Crime after a Fertility Shock:
Offending Behaviour of the 'Children of the Wall'

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Abstract: Birth selectivity has a large impact on children's future outcomes. This paper uses the fall of the Berlin Wall as an exogenous fertility shock: the number of births in East Germany dropped by more than 50 percent over a three years period after reunification of the two countries. Using a difference in difference strategy, we estimate that individuals from this cohort commit more crimes per head than both younger/older cohorts and their West German peers. This higher criminal propensity can be explained by negative selection whereby parents who gave birth to children during this period of great uncertainty have on average lower parenting skills. We explore underlying mechanisms and find that emotional attachment and intergenerational transmission of risk attitudes appear to play an important role in the fertility-crime relationship.

JEL codes: J13, K42

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1. Introduction

Families have a strong influence on the development of their children (see Almond and Currie (2011) and Black and Devereux (2011) for recent reviews) but the influence of parents start even earlier with the decision to have, or not, children at a given time. Factors affecting this decision are the socio-economic circumstances prevalent in the country (Sobotka et al, 2011). However, there impact may be heterogeneous, and dependent on the family initial conditions. For example, a labour income shock reduces the family budget but also reduces the opportunity costs of having a child. Since the income and substitution effects work in opposite directions, a negative income shock would lead to negative parental selection when the substitution effect dominates, which is more likely for less well off families.

Parental selection is potentially particularly stringent for criminal activity of the next generation since: i. the determinants of selection into fertility on parent characteristics and offending participation of children are correlated (Sampson and Laub, 1993); ii. criminality can be transmitted between generations (Hjalmarsson and Lindquist, 2012) and; iii. a small number of individuals can be responsible for a majority of crimes (Tracy, Wolfgang and Figlio, 1990). Indeed, Donohue and Levitt (2001) demonstrated the importance of parental selection on offending behaviour. In their seminal paper, they conclude that the legalisation of abortion in the U.S. in the Seventies was responsible for up to 50% of the drop in crime rates observed in the 1990s. Positive selection is associated with the parents of the marginal children being born having better characteristics or as Donohue and Levitt (2001) put it, the "unwanted children" not being born. Alternatively, Pop-Eleches (2006) demonstrates that an abortion ban in Romania in the 1960s lead to an improvement in children's outcome. This

negative selection was due to more educated women being more likely to rely on abortion as a birth control method.

Most of the literature on parental selection in developed countries has relied on change to the availability or costs of birth control methods, principally abortion. Abortion tends to be a highly controversial policy, and only a fraction of potential mothers use it as a birth control method[1]. As such, the estimated effects pertain to mothers who have (at the time) a strong preference for not having a child and may not be informative about the impact of parental selection in the general population. Moreover, the above mentioned papers rely on discrete legislation change to identify the consequences of selection but since the policy changes happen at a point in time and are thereafter permanent, it is difficult to separate the effects of the change in the abortion law from secular trends. Indeed Donohue and Levitt's findings have been plagued by controversies[2].

This paper attempts to further our understanding of the link between fertility decision, selection and future child's outcomes. Rather than relying on changes to the abortion legislation, which affects selected group of potential parents, this paper relies on a large political and social shock which affected fertility decisions of all adults over a short period of time; after which fertility decision reverted to normal[3]. As such the consequences of fertility selection can be estimated for a precisely defined cohort of children, and we can exclude that they are driven by any secular trend.

More precisely, following the collapse of the Berlin Wall in late 1989, the number of births, in what used to be the Democratic Republic of Germany (East Germany), dropped by

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[1] This is also an important issue for estimates relying on changes in the availability of legal abortion as they are also likely to be biased since they mostly ignore illegal abortion.

[2] Controlling for trends, Cook and Laub (2002), Foote and Goetz (2003), Joyce (2004) and Lott and Whitley (2007) refute that the change in abortion law lead to a significant drop in crime for the subsequent generation. All those arguments have been refuted by Donohue and Levitt (2004, 2008).

[3] An early example of the impact of social change on fertility is provided in Rindfuss et al (1978) who document the effect of Brown vs Board of Education in 1954 which declared school segregation illegal. This Supreme Court decision would have affected children being schooled in States still practicing discrimination; i.e. Southern States. This social change led to a drop in the number of white birth in the South of 0.7% in 1955 while birth numbers were increasing by close to 2 % nationally.

almost 50% over a three-year period; an unprecedented peace time event. The unanticipated sudden collapse of the communist regime in East Germany created uncertainties regarding welfare and cost of children, large upheavals in the economic conditions, as well as possibilities to migrate. Nine months after the fall of the wall, the number of monthly birth in East Germany plummeted by 40% and continued falling until 1994. Thereafter, the birth rate went back to trend. This event allows us to observe a much larger fertility drop than in previous studies, over a precisely defined location and short period of time. We also observe outcomes for cohorts born in the same years in former West Germany which due to the subsequent reunification of Germany where subject to the same policy environment when growing up but were not affected by this fertility shock. This homogenous control group enables us to set our analysis in a difference-in-difference setting, while previous analyses were basically relying on a simple before and after strategy. As such, this is the first paper that estimate a causal effect of parental selection on the criminal behaviour of the second generation and accounts for various trends that could have affected fertility decisions and later outcomes.

The empirical section relies on a combination of Lander level (i.e. German States) and micro level datasets (the German Socioeconomic Panel or GSOEP) available for the whole country since re-unification in 1990. This enables us to not only look at the aggregate effects of the fertility drop on children criminal outcomes but also to carefully consider the impact of never before observed individual characteristics of both mothers and their children. The richness of our data and the specificities of the natural experiment make it possible to shed some much needed light on the 'black box' of the underlying mechanisms behind the fertility-crime relationship.

We first clearly document the massive drop in birth rate observed in East Germany just after the fall of the Berlin Wall and give a number of explanations of why it happened in

the context of the historical and institutional background. Analysis of individual data points to strong evidence of negative selection into motherhood. Women who gave birth during this period of economic and political uncertainties were on average younger, less educated, and more likely to be unmarried mothers. These are typical traits associated with lower "parental skills" which lead their children to display worse outcomes on various socio-economic measures, including criminal participation.

Using Lander level panel data on arrests by age groups, we show that the offending behaviour of the 'Children of the Wall' (i.e. born in East Germany between 1991 and 1993) is much worse than could be expected. We estimate that from age eight onwards, they exhibit arrest rates at least 50 percent higher than comparable peers and they are over-represented by more than two-thirds in the arrestee population given their cohort size. These findings from our difference-in-differences strategy are robust to the inclusion of relevant time varying controls as well as to the addition of Lander specific time trends. We can exclude that our results are driven by some alternative factors since the increase in crime is observed each time the "Children of the Wall" enters an arrest age group and not only at a fixed point in time. Our results seem to confirm that parental selection may be perhaps the best predictor of the future criminality of a cohort. The large coefficients obtained may even be underestimates considering that the impact of this negative fertility selection should have been partly mediated by the smaller cohort size.

To understand the mechanisms by which negative parental selection affects criminal behaviour, we investigate how different the 'treated' children are in terms of their individual characteristics. At age 17, Children of the Wall are surprisingly similar to their peers in terms of broad educational attainment measures but they report significantly worse emotional relationships with their parents. We interpret this as indicating that child misbehaviour is most strongly influenced by a lack of parental emotional attachment and argue that it corroborates

the 'unwantedness' explanation which is often put forward in the abortion-crime literature. To further investigate underlying mechanisms, we consider the risk attitude of mothers and children which may have a strong impact on both fertility and offending decisions. We find that the women who gave birth just after the end of Communism in East Germany are much more willing to take risk and this is also true for their children. This fits well with recent evidence on inter-generational risk attitude transmission (Dohmen et al., 2012) and is perhaps one of the crucial pieces in understanding the fertility-crime relationship puzzle.

Compared to previous research we believe that this paper uses a cleaner identification strategy to estimate the impact of fertility decision on the criminal behaviour of future generations. This is because the natural experiment we exploit is unique as it led to very profound but short lived fertility shock which creates innate pre and post control groups. The re-unification also makes West Germany a natural control which enables us to account for the potential effect of common trends as never before since children on both side of the "border" where subject to similar educational and social environment when growing up. We confirm that fertility decision appears to have an extremely large impact on the crime rate of future generations. The data we have access to also makes it possible for the first time to look at the actual underlying mechanisms behind this relationship. Parental emotional attachment and risk attitude transmission come out as the strongest explanatory factors further suggesting the importance of considering non-traditional economic personality traits to understand human behaviour. These findings of parental selection have potentially important consequences on the decision of policy planners. Public provision should not only be based on the size of an incoming cohort and pay much more attention to its composition.

The rest of the paper is structured as follows. The next section describes the institutional background and illustrates the drop in fertility. Section 3 describes the different data sources used in this paper. Section 4 presents our difference in differences empirical

strategy. Section 5 reports and discusses our findings on mother selection, cohort criminal participation, and children characteristics. Section 6 checks for the impact of migration on the interpretation of our results and provide other robustness checks. Section 7 concludes.

2. Institutional Background and the Fertility Drop

2.1 The GDR and the German re-unification

In the aftermath of World War II, Germany was split into four zones each administered by one of the allied forces. In 1949, the Federal Republic of Germany (FRG or West Germany) and the German Democratic Republic (GDR or East Germany) were officially founded following these partitions. The GDR developed as one of the most rigid of the former European Communist regimes. As the two countries' economic and political performance diverged, more and 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. The Berlin Wall became the symbol of the forty year physical and socio-economic separation of a people which 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. This emblematically culminated with the televised destruction of the Berlin Wall on the evening of the 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. By July 1990, a common currency was introduced and re-unification was completed less than a year later in October 1990, see Judt (2005) for details. The very abrupt end of half a century of Communist rule and the express re-unification that followed led to a period of great socio-economic uncertainties for the population in the new East-German Landers. This was perhaps best

reflected by the massive fall in the number of births that occurred there in the years just after the fall of the Berlin Wall.

2.2 The Fertility Drop

Figure 1 reports the crude birth rate (per 1,000 population) between 1950 and 2008 for East and West Germany. What we first note is that up to 1989, the trends in both countries were very similar with: a post-war baby boom up to the early 1960s, a rapid decrease (readjustment) of fertility in the following decade, and a relative stabilisation between 1970 and 1990[4]. The fall of the Berlin Wall triggered a rapid and unprecedented collapse in birth rates in the East that was not observed in West Germany. Within a year, birth rate dropped by 40% and reached an all-time low in 1993, 50% lower than its 1989 level[5]. This is clearly a drastic decline in fertility and demographers have qualified it the "most substantial fall in birth rates that ever occurred in peacetime" (Conrad et al., 1996, p.331) and gone as far as suggesting that "East German adults appear to have come as close to a temporary suspension of childbearing as any such population in the human experience" (Eberstadt, 1994, p139).

What is also interesting for our identification strategy, is that the fertility drop was relatively short lived in nature. We note that the fertility rate strongly recovered from 1994 onwards in East Germany while it continued to gradually decline in the West. Perhaps the most efficient way to illustrate deviation in trends is to plot the year on year difference in difference coefficients of the crude birth rate between East and West Germany. This is depictured in Figure 2 with the horizontal line marking no difference in change in year on year fertility and the vertical line the fall of the Berlin Wall. In the forty years up to 1990, the

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[4] The slight increase in fertility in East Germany from 1974 onwards, is the result of the adoption of pro-natalist policies, providing a range of welfare benefits to parents (see Reinheckel et al. (1998) for details). However these policies were only relatively successful as they only managed to make the countries crude fertility rate catch up with the Western trend.

[5] Large drop in fertility were also observed in other countries following the end of communist regimes but the size of the fertility drop does not appear to be related to the harshness of the economic transition (Sobotka et al., 2011).

gap between the trends in the two countries had never exceeded + or − 10 percent. It then becomes almost − 50 percent in the year following the end of communism before returning to a positive value in 1994. Figure 2 clearly illustrates the extent and temporary nature of the fertility drop and it also designates the cohorts of children we should consider as 'treated' as those born between 1991 and 1993[6].

2.3 Explaining the Fertility Drop

It is quite obvious that there was an unprecedented drop in the number of births in East Germany after the fall of the Berlin Wall. Perhaps more complex is pin-pointing the exact factors which may have been responsible for this fertility drop. We discuss below some potential explanations. We do not dwell on the relative importance of these factors or whether women postponed, reduced their family size or whether the drop is due to an increasing fraction of women remaining childless, since our interest is only in the composition of the cohort of children born between 1991 and 1993[7].

Access to birth control methods

Most of the previous literature on fertility decision and child outcome has exploited policies which changed access to birth control, mostly access to abortion. We argue here that this is not a factor which can explain the drop in births we observe. First, access to birth control methods was very liberal in East Germany and the right to on-demand abortion was not changed before 1993 when it became quite restricted[8]. One might therefore expect that the drop in fertility was the result of an increased used of birth terminations. However, abortion

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[6] Since birth rate started dropping from August 1990 onwards, the 1990 cohort can be considered partially treated. However, in the absence of data on month of birth we cannot use the discontinuity. As such our estimates may under-estimate the effect of parental selection.

[7] We make a limited usage of post-1993 cohorts as those can be considered treated, if for example, the re-unification shock led to a postponement of fertility decisions and a catch-up in the following years.

[8] Sterilisation became then available, however this contraception method was used by less than three percent of women (Rheinheckel et al 1998)

figures do not back this up, since the number of abortions dropped by 40% between 1989 and 1992 (Eberstadt, 1994); less than the drop in birth numbers over the period. Hence the fall in birth is mostly due to a fall in conceptions.

This is also very consistent with the evidence reported in Figure 3 which plots the monthly number of births in East and West Germany from January 1990 to December 2000. The marked drop in children born in the East clearly starts in August 1990 (vertical line) which is exactly nine months after the fall of the Berlin Wall in October 1989. This evidence strongly indicates that conception decisions were only halted in the months after the end of Communism and that most women who had already conceived did not terminate their pregnancy. This is important for two reasons. First it means that our 'pre-treatment' groups (of mothers and children) is not selected and our analysis will include individuals exposed to the same socio-economic situation in East Germany as those 'treated' by the fertility shock of 1991-1993. Second, we will not face some of the problems that abortion availability has on fertility selection in the longer run. Ananat et al (2009) describe how it leads to an important reduction in the cost of the marginal pregnancy and consequently greatly increasing the potential number of unwanted births in effect almost cancelling out the abortion selection effect. This nine month gap between the fall of the wall and the drop in birth number also indicates that the latter is not solely driven by out-migration of potential mothers since freedom of movement became possible from November 1989 (more on migration below).

Internal migration

After the fall of the Berlin Wall, migration to the more opulent West became possible again and was unrestricted for citizens of the former GDR. A substantial number of individuals opted for this option and the population of East Germany dropped from 16.5 to 15.5 million between 1989 and 1994. Although this represents only 6 percent of the total

population, since movers were disproportionally of childbearing age, this migration has been calculated to responsible for up to 10 percent of the birth reduction observed (Eberstadt, 1994). Note also that between 1989 and 1994, the number of birth felt by 120,000 in East Germany but increased by only 9,400 in West Germany (Conrad et al, 1996), so clearly migration alone cannot explain the fertility drop in the East, nor would it invalidate our econometric approach since the impact on the control group appears limited (no change to the trend in birth rate in West Germany).

Still, since migration is highly selective, this may remain a worry for the validity of our results and the fertility decision mechanism that we argue is behind it, since a large selection of positively selected mothers to the west would lead to a contamination of our control group.

We propose two ways of dealing with this issue. Our first approach is to exploit individual data (GSOEP described in detail in the following section) to consider jointly individual migration and fertility decisions. We show in Appendix Table A1 that individuals who moved to West Germany were indeed positively selected on most socio-economic characteristics. More interestingly, in Table A2, we report the difference in probability of migration if a child was born (East or West) between 1991 and 1993. This difference becomes reassuringly insignificant when compared to all women who made a comparable fertility decision just before and just after our Children of the Wall were born (i.e. the most comparable control group). Our second approach is to collect Lander to Lander population movements from 1991 to 2010 to examine the effect of female migration on our main outcome results for their children. By including a measure of the proportion of potential mothers who moved West we should be able to see the importance of migration on our findings. This is important not only to consider the effect of migration on the selection mechanism that explains the fertility drop in the East. It will also account for the possibility of

a contamination of Western Lander cohort arrest rates due to influxes of migrants after the fall of the Berlin Wall. We do this as a robustness check when we present our crime results in Section 6.2.

Other societal change

The cohort of women coming to their peak fertility age in 1989 we as born in the early Seventies, a period that had been characterised by a sudden drop in fertility. Without any change in environment or reproductive behaviour, we would thus have expected the number of birth to decrease in East Germany at the beginning of the Nineties. This cohort effect contributes about 10% of the drop in the number of birth observed (Eberstadt, 1994).

A related explanation for the drop in fertility would be a deterioration of the health conditions following the collapse of the free-care system available under communist regimes. Eberstadt (1994) does indeed report an increase in mortality following the collapse of the wall which mostly affected men aged 15-44 whose mortality rate increased by 30% over 1989 values. Female health for the same age group also deteriorated with mortality rate increasing by about 10%. However, infant mortality dropped by 20% over the same period. These effects may be partially driven by changes in the composition Overall, it is unclear how much these changes in the health system may have affected fertility decisions.

The communist regime of East Germany promoted pro-natalist policies from 1972 onwards following a drop in the fertility rate below replacement rate in the previous years. These policies, nicknamed the Honecker Berg led to a short lived fertility boom, before fertility rate returns on trend with the West German one. The policies included financial incentives for birth (and marriage) worth about one month of the average net-salary for each birth, possibility of interest free loans for parents and provision of apartments[9]. Other key

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[9] See Rheinheckel et al. (1998) and Conrad et al (1996) for further details.

policies were the provision of free childcare for children aged one and above, and from 1976 onwards a one-year maternity leave on full salary[10]. By the end of the Eighties, up to 85% of under 3 year olds in East Germany were in state provided nursery compared to only 5% in the West (Reinheckel et al (1998). These policies allowed the full employment of mothers; more than 70% of married mothers were fully employed in the East in 1988, this compares with less than 20% in West Germany (Reinheckel et al, 1998). Since childcare was often provided by employers, the turmoil of re-unification and the plunge in the number of children led to a dramatic fall in the provision of childcare after 1990. Overall, the cancellation of pro-natalist policies after 1990 led to a substantial increase in the direct costs of children post-reunification.

Socio-Economic Uncertainty

In the communist economy there was no uncertainty concerning jobs and wages, so that couples could plan from a young age to have children. In the months immediately following the fall of the Berlin Wall, full employment was artificially maintained in the East. However, by Autumn 1991 the East German economy had lost an estimated 2.4 million jobs, close to a quarter of all jobs at the end of summer 1989. By the end of 1992, the total decline in employment exceeded 35 percent of the pre-unification labour force (Biichtemann and Schupp 1992). Moreover, women were particularly affected by unemployment and Rheinheckel et al. (1998) report that in 1990, 45 percent of women on maternity leave lost their jobs. Add to this the removal of most of the welfare benefits linked to children, the disappearance of childcare and a large increase in housing costs, this made the future very uncertain and children unaffordable to most families, at least in the short-run. The change to a market economy may have also altered the trade-off quantity/quality of children a la Becker (1991). Post-unification, East German parents may have

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[10] The policies targeted achieving equal opportunity for men and women in a communist society, but may also have had to do with chronic shortage of labour, and low wages, making women participation to the labour force a necessity (Conrad et al, 1996).

decided to have less children but invest substantially more in them in order to give them the best chances of success in a competitive economy.

This negative economic environment was mitigated by large transfers from the West and a generous one to one conversion of the OstMark to the DeutscheMark (July 1990), so much so that by 1992 disposable income in East Germany had doubled over its 1989 level. Nonetheless in the 1992 European Comparative Population Policy Acceptance Survey, 78% of East Germans aged 25-39 cited economic circumstances as one of the main reasons for the drop in fertility. The other reasons were costs of raising children (60%) and fear of the future (49%).

Economic uncertainty may have ambiguous impact on fertility with the income effect leading to a reduction in fertility and the substitution effect pushing the other way as the opportunity costs of children decreases. Indeed Kreyenfeld (2010) and Bhaumik and Nugent (2005) report heterogeneity in responses to unemployment risk with more educated women postponing fertility and less educated women increasing fertility during periods of economic uncertainties. In the case of the collapse of the Berlin Wall, some groups of women did not change their fertility decisions: teenage mothers, women aged 40 and above, or reduced their birth rate less than average, such as single mothers. As such, the proportion of children born from unmarried mothers rose from 34% in 1989 to 42 in 1992[11] (Eberstadt, 1994).

Children born out of less educated, younger or single mothers are in general more at risk of being involved in criminal activity, as such the trends in these factors are consistent with a worsening of outcomes for the children born in the aftermath of the German re-unification.

3. Data Sources

Individual Level Data: The GSOEP

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[11] This increase in single motherhood is partly due to the drop in marriages, which also dropped by 60% over the period 1989-1994 (Conrad et al. 1996).

The German Socioeconomic Panel (GSOEP) is a longitudinal survey of private households, established in West Germany in 1984 and carried out annually. Since 1990, it has also covered the territory of the former GDR. It is updated annually to collect any new information on all household members and we use the latest available version which is available for all individual from 1990 to 2010. This gives us an initial sample of almost 50,000 unique individuals with about a quarter living in East Germany for which we have a very wide range of socio-economic information. This includes detailed personal characteristics and answers to extensive questionnaires for all members of households ever surveyed, including retrospective information when necessary. It is also split by special topic modules and we make specific use of the motherhood, young adult (aged 17), and risk preferences modules in this paper. GSOEP unfortunately does not contain a single question on self-reported criminal participation. More information on the GSOEP is available at http://panel.gsoep.de/.

Lander Level Data

Crime data is available at the Lander level on a yearly basis from the Polizeiliche Kriminalstatistik (PKS). We use information on number of arrests of German citizen from 1993 to 2010 for 5 Eastern and 10 Western states (we exclude Berlin, the only Lander which straddles the old East/West border). The data reports the age of arrested German Citizens, however it is grouped into the following age categories: 8-13; 14-17; 18-20; 21-24; 25+. This slightly complicates the definition of our treatment indicator and we explain how we solve this issue when we present our empirical strategy in the next section. From the same source, we also obtain the number police personnel active by year and Lander. We add to this state level panel data information on population size by age, nationality and gender, and overall

and youth unemployment rates[12]. Staff at the German statistical agency was also able to provide us with Lander to Lander registered migration flows from 1991 to 2010[13]. Altogether the panel dataset we generate covers 5 age groups in 15 states over 18 years and as such is composed of 1,350 observations.

4. Empirical Strategy

For all outcomes our empirical strategy relies on a difference in differences approach which exploits the natural experiment provided by the post-Berlin Wall drop in birth rates. We always compare the characteristics or outcomes of women who gave birth and of their children who were born in East Germany in 1991, 1992, and 1993 to both comparable individuals born before or after (when possible) in the ex-GDR. All specifications also include the non-treated control individuals or Landers from West Germany enabling us to obtain estimates cleaned of common-trends. However, because of the nature and structure of our individual and Lander level data, we must define two different modeling strategies that depict our general difference in differences approach.

Individual Level Data

We rely on GSOEP to first highlight selection into motherhood and later investigate deviations in children characteristics to assess whether their criminality stems from observable characteristics. These estimates are all based on the following difference in differences set up, where *Y* is a set of various outcomes:

$$Y_i = \alpha + \beta CoW_i + East_i + Yr_i + X_i + \varepsilon_i \tag{1}$$

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where i denoted individuals and CoW is dummy for 'Children of the Wall' which is 1 if gave birth (or born) in the East between 1991 and 1993 and 0 otherwise. $East$ is a dummy for being in East Germany at birth, and Yr is a year of last survey dummy. All specifications are weighted by cohort size to take into account the smaller proportion of CoWs.

Lander Level Crime Data

A difficulty with the arrest data is that it is only available by age-group and we compute the proportion of grouped cohort that is treated: E.g. Arrest age-group 8-13 is $1/6^{th}$ treated in 1999 (8 year old born in 1991); $2/6^{th}$ in 2000 (8 year old born in 1992 and 9 year old born in 1992), and so on. Table 1 reports the fraction of the population treated for the various crime age group and crime years. We use these fractions interacted with the 'Children of the Wall' dummy for a cohort being born in an Eastern Lander between 1991 and 1993 and this will take into account the variation of intensity of treatment over the years[14].

We will consider two main outcomes for criminal participation which are:

i) $Y_{ast} = \ln\left(A_{ast} \Big/ \dfrac{N_{ast}}{1000}\right)$; where A is the number of German national arrestees, and N is the population. The subscript *a, s* and *t* refers to the age group, the state, and time specific. i) can thus be interpreted as the log of age-group specific arrestees per 1,000 of age group population

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[14] These proportions do not take into account that the CoW cohorts were smaller and thus are likely to under-estimate the treatment effect. To solve this problem, we weight all regressions by age-group population size. Another issue here is that within an age-group each age is very unlikely to be uniformly arrested (e.g. the 8 year will represent a much smaller proportion of arrestees as the 13 year olds in the 8 to 13 age group). This is not an important problem if we make the simple assumption that these relative arrest age proportions within age groups are on average relatively similar in East and West Germany.

ii) $Y_{ast} = \dfrac{A_{ast} / A_{st}}{N_{ast} / N_{st}}$; i.e. the ratio of proportion of arrestees/proportion of the population

for age group *a* in Lander *s* in year *t*. We then model these two outcomes with the following

linear relation:

$$Y_{ast} = \beta PropCoW_{ast} + \delta Z_{st} + Yr_t + Age_a + \alpha_s + \varepsilon_{ast} \tag{2}$$

Where $PropCoW$ is an interaction between an ex-GDR Lander indicator and the proportion

in a specific age-group cohort that are born in 1991-1993. *Age, Yr*, and α_a are sets of

dummies for year age-group, and Lander respectively. *Z* is a set of time varying Lander

specific controls; specifically: number of police personnel per 10,000 population, proportion

of foreign born per age group[15], and overall and youth unemployment. The standard errors are

then clustered at the Lander level.

As robustness checks, we also do the following: i) to account for potential state

specific unobservable characteristics, we relax the assumption of common trend and instead

use Lander specific time trends. ii) To test the impact of internal migration, we also include

the proportion of potential mothers who have migrated from Eastern to Western Landers.

5. Results

5.1 Parental selection

As already discussed, the large fertility drop we study is certainly not random across

women and is likely to be driven by selection into motherhood. Our prior is that, faced with a

high level of uncertainty for the future and a re-optimisation of the fertility decision under a

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[15] Although all our Lander level analysis focuses on German born individuals, we believe it is important to take into account the proportion of foreign born individuals in each age-groups in our models for two reasons. First,

new set of (unknown) constraints, it is women with relatively higher socio-economic status which will choose to delay having children until the social conditions have been clarified.

To test this hypothesis we use equation (2) for a set of observable maternal characteristics. Table 2 presents estimates of how the mothers of 'Children of the Wall' differ from other mothers on a number of characteristics. We find that on average they are about a year younger, have fewer years of education, and are currently statistically less likely to be married (or cohabiting). Mothers of CoWs are on average, between 1991 and 2010, slightly less attached to the labour market and have lower incomes but the coefficients are here only marginally significant. Overall these are classic indicators of mothers who usually possess relatively lower parental skills and confirm that the fertility shock was a result of negative selection into motherhood. As such, the Children of the Wall cohorts have an over-representation of individuals with mothers with lower parenting skills. . A smaller cohort of children resulting from a negative selection *into* motherhood is unique to our natural experiment and should help interpretation of our results. Legalization of abortion in the US resulted in less children being born from mothers with relatively worse parental characteristics. Research using this policy has therefore been unable to distinguish the potential positive effect of smaller cohort size from the effect of positive selection into fertility on child outcomes it seeks to estimate. Here, we will also not be able to disentangle these two effects but we can argue that, if anything, the smaller cohort size should be beneficial for the Children of the Wall's outcome[16]. Our estimates will therefore be lower bounds of the true impact of fertility selection on the offending behaviour of the following generation.

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[16] The Romanian abortion ban studied by Pop-Eleches (2006) resulted in larger cohorts of positively selected children and could have naturally led to underestimates of the fertility selection effect. The author however prefers to control for socio-economic composition of mothers to show that the ban led to worse outcomes for children. He therefore shows that the larger cohort size effect (or crowding out effect as it is called in this paper) goes in the same direction as the treatment effect and therefore attempts to measure its importance.

6.2 Criminal Participation

Before turning to our statistical analysis, we illustrate graphically the evolution of crime, by age group, in East and West Germany from 1993 to 2010 using the two outcomes of. Figures 4a to 4e depicts the arrest rate per 1,000 population (top graphs) and the arrestee to population ratio[17] (bottom graphs) for the five age groups we have available. The vertical lines mark the beginning and the end (when possible) of the inclusion of treated individuals in the cohort. Remember that the 1990 cohort is partially treated and as such movement may happen on the left of the first vertical line. Figures 4a (8 to 13 years old) and 4b (14 to 17 years old) reveal a strikingly similar pattern with the criminality of Eastern cohorts of youths markedly increasing, and diverging from that of their Western peers, as the proportion of Children of the Wall increases. What is also noticeable is the drop in this difference as the cohorts of East Germans is no longer composed of treated individuals. In Figure 4c (18 to 20 year olds), only 2009 and 2010 include Children of the Wall but the divergence with West German trend is also clearly apparent, especially when looking at the arrestee to population ratio graph. Figures 4d (21 to 24 year olds) and 4e (25 years and older) do not show any important deviation between East and West German arrest trends which is what we would have expected with none of these cohorts yet including the treated individuals. These patterns are consistent with negative selection whereby parents who gave birth in East Germany between 1991 and 1993 had characteristics that made their children much more crime prone. Also, the great similarity in pre-treatment trends in all figures is very reassuring for the validity of the difference-in-difference approach we adopt and turn to now. Moreover, it

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[17] To be clear, the 'arrestee to population ratio' is constructed as the proportion of arrests age group a represents among all arrests divided by the proportion of population age group a represents among all the population. We believe this measure of criminal activity should capture better the fast changing size of the CoW than when using the arrest rate where population is the denominator,

should be noted that the effect on arrests appear every time the cohort enter (and leave) an age group. As such, it is unlikely that the effects are driven by some other factors – like a reform of the police in East Germany – which may have been concomitant with one increase in time at one period, but not with repeated increases over time.

Table 3 reports the estimates of OLS estimates following equation (2) and using the state level panel data on arrest. The results are presented for the two measures of criminality (log arrest rate and arrests to population ratio) and the specification include sequentially: only age group, Lander, and year dummies columns (1) and (4); time varying Lander controls in columns (2) and (5); and Lander specific time trends in columns (3) and (6). Finally, the estimates are alternatively for all age groups in row (i); under 25s only in row (ii); and only cohorts including treated individuals or under 21s in row (iii). These results all confirm that Children of the Wall engaged disproportionally more in criminal activity. Looking at the most conservative estimates, the fullest specifications for under 21s only, we estimate that they represent more than 2/3rd as many arrestees than their cohort size would suggest and have arrest rates over 50 percent above expectations.

Before we interpret these results, we want to make sure that they are not driven by a potential alternative selection mechanism other than fertility selection: internal migration. We have created for each year and age group a measure of the net proportion of potential mothers who have left each Lander[18]. We include this variable in specifications with and without Lander specific time trends for our preferred groups of young individuals in Table 4. The coefficient on the migration of potential measure is often relatively large but never significant. Most reassuringly we do not find that the inclusion of this migration proxy

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[18] Note that this number is mostly negative for most Eastern Landers but often positive for Western ones. We expect this to therefore also partially capture effects of internal migration of potential mothers West on the cohorts born in the host Landers.

changes any of our results significantly and the estimates remain50 percent higher arrest rate and 70 percent arrest to population ratio for the Children of the Wall.

These are very large effects but they are actually very much in line with Donohue and Levitt (2001, 2004, 2009) who concluded that abortion repeal is responsible 50 percent of the drop in crime observed in the US in the 1990s. We must also remember that we had argued that our estimates were lower bound due to the small size of the CoW cohort and our results are therefore suggestive of an extremely strong impact of parental selection on criminal participation of children. The next section attempts to explore some mechanisms that may explain why this happens.

6.3 Child Characteristics and Parental Relationship

To explore the underlying mechanisms that may account for the high offending probability of the CoW cohort we consider how they compare to peers on a large number of characteristics. We do this by using GSOEP information collected when individuals are aged 17[19] and implementing the model described in equation (1). We focus on two main sets of characteristics which are likely to be associated with criminal activity: educational achievement and parental relationship. The results are reported in Table 5. Surprisingly, for none of the measures of educational performance (dropping out of school, repeated grade, and having test scores in math and German above average) are the differences between the CoW and the other cohorts significant. Worse school outcomes and the associated poor labour

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[19] The last GSOEP survey available is from 2010 which means that the last individuals who completed this special module were born in 1993. Consequently we do not yet have in our control group children born after the fertility shock subsided but only the ones born before.

market expectations do not seem to be able to explain the offending behaviour of the Children of the Wall.

Looking at parental relationship, CoW are not significantly more likely to fight or argue with their mother or father. However, these children are 13 to 15 percentage points less likely to report feeling loved by their parents. This indicates that parents who decided to have children at time of great economic uncertainties may have been worse parents who did not develop the appropriate emotional connection with their children. It is an important finding and a surprising one considering that there were no real barrier to birth termination at the time and therefore the unwanted argument is hard to defend. If anything these children must have been really wanted to have them when the future was so uncertain.

The fertility choice and the effect on children may perhaps best be explained by certain aspects of individual preferences. Risky behaviour has long been associated with most youth unsafe activities (Gruber, 2001) and recent literature has pointed out the importance of risk attitude in predicting individual economic outcomes (Dohmen et al 2011). We therefore exploit the very detailed risk attitude information contained in GSOEP and test if this may play an important role in the fertility-crime relationship we study. The results for mothers and children (both limited to births between 1980 and 2009) are presented in Table 5. We find strong evidence that both women of a CoW and the children themselves are significantly more willing to take risk. These results hold with the inclusion of individual's age and education level[20]. The pattern of our results also fits very well with new evidence that parents transmit preferences for risk to their children (Dohmen et al 2012). Our estimates therefore suggest that differences in risk preferences may play an important role in explaining why

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[20] An interesting finding here also stems from the coefficient on the East dummy we report: significant for mothers but not for their children. It appears to confirm the assumption put forward by Alesino and Fuchs-Schündel (2007) of a convergence of preferences between East and West Germans within a generation as individual exposure to Communism decreases.

certain women are less likely to respond to environmental incentives when making fertility decisions and why their children subsequently end up making poor life decisions such as participating in crime.

7. Conclusion

This paper highlights the effects of parental selection on subsequent criminal activity of the second generation. Rather than relying in changes in abortion law, which affects only part of the population; we use a large social and political shock. The collapse of the Berlin Wall in 1989, led to a 50 percent drop in fertility over a four years period, before fertility went back to trend. As such, the effect of parental selection can be estimated for a precisely defined cohort of children and is such not driven by secular trends. We report that children born in East Germany in the aftermath of the regime changed are 50 percent more likely to be arrested than those from previous cohorts. We then identify some potential mechanism by which this greater criminal propensity may happen.

Note that the crime estimates are of the same scale as those obtained in the U.S. for the impact of abortion on crime. Since the country, the identification and the population affected are different, this was rather unexpected. In the U.S., the reduction in crime followed the introduction of abortion which reduced the number of children born from (black) single mothers. Here the mechanism is that with the economic uncertainties following the fall of the Berlin Wall, older and more educated women postponed having children or migrated to the West. As such the CoW cohort is disproportionally composed of children with mothers of less favourable characteristics. Moreover, parents of CoW have worse parenting skills since their children are 12 percentage points less likely to report being loved by them. We also argue that

risk preferences play an important, and previously unnoticed, role in explaining both the fertility choice of parents and the criminal participation of their children.

Our findings suggest two important policy implications. First, even when all birth control options are available, a substantial proportion of women still make poor fertility choices which will negatively impact on their children's future. It is very difficult to see how to prevent this without resorting to policies which would be socially unacceptable. Second, since these births cannot be realistically prevented, the viable option is clearly to opt for early childhood intervention. This is the time when preferences are most likely to be malleable by increasing cognitive ability (Dohmen et al 2010) which would in any case also greatly improve future life opportunities. The real challenge is to find a way to target efficiently such intervention at the right children which could only be achieved by identifying the 'reckless' mothers.

These findings have also some more straightforward and important implications for policy planners. Rather than base the decisions regarding public investment on cohort size only, there is scope for adjusting these investment for the quality of the cohort – which should then be proxied. In this case, despite its small size, this cohort would have benefited from additional investment to compensate for the lower average quality of their parents.

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Figure 1: Annual Crude Birth Rate per 1,000 Population from 1950 and 2008
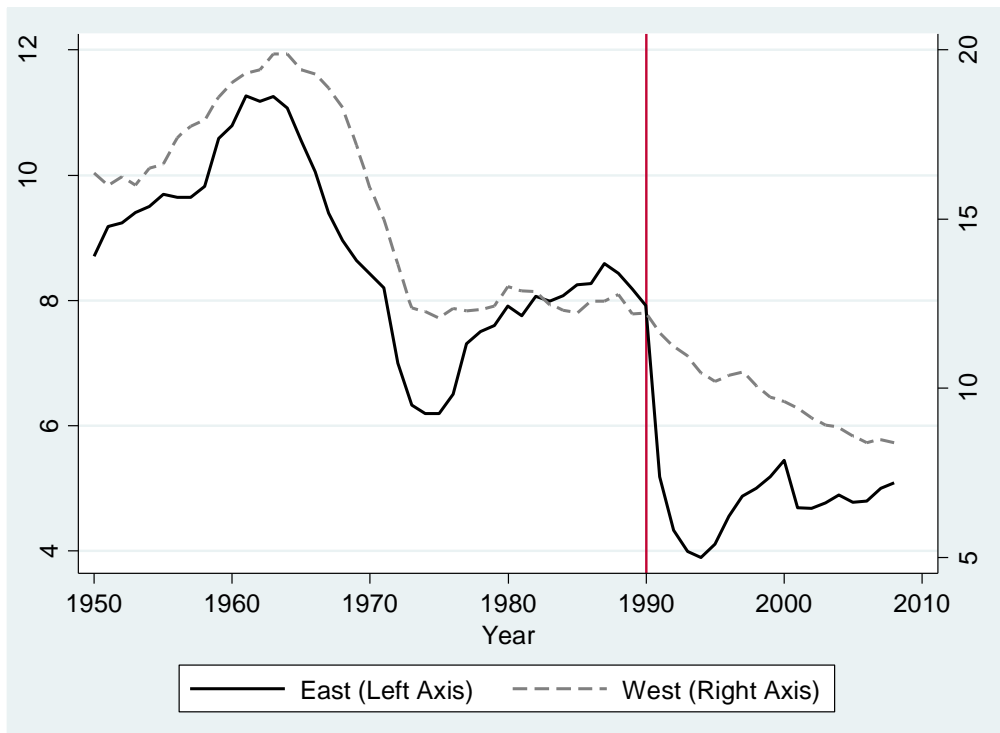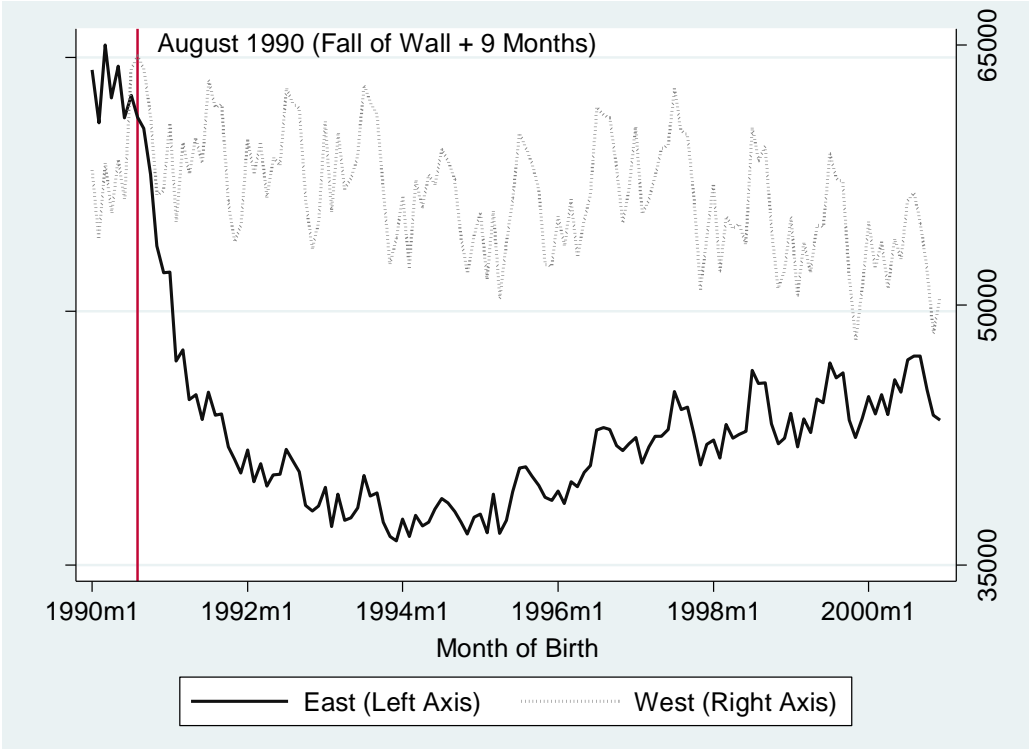

Source:

Figure 2: Difference in Difference Coefficients of East Vs West Crude Birth Rates per 1,000 Population from 1951 and 2008
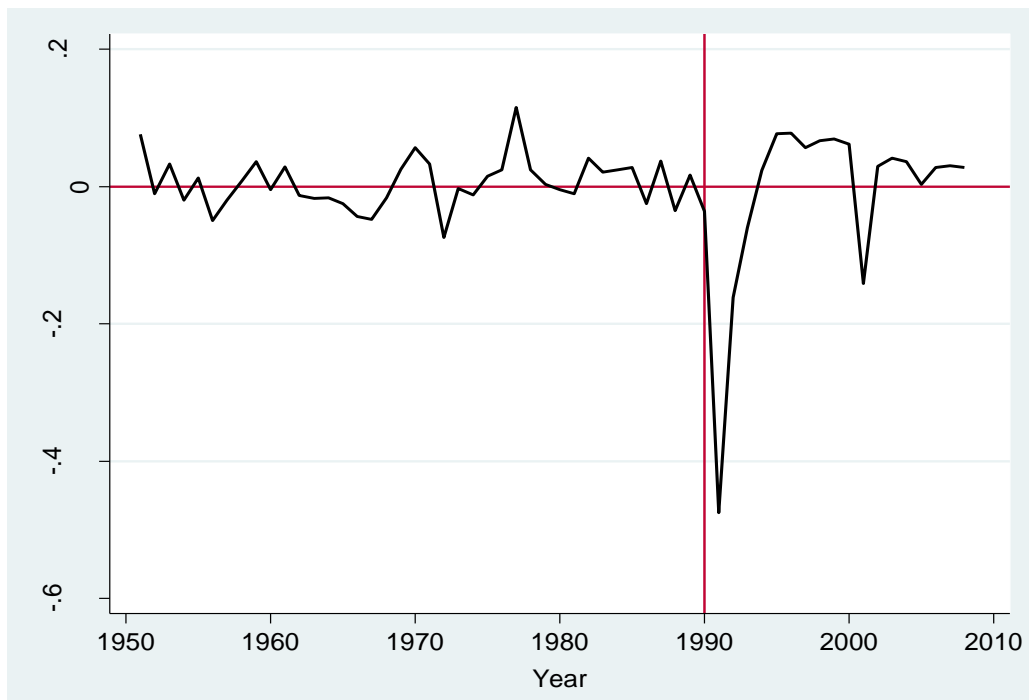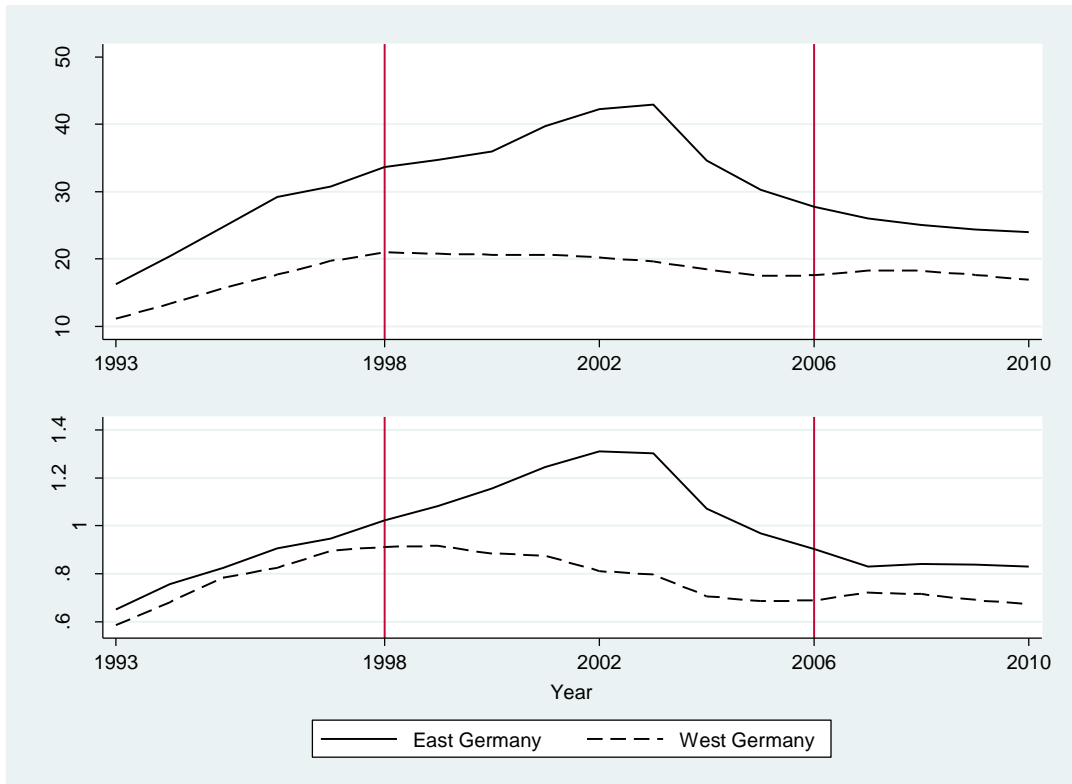
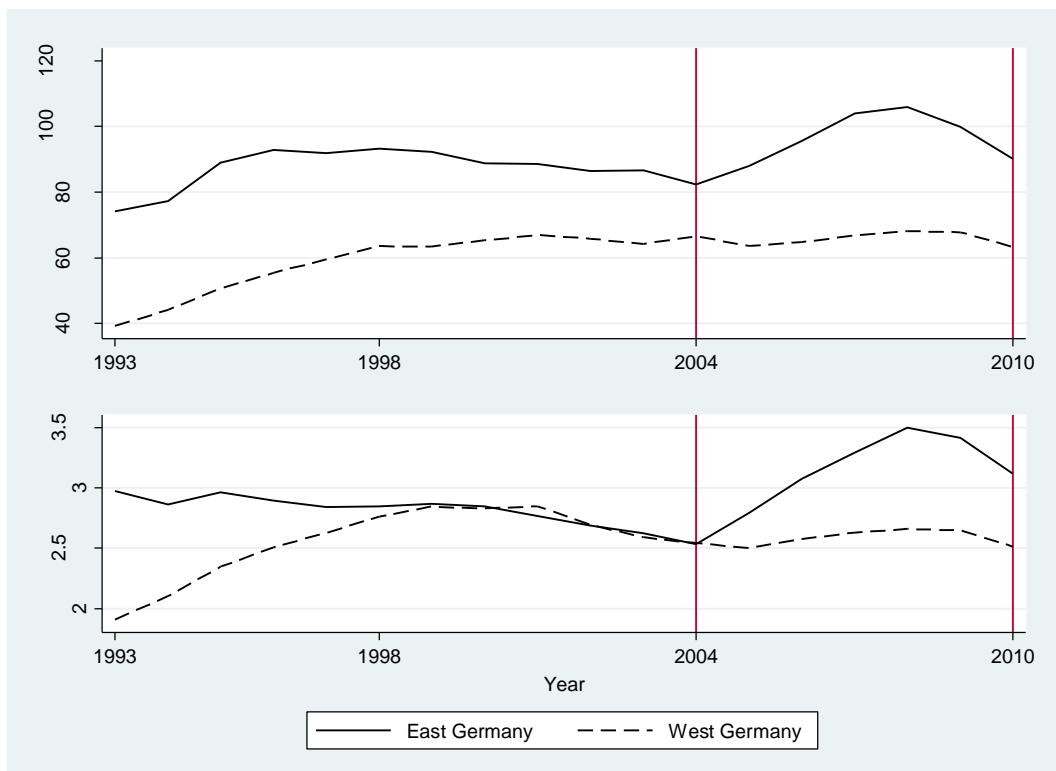**Figure 2: Monthly Number of Birth from 1990 to 2001**

Source:

Figure 4a: Arrest Rates and Arrest/Population Ratio of 8 to 13 Year Olds

Source: Polizeiliche Kriminalstatistik statistical yearbooks 1993 to 2011

Figure 4b: Arrest Rates and Arrest/Population Ratio of 14 to 17 Year Olds

Source: Polizeiliche Kriminalstatistik statistics yearbook 1993 to 2011

Figure 4c: Arrest Rates and Arrest/Population Ratio of 18 to 20 Year Olds

Source: Polizeiliche Kriminalstatistik statistics yearbooks 1993 to 2011
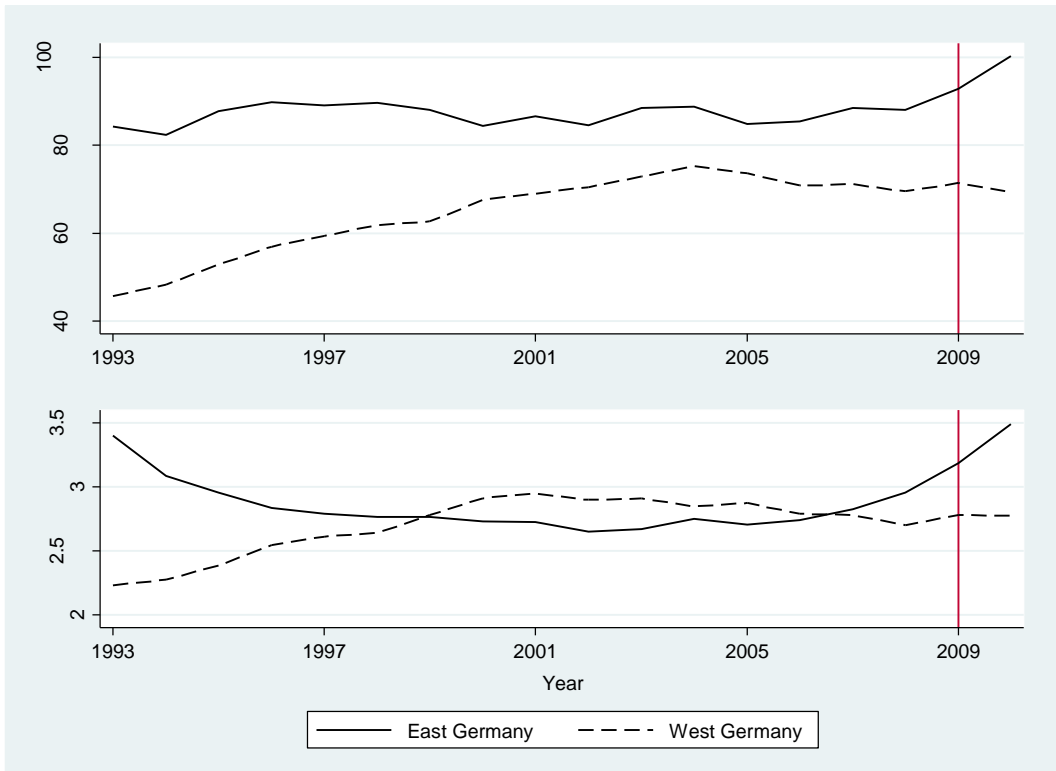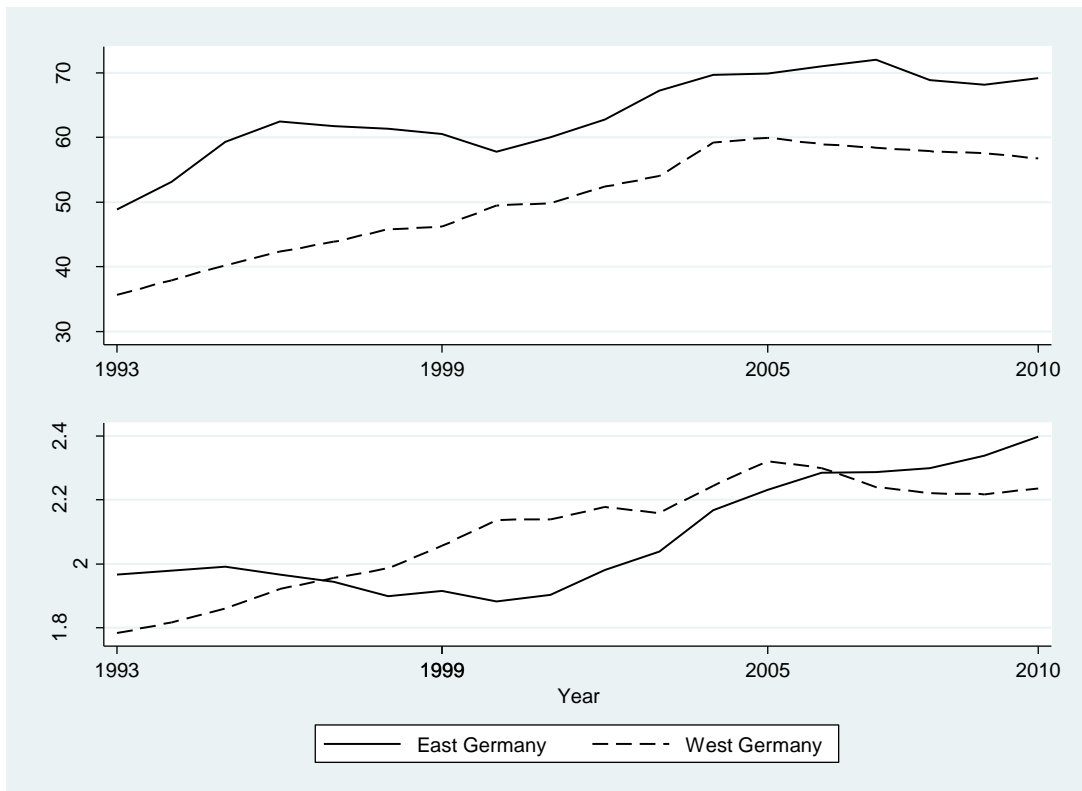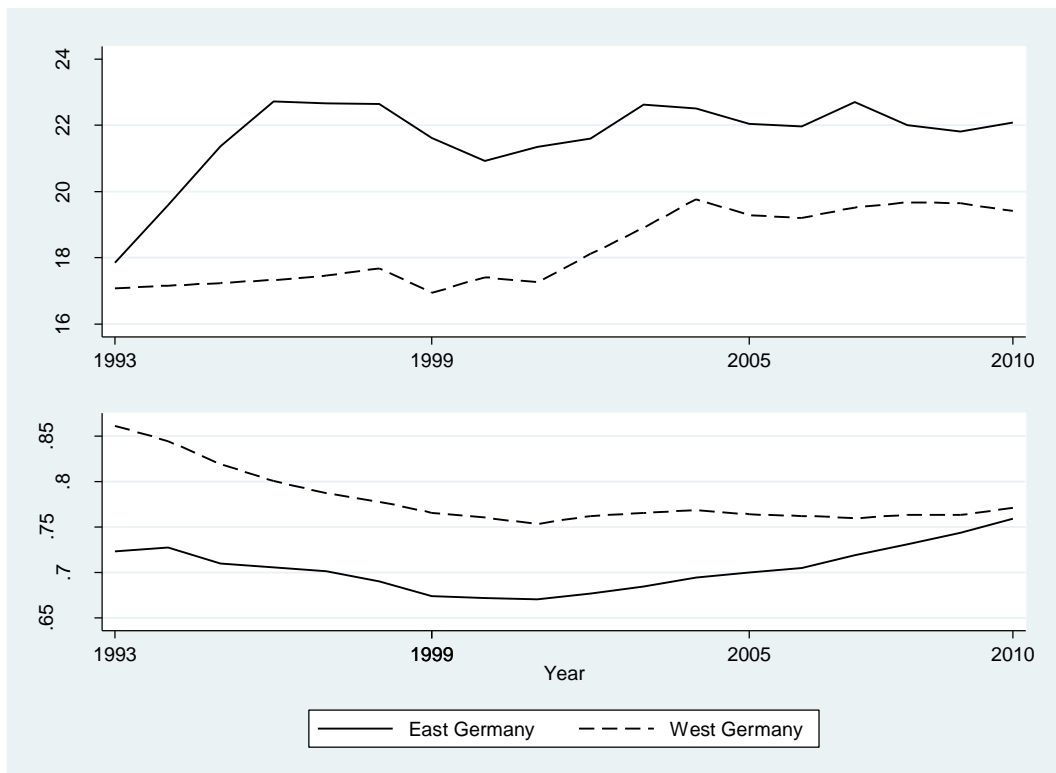
Figure 4d: Arrest Rates and Arrest/Population Ratio of 21 to 24 Year Olds

Source: Polizeiliche Kriminalstatistik statistics yearbook 1993 to 2011

Figure 4e: Arrest Rates and Arrest/Population Ratio of 25+ Year Olds

Source: Polizeiliche Kriminalstatistik statistics yearbook 1993 to 2011

Table 1: Fraction of Children of the Wall in different Groups over Time

Age Group/ Year	8-13	14-17	18-20	21-24
1998	0	0	0	0
1999	1/6	0	0	0
2000	2/6	0	0	0
2001	3/6	0	0	0
2002	3/6	0	0	0
2003	3/6	0	0	0
2004	3/6	0	0	0
2005	2/6	1/4	0	0
2006	1/6	2/4	0	0
2007	0	3/4	0	0
2008	0	3/4	0	0
2009	0	2/4	1/3	0
2010	0	1/4	2/3	0
2011	0	0	3/3	0

Note: Children of the Wall are defined as being born in an Eastern Lander between 1991 and 1993.

Table 2 – Differences in Characteristics of *Mothers* of the 'Children of the Wall'

	Age of Mother	Years of Education	Mother Married	Mother Employed	Mother Log(Income)
CoW	-1.062*** (0.354)	-0.454** (0.208)	-0.143*** (0.051)	-0.085* (0.047)	-0.108* (0.062)
Born in East Germany	-2.649*** (0.148)	0.961*** (0.079)	-0.087*** (0.014)	0.088*** (0.013)	-0.205*** (0.018)
Survey Year Dummies	Yes	Yes	Yes	Yes	Yes
Cohort Size Weight	Yes	Yes	Yes	Yes	Yes
Sample Size	11,971	6,561	6,690	6,690	6,690

Note: CoW is the interaction of having a child between 1991 and 1993 and being born in East Germany. Standard errors are clustered at the Lander level. *, **, and *** denote respectively significance at the 1, 5, and 5 percent level. Source: GSOEP 1990 to 2010.The sample size is much larger for Age of Mothers because we also use information for parental age given by respondents whose mother is not participating in GSOEP.

Table 3 – OLS: Cohort Arrest Rates & Arrest/Population Ratios

Proportion of Cohort that are CoW	Log Arrest Rate			Arrest to Population Ratio		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
i - All Age Groups	0.754*** (0.097)	0.726*** (0.109)	0.763*** (0.105)	1.094*** (0.092)	0.977*** (0.118)	0.979*** (0.119)
ii –Under 25s Only	0.436*** (0.039)	0.610*** (0.089)	0.681*** (0.077)	0.745*** (0.046)	0.883*** (0.096)	0.937*** (0.084)
iii –Under 21s Only	0.390*** (0.036)	0.509*** (0.077)	0.542*** (0.063)	0.711*** (0.063)	0.671*** (0.082)	0.705*** (0.059)
Age Group, Lander, and Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Lander Time Varying Controls	No	Yes	Yes	Yes	Yes	Yes
Lander Specific Time Trends	No	No	Yes	Yes	Yes	Yes

Note: The sample sizes are respectively: 1,350 for i; 1,080 for ii; and 810 for iii. The Lander time varying controls are: overall unemployment and youth unemployment rates; proportion foreign born by age groups; and number of police officers per 1,000 population. Robust standard error clustered at Lander level in parenthesis. *, **, and *** denote respectively significance at the 1, 5, and 5 percent level.

Table 4: Robustness - Cohort Arrest Rates & Arrest/Population Ratios Accounting for Effect of Migration of Potential Mothers

	Log Arrest Rate		Relative Size of Arrests/Population	
	Under 25s Only	Under 21s Only	Under 25s Only	Under 21s Only
Proportion of Cohort that are CoW	0.628*** (0.077)	0.506*** (0.073)	0.897*** (0.083)	0.698*** (0.059)
Proportion of Potential Mothers Migrating	1.829 (1.402)	1.402 (1.093)	1.362 (1.907)	0.296 (1.137)
Age Group, Lander, and Year Dummies	Yes	Yes	Yes	Yes
Lander Time Varying Controls	Yes	Yes	Yes	Yes
Lander Specific Time Trends	Yes	Yes	Yes	Yes
Sample Size	1,080	810	1,080	810

Note: The 'Migration of Potential Mothers' measure is created as the net migration of women from a Lander divided by the number of prime aged women in the same Lander at the time when the individuals in a cohort would have been born.. The Lander time varying controls are: regular unemployment and youth unemployment rate; proportion foreign born by age groups; and number of police officers per 1,000 population. Robust standard error clustered at Lander level in parenthesis. *, **, and *** denote respectively significance at the 1, 5, and 5 percent level.

Table 5: Differences in Characteristics *at Age 17* of the 'Children of the Wall'

	Educational Attainment			Parental Relationship			
	School Drop-Out	Repeated Grade	Test Score Above Average	Fight with Mother	Fight with Father	Mother Loves Me	Father Loves Me
CoW	-0.017 (0.019)	0.062 (0.048)	-0.015 (0.054)	0.090 (0.057)	0.077 (0.062)	-0.126** (0.047)	-0.150*** (0.056)
East	.001 (.007)	-0.051*** (0.017)	-0.070*** (0.019)	-0.070*** (0.022)	-0.082*** (0.023)	0.038* (0.022)	0.004 (0.021)
Survey Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort Size Weight	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size	3,376	3,472	3,256	3,021	3,043	3,007	2,995

Note: CoW is the interaction of being born between 1991 and 1993 and being born in East Germany. Standard errors are clustered at the Lander level. *, **, and *** denote respectively significance at the 1, 5, and 5 percent level. Source GSOEP 1990 to 2010.

Table 6: Risk Attitude Results: Mothers and Children

	Mothers (child 1980 to 2009)			Children (born 1980 to 2009)		
	Dependent Variable = Proportion Willing to Take Risk (i.e. Risk Attitude > 5 out of 10)					
CoW	0.100** (0.042)	0.082** (0.040)	0.088** (0.041)	0.141*** (0.052)	0.117** (0.053)	0.117** (0.053)
East	0.106*** (0.011)	0.038*** (0.011)	0.035*** (0.011)	-0.003 (0.016)	0.003 (0.016)	0.004 (0.016)
Age	-	-0.010*** (0.000)	-0.002** (0.001)	-	-0.015*** (0.003)	-0.014*** (0.003)
Education	-	-	0.014*** (0.002)	-	-	-0.001 (0.001)
Year of survey Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cohort Size Weight	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size		9,183			4,560	

Note: CoW is the interaction of having had a child for mothers and for being born between 1991 and 1993 in East Germany. Risk attitude measures come from the average of the 2004, 2006, 2008, 2009, and 2010 of questions on the willingness to take risk ranked between 0 (minimum) and 10 (maximum). *, **, and *** denote respectively significance at the 1, 5, and 5 percent level. Source GSOEP from 1990 to 2010.

Appendix A: East to West Migration

Table A1: Differences in Characteristics between Stayers and Movers

	Stayed East	Moved West	Difference
Males	0.500	0.465	-0.034**
Age	40.1	39.7	-0.389
Married	0.532	0.424	-0.107**
High School	0.885	0.897	0.012
Years of Education	12.1	12.6	0.461***
Employed	0.509	0.688	0.180***
Yearly Income (€)	30,475	34,886	4,410***
Family with Child Born 1991-93, East or West	0.020	0.009	0.010***
Observations (Max)	12,029	995	-

Note: ** and *** denote significance of the t-test between the average for population of Stayers and Movers at the 5% and 1% confidence level. Source GSOEP 1990 to 2010

Table A2: Probability of Moving West if Born East

	All	Women Only	Mothers 1988-1996
Family with Child Born 1991-93, East or West	-0.021*** (0.004)	-0.020*** (0.006)	-0.008 (0.009)
All Controls	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Observations	80,123	43,411	8,889

Note: The controls are all the variables for which the means are reported in Table 5.1. *, **, and *** denote respectively significance at the 1, 5, and 5 percent level.