomes. To further explore these issues, we carry out two extensions that exploit the unique nature of the SOEP data to further test parental selection in bad economic times.

5.3 Testing Parental Selection in Bad Economic Times

5.3.1 Direct Evidence of Selectivity into Fertility in Bad Times

Thus far, we have provided a wealth of evidence that the women who had children in the aftermath of the fall of the Wall where, *on average*, negatively selected, and we have attributed this selection to the high level of economic uncertainty during this period. To more directly test this mechanism, we exploit the longitudinal information in the SOEP to combine answers for all women who answered three relevant questions about (i) economic uncertainty, (ii) fertility decision and (iii) education level. We regress the probability of having a child in the period 1991-1993 on education level for all women aged 17 to 47 who were interviewed in the SOEP on a measure of economic uncertainty in year *t-1* (i.e., dummy for being 'very worried' about 'the general economic development')[24]. We find that perceived economic uncertainty is negatively related to fertility decision in the following year for all women, confirming our previous cohort level evidence. We subsequently include an interaction of years of education and economic uncertainty in the probability model that we estimate, and the interaction is negative and significant.

[Figure 5 about here]

positive parental trait, this creates a reverse causality problem, and we therefore do not report these results here. They can be found in an earlier version of the paper, however (see Chevalier and Marie 2015).

[24] The model also includes education, age and year dummies, and the standard errors are clustered at East level to account for important common age shocks on fertility which are likely to be different between East and West Germany.

This is best illustrated in Figure 5, which reports the estimated probability of giving birth by education level, split by level of worry about the economy in the previous period. An initial observation is that more worried women (solid line) are less likely, on average, to have a child a year later. Interestingly, at a low level of education, there is little difference in the probability of giving birth between the very and not so worried women. By contrast, at a higher level of education, a fertility gap opens between the two groups to such an extent that highly educated women who are very worried about the economy are 50% less likely to give birth in the next period compared with those of the same education level who are not worried. This evidence reinforces our argument that economic uncertainty not only affects the fertility of mothers but also their selection, whereby those with disproportionally unfavorable characteristics are less responsive to economic shocks.

5.3.2 Worse Mothers or Bad Times?

Finally, despite strong evidence of parental selection, the differences in the characteristics and behavior of the *CoW* could also be consistent with the fetal programing (Barker [1995]) and early life adversity (Conti and Heckman [2013]) hypotheses. For example, Aizer, Stroud and Buka (2015) show that maternal stress in utero has long-term negative consequences for children and that this effect is stronger for low socioeconomic status mothers. Due to the high level of uncertainty faced by mothers after the end of communist-ruled East Germany, these children could have experienced heightened levels of stress in the womb and during their very early years. In turn, this could have shaped their preferences and behavior in the way to cope with such a world, which may have caused the lower outcomes that we have observed for these children. Is this a credible explanation, and what could we do to test for this underlying mechanism? In any case, our previous results indicating that the mothers of *CoW* had worse parental skills and that these children performed worse than their peers who grew up in the same environment are difficult to reconcile with this theory alone. Nonetheless, we propose two simple robustness tests of the early life adversity hypothesis.

First, we run a placebo regression whereby the *CoW* treatment is redefined as children born between March 1986 and July1989 and drop all children born from August 1990 onwards. These children were conceived before any social unrest started in East Germany, but they started school in re-unified Germany. As such, they were not selected at birth but did

experience the disruption and stress of the regime change at a young age. For this cohort, we do not observe any significant negative effects on educational attainment or supportive parenting compared to our control groups. This confirms that the negative effects found for the *CoW* are driven by parental selection and not directly by the disruptive economic and social environment during early childhood.

Additionally, we provide a stronger test to see whether the *CoW* effects are driven by parental selection by using the family identifier in the SOEP and identifying all children born between January 1987 and July 1989 who have brothers or sisters born between August 1989 and December 1993 in East Germany. We label these children *CoW Siblings*. These children could not have been "programed" since they were born before the transition period that followed the collapse of the Berlin Wall and—in the absence of negative parental selection—should not report different outcomes than other children. If they do, it would strongly indicate that the negative outcomes that we have observed are due to the poorer parenting skills of their (shared) mothers rather than because *CoW* were born in difficult economic times. For this sample, we conduct an estimation akin to our general DiD approach to estimate the education and mother-child relationship outcomes observed at age 17 in SOEP, albeit with the main coefficient of interest now the dummy of being a *CoW Sibling* born before the fall of the Berlin Wall.

[Table 7 around here]

The estimates reported in Table 7 indicate that *CoW Siblings* also display relatively worse outcomes on a number of our educational attainments. In particular, they are 50% more likely to have repeated a grade by age 17 and are as likely as their younger siblings to have dropped out (although not significantly due to the smaller sample size). Similarly, they report a poorer quality relationship with their mothers. The estimated coefficients on 'mother loves me' and 'supportive parenting' are very similar for the older and younger siblings, indicating that this is likely to be a mother's characteristics. Since *CoW* siblings experienced the relatively stable times of the old regime while in the womb and during their very early life, this strongly supports the notion that the observed effects for the *CoW* are due to negative parental selection and not to fetal programing, which we thus reject as the underlying mechanism behind our findings[25].

[25] An alternative way to test that the *CoW* effects are driven by family characteristics rather than the economic and social environment is to run a family fixed effect model. This directly compares the parenting skills and

6. Conclusion

This paper highlights that the economic environment can strongly influence not only cohort sizes but also cohort composition. Using the natural experiment created by the fall of the Berlin Wall and the subsequent temporary collapse of fertility in East Germany, we report that children born during the transitional time of great economic uncertainty performed worse on various dimensions of their schooling. These effects are driven by differences in the observable characteristics of mothers as well as by dissimilarities in behavior; for instance, mothers who conceived in the aftermath of the fall of the Berlin Wall provided less educational inputs to their children and had lower emotional attachments. The differences are also observed for their older children who were conceived at the time of the relative economic stability associated with the communist regime, thus highlighting that the results are driven by parental selection and not a specific "time of birth" effect.

Our findings concerning the large effects of parental selection on the outcomes of future generations have important implications for policy planners. First, rather than basing decisions regarding public investment on cohort size only, there is scope for adjusting these investments for cohort quality, especially if peer effects are important. In this case, despite its small size, this cohort would have benefited from additional investment to compensate for the lower parental provision. However, divergence in educational outcomes starts early, meaning that any interventions to compensate for the worse parental skills would have to take place early in childhood (Cunha and Heckman [2007]) and focus on affecting personality traits (Heckman, Pinto and Saveleyev [2013]). There is however scope to try and cancel out the negative impact of parental selection on children's educational outcomes with pre-school programs since the positive longer term impact of such interventions have been estimated to be almost symmetrically equivalent to our estimates (Anderson [2008] and Deming [2009]).

Our findings also suggest that certain women will choose to have children even if the conditions for making this decision are less than optimal. The problem is that women who did not adjust their fertility to economic uncertainty were also the ones with less human capital

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educational outcome of siblings after accounting for the unobservable fixed family characteristics. If the *CoW* effects are driven by parental selection, we would expect that the within-family estimates would be insignificant. Indeed, we find that the within-family sibling educational outcome differences are close to zero for *CoW*. The effects on parenting competence are also insignificant but are admittedly much less precisely estimated—see Table A3 in the on-line appendix. Altogether, these tests support that conclusion that the poorer outcomes observed for *CoW* are driven by negative parental selection rather than "time of birth" effects.

and lower parenting skills. This suggests that people who actively plan the timing of fertility make better parents, while for others, influencing their conception behavior is probably not feasible. However, there are opportunities for interventions aimed at improving parental skills even before the child is born. Experimental evidence on the impact of home visiting programs aimed at at-risk mothers and their family that start before the birth of the child, such as Preparing for Life in Dublin (Doyle et al [2013]), Pro Kind in Germany (Sandner [2012]) and Healthy Families America (LeCroy and Crysik [2011]), are promising. The real challenge remains to find a way to efficiently target such interventions at the right mothers/children when the selection effects are driven by typically unobservable characteristics like emotional attachment and parental educational input. Additionally, timing of birth within the business cycle could be used as a new additional indicator to identify mothers and target children from cohorts as being at greatest risk of poor educational outcomes.

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Table 1: Test scores and related outcomes at age 10 and 15

	CoW	Mean	Effect size	Obs,
At age 10- IGLU 2001				
Normalized reading score	-0.150** (0.074)	n.a.	n.a.	5,036
Overall reading score <p(10)	0.056** (0.024)	0.085	0.660	5,036
Overall reading score > p(90)	0.002 (0.021)	0.104	0.000	5,036
At age 15- PISA 2006				
Norm. Math score	-0.064*** (0.022)	n.a.	n.a.	28,008
Math score <p(10)	0.023*** (0.009)	0.083	0.280	28,008
Math score > p(90)	0.008 (0.010)	0.105	0.070	28,008
Norm. Reading score	-0.078*** (0.020)	n.a.	n.a.	28,008
Read score <p(10)	0.017** (0.008)	0.075	0.224	28,008
Read score > p(90)	0.002 (0.010)	0.105	0.022	28,008

Notes: *CoW* is defined as respondents born from August 1990 to December 1990 and schooled in East Germany. Estimates are weighted to account for sample design and non-response. Standard errors are clustered at the school level.
IGLU Control: Gender, mother born abroad, father born abroad, number of children in household. month and year of birth dummies, post-August 1990 birth and a school fixed effect.
PISA Control: Gender, mother born abroad, father born abroad, month of birth dummies (all children are born in 1990), post-August 1990 birth and a school fixed effect.

Table 2 – Self-Reported School Outcomes of the *Children of the Wall* at Ages 12 and 17

	Age 12 – DJI			Age 17 - SOEP		
	Repeated Grade	**Learning Easy**	**Gets on Well with Peers**	**Low Track**	**Repeated Grade**	**School Drop-Out**
Child of the Wall (East * Transition)	0.065*** (0.008)	-0.066** (0.027)	-0.125** (0.048)	0.027* (0.014)	0.022 (0.024)	0.018*** (0.005)
Born East	-0.020 (0.013)	0.002 (0.012)	0.008 (0.037)	-0.050*** (0.011)	-0.036*** (0.004)	-0.001 (0.003)
Born Transition (i.e., Aug 1990 – Dec 1993)	0.010 (0.011)	-0.004 (0.018)	0.131*** (0.028)	-0.054*** (0.015)	-0.011 (0.017)	-0.034*** (0.006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.147	0.163	0.654	0.084	0.211	0.036
Effect size at mean	0.449	-0.402	-0.190	0.321	0.103	-0.498
Sample Size	1,450	1,451	1,451	3,506	3,497	3,636

Note: *CoW* is an interaction of living in East Germany and being born between August 1990 and December 1991 for the DJI and an indicator of being born in East Germany between August 1990 and December 1993 for the SOEP. DJI estimates are re-weighted to account for design and non-response. Robust standard errors clustered by child year of birth and East/West reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively.
DJI: Repeat grade is a dummy variable taking the value 1 if pupil reports to have already repeated a grade. 'Learning easy' and "Get on Well with Peers" are dummy variables taking the value 1 if the pupil completely agrees (on a four-point scale) to these questions. The controls used in all DJI specifications include gender, gender, mother's age, number of siblings, as well as year and month of birth dummies.
SOEP: All information is taken from questions asked to individuals aged 17 between 1990 and 2012 (i.e., born 1982 to 1995). 'Low Track' indicates that the individual reports being enrolled in the lowest educational track of the German school system (i.e., *Hauptschule*). The controls used in all SOEP specifications include controls for gender, mother's age, number of siblings, birth order, as well as year and month of birth dummies.

Table 3 – Positive or Negative Selection?
Differences in Characteristics of Mothers of the 'Children of the Wall'

SOEP	Age Mother	Teenage Mother	Years of Education	High School	Employed
Child of the Wall (East * Transition)	-0.638*** (0.218)	0.034** (0.015)	-0.715*** (0.125)	-0.078*** (0.019)	-0.116*** (0.027)
Birth East	-2.858*** (0.063)	0.064*** (0.008)	0.886*** (0.055)	0.135*** (0.010)	0.039*** (0.012)
Birth Transition (i.e., August 1990-December 1993)	1.257*** (0.088)	-0.040*** (0.013)	0.335*** (0.036)	0.015 (0.012)	0.046** (0.021)
Age of Mothers	No	No	Yes	Yes	Yes
Mean value of outcome	26.47	0.058	12.258	0.872	0.774
Effect size at mean	-0.024	0.586	-0.058	-0.088	-0.150
Sample Size	4,420	4,420	4,358	4,420	4,420

Note: Based on SOEP waves 1990 to 2012 for all women who had a child in East or West Germany between 1982 and 1995. All specifications include number of children and child year of birth dummies. Robust standard errors clustered by child year of birth and region reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively.

Table 4 – Family Composition *at Age 12* (DJI) and *Age* 17 (SOEP)

	At age 12 (DJI) *As Reported by the Child*			At age 17 (SOEP) *As Reported by the Mother*		
	Lives with Father	**Experienced Divorce/ Separation**	**Experienced New Partnership**	**Still with Father**	**Married Now**	**Never Married**
Child of the Wall (i.e., East * Transition)	-0.100*** (0.008)	0.064** (0.020)	0.090* (0.040)	-0.067*** (0.017)	-0.033** (0.013)	0.046*** (0.011)
Born East	-0.106*** (0.010)	0.059*** (0.008)	0.057*** (0.006)	-0.011 (0.015)	-0.058*** (0.011)	-0.015** (0.006)
Born Transition (i.e., Aug 1990 – Dec 1993)	0.035 (0.030)	-0.084* (0.040)	-0.061 (0.018)	-0.159*** (0.007)	-0.013** (0.005)	-0.037** (0.010)
Mean value of outcome	0.780	0.191	0.153	0.618	0.721	0.059
Effect size at mean	-0.129	0.334	0.589	-0.109	-0.046	0.792
Sample Size	1,445	1,441	1,441	4,420	4,420	4,420

Note: *CoW* is the interaction of being born between August 1990 and December 1991 (DJI) or being born between August 1990 and December 1993 (SOEP), and living in East Germany. Robust standard errors clustered by child year of birth and East/West reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively. Effect size is measured as the effect of *CoW* at the mean value for the variable: this is not reported for normalized scores.
DJI: Additional controls include year and month of birth, gender, age of mother and number of siblings. The variables of interest are defined as follows: Experienced data: Positive answer to "Have you experienced the following event …?";.
SOEP: Based on 1990 to 2012 waves for all women who had a child in East or West Germany between 1982 and 1995. All specifications include number of children and child year of birth dummies.

Table 5: Parental Education Inputs and Income when Child is Aged 10 to 17

	COW	Mean	Effect Size	Obs,	Cond. Track
At age 10 IGLU					
Pre-school reading activity	-0.186*** (0.063)	n.a.	n.a.	4,976	No
Parent reading score	-0.164*** (0.070)	n.a	n.a.	5,220	No
Number of books at home	-16.744*** (5.596)	83.12	-0.201	5,765	No
At age 12: DJI					
Parents care about school	-0.108*** (0.040)	n.a	n.a.	1,446	No
At age 15: PISA					
Homework hours	-0.298* (0.167)	8.134	-0.04	27,126	Yes
Courses outside school	-0.068*** (0.016)	0.352	-0.194	28,008	Yes
Education Resources	-0.066** (0.031)	n.a	n.a.	27,968	Yes
Wealth	0.005 (0.031)	n.a	n.a.	27,997	Yes
At age 17: SOEP					
Household Raw Income	-0.153** (0.058)	n.a	n.a.	4,420	No
Household Net Income	-0.071 (0.058)	n.a	n.a.	4,420	No

Note: In IGLU and PISA, *CoW* is defined as respondent born from August 1990 to December 1990 and schooled in East Germany. For DJI, *COW* is defined as being born between August 1990 and December 1993 and currently living in the East. For *SOEP*, COW is defined as being born from August 1990 to December 1993 from a mother who lived in the East in 1989. Estimates are weighted to account for sample design and non-response. Standard errors are clustered at the month/year * region level. In all surveys, controls are gender, age of mother, month of birth dummies and post-August 1990 birth. In IGLU, number of siblings and school fixed effects are also included; in DJI, number of siblings is also included, in PISA, dummies for parents born abroad and school fixed effects are included; IGLU: Pre-school reading is a normalized score of activities that parents engaged in (often, sometimes, never) before the child entered school. The activities are read, tell stories, sing, play with alphabet toys, reading games on computer, word games, write letters, read signs, watch programs teaching how to read. Parent reading score is a normalized score of answers (Every day, Once a week, Once a month, Never) to "How often read aloud to child?" and "How often listen to child read aloud?". Number of books is the average of the child and parents' report on the number of books at home. DJI: Parent care about schooling is a normalized score of answers on a four-point scale to the question "How important is your school performance to your parents, my parents support me with problems at school, my parents attend school meetings". PISA: "home work hours" is the sum of the self-reported amount of time spent studying for Science, Math, German and other subjects. "Courses outside school" is an indicator of whether the pupil has additional courses on subject also studied at school. "Wealth" is a normalized score based on answers to the following "have a desk", "own room", "a quiet place to study", "a computer", "internet link", "DVD player", "Dish-washer". SOEP: Household Raw Income is created from the average income reported yearly from 1990 and 2010 by women who had a child between 1982 and 1995. Household Net Income is the self-reported average income for the same 20 year period after accounting for social transfers. All specifications include number of children and child year of birth dummies.

Table 6 – Maternal Relationship and Support as Reported by Children at age 12 and 17

	Age 12 (DJI)		Age 17 (SOEP)	
	Relationship with Mother	**Difficult Family Index**	**Mother Loves Me**	**Supportive Mother Index**
Child of the Wall (i.e., East * Transition)	-0.110*** (0.015)	0.206*** (0.036)	-0.173** (0.063)	-0.304*** (0.094)
Born East	0.120*** (0.007)	-0.062 (0.037)	0.031* (0.017)	0.138** (0.059)
Born Transition (i.e., Aug 1990 – Dec 1993)	0.222*** (0.025)	-0.263*** (0.028)	-0.022 (0.039)	-0.443*** (0.156)
Mean value of outcome	n.a.	n.a.	0.460	n.a.
Effect size at mean	n.a.	n.a.	-0.368	n.a.
Sample Size	1,402	1,427	3,477	3,413

Note: *CoW* is the interaction of being born between August 1990 and December 1991 (DJI) or being born between August 1990 and December 1993 (SOEP), and living in East Germany (or mother lived in East Germany in 1989 for SOEP). Robust standard errors clustered by child year of birth and East/West reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively. Effect size is measured as the effect of *CoW* at the mean value for the variable: this is not reported for normalized scores.

DJI additional controls include year and month of birth, gender, number of siblings and mother's age. The variables of interest are defined as follows: relationship with mother: normalized score based on the sum of answers to the following questions: "How satisfied are you currently with your maternal/paternal relationship?", "Do you have a good relationship with maternal/paternal figure?", "Does your maternal/paternal figure support you when you need it?", and "How important is your maternal/paternal figure?". Difficult family is a normalized score from the sum of answers to the following questions "I'm happy with my family", "our family argues", "we can speak about anything", "Everyone can do what they want", "we have fun together".

SOEP: All specifications include controls for gender, mother's age, number of siblings, birth order, year and month of birth. The variables of interest are defined as follows: Mother Loves Me comes from the question "Mother Shows that she Loves You", from which we generate a dummy variable that takes the value 1 answer is 'very often' or 'often' and 0 otherwise. Supportive Parenting is derived from a multi-item scale of nine questions as described in Weinhardt and Schupp (2011).

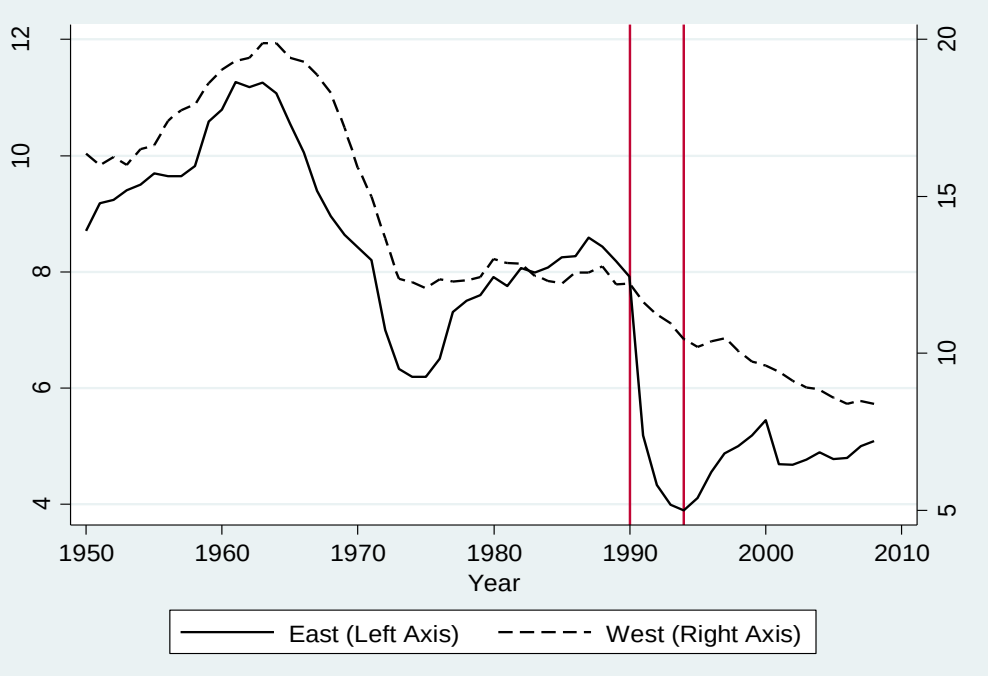
Table 7: Educational Attainment and Maternal Relationship at Age 17 of *CoW Siblings*

	Educational Outcome			Maternal Relationship	
SOEP – Age 17	**Low Track**	**Repeated Grade**	**School Drop-Out**	**Mother Loves Me**	**Supportive Mother Index**
Sibling of a Child of the Wall (i.e., CoW * Pre-Transition)	-0.037 (0.028)	0.121*** (0.037)	0.027 (0.017)	-0.134*** (0.039)	-0.250** (0.116)
Born East	-0.035** (0.012)	-0.051** (0.014)	-0.001 (0.006)	0.051** (0.020)	0.212 (0.063)
Sibling Born Pre-Transition (i.e., Jan 1987 – Jul 1990)	0.024 (0.015)	-0.028 (0.025)	-0.017** (0.007)	0.064** (0.029)	0.246** (0.112)
Controls	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.093	0.223	0.037	0.427	-
Effect size at mean	-0.404	0.544	-0.724	-0.314	-
Sample Size	1,995	1,988	2,072	1,944	1,906

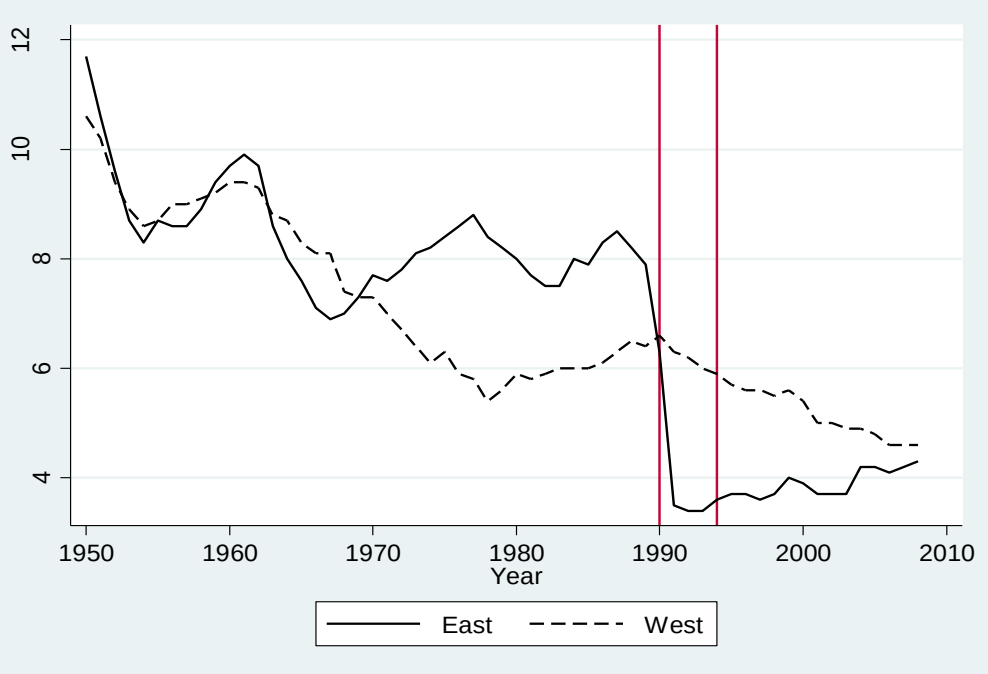
Note: *CoW Sibling* is an indicator of being born between January 1987 and July 1990 and having a brother or sister born in East Germany between August 1990 and December 1993 (i.e., a *CoW*). All specifications and definitions of outcome variables are as in Table 2 and 6 above for SOEP results. Robust standard errors clustered by child year of birth and East/West are reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively.

Figure 1: Birth and Marriage Rates in East and West Germany from 1950 to 2008

A) Annual Crude Birth Rate per 1,000 Women from 1950 and 2008

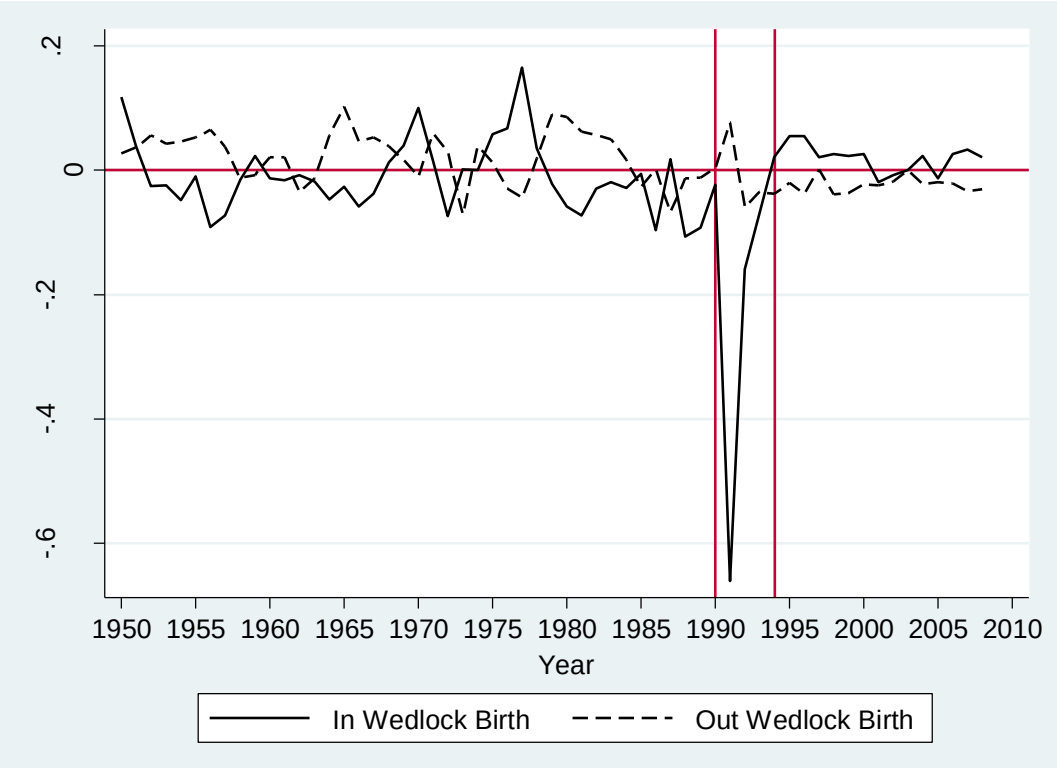


B) Annual Marriage Rate per 1,000 Inhabitants from 1950 to 2008



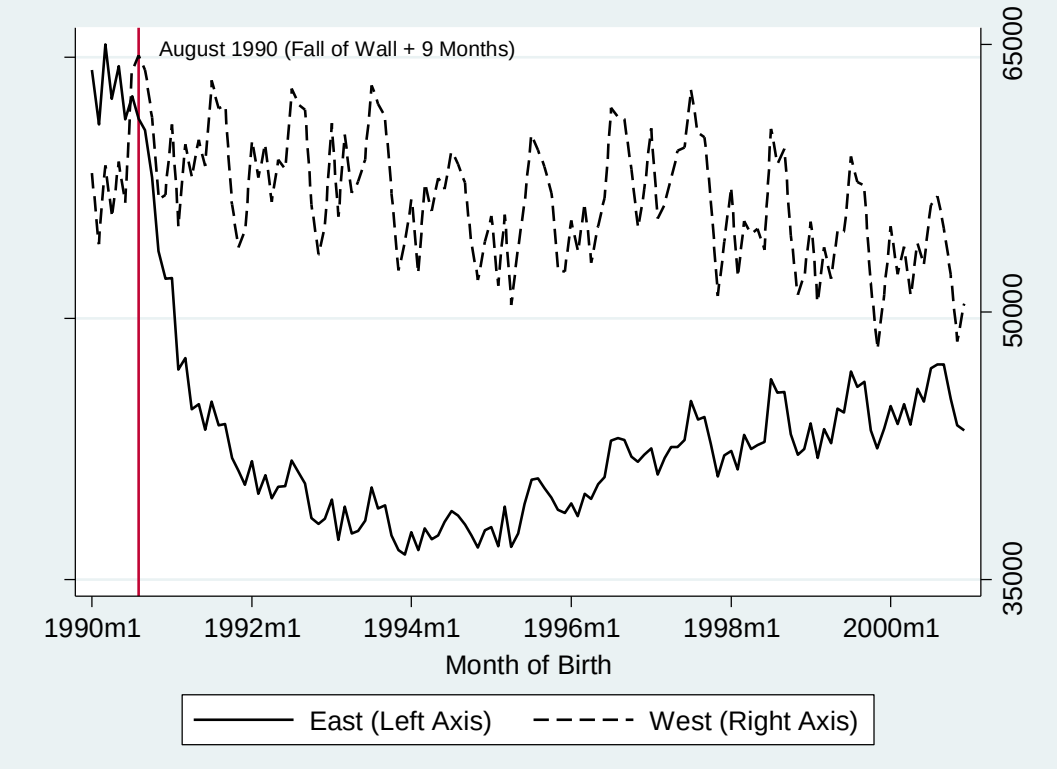
Notes: Authors' own calculations based on administrative population data from the Federal Institute for Population Research (http://www.bib-demografie.de). East refers to the former East Germany Länders and West to the territories of the formal Federal Republic. Berlin is omitted.

Figure 2: Birth Rate by Marital Status (In and Out of Wedlock)
Year-on-Year Difference between East and West Germany from 1950 to 2008



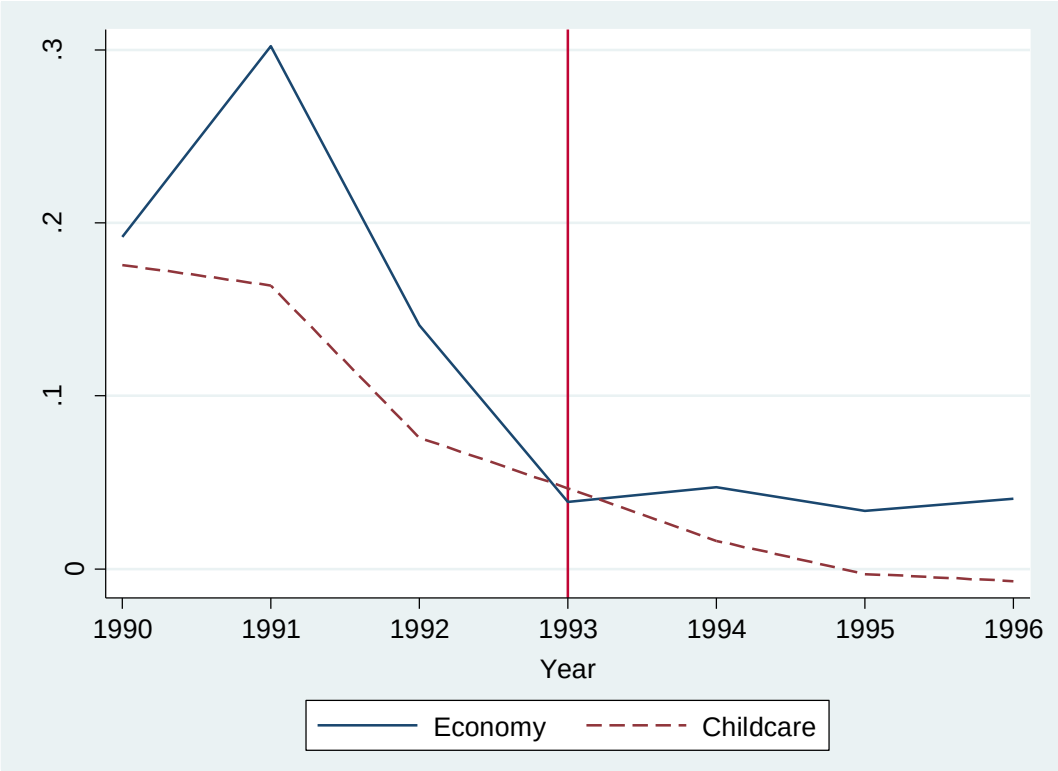
Notes: Graph shows the difference-in-differences coefficients of the change in the year-on-year birth rate by marital status between East and West Germany. Authors' own calculations based on administrative population data from the Federal Institute for Population Research.

Figure 3: Monthly Number of Births in East and West Germany from 1990 to 2000



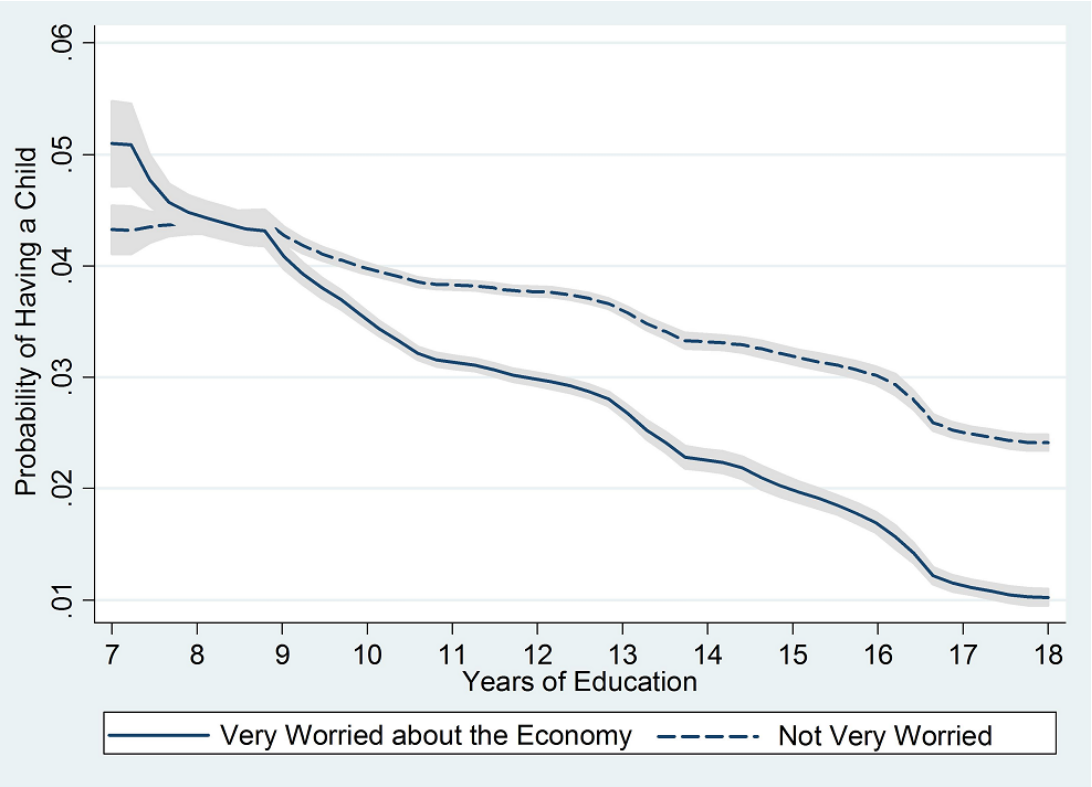
Notes: Administrative birth data from the Federal Institute for Population Research

Figure 4: Difference in the Proportion of East and West Germans who are Very Worried about the Economy or Childcare from 1990 to 1996



Note: The graphs are based on the difference in the proportion of East and West Germans responding 'very' (other possible answers: 'somewhat' or 'not at all') to questions asked yearly in the SOEP concerning an individual's level of worry about "the general economic development" and "childcare availability".

Figure 5: Economic Uncertainty and Fertility Decision:
Probability of Having a Child by Economic Worry and Education Level



Note: The graph plots the estimated probability of having a child in the period 1991-1993 separately for individuals reported to be very worried about the economy ('very' = 1 and 'somewhat'/'never = 0) or not by years of education for all women aged 17 to 47 surveyed in SOEP during this period. The probit model that generates these coefficients also includes education, age and year dummies. The gray area represents the 95 percent confidence intervals.

Online Appendix Tables with Additional Results – Not for Publication

Table A1: Test Scores at age 15 – Placebo Cohort (i.e., Using PISA 2003 and Treatment: Born from August 1987 to December 1987 and Schooled in East Germany)

Placebo Treatment	***PLACEBO***	Mean	Effect size	Obs,
At age 15- PISA 2003				
Norm. Math score	-0.023 (0.020)	n.a.	n.a.	31,716
Math score <p(10)	-0.003 (0.008)	0.099	-0.034	31,716
Math score > p(90)	0.008 (0.008)	0.100	0.085	31,716
Norm. Reading score	-0.031 (0.022)	n.a.	n.a.	31,716
Read score <p(10)	0.014* (0.008)	0.100	0.139	31,716
Read score > p(90)	0.025*** (0.009)	0.100	0.251	31,716

Notes: *Placebo* is defined as respondents born from August 1987 to December 1987 and schooled in East Germany.
Estimates are weighted to account for sample design and non-response. Standard errors are clustered at the school level. PISA Control: Gender, mother born abroad, father born abroad, month of birth dummies (all children are born in 1990), post-August 1990 birth and a school fixed effect.

Table A2 – Education and Support at Age 17 for Placebo Cohort (Treatment: Born East in 3 Years and 5 Months before Fall of Wall)

	Educational Outcome			Maternal Relationship	
SOEP – Age 17	**Low Track**	**Repeated Grade**	**School Drop-Out**	**Mother Loves Me**	**Supportive Mother Index**
Placebo Cohort (i.e., East * Pre-Transition)	-0.022 (0.016)	-0.000 (0.016)	-0.003 (0.006)	-0.016 (0.026)	-0.071 (0.129)
Born East	-0.040*** (0.011)	-0.054*** (0.012)	0.001 (0.005)	0.042* (0.021)	-0.162 (0.053)
Born Pre-Transition (i.e., Mar 1986 to Jul 1989)	0.082*** (0.012)	0.021 (0.025)	-0.005 (0.012)	0.018 (0.052)	0.369** (0.128)
Controls	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.085	0.214	0.037	0.456	-
Effect size at mean	-0.259	-0.001	-0.072	-0.034	-
Sample Size	2,729	2,721	2,834	2,696	2,629

Note: Robust standard errors clustered by child year of birth and East/West reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively. Effect size is measured as the effect of *Placebo* at the mean value for the variable: this is not reported for normalized scores. All specifications include controls for gender, mother's age, number of siblings, birth order, year and month of birth. The variables of interest are defined as follows: 'Low Track' indicates that the individual reports being enrolled in the lowest educational track of the German school system (i.e., *Hauptschule*). Mother Loves Me comes from the question "Mother Shows that she Loves You", from which we generate a dummy variable that takes the value 1 answer is 'very often' or 'often' and 0 otherwise. Supportive Parenting is derived from a multi-item scale of nine questions as described in Weinhardt and Schupp (2011).

Table A3 – Education and Support at age 17 – Family Fixed Effects Evidence

	Educational Outcome			Maternal Relationship	
SOEP – Age 17	**Low Track**	**Repeated Grade**	**School Drop-Out**	**Mother Loves Me**	**Supportive Mother Index**
Child of the Wall (i.e., East * Transition)	0.072 (0.045)	-0.005 (0.087)	0.007 (0.034)	-0.099 (0.106)	0.222 (0.352)
Born East	-0.012 (0.165)	0.207 (0.185)	-0.028 (0.030)	0.115 (0.239)	-0.280 (1.170)
Born Transition (i.e., Aug 1990 to Dec 1993)	-0.113* (0.057)	-0.013 (0.065)	-0.045 (0.043)	0.095 (0.082)	0.203 (0.464)
Controls	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.084	0.211	0.036	0.460	-
Effect size at mean	0.854	-0.024	0.184	-0.215	-
Sample Size	3,506	3,497	3,636	3,477	3,413

Note: Robust standard errors clustered by child year of birth and East/West reported in parenthesis. *, **, and *** denote significance at the 1, 5, and 10 percent level, respectively. Effect size is measured as the effect of *CoW* at the mean value for the variable: this is not reported for normalized scores. All specifications include controls for gender, mother's age, number of siblings, birth order, year and month of birth. The variables of interest are defined as follows: 'Low Track' indicates that the individual reports being enrolled in the lowest educational track of the German school system (i.e., *Hauptschule*). Mother Loves Me comes from the question "Mother Shows that she Loves You", from which we generate a dummy variable that takes the value 1 answer is 'very often' or 'often' and 0 otherwise. Supportive Parenting is derived from a multi-item scale of nine questions as described in Weinhardt and Schupp (2011).