DISCUSSION PAPER SERIES

IZA DP No. 9004

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

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April 2015

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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Discussion Paper No. 9004
April 2015

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IZA Discussion Paper No. 9004
April 2015

ABSTRACT

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

After the fall of the Berlin Wall, East Germany experienced an unprecedented temporary drop in fertility driven by economic uncertainty. Using various educational measures, we show that the children born during this nativity slump perform worse from an early age onwards. Consistent with negative selection, mothers who gave birth in that period had worse observed personal characteristics. These children are also less likely to have grown up within stable family environment. Investigating underlying mechanisms reveals that parental educational input and emotional attachment were also lower for these children. Finally, sibling analysis enables us to reject time of birth effects.

JEL Classification: J13, I20

Keywords: parental selection, fertility, economic uncertainty, education

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* We thank Derek Neal and two anonymous referees for their comments on an earlier version of the manuscript. We are also grateful for feedback on previous versions of the paper from Rajeev Dehehjia, Thomas Dohmen, Nicola Fuchs-Schündeln, Gauthier Lanot, João de Mello, Christian Traxler, Tanya Wilson, Justin Wolfers and participants at various workshops, conferences and seminars. Note that part of the text is similar to an earlier version of this work looking at a different outcome. This version supersedes the previous one. We also want to thank IQB–Berlin for providing us access to the IGLU2001 and PISA German Oversamples datasets, as well as DJI and DIW for granting us access to the DJI survey and SOEP, respectively. Chevalier would like thank the British Academy (MD133047) and GSBE (M.11.5122) for grants that made this research possible. Marie is grateful for financial support for this research from the Netherlands Organization for Scientific Research (NWO Veni # 451.12.005).

1. Introduction

This paper documents how the socio-economic 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, focusing on family composition and parenting behavior that could lead to negative effects on education. The results confirm the large effect of parental selection. Further tests dismiss alternative explanations for the worse 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 (2012) 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 parental time investment, it also prompts a positive substitution effect that pushes the demand for children in the opposite direction. Which effect is stronger is a priori ambiguous but since fertility is pro-cyclical, the income effect appears to dominate overall. However, the relative size of the income and substitution effects may differ across family types, leading to the economic environment 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 less educated ones. 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, in a mechanism that Currie, Duque and Garfinkel (2015) confirm 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 variations in the economic environment, which were largely unexpected. More precisely, following the fall of the Berlin Wall and the collapse of the collectivist socio-economic system, East Germany went through a period of high economic uncertainty. Concomitantly, the fertility rate in the former GDR was more than halved over a three-year

period, an unprecedented peace-time event, before stabilizing[1]. Throughout the manuscript, we refer to these cohorts born in the Eastern Länder[2] 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 creates 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 socio-economic environments when 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 and we thus apply 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 (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, by contrast, we would 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.

Third, the literature on parental selection has been mostly unable to comprehensively document certain parental characteristics that are likely to be associated with both fertility

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

[2] Throughout the paper, we will use "Land" 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 is Länder.

selection and children's outcomes. We fill this gap by exploiting very rich individual level datasets with information on mother and child 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 previously 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 from the possible adverse economic environment that they and their mothers faced. For example, the fetal programming hypothesis (Barker, 1995) asserts that parental stress while in the womb can lead to abnormal emotional control (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 [2012], 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* with their older siblings born in the economically stable times of East Germany. These older siblings are mostly expected to display similar outcomes if these are driven by 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 birth rate observed in East Germany just after the fall of the Berlin Wall and especially the drop in in-wedlock birth. We subsequently offer a number of explanations as to why it happened in the context of the historical and institutional background, whereby the very high level of economic uncertainty

[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.

in East Germany in the years following German reunification emerges as the main reason for the fertility reduction. In the absence of any national test, we exploit German oversamples at two international tests (Progress in International Reading Literacy Study or PIRLS and Program for International Student Assessment or PISA) to objectively assess the performance of *CoW* at ages 10 and 15, compared to their classmates. 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 worse outcomes of the *CoW*, we investigate the selection into parenthood of the mothers of these children. Using our various sources, we report strong evidence of the negative selection 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 come from poverty as families with children born after the fall are not poorer, thanks to the relatively large social transfers. The various datasets allow us to further explore the possible mechanisms that could explain the worse educational outcomes of *CoW*, whereby we uncover substantial differences in parental behavior; for instance, these parents were less likely to read to their children and more 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 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 parents' characteristics and behavior. Second, the test score analysis involves comparing children in the same school born only a few months apart, as such environmental differences cannot explain the large differences in educational attainment. While one could still agree that the timing of the stress while in the womb matters, the *CoW*s' older siblings - who were born under the stable times of the communist regime - also had worse educational outcomes and

poor relationships with their mothers. A final 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 women's education level, her believes 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 have children, but also that crucially this response was much stronger for women with higher levels of education.

Our findings clearly show that the cohort of children born during the period of substantial economic uncertainty that we study 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 on its composition. Second, since remedial policies are most effective when taking place 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 those skills could thus 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 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 that 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 differences-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, before 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) being officially 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, a wall was built around the western part of the city in 1961, with the Berlin Wall 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 9th November 1989, as the borders between East and West Germany were declared opened. There was a strong political will to quickly re-unite the two countries, especially with the organization of election as early as March 1990 where the communist party in East Germany was heavily defeated. Two month 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 period of great socio-economic uncertainties 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, 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

[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 behaviour (Bursztyn and Cantoni [2012]) 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 period as we do in this paper.

the mid-1980s[5], which is the origin of the study period. 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 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 birth 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 slightly. This suggests that the cohorts born in East Germany between 1990 and 1993 were not only dramatically smaller but also negatively selected in terms of family structure.

[Figure 2 about here]

[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.

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 and pattern.

[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, as such, we define as 'Children of the Wall', the cohorts of individuals born between August 1990 and December 1993 in an Eastern Länder; 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 to 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), which 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, and the fewer 'unwanted' children in a cohort that it implies.

2.3.2 Internal Migration

One of the most important changes in the life of East Germans after the fall of the Berlin Wall was that 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

[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.

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 over 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.

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, since we allocate the treatment status based on the mother's place of residence in 1989, rather than current location. Results from the different sources point to the same mechanism, as such internal migration is unlikely to be the driver of the observed selection effects. Additionally, we run regressions based on the SOEP data using current location rather than location of the mother in 1989 to allocate treatment, to test how much internal migration may bias our results. Results from these regressions are never statistically different from those presented. As such, 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, owing to 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 if income inequality increased in the East. Can we thus still claim that economic uncertainty drove the drastic fall in the number of birth 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 allow us to track the evolution of the perception of 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 by 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 assumption that economic uncertainty was one of the main factors behind the drop in fertility in the East[10]. Since the

[9] The Population Policy Acceptance Study (PPAS) is a comparative survey of European attitudes and opinions concerning demographic changes, demographic behaviours 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

[10] Additionally, in 1991, 45% of East German workers asked about their 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

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 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 scrutiny. 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 various 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 East Germany[12]. The sampling included 4th grade children in 2001, 25 percent of whom were born before August 1990. 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 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

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] See Mulis et al. (2003) and OECD (2007) for general information on the PIRLS 2001 and PISA 2006 tests, respectively.

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

[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.

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 7) across the world. The PISA assesses the reading and math skills of students, as well as collecting survey information from pupils, parents and teachers. Typically, the testing last for about two hours per student through a combination of multiple choice questionnaires and open-ended questions. Germany over-sampled the 2006 PISA and IQB has identified for us schools located in the former East Germany, excluding Berlin, and we rely on school fixed effect models to eliminate any state-specific effects. The German sample contains 34,516 children, of whom we keep those born in 1990 in Germany (30,650), 12% of whom are *CoW* (born in or after August 1990 and currently living in East Germany).

3.1.3 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, 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 Länder 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 who live in the East. The SOEP includes detailed personal characteristics and extensive questionnaires for all members of the households, 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/relationship as reported by the children[14].

3.2 Empirical Strategy

For all outcomes, our empirical strategy relies on a difference-in-differences approach whereby we 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 enable us to naturally control for common macro shocks and time trends. The basic specification used throughout is as follows:

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

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 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 a Child of the Wall (i.e. born August 1990 to December 1993 in an Eastern Länder) or her mother and zero otherwise. 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

[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/

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 difference framework explained above, whereby we compare test results for children from the same classroom born before and after August 1990 in East and West Germany. 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[15]. We additionally control for gender, number of 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 after the fall of the Wall. The upper panel of Table 1 reports the estimate of the interaction term on three outcomes: normalized 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 classroom peers 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, whereby 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 streamed 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, whereby 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 East and West Germany. The base

[15] Threats to this assumption would be that school years are organised 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.

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[16]. Again, we find that the results are mostly driven by a worsening in the left tail of the test score distribution, whereby *CoW* are 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[17].

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 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 we control for school-specific fixed effects and compare children in the same classroom, these results are not driven by changes to the curriculum or other institutional differences that would affect only East German children born after August 1990. 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

As well as those objective measures of educational performance, 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 on well with their peers, which are two indicators of a lower taste for schooling.

[Table 2 around here]

[16] 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.

[17] 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 they are not presented to save space, but they are available upon request.

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

Overall, we have consistently found that the *CoW* display or report much worse 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 (a -0.150 of a standard deviation in reading score) to the difference in test scores between children who attended or not the Head-Start pre-school program (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 enrolment or not in the Perry Preschool (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 this phenomenon in terms of the mother's and family characteristics, as well as the perceived quality of parenting and relationship as reported by the children themselves.

5. Who Gives Birth in Times of Economic Uncertainty?

5.1 Parental Selection

5.1.1 Mothers' Socio-Economic 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 prior 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 quite different to their Western peers on average 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 women who chose to have 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 for the family structure of these children when they were 17 years old using the mother relationship history (since birth) in the SOEP: by then, *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 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 the standard observable socio-economic 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 maternal relationship, as well as parental educational input.

5.2 Parental Input and Quality

5.2.1 Parental Inputs: Educational Inputs and Income

As well as those general indicators of the quality of the relationship, the various surveys allow us to investigate the variations in parental inputs that are related to education. Here, we rely on the child survey from the IGLU (age 10), DJI (age 12/13) and PISA (age 15) to investigate differences in parental reading behavior and interest in the child's education. Moreover, we also assess whether one of the channels of worse educational performance is related to 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 results, 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[18].

[Table 5 about here]

[18] 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.

Are these differences driven by wealth/income differentials? The last row of the PISA panel in Table 5 suggests otherwise, revealing no significant difference in the average wealth of *CoW* households as measured from children's reporting on a list of items available at home. To strengthen these findings, we also assess whether *CoW* households are poorer, by computing the average gross and net income during childhood in the SOEP. Consistent with the lower employment probability of mothers and their greater propensity to live in single-headed household, *CoW* households have a lower gross income. However, due to the generosity of the German welfare net, there is no significant difference in terms of net income, meaning that the worse inputs are unlikely to be driven by poverty. In any case, it would be unclear why – without parental selection – economic deprivation would have disproportionally affected parents whose children were conceived just after the fall of the Wall.

Another possible test to show that our results are not driven by income is to include it – or other associated observable characteristics – as additional controls when measuring the impact of being born in East Germany just after the fall on the Wall on outcomes. 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.[19] This leads us to conclude that economic deprivation– or indeed, related observable characteristics of the parents – cannot be the main driver of the markedly worse educational outcome of their children.

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 skills quality. In both surveys, children answer a battery 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, as assessed by the child at age 12 (DJI) and 17 (SOEP). Note that we mostly focus here on maternal relationship and support as we have documented a large negative selectivity in the probability of these children living with their fathers.

[19] 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 parental 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. Similarly, "argument with mother" is a normalized score based on the sum of answers to questions about "How often do you have arguments about…" the following issues: manners, appearances, untidiness, going out, music, political views, friends, girl/boyfriends and help with the house. A positive value indicates a greater frequency of arguments. *CoW* reported a higher frequency of arguments with their mothers, by .04 of a standard deviation, although this coefficient is not statistically significant. Finally, the DJI allows us to construct another measure of the child's perceive quality of life at home, as reported in the difficult family score. This 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 three questions: "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; "Fight with Mother", which is derived from the answer to a four-point scale question "Argue Or Fight With Mother", from which we create a dummy variable that takes the value 1 when the answer is '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 first strong indicator of maternal attachment is whether teenagers feel (very often) loved by their mothers. Our estimate in Table 6 indicates that two-thirds of *CoW* are less likely to be in this category, suggesting a much lower level of maternal attachment. Another strong predictor of the quality of the child-parent relationship is the

frequency of fights, which is a relatively rare event, with only 4 percent of children reporting this as occurring very often. However, this probability increases by almost 150 percent for *CoW*, indicating a worsening of the maternal relationship since age 12, as arguing with mother was not significantly different for these children at that age. 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.

These very robust findings on poorer maternal relationship quality and the low 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, whereby 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. Practically, we regress the probability of having a child in the period 1991/93 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').[20] We find

[20] 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.

that perceived economic uncertainty is negatively related to fertility decision in the following year for all women, thus 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, whereby this interaction is negative and significant.

[Figure 5 about here]

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. A first 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 the 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 selections, 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 programming (Barker [1995]) and early life adversity (Conti and Heckman [2013]) hypotheses. For example, Aizer, Stroud and Buka (2009) show that maternal stress in utero has long-term negative consequences for children, and that this effect is stronger for low socio-economic status mothers. Due to the high level of uncertainty faced by mothers after the end of Communist 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 a 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 test of the early life adversity hypothesis.

First we run a placebo regression whereby the *CoW* treatment is redefined as children born between March 1986 to July 1989 and drop all children born from August 1990 onwards. These children were conceived before any social unrest started in East Germany but started schools 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 that 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 "programmed" since they were born before the uncertainty following the collapse of the Berlin Wall and - in the absence of negative parental selection - should not report different outcomes to other children, as seen above. If they do, it would strongly indicate that the negative outcomes that we have observed are due to the poorer parenting skills of the mothers they share in common 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 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 worse 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 relative certain 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 programming, which we thus reject as the underlying mechanism behind our findings[21].

6. Conclusion

This paper highlights that the economic environment strongly influences 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 conceived during the 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 selections 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 outcome 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 skills (Heckman, Pinto and Saveleyev [2013]). There is however scope to try and cancel out the

[21] 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 educational outcome and parenting skills of siblings, after accounting for the unobservable fixed family characteristics. If the CoW effects are driven by parental selection, we would indeed expect that the within family estimates would be insignificant. Indeed, we find that within sibling educational outcome differences are close to zero for CoWs. The effects on parenting competence are also insignificant apart from fighting with mothers but are much less precisely estimated – see table results in on-line appendix. Altogether, these tests support that the worse outcomes observed for CoW are driven by negative parental selection rather than a time of birth effects.

negative impact of parental selection on children educational outcome with pre-school programs since the positive longer term impact of such interventions have been estimated to be almost symmetrically equivalent (Anderson [2008] and Deming [2009]).

Our findings also suggest that certain women will always choose to have children, even if the conditions for making this decision are less than optimal. It is therefore probably not possible to design policies to change their fertility behavior but however perhaps possible to intervene at this very early stage. Experimental evidence on the impact of home visiting programs aimed at at-risk mothers and their family that start even before the birth of the child, such as Preparing for Live 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 since 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 from 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		
Panel A: Age 12/13 - DJI	**Repeated Grade**	**Learning Easy**	**Gets on Well with Peers**	**Low Track**	**Repeated Grade**	**School Drop-Out**
Child of the Wall	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 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 1991 for the DJI and an indicator of being born in East Germany between August 199 and 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 complete 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 * 1991-93)	-0.638***	0.034**	-0.715***	-0.078***	-0.116***
	(0.218)	(0.015)	(0.125)	(0.019)	(0.027)
Birth East	-2.858***	0.064***	0.886***	0.135***	0.039***
	(0.063)	(0.008)	(0.055)	(0.010)	(0.012)
Birth August 1990-93	1.257***	-0.040***	0.335***	0.015	0.046**
	(0.088)	(0.013)	(0.036)	(0.012)	(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 * 1991-93)	-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 1991-1993	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 1991 (DJI) or being born between 1991 and 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 …?"; Difficult family, 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: 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: *CoW* is defined as respondent born from August 1990 to December 1990 and schooled in East Germany – For *SOEP*, the location is based on maternal residence 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?, 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: Taken from reported income from 1990 and 2010 by women who had a child between 1982 and 1995. Net income is reported income 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	**Arguments with Mother**	**Difficult Family Index**	**Mother Loves Me**	**Fight with Mother**	**Supportive Mother Index**
Child of the Wall (i.e. East * 1991-93)	-0.110*** (0.015)	0.039 (0.032)	0.206*** (0.036)	-0.173** (0.063)	0.052*** (0.016)	-0.304*** (0.094)
Born East	0.120*** (0.007)	-0.167*** (0.024)	-0.062 (0.037)	0.031* (0.017)	-0.033*** (0.004)	0.138** (0.059)
Born 1991-1993	0.222*** (0.025)	-0.076 (0.110)	-0.263*** (0.028)	-0.022 (0.039)	-0.011 (0.017)	-0.443*** (0.156)
Mean value of outcome	n.a.	n.a.	n.a.	0.460	0.036	n.a.
Effect size at mean	n.a.	n.a.	n.a.	-0.368	1.436	n.a.
Sample Size	1,402	1,404	1,427	3,477	3,496	3,413

Note: *CoW* is the interaction of being born between August 1990 and 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, number of siblings and mother's age. The variables of interest are defined as follows: relationship with mother/father: 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?" "How important is your maternal/paternal figure?" Argument with mother/father: normalized score based on the sum of answers to questions about "How often do you have arguments about…" manners, appearances, untidiness, going out, music, political views, friends, girl/boyfriends, help with house. 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. Fight with Mother derives from the answer to a four-point scale question "Argue Or Fight With Mother", from which we create a dummy variable that takes the value 1 when the answer is 'very often' and 0 otherwise. Supportive Parenting is derived from a multi-item scale of nine questions as described in Weinhardt and Schupp (2011).

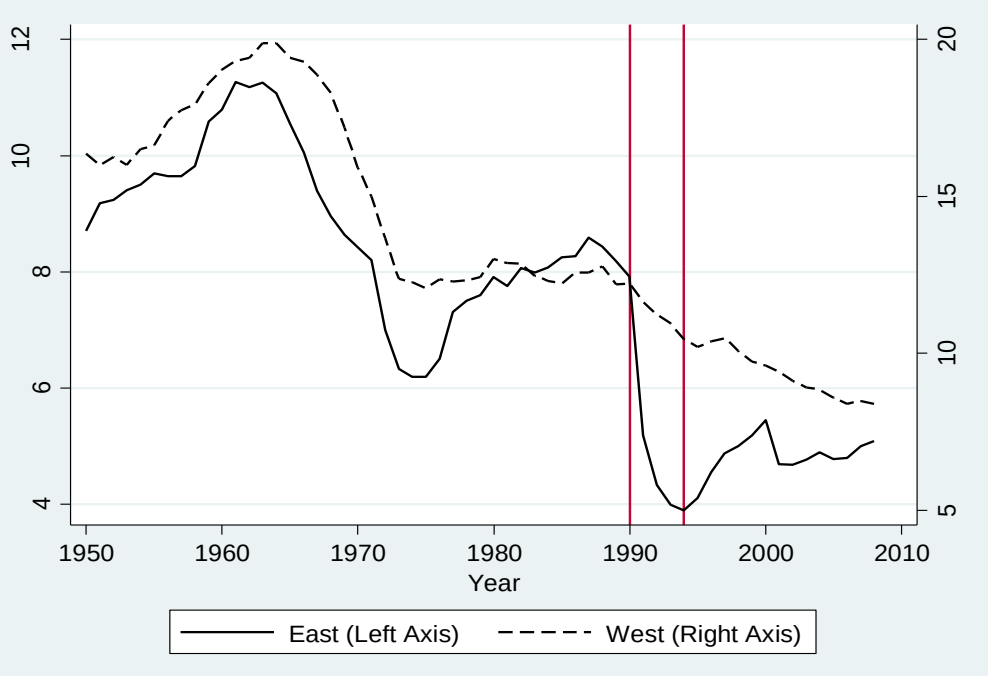
Table 7: Educational Attainment and Maternal Relationship at Age 17 of *CoW Siblings*

	Educational Outcome			Maternal Relationship		
SOEP – Age 17	**Low Track**	**Repeated Grade**	**School Drop-Out**	**Mother Loves Me**	**Fight with Mother**	**Supportive Mother Index**
Sibling of a *CoW*	-0.037	0.121***	0.027	-0.134***	-0.021	-0.250**
(*CoW* * Born 1987 to 1989)	(0.028)	(0.037)	(0.017)	(0.039)	(0.014)	(0.116)
Born East	-0.035**	-0.051**	-0.001	0.051**	-0.036***	0.212
	(0.012)	(0.014)	(0.006)	(0.020)	(0.004)	(0.063)
Sibling Born	0.024	-0.028	-0.017**	0.064**	0.009	0.246**
Aug 1990 – Dec 1993	(0.015)	(0.025)	(0.007)	(0.029)	(0.017)	(0.112)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.093	0.223	0.037	0.427	0.040	-
Effect size at mean	-0.404	0.544	-0.724	-0.314	-0.515	-
Sample Size	1,995	1,988	2,072	1,944	1,953	1,906

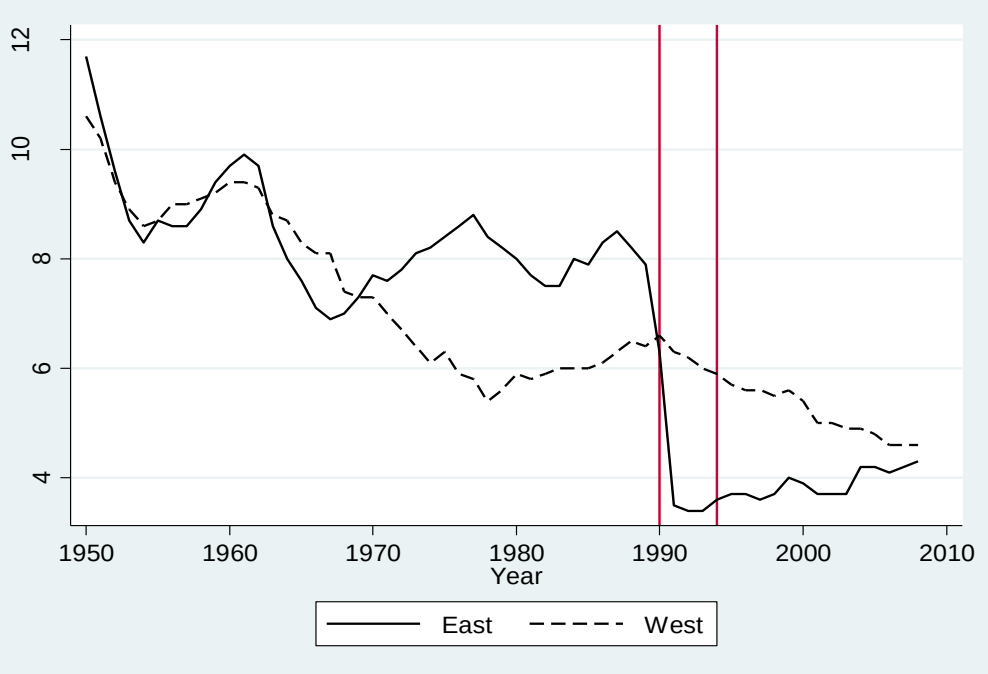
Note: *CoW Sibling* is an indicator of being born between January 1987 and July 1990 and having a brother or sister born in East Germany between August 1990 and December 1993 (i.e. a *CoW*). All specifications and definitions of outcome variables are as in Table 2 and 6 above for SOEP results. Robust 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

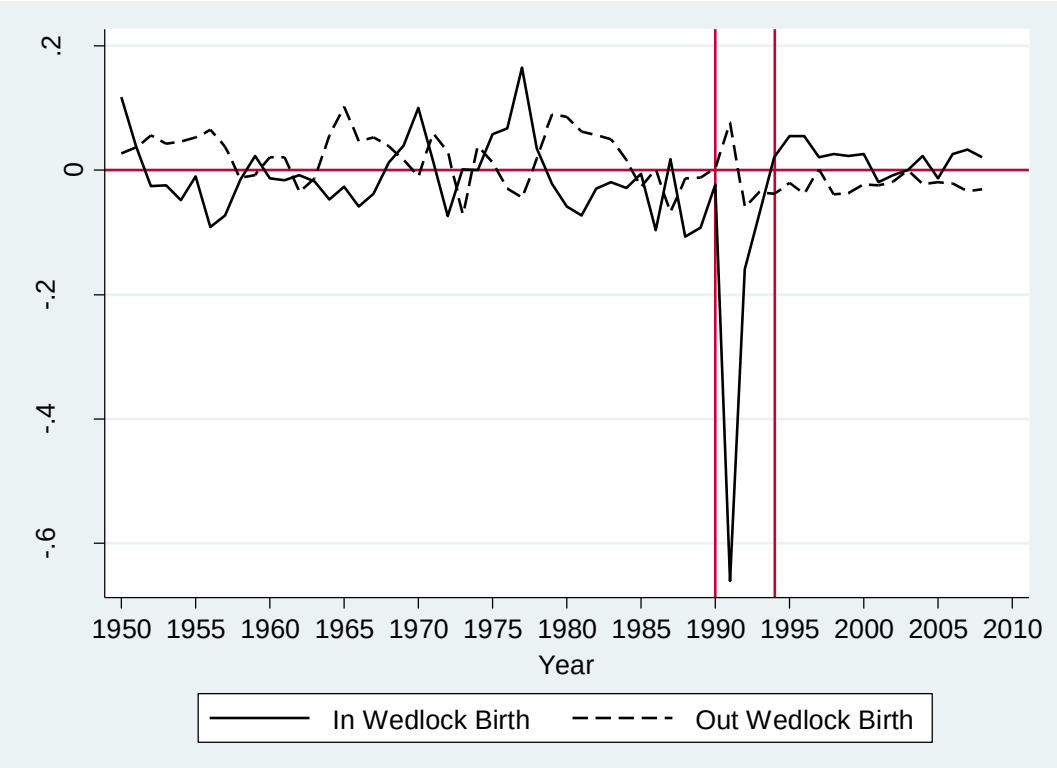


B] Annual Marriage Rate per 1,000 Inhabitants from 1950 to 2008



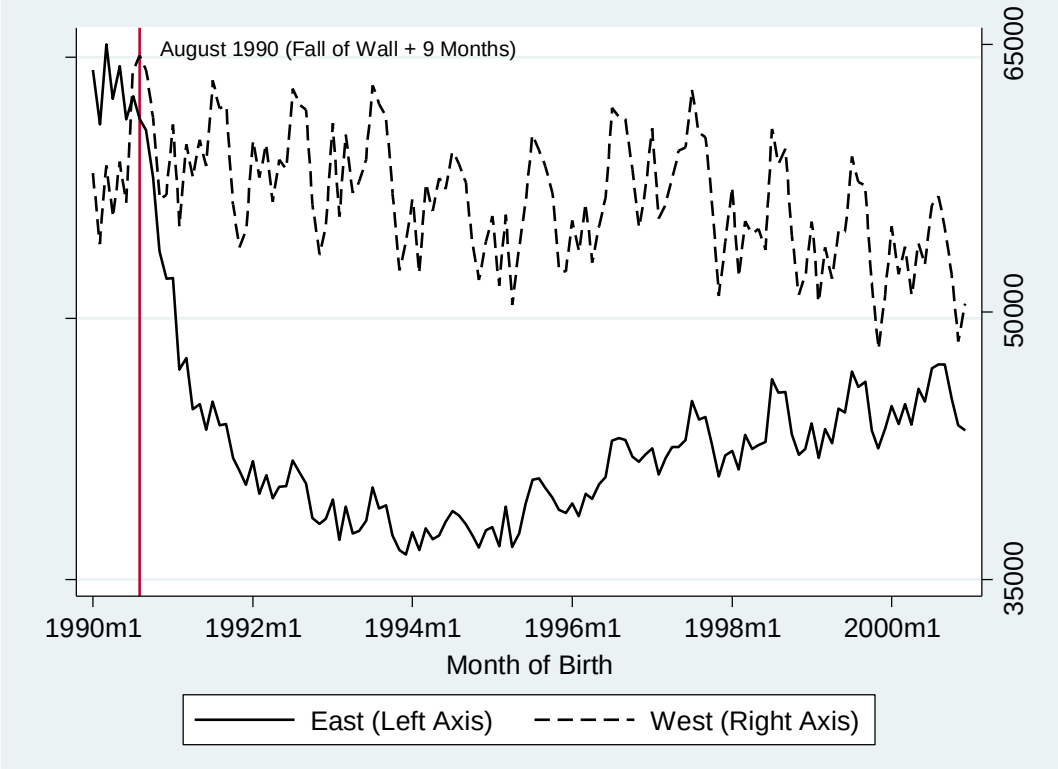
Notes: Authors' own calculations based on administrative population data from the Federal Institute for Population Research (http://www.bib-demografie.de). East refers to the former East Germany Länders and West to the territories of the formal Federal Republic. Berlin is omitted.

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



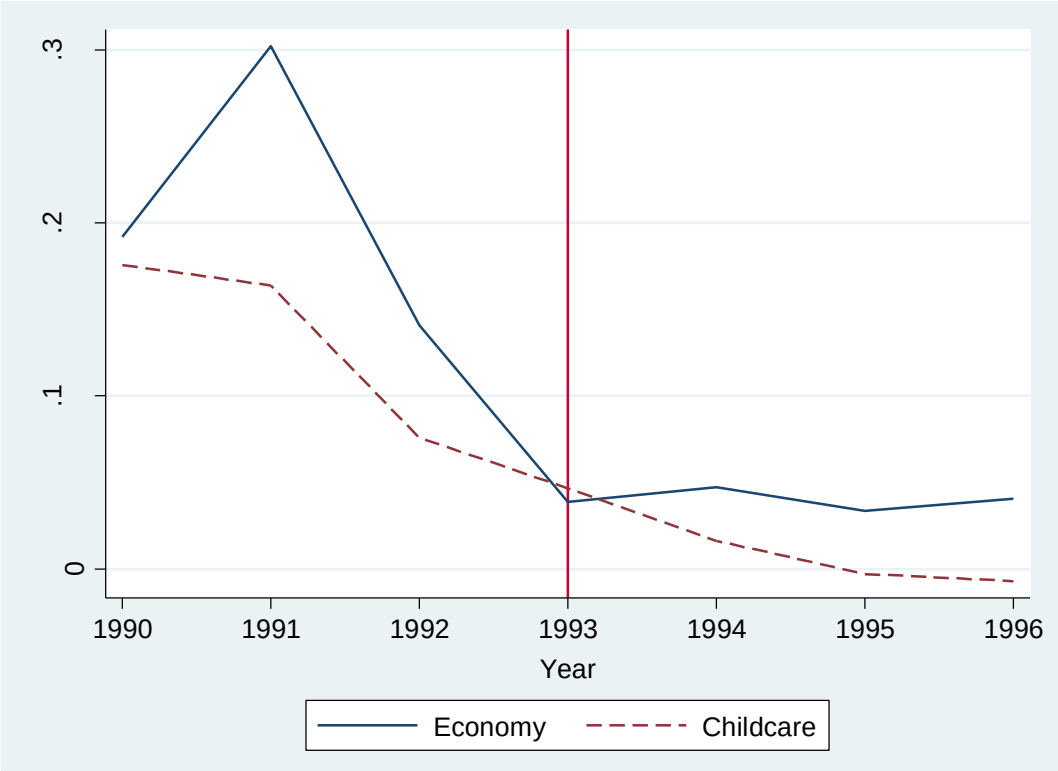
Notes: Graph shows the differences-in-differences coefficients of the change in the year-on-year birth rate by marital status between East and West Germany. Authors' own calculations based on administrative population data from the Federal Institute for Population Research.

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



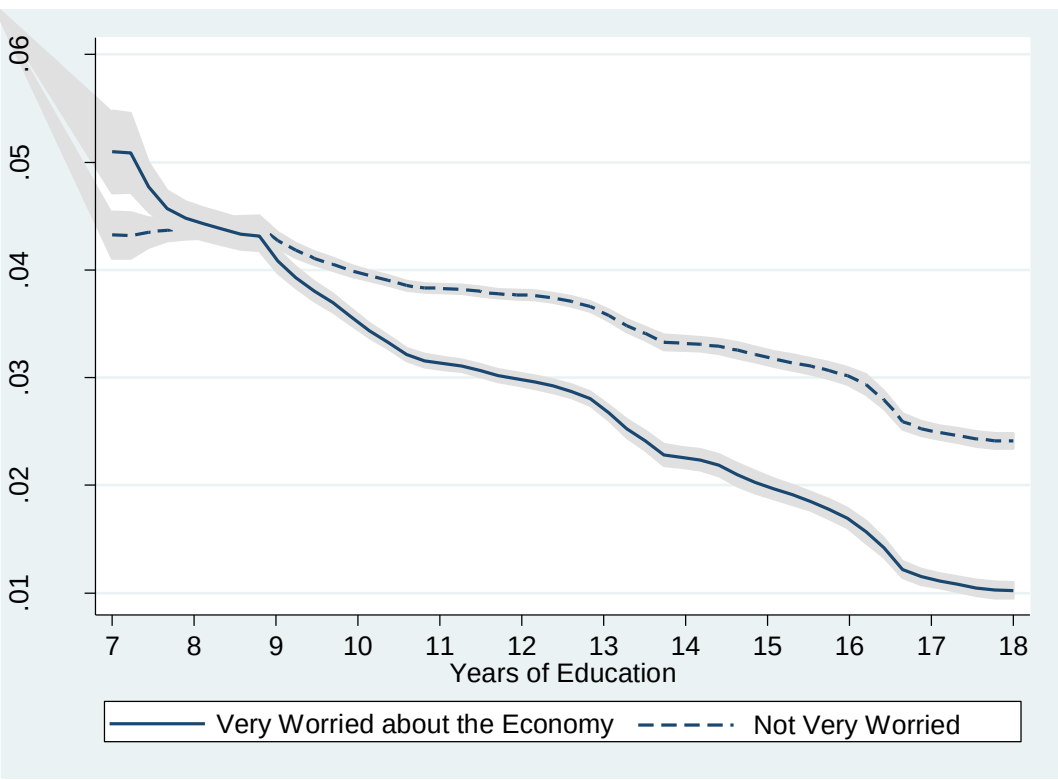
Notes: Administrative birth data from the Federal Institute for Population Research

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 individual 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 1991/93 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	*CoW*	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: 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**	**Fight with Mother**	**Supportive Mother Index**
Born East * Born March 1986 to July 1989	-0.022 (0.016)	-0.000 (0.016)	-0.003 (0.006)	-0.016 (0.026)	-0.004 (0.008)	-0.071 (0.129)
Born East	-0.040*** (0.011)	-0.054*** (0.012)	0.001 (0.005)	0.042* (0.021)	-0.032*** (0.004)	-0.162 (0.053)
Born March 1986 to July 1989	0.082*** (0.012)	0.021 (0.025)	-0.005 (0.012)	0.018 (0.052)	0.052*** (0.013)	0.369** (0.128)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.085	0.214	0.037	0.456	0.036	-
Effect size at mean	-0.259	-0.001	-0.072	-0.034	-0.106	-
Sample Size	2,729	2,721	2,834	2,696	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 *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. Fight with Mother derives from the answer to a four-point scale question "Argue Or Fight With Mother", from which we create a dummy variable that takes the value 1 when the answer is 'very 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**	**Fight with Mother**	**Supportive Mother Index**
East * Born August 1990 to December 1993	0.072 (0.045)	-0.005 (0.087)	0.007 (0.034)	-0.099 (0.106)	0.106** (0.043)	0.222 (0.352)
Born East	-0.012 (0.165)	0.207 (0.185)	-0.028 (0.030)	0.115 (0.239)	-0.182 (0.115)	-0.280 (1.170)
Born August 1990 to December 1993	-0.113* (0.057)	-0.013 (0.065)	-0.045 (0.043)	0.095 (0.082)	-0.038 (0.037)	0.203 (0.464)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean value of outcome	0.084	0.211	0.036	0.460	0.036	-
Effect size at mean	0.854	-0.024	0.184	-0.215	2.932	-
Sample Size	3,506	3,497	3,636	3,477	3,496	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. Fight with Mother derives from the answer to a four-point scale question "Argue Or Fight With Mother", from which we create a dummy variable that takes the value 1 when the answer is 'very often' and 0 otherwise. Supportive Parenting is derived from a multi-item scale of nine questions as described in Weinhardt and Schupp (2011).