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**Conference Paper**

## Permanent Changes in the Wage Structure and the East German Fertility Crisis

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik  
- Session: Marriage and Children, No. B02-V2

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Arntz, Melanie; Gathmann, Christina (2014) : Permanent Changes in the Wage Structure and the East German Fertility Crisis, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2014: Evidenzbasierte Wirtschaftspolitik - Session: Marriage and Children, No. B02-V2, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

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# PERMANENT CHANGES IN THE WAGE STRUCTURE AND THE EAST GERMAN FERTILITY CRISIS \*

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This version: February 14, 2014

## Abstract

After the fall of the Berlin wall, the total fertility rate in East Germany tumbled from 1.7 (1989) to a stunning 0.7 children per woman (1994). While this fact is well-documented, little is still known about the crisis's underlying causes. We propose a new explanation: permanent shifts in the East German wage structure that are plausibly exogenous from the individual's perspective. Economic transition dramatically increased the returns to human capital in East Germany. Economic theory suggests that rising returns to experience and education favor career investment and the postponement of births. Our results suggest that women postpone fertility when the wage penalty for time off work in the current period are high; and the postponement is much stronger for high-skilled women. Overall, our estimates can account for a substantial fraction of the observed fertility decline and demonstrate that incentives in the labor market have a strong influence on fertility decisions.

**Keywords:** Fertility, Wages, Unemployment, East Germany

**JEL Classification:** J13, J31, P31, P36

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\*We are grateful to the research program "Strengthening Efficiency and Competitiveness in the European Knowledge Economies" (SEEK) by the state of Baden Württemberg for generous funding. We thank Martha Bailey, Nicole Gürtzgen and participants at the SEEK Conference at the ZEW Mannheim for useful comments. All remaining errors are our own.

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# 1 Introduction

After the fall of the Berlin wall, the total fertility rate (TFR) in East Germany, which describes the average number of children a woman will have over her childbearing years, tumbled from 1.7 (1989) to 0.7 (1994) children per woman on average. Total fertility rates below one are rare events during peacetime – which has prompted many observers to call this episode the "East German fertility crisis"<sup>[1]</sup> Figure 1 shows the total fertility rate in West and East Germany prior to and after unification. In the decade prior to unification, East German fertility rate consistently exceeds West German fertility rate by about 0.3 – 0.4 children per woman. In the years after unification, total fertility in East Germany drops sharply, started to recover after 1995 and approaches West German levels of about 1.3 – 1.4 children per woman only by 2008.

A large literature has documented the fertility crisis in East Germany (see, for example, (Eberstadt 1994); (Billingsley 2010); (Kreyenfeld 2004)). Yet, little is known what exactly explains the dramatic change in fertility behavior among East German women after unification. An early attempt attributes the rapid decline in East German fertility rates to the economic uncertainty and sense of crisis in the first years after unification ((Witte and Wagner 1995); (Kreyenfeld 2010)). However, the crisis argument has difficulties to explain why fertility behavior did not bounce back in the 1990s when the uncertainty surrounding unification was resolved.<sup>[2]</sup>

An alternative explanation argues that the fertility crisis is nothing but an adjustment process to the lower fertility levels in West Germany (see, for example, (Conrad, Lechner, and Werner 1996); (Lechner 2001)). After 1990, East Germany basically inherited the legal and institutional framework from West Germany. Facing similar institutional and economic incentives, so the argument goes, East German women converge in their fertility to their West German counterparts. Despite the common institutional framework however, East and West Germany differ along important socio-economic characteristics even today (see also (Kreyenfeld and Konietzka 2004); and (Goldstein and Kreyenfeld 2011)). East German women have higher

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<sup>1</sup>Similar, though considerably less dramatic declines in the fertility rate were observed in other transition countries, most notably Russia or the Czech Republic (see, for example, (Billingsley 2010); (Sleebos 2003); (Sobotka 2003)).

<sup>2</sup>There is mixed empirical support for the crisis explanation even for the initial years after unification. Bhaumik and Nugget (2005) report a negative correlation between employment risk and fertility, while Kreyenfeld (2010) fails to find a statistical relationship between job uncertainty and fertility in East Germany after 1990.

employment rates and fewer women are employed in part-time work, for example. And both wages and household income are still lower in East Germany than in West Germany even more than two decades after unification. Given these persistent differences, it remains an open question what explains the dramatic changes in East Germany fertility.

Here, we propose a novel explanation for the observed fertility decline. Rather than a crisis phenomenon or mere adaptation to West Germany, we explore the link between permanent changes in the labor market and fertility behavior. After 1990, the transition process of the East German economy resulted in substantial changes in its wage and employment structure. Jobs were destroyed at a massive scale as many companies were unable to compete with firms from West Germany. Wages began to reflect market principles in the early 1990s. As a consequence, returns to education, which were modest in the socialist economy, rose rapidly after unification, especially for the high-skilled. Returns to work experience rose substantially - creating steep age-earnings profiles that young women entering the labor market faced after 1990. As a result, substantial wage penalties for time away from work for childbirth and childcare emerge after unification, especially for very young and for high-skilled women in East Germany.

Economic models of fertility suggest that permanent shifts in the wage structure affect the demand for children through the opportunity costs of having children (often measured as wages and employment opportunities of the mother) and the income effect (often measured as male wages and other income in the household). In addition, the restructuring of the economy after unification should affect the timing of childbirth as well. In particular, women postpone births as skill depreciation or fewer career opportunities after time off work reduce lifetime earnings associated with early childbirth.

To quantify these mechanisms, we make use of unique administrative data from the German Federal Pension Fund which provide comprehensive fertility histories of a 1% sample of all West and East German women born between 1940 and 1977. We combine the fertility histories with data on earnings and household income from the German Socio-Economic Panel (GSOEP) for the pre- and post-unification period; and data on employment and unemployment in East and West Germany from administrative social security records.

Merging these data sources, we exploit variation at the age  $\times$  time  $\times$  region level and across

education groups to study the consequences of permanent changes in wages and employment on fertility behavior. As the variation in wages, income and employment are the consequence of a much broader restructuring of the East German economy according to market principles, these changes are plausibly exogenous from the perspective of the individual East German woman. Our empirical strategy then identifies the role of permanent wage and employment changes for the demand for children and the timing of birth in East Germany after unification.<sup>3</sup>

Our estimates suggest that prior to unification, wages, income and wage differentials by skill had little influence on fertility choices. After unification, wages and in particular the penalties associated with time off work become significant determinants of the demand for children and the timing of births. Rising wage penalties of childbearing (through time off work) substantially reduce fertility at early ages, especially among high-skilled women.

Like earlier studies, we find that male wages and household income have a positive effect on current fertility. Furthermore, male unemployment rates have a negative effect on current period fertility suggesting that expected lower income through employment risk reduces fertility. In contrast, female unemployment rates have a positive effect on current-period fertility. This result would be consistent with periods of high unemployment reducing the opportunity cost of female time (an important input in the case of infants and small children). Together, the permanent changes in wages and unemployment can explain a substantial share of the observed decline in the demand for children as well as the postponement of births.

Our paper contributes to three different literatures. The paper is most closely related to studies on the link between economic incentives and fertility. An older literature identifies strong links between opportunity costs of a child, typically measured as the current wage, skill level or occupation, and fertility ((Heckman and Walker 1990); (Merrigan and St.-Pierre 1998); (Schultz 1985); (Happel, Hill, and Low 1984); (Gustafsson 2001) provides a nice survey of the earlier literature). One of the key challenges in this literature is to find plausibly exogenous variation in income, wages and employment to identify their effects on fertility behavior (see (Hotz, Klerman, and Willis 1997); but see (Schultz 1985)). A second challenge is to distinguish

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<sup>3</sup>In a paper complementary to ours, (Adda, Dustmann, and Stevens 2011) develop a dynamic life-cycle model of occupation choice, labor supply and fertility which they use to study the career costs of childbearing in West Germany.

the effects of transitory changes in wages and employment induced, for example, by business cycle fluctuations and individual job loss from permanent changes in the wage structure.

More recently, the income effect has been identified using job displacements of the husband ((Lindo 2010) for the US; (Del Bono, Winter-Ebmer, and Weber 2012) for Austria) or policy reforms (see (Milligan 2005) for Canada; (Björklund 2006) for Sweden; (Cohen, Dehejia, and Romanov 2013) for Israel; (Laroque and Salanie 2013) for France) as source of identification. For very different contexts, these studies typically find a positive income effect.<sup>4</sup> Our analysis in turn exploits plausibly exogenous permanent changes in the wage structure for identification.

Our paper also contributes to a recent literature on how access to birth control affects women’s careers and earnings ((Goldin and Katz 2002); (Bailey 2006); (Bailey 2012)).<sup>5</sup> Our paper employs a similar estimation strategy exploiting aggregate changes that are plausibly exogenous from the individual’s perspective for identification. Yet, we focus on the reverse relationship: how permanent changes in wages and career opportunities affect family formation and fertility behavior.

In our East German setting, unemployment and job loss are important and long-lasting features of the transition process in East Germany. As such, our paper is also related to the literature on the cyclicity of fertility ((Dehejia and Lleras-Muney 2004); see (Butz and Ward 1979) for an early contribution) and the influence of job displacement on fertility (see (Del Bono, Winter-Ebmer, and Weber 2012) for Austria, (Huttunen and Kellokumpu 2012) for evidence from Finland).

Finally, our paper also contributes to studies on the fertility effects of education. The literature typically finds that more education results in postponement of births (e.g. (Black, Devereux, and Salvanes 2008)). The effect on total completed fertility is less clear: some studies report negative effects ((Leon 2006) for the US; (Lavy and Zablotsky 2011) for Israel), while others find no such effect ((McCrary and Royer 2011) for the United Kingdom). Our results clearly suggest that higher education leads to a postponement of births - but only after unification when skill differentials become large.

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<sup>4</sup>(?) finds that tax incentives might also influence the timing of birth in the United States.

<sup>5</sup>(Hotz, McElroy, and Sanders 2005) and (Miller 2011) in contrast use fertility shocks (like miscarriages) to analyze the effect of fertility on career wages and other labor market outcomes in the United States.

Understanding the determinants of low fertility rates has important policy implications. Many countries in the European Union (e.g. Italy, Spain or Germany) and elsewhere (e.g. Russia or Japan) have fertility rates similar to East Germany ((Sleebos 2003)). The total fertility rate in the European Union was only 1.6 in 2009, Russia has currently a total fertility rate of about 1.7 children per woman - well below the replacement level of 2.1 children per woman. As a consequence, these countries have declining populations raising important questions about the sustainability of social security (if built on a pay-as-you-go system) or future economic competitiveness, to name just a few pressing issues. Rather than just managing those challenges, we need to identify mechanisms through which childbearing can be encouraged. For example, if low fertility is mostly determined by low financial resources, family policies that support families with children seem most appropriate. If in contrast, child penalties in the labor market or skill depreciation during time off work are important, the focus of policy-makers should be on policies like childcare provision or maternity leave legislation.

The paper proceeds as follows. The next section provides a more detailed picture of fertility and wage changes after unification. Section 3 discusses the theoretical mechanisms between economic restructuring after unification and fertility behavior. Section 4 discusses the data sources we combine fertility histories, wages, income, employment and other control variables in East and West Germany before and after unification. Section 5 introduces our empirical strategy and reports the main results. Section 6 probes the validity of our findings to alternative explanations and specifications. Finally, Section 7 concludes.

## **2 The Fertility Crisis and Changes in Wages in East Germany**

### **2.1 Fertility patterns before and after unification**

We now take a closer look at the specific changes underlying the evolution of the aggregate total fertility rate in Figure 1. The East German transition process was characterized by a sharp increase in the mean age at first birth (see also (Kreyenfeld 2009); (Kreyenfeld 2012)). Figure 2 shows the share of first births that occur at a certain age of a cohort. Women born prior to 1965 had their first child in the socialist regime at age 20 or 21. In the cohorts born 1970 or later

(who were 19 years-old in 1989), there is clear tendency to shift their first birth to later ages. This postponement of births is also reflected in aggregate statistics which show an increase in the mean age at first birth in East Germany by about five years after unification (see Figure A2 in the appendix). As a consequence, the mean age at first birth slowly converges to, but remains below West German levels (see also (Arránz Becker, Lois, and Nauck 2010); (Kreyenfeld 2009)).<sup>6</sup>

A second development is that the fraction of women who have two and three or more children declines substantially after 1990 (see also (Kreyenfeld 2009) for related evidence). Figure 3 decomposes the total fertility rate in East Germany (the top line) by first births, second birth and higher-order births. The picture again reflects the temporary decline in first births due to the postponement of births among younger women. For second and higher-order birth, however, there is a permanent decline: whereas second births contributed 37% to the TFR in 1989, the share declines to 29% in 2001. Similarly, three or more children contributed 15% to the total fertility rate in 1989, but only 11% in 2001. As a consequence, the probability of having two or more children is significantly lower in East Germany than in West Germany (see also (Arránz Becker, Lois, and Nauck 2010) for additional empirical evidence).<sup>7</sup>

In contrast to age at first births, we see no dramatic change in the mean age for second or higher-order births (see Figure A3 in the appendix). While there is clear upward trend in the mean age in both East and West Germany, there is no observable trend break after unification.<sup>8</sup>

The third interesting development is that changes in fertility behavior after unification are not distributed uniformly across skill groups (see, for example, (Kreyenfeld 2006) for a similar observation). Before unification, total fertility rates are quite similar across skill levels and hovered around 1.6 – 1.7. Figure 4 shows that total fertility changes little for low-skilled women after unification. Yet, there is dramatic fertility decline among medium-skilled and

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<sup>6</sup>A postponement of births (a "tempo effect") results in a lower total fertility rate than actual completed fertility by women aged 18 to 45. To study how much tempo effects reduce TFR, one can calculate an adjusted TFR that accounts for the change in mean age for each birth order (see (Bongaarts and Feeney 1998) for details of the calculation). Luy and Pötsch (2011) find that the tempo-adjusted TFR still falls by 0.4 between 1986-90 and 1996-2000 compared to 0.47 for the unadjusted TFR. Compared to West Germany, East Germany's adjusted TFR is higher (by 0.3) in the decade prior to unification, but converges to lower West German levels of about 1.6 by around 2007. Hence, both tempo and level effects drive the change in TFR observed in Figure 1.

<sup>7</sup>Existing analyses of desired fertility match this pattern. Survey evidence suggests that East Germans are significantly more likely than West Germans to say that they prefer to have a single child ((Dorbritz 2005)).

<sup>8</sup>At the same time, East German women are still less likely to remain childless (see Figure A4 in the appendix) than women in West Germany (see also (Dorbritz and Schwarz 1996)). Note that the upward trend for younger cohorts occurs because they have not yet completed their fertility.



especially among high-skilled women. Among high-skilled women, the total fertility rate fell by 0.99 between 1989 and 1995, whereas total fertility fell only by 0.1 for low-skilled women over the same period. The heterogeneous response persists well into the 2000s.

Overall, the descriptive evidence suggests that unification induced three important shifts in fertility behavior: (1) a sharp increase in the age at first birth (a tempo effect); (2) a decline in the share of women with two and more children (a level effect); and (3) a much stronger response among high-skilled women (heterogeneity). We will next document the major changes in the labor market that occurred in East Germany after unification.

## **2.2 Evolution of Wages and Income after Unification**

With unification in October of 1990, East Germany adopted the political and institutional framework of West Germany. The dismantling of the East German economy began shortly after the fall of the wall in November 1989 and continued in the following years. During the transition to a market economy, many jobs in the socialist economy were destroyed. As a consequence, unemployment rose rapidly after unification (see Figure A4). In addition, aggressive wage bargaining between unions (mostly from the West) and East German employers (or their representatives) resulted in rapid growth in average wages shortly after unification (see Figure A5).

As the East German economy was transformed into a market economy, the wage and employment structure underwent dramatic changes after unification that were largely exogenous from the point of view of the individual. To trace changes in the structure of wages net of employment changes, we work with wage information that includes imputed wages for non-workers. Details on how we imputed wages are provided in the data section below as well as the data appendix.

The first important development is that returns to work experience rise substantially during the East German transition. In the socialist economy, age-earnings profiles were relatively flat (see also (Bird, Schwarze, and Wagner 1994) and (Krueger and Pischke 1995) for related evidence). Figure 5a shows the evolution of age-earnings profiles using a synthetic cohort approach. The age-earnings profile for 1995, for example, shows what East Germany women between the ages of 20 to 60 earned in 1995. If skills accumulated in the socialist regime depreciate (or there is some other cohort effect) however, the synthetic cohort approach underestimates the

actual earnings young women today will have in twenty years. Figure 5b exploits the panel dimension instead to trace the earnings of women aged 20, 25, 30 or 35 years in 1990 over the period from 1990 to 2009. The panel evidence suggests that actual earnings profiles were even steeper suggesting substantial returns to work experience for young women in East Germany after unification.

A second important shift concerns the returns to education. Figure 6 plots wage differentials by skill group in the socialist regime (1989/1990) and for selected years after unification (1995, 2000 and 2005) relative to low-skilled wages prior to unification (1989/90). Wage differentials across skill groups were non-trivial even in the socialist regime: high-skilled women in Germany earned about 85% more per month than low-skilled women. During the 1990s however, skill differentials rise substantially. By 2005, high-skilled women in East Germany earn 375% more than low-skilled women in 1989/90 - and still 265% more than low-skilled women in East Germany in 2005.

As a result of the shifting wage structure and high unemployment rates, the penalty for leaving the labor market for childbirth and childcare rose dramatically in East Germany during the 1990s. To demonstrate this, we calculate predicted career wages for women giving birth to a child at different ages both for the pre- and post-unification period. These career wages are based on a Mincer earnings regression of log monthly wages on potential experience, potential experience squared, indicators for medium- and high-skilled and interactions between the skill level and experience profile. In addition, we include dummy variables whether a woman gave birth at age 20-24, age 25-29, age 30-34 or age 35 and above, and interactions between those dummy variables and the skill group and experience profile. To allow for differences in skill prices across time and space, the regression is further run separately for East and West Germany as well as for the pre-unification period and several post-unification periods (1990-1994, 1995-1999 and 2000-2004). Career wages are then calculated as predicted wages from that regression summed over the next fifteen years of a woman's labor market career for all women aged 20 to 40<sup>9</sup>

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<sup>9</sup>These career wages underestimate the true wage cost of childbearing for two reasons: first, we do not count wage losses from time out of the labor market prior to and after the birth or for parental leave. Second, we estimate career wages from actual choices; to the extent that potential wage losses are an important factor in fertility decisions, observed fertility and its timing is chosen to minimize wage losses (among other factors). The costs of purely accidental birth could be even larger. As such, we think that our wage penalties are a conservative

Figure 7 shows the loss in career wages for a woman giving birth to a child at a certain age relative to the career wages of a childless woman. In East Germany, wage penalties for childbirth even at very young ages carried essentially no wage penalty. This situation changes completely after unification. Child penalties, especially for women with a childbirth between 20 and 24 rise to about 13% relative to a woman without a child. Wage penalties at later ages are also larger than in the socialist economy, but with 5.7% to 7.8% much lower than for young mothers. The comparison with West German in the bottom panel also shows that wage penalties for childbearing are still much lower in East Germany than in West Germany. In West Germany, child penalties for women aged 20-24 and women aged 25-29 (relative to a childless woman) may exceed 30%.

### 3 Theoretical Considerations

Static fertility models ((Becker 1960); (Becker 1965); (Willis 1973)) provide a framework to analyze the impact of wage changes after unification on completed fertility. Taking children to be normal goods, a permanent increase in household income would raise the demand for children.<sup>10</sup>

Permanent wage increases (holding other income constant), in turn, induce both income and substitution effects. Assuming that women are the primary caretaker of very young children, growing wages for men should primarily have an income effect and hence, increase the demand for children.

For female wages, in contrast, the substitution effect, raising her opportunity cost and hence, the price of having a child, becomes important. Several studies have reported negative effects of female wages on completed fertility (see (Heckman and Walker 1990); (Merrigan and St.-Pierre 1998); (Schultz 1985); (Ward and Butz 1980), for example). Rising women's wages should then reduce completed fertility in East Germany.<sup>11</sup>

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estimate.

<sup>10</sup>The predictions from the Becker model refer to the quality-adjusted demand for children. Note that quantity predictions are generally ambiguous once quality considerations are taken into account. In the theoretical discussion, we abstract from potential effects on child quality.

<sup>11</sup>If changes in wages after unification are only transitory, there would be no effect on total fertility but timing of births would still respond. The descriptive evidence, however, clearly suggests that changes in the East German wage structure and income were permanent adjustments to a market economy. Further, if households are uncertain

Even holding the total number of children constant, however, couples time their fertility over the life-cycle to maximize lifetime income ((Heckman and Walker 1990); (Hotz, Klerman, and Willis 1997). With no skill depreciation (or otherwise lower future earnings) after a time away from the labor market, fertility will be high when opportunity costs, i.e. wages, are low. In that case, women tend to have children at the beginning of their career or even when they are still in education.

No skill depreciation and low wage penalties of motherhood fit the situation prior to unification. Since opportunity costs were low at the beginning of the career and the wage penalties of leaving the labor market were low, women of all skill groups had their first child in their early twenties.<sup>12</sup>

The situation changes completely after unification. Steeper age-earnings profiles, if paired with skill depreciation, imply substantial wage penalties for leaving the labor market. Together, these impose additional opportunity costs of having a child early in the life-cycle because wages are lower later in the career as well. In response, women should postpone their births to a later age if the future career costs exceed the value of having a child early in the life-cycle (see (Hotz, Klerman, and Willis 1997) for an excellent survey).

In addition, time off the labor market will also interrupt a woman's career and reduce not only future employment, but also one's future career options. If women face fewer career options after time off work (as in a so-called "mommy track"), they might postpone births until she moves up the age-earnings profile. Germany seems to fit well into this pattern. The labor market in West Germany, which was by and large instituted in East Germany after 1989, is associated with a lot of part-time work by mothers and a substantial wage penalty associated with part-time work.<sup>13</sup> Career options would then be a second explanation why East German women would postpone births to a later period in their life-cycle after unification.<sup>14</sup>

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about the nature of wage changes, they might still respond to a permanent shock as if it was transitory. Given the rapid adjustment in East Germany under the guidance of West Germany, we would argue, however, that most households knew the changes in East Germany were permanent.

<sup>12</sup>Most women could return to their old employer after a maternity leave and free fulltime childcare was provided by the state. There were also other benefits of early parenthood, such as access to rationed housing and other family subsidies, which we turn to in the robustness section.

<sup>13</sup>Furthermore, family policy provides generous maternity benefits for an extended leave and the tax system encourages part-time work of the second earner (through income tax splitting).

<sup>14</sup>Imperfect capital markets could be another influence on the timing of fertility. With imperfect capital markets, the path of future wages of other household members, most notably the partner or husband, will influence fertility

We also expect that high-skilled women respond more strongly to the new labor market incentives after unification. Since human capital loss and wage penalties for time away from the labor market are more important for skilled women, high-skilled women should postpone births even more than low-skilled women (see (Gustafsson 2001) for evidence from Sweden).<sup>15</sup>

## 4 Data Sources

We combine several data sources to analyze the impact of permanent shifts in employment and wage structure on fertility in the East German transition process. We describe each of them in turn. A more detailed description of the sample and the construction of our variables is provided in the data appendix.

### 4.1 Fertility Histories

To study changes in fertility decisions of East German women after unification, we need high-quality data on fertility histories in East Germany before and after unification. Such data have recently become available from the German Pension Fund.

This administrative dataset contains the labor market and fertility history of a 0.25% sample of all individuals with at least one pension-relevant spell but no pension receipt by the end of 2007. Overall, the dataset covers approximately 96% of the population born between 1940 and 1982 (see (?)). For these cohorts, the data record all pension-relevant spells on a monthly basis starting from age 15. These include employment in the private and public sector, certain self-employed professions (e.g. artists), long-term illness covered by health insurance, periods of care for an elderly person or children under the age of three.

Most importantly for our purpose, the pension data also record the birth dates of all children which are verified by birth certificates. The reliability of the fertility and employment histories are considered very high. For our empirical analysis, we restrict the sample to women born

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decisions. In particular, couples will postpone births to periods when the income of the partner is high as female wages are used to smooth consumption. With human capital loss and career opportunities, it is, however, not clear-cut that fertility will be higher in periods where the partner's wage is high.

<sup>15</sup>In addition, rising returns to education would further delay births among women born 1970 or later who invest in more education after unification (see (Black, Devereux, and Salvanes 2008), for example). We will return to this issue below.

between 1940 and 1977 because their records have been verified by the federal pension agency and the insured woman.

We define an East German as someone born and raised in East Germany prior to unification. However, the pension data only record the region of residence in 2007. Based on an individual's employment history, we define an East German as someone with an pension-relevant spell in East Germany prior to unification. For younger cohorts, we define East German origin if the first employment spell is in East Germany. If we cannot classify a person based on these rules, we use the region of residence in 2007 instead. Because fertility decisions differ by formal education, we also distinguish three skill levels: the unskilled, the medium-skilled (those with high school or vocational degree) and the high-skilled (those with a tertiary education).

To focus on the changes shortly before and after unification, we further restrict the empirical analysis to women aged 20 to 40 years in the period from 1980 to 2000. For each woman, we thus have an unbalanced panel whether a child was born during a year or not and when the mother was employed or not. Overall, our dataset contains information about 4,400 East German women and 11,400 West German women who had close to 9,000 birth during a total of 157,434 person-years between 1980 and 2000.

## **4.2 Wages and Household Income**

To measure changes in wages and household income for East and West Germans both before and after unification, we use data from the German Socio-Economic Panel (GSOEP). The household panel surveys around 24,000 individuals each year, of which 6,000 are from East Germany, about their wages, household income, employment and household structure. The survey started in 1984 in West Germany and was extended in 1990 to East Germany. Most importantly, the survey asked East Germans in 1990 about their wages and income prior to the fall of the Berlin Wall (May 1989) and prior to German unification (May 1990).

We use the wage information for 1989 and 1990 to construct wages and income for the pre-unification period in East Germany and the data between 1991 and 2009 to characterize wages and income in the post-unification period. For West Germany, we use wage and income information from 1984 to 1989 for the pre-unification period and data from 1991 to 2009 for the

post-unification period. Wages are measured as monthly gross earnings and deflated to 2005 Euros. We use several income categories available for 1989 and 1990 (labor and capital income as well as public transfers) to construct a consistent series of household income for the pre- and post-unification period.

As in the pension data, we define three skill groups: low-skilled (those without a vocational training or highschool degree), medium-skilled (those with a highschool degree and/or a vocational degree) and high-skilled (those with a tertiary education). Since the GSOEP elicits the location of residence prior to the fall of the Berlin Wall in 1989, we know exactly who is of East German origin irrespective of their current residence.

### 4.3 Employment and Unemployment Rates

For measures of unemployment and employment rates, we use social security records from the Institute for Employment Research. The data contain social security records of close to 1.4 Mio. individuals in Germany, covering employment spells in the private and public sector as well as unemployment spells (if transfers from the unemployment insurance are received) between 1975 and 2004.

Based on this information, we are able to define employment, unemployment and non-employment rates by age (3-year age bands from age 20 to 40) and skill group (low-, medium-, and high-skilled) separately for East and West Germany and year. We calculate the unemployment rate as the share of unemployed women (men) among all women (men) who are either employed or unemployed on June 30 of each year. Similarly, we calculate employment rates as the share of employed women (men) among all women (men) recorded in the data as either employed, unemployed or non-employed.

For East Germany, the social security records start in 1992. We assign the 1992 information to the missing post-unification year 1991. For the pre-unification period up to 1990, we assign a zero unemployment rate because involuntary unemployment (and unemployment benefits) did officially not exist in the socialist regime. Analogously, we assume that all East Germans were employed prior to unification. Table 1 contains descriptive statistics of our sample as well as the major explanatory variables that we estimate using the following two datasets.

## 5 Estimation and Main Results

### 5.1 Empirical Strategy

We first use the pre-unification period to explore the link between the labor market and fertility in the socialist regime. In a second step, we expand the period of analysis to East German women in the post-unification period. Finally, we pool East and West German women over the full period which enables us to control for common institutional effects (for example, family policies and other labor market institutions) in the post-unification period.

Our empirical strategy relies on the fact that women were differentially affected by the transition process after 1989. Women who spent most of their childbearing years in the socialist regime (the cohorts born between 1940 and 1955, for example) had completed their fertility before 1990. For these cohorts, unification and the associated changes in the labor market will have little effect on their behavior. Cohorts born between 1955 and 1966 which were between 23 and 35 were partially affected by unification. Given the young mean age at first births, many of these women have given births to their first child in the socialist regime. Unification mostly affects their decision to have a second or more children. The cohorts born 1967 or later - and especially those born after 1970 only enter their childbearing years after unification. For them, the decisions for all births will be affected by the changes in the East German labor market after unification. Faced with substantial skill premia, we also expect that fertility responses are strongest among high-skilled women.

Overall, we exploit variation by birth cohort, time, region and education to estimate variants of the following model:

$$\begin{aligned} Y_{iaert} = & \beta_1 * ChildNow_{aert} + \beta_2 * ChildNext_{aert} + \delta_1 * AverageWage_{aert} + \\ & + \delta_2 * Unemployment_{aert} + \gamma_1 * Post1990_t + \gamma_2 * East_r + \\ & + \gamma_3 * Post1990_t * East_r + \lambda' X_{iaert} + \epsilon_{iaert} \end{aligned} \quad (1)$$

where the dependent variable  $Y_{iaert}$  are fertility measures for an individual  $i$ , at age  $a$ , of education group  $e$ , in region  $r$  and in year  $t$ .



Our main variables of interest are  $ChildNow_{aert}$  and  $ChildNext_{aert}$  which provide a summary measure of the child penalty associated with child birth. Both measures calculate the average career wage per month (corrected for selection in the labor market) when a woman has a child in the current year versus in later years. We expect that higher career wages in the current period delay or reduce childbearing ( $\beta_1 < 0$ ), whereas higher career wages in the future encourage childbearing in the current period ( $\beta_2 > 0$ ).

We also control for aggregate wage growth (of men and women separately) and for unemployment (or employment) rates in an age x year x region x education cell. We further allow fertility to differ between pre- and post-unification, to differ between East and West and allow for a differential shift in East Germany after unification. Finally, we control for education and age effects; in some specifications, we allow for differential age patterns in East Germany. Finally, we include an indicator for the post-unification period to capture other influences in unified Germany, a differential effect for East Germany (and the interaction between the two).

## 5.2 Main Results

Table 2 shows marginal effects from a probit model for all births. The first column restricts the sample to the pre-unification period in East Germany. The estimates show that wages or the costs of having a child now versus later have little effect on the decision to have a child. It is also interesting to note that fertility differences across skill groups are very small. As suggested by the descriptive evidence (see Figure 4), medium- and high-skilled women were equally likely to have a child in the socialist economy than low-skilled individuals.<sup>16</sup>

Subsequent specifications pool pre- and post-unification period for East German women (column (2)) and then include West German women as well (column (3)). The relationship between labor market variables and fertility changes completely. After unification, higher career wages in the current period increase fertility, while higher career wages in future periods reduce fertility. Both male wages (a proxy for other income) and female wages show a positive effect suggesting a positive income effect (which dominates the substitution effect in the case of female wages). The effect of career wages is substantial: a one standard deviation in career wages in

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<sup>16</sup>We do not include unemployment in this specification as the official unemployment rate was zero in the GDR.

the current period would reduce fertility by 4 percentage points (or about 0.2 of a standard deviation in birth rates).

Unemployment rates have opposing effects on fertility: higher unemployment among men reduce fertility - likely driven by an income effect. Female unemployment rates in turn increase fertility suggesting that periods of unemployment reduce the time cost of having a child. Finally, stark differences between high- and low-skilled women emerge after unification : while low-skilled women have higher fertility, high-skilled women have lower fertility than the medium-skilled.<sup>17</sup>

Table 3 explores how wages and unemployment affect first birth versus higher-order births. The results indicate that career wages have a much stronger effect on the timing of the first birth (column 2). In contrast, the relationship between career wages in the current period and a higher-order birth is weak. Table 3 also shows that high employment rates for women reduce the propensity to have an additional child. Further, high-skilled women are more likely to have a second child - in contrast to the pattern observed for first births.

### 5.3 Robustness Analysis

In this section, we explore the validity of our results to alternative specifications and additional controls. Our main results use a (narrow) definition of unemployment to control for the labor market opportunities. However, actual employment rates in the same age x education x region x year cell might be a better proxy for job opportunities. The first specification in Table 4 shows that the basic effect of wages and fertility remains unchanged when we include male and female employment rates as controls.

The second specification includes household income in addition to our wage measures. As expected, we find a positive income effect. The observed increase in household income observed in East Germany after unification should therefore increase the demand for children - which works against the negative fertility shock in the post-unification period shown in Figure 1.

Unification has not only affected wages and employment opportunities in East Germany. In

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<sup>17</sup>Perry (2003) shows for the United States that the income effect dominates for high-wage earners (positive effect of female wages on fertility), while the substitution effect dominates for low-wage earners (negative effect of female wages on fertility). Hence, we might expect that fertility would decline for the low-skilled but increase for the high-skilled after unification. Our evidence points to the opposite pattern for the post-unification period.

addition, East Germany basically introduced the legal and institutional framework from West Germany. To control for the influence of other policy changes, our next step is to explore the robustness of our results to the inclusion of other public policies.

## 6 Conclusion

Our results so far suggest that the fertility crisis in East Germany was the combined result of a postponement of first birth and a decline in higher-order births among East German women. These fertility changes are systematically related to changes in the East German labor market. Most importantly, as wages started to reflect market prices for human capital, young women faced high potential returns to education and work experience after unification. As expected, these changes encourage career investments at the expense of early childbearing. These changes occurred despite the excellent infrastructure of childcare, outmigration to West Germany or abroad or changes in family policies and financial support. As such, the evidence supports the idea that work incentives in the labor market have an important influence on childbearing decisions.

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## A Data Appendix

### A.1 Fertility Histories

The data for fertility histories before and after German unification come from the German Pension Fund (FDZ-RV), the so-called VSKT 2007. It is the most comprehensive data source for individual fertility and employment biographies in Germany. In particular, it covers full fertility and employment records for a 0.25% sample of all actively insured and not yet retired individuals who have at least one pension-relevant spell by the end of 2007.

Since employment in the private and public sector is subject to mandatory pension contributions, the vast majority of the German population has at least one record in the pension data. Additional pension-relevant spells include certain self-employed professions (e.g. artists), periods of long-term illness covered by health insurance and periods of care for an elderly person or children under the age of three.

The reliability of these administrative records is very high. Prior to be used for calculating pension payments, the account has to be authorized by the individual concerned. A person can voluntarily authorize her pension account at any time. For individuals aged 30 or older, the pension fund actively requests the authorization of pension accounts. As a consequence, the data for 2007 are most reliable for cohorts born until 1977, which are 30 years or older in 2007. The data contain a relatively high share of non-authorized accounts for cohorts born after 1977. Since authorized accounts tend to underreport births, we restrict the analysis to cohorts born between 1940 and 1977.

The data contain the birth dates of children ever born until 2007 by the respective birth cohorts. The total fertility rate we calculate based on these data slightly underestimates the actual fertility rate because children born to civil servants or women not in the pension system in 2007 (because of death or prior pension receipt) are not recorded. Prior evidence suggests that the data miss only about 5% of births. Hence, we think that the bias is small, especially compared to other survey data (see (Kreyenfeld and Mika 2006)).<sup>18</sup> The pension data thus provide the most comprehensive data on fertility histories in Germany.

Children are almost always recorded in the mother's pension record. Only about 0.04% of children are recorded in the father's pension record, mostly when the father is widowed (see also (Kreyenfeld and Mika 2006)). In the authorization process, the existence of children recorded are verified by birth certificates.

The pension data, like other administrative data sources, only record the current residence in 2007. Current residence in 2007 however does not account for East German women who moved to West Germany and vice versa. To define women of East German origin, we proceed as follows: we know the region of origin of all women with an employment spell prior to unification. For all other women, we rely on the employment history from the social security records that has been merged to the pension data. We use the region of the first recorded employment spell after unification to identify a woman from West or East Germany. For the remaining missings, we use the place of residence in 2007 to assign East and West German origin. Any measurement error from this procedure will be stronger for the youngest cohorts because they might not have had an employment spell. We return to the issue of East-West migration in the robustness section.

For our analysis, we distinguish between unskilled women, women with a vocational training and women with a tertiary education. The pension data report educational attainment only for the employment spell that is recorded in 2007. To fill in missing values, we use the same strategy as for the region of origin above. Based on the full employment histories from the social security records between 1975 and 2007, we assign the educational information available there. Based on this additional information, we are able to reduce missings on formal education to 9.8% for

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<sup>18</sup>The comparison refers to completed pension records (vollendete Versichertenkonten). Alternatively, we could simply compare our TFR estimates with the official estimates by the Federal Statistical Office

East German and 16.4% for West German women. Most of the missings in East Germany are for older women who completed their fertility history prior to unification and hence, should have little effect on our results.

## A.2 Wage and Household Income Data

To construct measures of wages and income before and after unification, we use the German Socio-Economic Panel (GSOEP).<sup>19</sup>

The annual panel surveys around 12,000 households about their wages, household income, employment and household structure. Currently, about 24,000 individuals, of which 6,000 are from East Germany, participate in the survey. The survey started in West Germany in 1984 and extended to East Germany in 1990. We restrict the sample to men and women between the ages of 20 and 60.

In 1990, the survey asked East Germans about their wages and income prior to the fall of the Berlin Wall (May 1989) and prior to German unification (May 1990). We use the wage information for 1989 and 1990 to construct wages and income for the pre-unification period in East Germany; we use data between 1991 and 2009 to characterize wages and income in the post-unification period. For West Germany, we use wage and income information from 1984 to 1989 for the pre-unification period and data from 1991 to 2009 for the post-unification period. Wages are measured as monthly gross earnings and converted to 2005 Euros using the national consumer price index.

East Germans were also asked in 1989 and 1990 about several sources of income. We combine those with similar categories for 1991-2009 to construct a consistent series of household income for both the pre- and post-unification period. Household income is measured as the sum of labor, capital and public transfers. Labor income includes earnings as well as bonus payments. Public transfers are calculated as the sum of maternity benefits, maternity leave payments, regular pensions, pensions for widows and orphans, student grants, unemployment benefits and welfare benefits.

As in the pension data, we distinguish three skill groups: low-skilled (those without a vocational training or highschool degree), medium-skilled (those with a highschool degree and/or a vocational degree) and high-skilled (those with a tertiary education). Finally, the GSOEP elicits both the current residence (East or West Germany) as well as the location of residence prior to the fall of the Berlin Wall in 1989. For the main analysis, we use women of East German origin (who lived in East Germany in 1989) irrespective of their current residence.

## A.3 Employment and Unemployment Rates

For measures of unemployment and employment rates, we use administrative data from the social security records by the Institute for Employment Research. These data contain a 2% sample of all social security records in Germany, thus covering spells of employment in the private and public sectors between 1975 and 2004. The data only exclude the self-employed and civil servants. In addition to the employment spells, we have information on the receipt of unemployment insurance benefits.

Based on this information, we are able to define three types of spells: employment, unemployment and non-employment. Employment spells are clearly identified in the data. The distinction between unemployment and non-employment in contrast, is not always clear-cut because a person is only recorded as unemployed in the data if she receives unemployment insurance benefits. While unemployment benefits are paid by the unemployment insurance to all unemployed with a minimum work record, the receipt of unemployment assistance (after unemployment insurance

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<sup>19</sup>While the pension records contain some indication about the level of earnings during an employment spell (the so-called "Entgeltpunkte"), it is difficult to infer actual earnings from this information in a consistent way.



benefits are exhausted) is means-tested. As a consequence, a long-term unemployed person may not be recorded as unemployed in the social security data. Instead, the spell might be recorded without any further information on the labour market status of the person involved.

To solve this issue, we use two alternative measures: a narrow and a broad definition (see (Fitzenberger and Wilke 2010) for details). The narrow definition defines the unemployment rate as the share of women (men) who are unemployed among all unemployed and employed women (men). As this unemployment rate is tied to benefit receipt, it is a lower bound to the true unemployment rate. The broad definition of unemployment also includes spells without any further information as long as there has been an initial receipt of unemployment benefits. We then define the employment rate as the share of women (men) who are employed among all employed, unemployed and non-employed women (men). The resulting employment rates provide an upper bound to actual employment because the data does not include working-age individuals who have never been employed prior to becoming non-employed.

All unemployment and employment rates are calculated for June 30 of each year between 1980 to 2000. We calculate separate rates by skill group, age, East and Western Germany. As in the other data sets, we distinguish low-skilled (those without a vocational training or highschool degree), medium-skilled (those with a highschool degree and/or a vocational degree) and high-skilled (those with a tertiary education). We further distinguish between West and East Germany based on current residence. Finally, we calculate the unemployment rates for seven age groups between age 20 to 40 (age 20-22, 23-25, 26-28, 29-31, 32-34, 35-37, 38-40).

For West Germany, we have 441 cells of unemployment/employment rates (21 years  $\times$  7 age groups  $\times$  3 education groups). For East Germany, we only have post-unification information starting in 1992. We apply the 1992 information to the missing post-unification year 1991. For the pre-unification period up to 1990, we assign an unemployment rate of zero because involuntary unemployment (and hence, unemployment benefits) did not really exist in the socialist regime. Similarly, we assume that all working-age individuals were employed in East Germany prior to unification.

## B Construction of the Wage Offer Distribution

While most East German women worked in the GDR, employment rates declines substantially after unification. To adjust wages for selective non-participation, we employ methods commonly used in the literature on racial and gender wage gaps ((Chandra 2003); (Johnson, Kitamura, and Neal 2000); (Neal 2004); (Olivetti and Petrongolo 2008)).

The first method exploits the panel structure of the GSOEP. We use available information in adjacent waves ( $\pm 1$  year or  $\pm 3$  years) to fill in missing wages. In addition, we construct mean wages using adjacent wages after adjusting for aggregate wage growth (by adding or subtracting a growth factor).

As an alternative, we use a semiparametric control function approach. In a first step, we predict employment with a probit model. As exclusion restriction, we use household size and the presence of a partner in the household. In the second step, we include a flexible cubic function of the predicted employment probability in a Mincer earnings regression.

Our third approach uses mahalanobis matching to predict wages for those not employed in a year. Specifically, we match on education, labor market experience (linear and squared), interactions between education and labor market experience, marital status, household size and the presence of a partner as well as state and year fixed effects.

Finally, we use various assumptions about the position of non-workers in the wage distribution to impute missing wages. The basic assumption is that all non-workers would earn wages below the median. A somewhat weaker assumption is that non-workers would earn below the median conditional on their education, age, gender and region. Alternatively, we assume that

non-workers (conditional on education, age, gender, region and year) earn below the median if they have not worked in the past two years; otherwise, non-workers earn the median wage.

Figure A5 in the appendix shows wage densities for alternative imputation methods and compares it to the observed wages without imputation. The main empirical analysis uses average wages where missing values are imputed from the panel structure (available data in the three adjacent waves) or a median restriction (assuming that non-workers earn wages below the median wage in the respective year). In the robustness section, we probe the validity of our main results to alternative wage imputation methods.

**Table 1: Summary Statistics**

	<u>East Germany</u>		<u>West Germany</u>	
	Mean	Std. Deviation	Mean	Std. Deviation
Probability of a Birth	0.05	0.22	0.06	0.24
Career Wages if Child Now	2138.93	483.78	1960.88	604.56
Career Wages if Child in Future	2276.92	500.28	2049.46	634.94
Mean Female Wages	1240.78	356.01	1859.60	403.96
Mean Male Wages	1434.52	462.38	2253.12	545.55
Mean Household Income	1416.05	575.74	1862.45	435.98
Female Unemployment Rate	7.02	6.97	4.35	1.35
Male Unemployment Rate	5.92	6.16	5.10	2.05
Female Employment Rate	83.59	23.59	81.08	5.33
Male Employment Rate	84.99	23.57	84.70	5.63
Low-skilled	0.07	0.26	0.20	0.40
Medium-Skilled	0.81	0.39	0.70	0.46
High-skilled	0.11	0.32	0.10	0.31
Observations	45,099		112,335	

*Notes :* The sample are women aged 18 to 40 in East and West Germany. Low-skilled do not have any vocational degree, medium-skilled have either completed high school or a vocational degree; and high-skilled have a tertiary education.

*Source :* Scientific-Use File of Administrative Pension Data.

**Table 2: Effect of Wages and Unemployment on Fertility**

	<u>East Germany</u>		<u>East and West Germany</u>	
	Prior to 1990 (1)	1980-2001 (2)	1980-2001 (3)	1980-2001 (4)
Career Wages if Child Now	-0.012 -0.43	0.006*** (3.58)	0.032*** (5.53)	0.063*** (7.55)
Career Wages if Child in Future	-0.025 -1.22	-0.007*** -4.57	-0.016** -3.01	-0.048*** -6.34
Mean Wage Women	0.004 (0.47)	0.004** (2.78)	0.028*** (5.36)	0.030*** (5.37)
Mean Wages Men	0.004 (0.61)	-0.001 (0.72)	0.020*** (4.49)	0.002 (0.44)
Unemployment Rate Men		0 (0.43)	-0.001 (0.14)	0 (0.01)
Unemployment Rate Women		0 (-0.87)	-0.005 (1.05)	-0.001 (0.22)
Low-Skilled	-0.041 (-1.46)	0.007 (1.43)	0.309*** (13.64)	0.244*** (10.19)
High-Skilled	0.586 (0.77)	0.009 (1.58)	-0.543*** (-11.33)	-0.412*** (-8.26)
Years 1990-1995		-0.018*** (-6.95)	-0.064*** (-4.54)	-0.046** (-3.24)
Years 1996-2001		-0.015** (-3.23)	-0.089*** (-5.92)	-0.057*** (-3.67)
Post-Unification*East			-0.418*** (-7.52)	-0.369*** (-6.58)
Age Fixed Effects	Yes	Yes	Yes	Yes
East Fixed Effects	No	No	Yes	Yes
Age Fixed Effects * East Fixed Effect	No	No	No	Yes
Observations	13,574	40,665	158,544	158,544
R Squared	0.102	0.088	0.057	0.059

*Notes :* The table reports marginal coefficients from a probit model where the dependent variable is equal to one if a woman has a child in the current year and zero otherwise. Wages, income and unemployment rates are averages at the age, year, region and education level. T-statistics are reported in parentheses.

**Table 3: First Births versus Higher-order Births**

Probit Model	<u>East and West Germany Pooled</u>		
	All Births (1)	First Births (2)	Higher-order Births (3)
Career Wages if Child Now	0.033*** (5.65)	0.003*** (6.04)	-0.004* (-2.00)
Career Wages if Child in Future	-0.019*** (-3.50)	-0.001 (-1.68)	0.002 (0.90)
Mean Wage Women	0.028*** (5.32)	0.002*** (5.06)	0.005** (2.69)
Mean Wages Men	0.018*** (3.98)	0.001*** (3.44)	-0.004** (-2.86)
Employment Rates Men	-0.004 (-1.26)	0 (-0.40)	0.001 -1.34
Employment Rates Women	0.017*** (5.17)	0.001*** (4.81)	-0.002* (-2.35)
Low-Skilled	0.402*** (13.99)	0.039*** (10.06)	-0.017* (-2.27)
High-Skilled	-0.545*** (-11.77)	-0.025*** (-24.66)	0.056*** (4.30)
Years 1990-1995	-0.074*** (-5.24)	-0.002* (-2.19)	-0.034*** (-9.19)
Years 1996-2001	-0.014 (-0.70)	0 (0.27)	-0.030*** (-5.40)
Post-Unification*East	-0.290*** (-6.12)	-0.011*** (-4.61)	-0.043*** (-4.15)
Time Period Used for Estimation	1980-2001	1980-2001	1980-2001
Age Fixed Effects	Yes	Yes	Yes
East Fixed Effect	Yes	Yes	Yes
Observations	158,544	120,827	37,717
R Squared	0.057	0.074	0.051

*Notes :* The table reports coefficients from a probit model where the dependent variable is equal to one if a woman has a child in the current year and zero otherwise (in column (1)), whether a woman has her first birth in the current year (in column (2)) or have a second or higher-order births in the current year (in column (3)). Wages, income and unemployment rates are averages at the age, year, region and education level. T-statistics are reported in parentheses.

**Table 4: Robustness Checks**

Probit Model	East and West Germany Pooled over 1980-2001					
	Employment Rates		Household Income		Supply of Childcare	
	(1)	(2)	(3)	(4)	(5)	(6)
Career Wages if Child Now	0.033*** (5.65)	0.061*** (7.39)	0.032*** (5.48)	0.061*** (7.35)	0.060*** (7.30)	0.052*** (6.10)
Career Wages if Child in Future	-0.019*** (-3.50)	-0.048*** (-6.36)	-0.019*** (-3.56)	-0.049*** (-6.52)	-0.049*** (-6.51)	-0.045*** (-5.86)
Mean Wage Women	0.028*** (5.32)	0.030*** (5.42)	0.024*** (4.26)	0.024*** (3.99)	0.024*** (3.99)	0.020*** (3.40)
Mean Wages Men	0.018*** (3.98)	0.001 (0.16)	0.017*** (3.87)	-0.001 (-0.11)	-0.001 (-0.16)	-0.001 (-0.19)
Household Income			0.000 (0.00)	0.0001** (0.00)		
Employment Rates Men	-0.004 (-1.26)	-0.005 (-1.72)	-0.003 (-1.24)	-0.005 (-1.71)	-0.005 (-1.55)	-0.014** (-2.99)
Employment Rates Women	0.017*** (5.17)	0.013*** (3.91)	0.018*** (5.34)	0.014*** (4.20)	0.014*** (4.20)	0.041*** (7.00)
Household Income			0.006 (1.85)	0.009** (2.97)	0.009** (3.07)	0.013*** (4.34)
Supply of Childcare Slots					-0.000** (-2.58)	-0.000* (-2.39)
Low-Skilled	0.402*** (13.99)	0.308*** (9.97)	0.398*** (13.86)	0.298*** (9.63)	0.300*** (9.68)	0.354*** (10.96)
High-Skilled	-0.545*** (-11.77)	-0.425*** (-8.74)	-0.532*** (-11.36)	-0.401*** (-8.16)	-0.395*** (-8.03)	-0.311*** (-6.12)
Years 1990-1995	-0.074*** (-5.24)	-0.054*** (-3.75)	-0.082*** (-5.53)	-0.065*** (-4.39)	-0.065*** (-4.34)	-0.054*** (-3.56)
Years 1996-2001	-0.014 (-0.70)	-0.003 (-0.16)	-0.031 (-1.45)	-0.03 (-1.44)	-0.028 (-1.35)	0.024 -1.06
Post-Unification*East	-0.290*** (-6.12)	-0.280*** (-5.80)	-0.286*** (-6.04)	-0.275*** (-5.71)	-0.297*** (-6.12)	-0.304*** (-5.42)
Age Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
East Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Age FE * East FE	No	Yes	No	Yes	Yes	Yes
Observations	158,544	158,544	158,544	158,544	158,544	158,544
R Squared	0.057	0.06	0.057	0.06	0.06	0.06

Notes : The table reports marginal coefficients from a probit model where the dependent variable is equal to one if a woman has a child in the current year and zero otherwise. Wages, income and unemployment rates are averages at the age, year, region and education level. T-statistics are reported in parentheses.

Figure 1: Evolution of Total Fertility Rate in East and West Germany

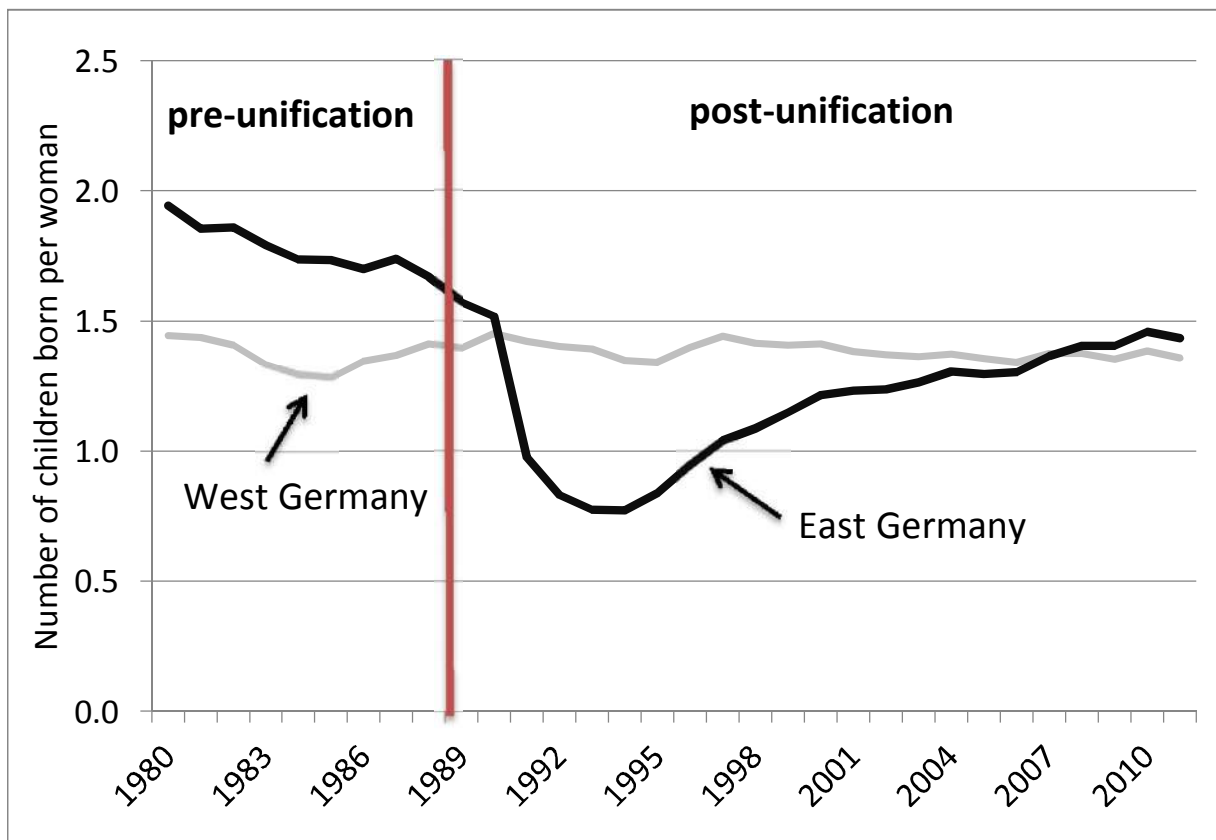
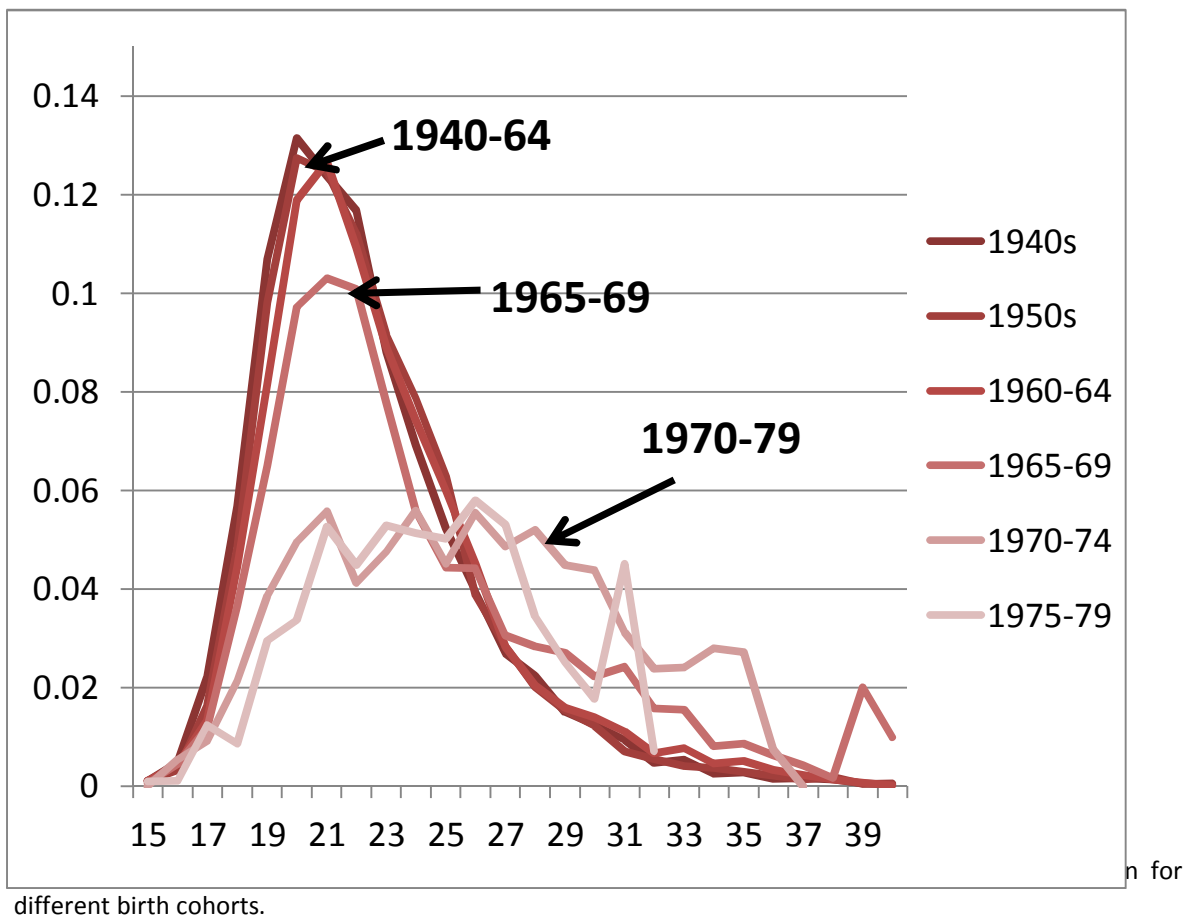
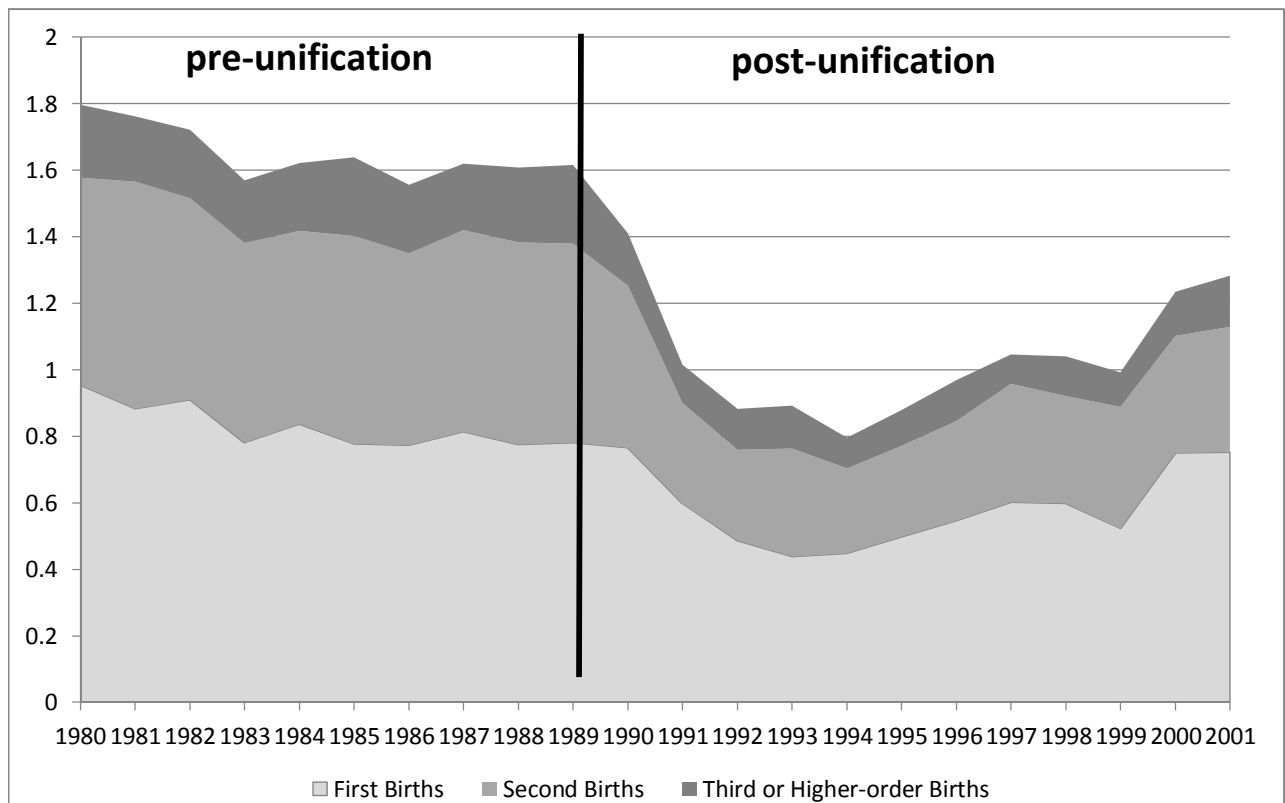


Figure 2: Age at First Birth in East Germany by Birth Cohorts



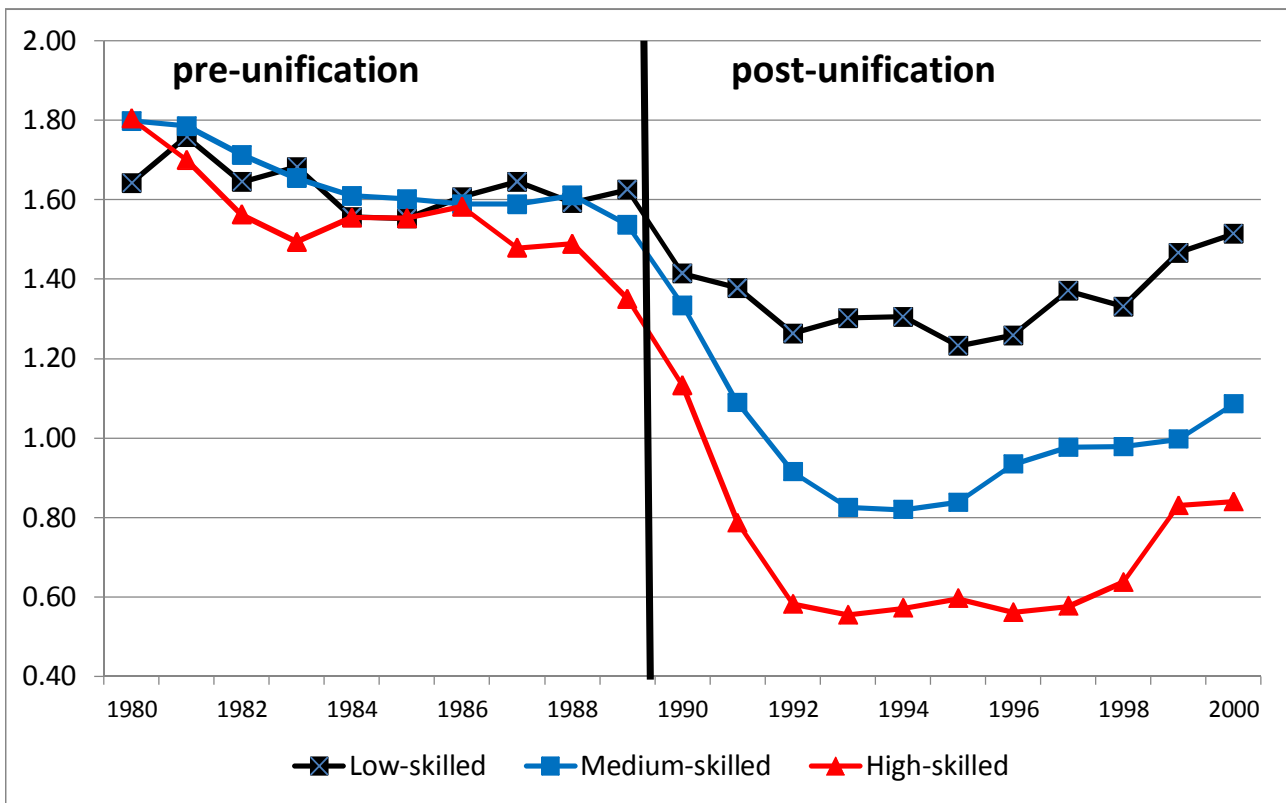


**Figure 3: Contribution of Different Birth Orders to TFR in East Germany**



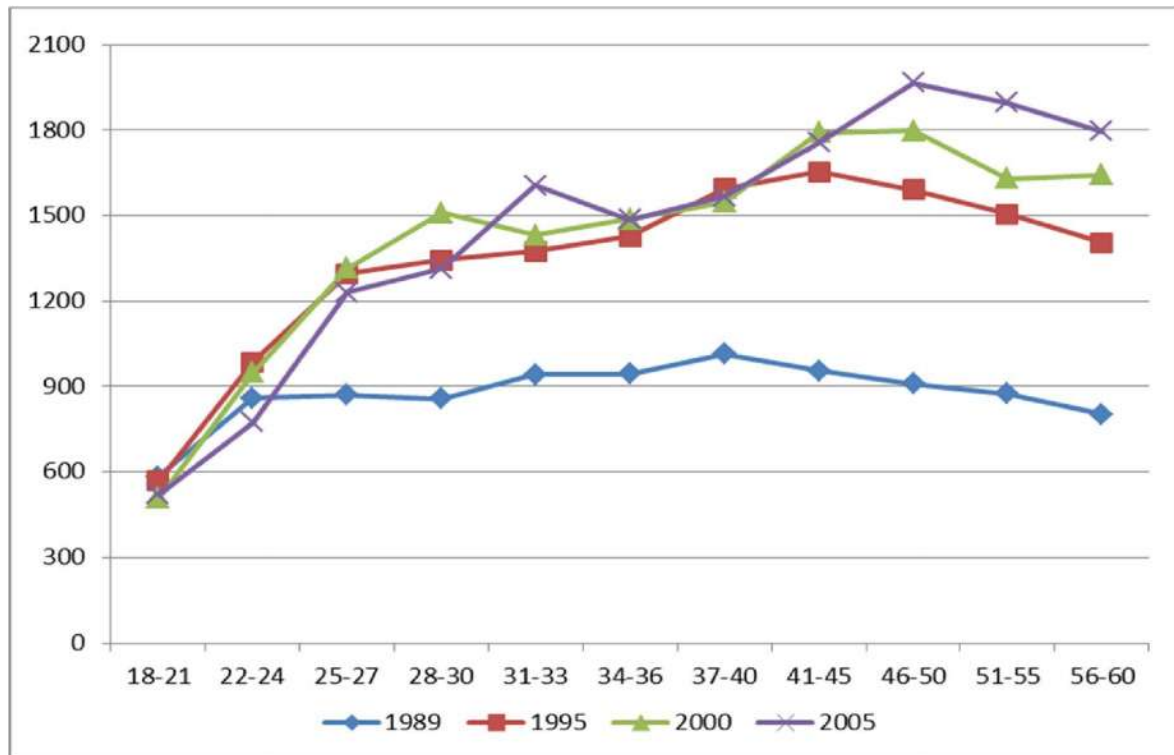
*Notes :* The figure shows the cumulative contribution of first, second and higher-order births to the total fertility rate. The contribution of the first births is calculated by summing over the age-specific fertility rates for first births among all women aged 15-49. Second and higher-order births are calculated correspondingly. The top line shows the evolution of the total fertility rate in East Germany.

Figure 4: Total Fertility Rate in East Germany by Skill Level

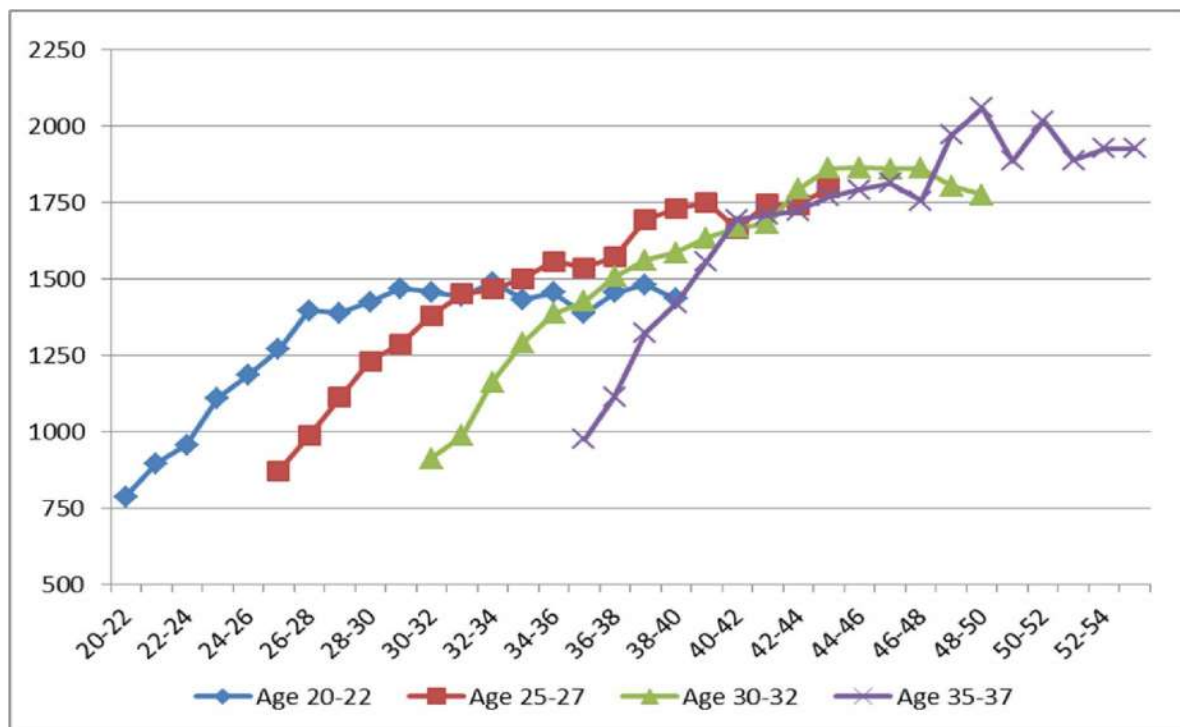


Notes : The figure shows the total fertility rate, i.e. the sum of age-specific fertility rates in each year among women aged 15 to 49 by skill group. The numbers shown are calculated from using a 3-year moving average. Low-skilled are women with no vocational degree; medium-skilled women have a high school or vocational degree; and high-skilled women have a tertiary education.

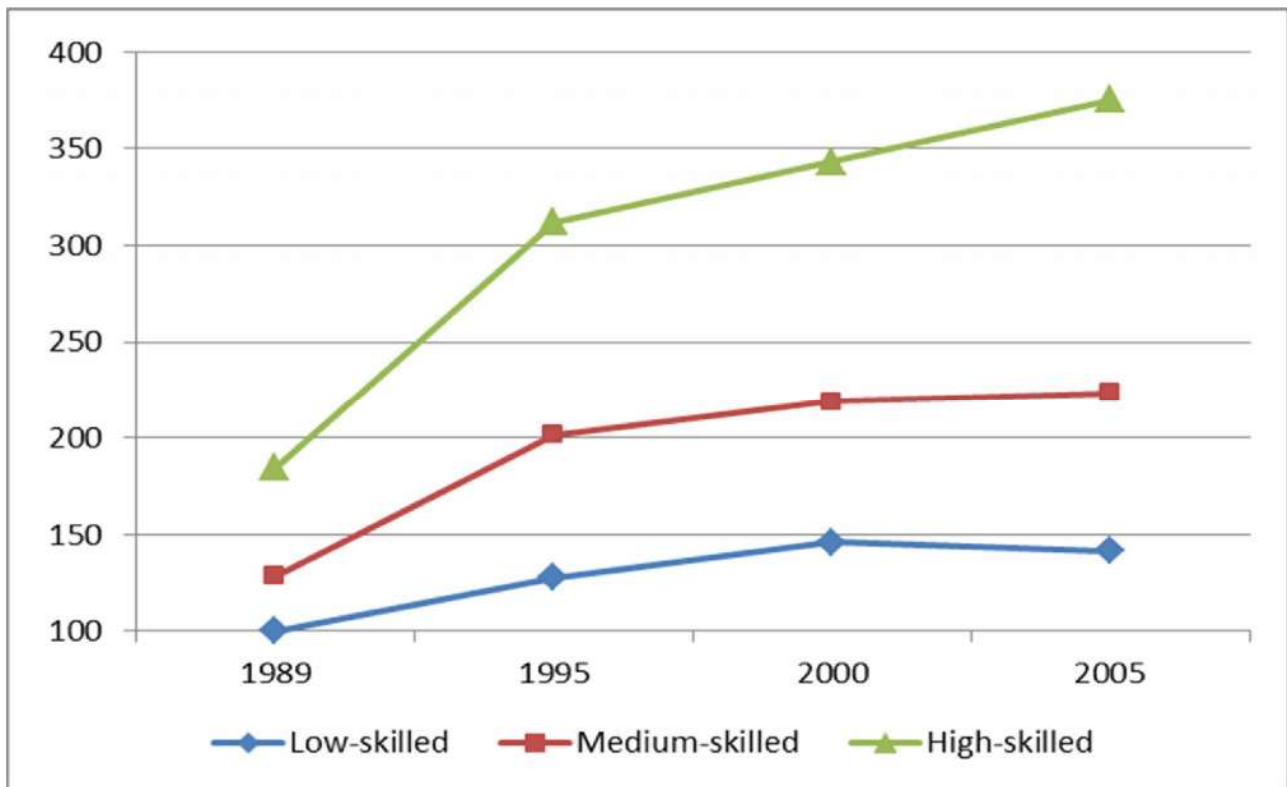
**Figure 5a: Age Earnings Profiles of East German Women (Cross-Section)**



**Figure 5b: Age Earnings Profiles of East German Women after Unification (Panel Data)**

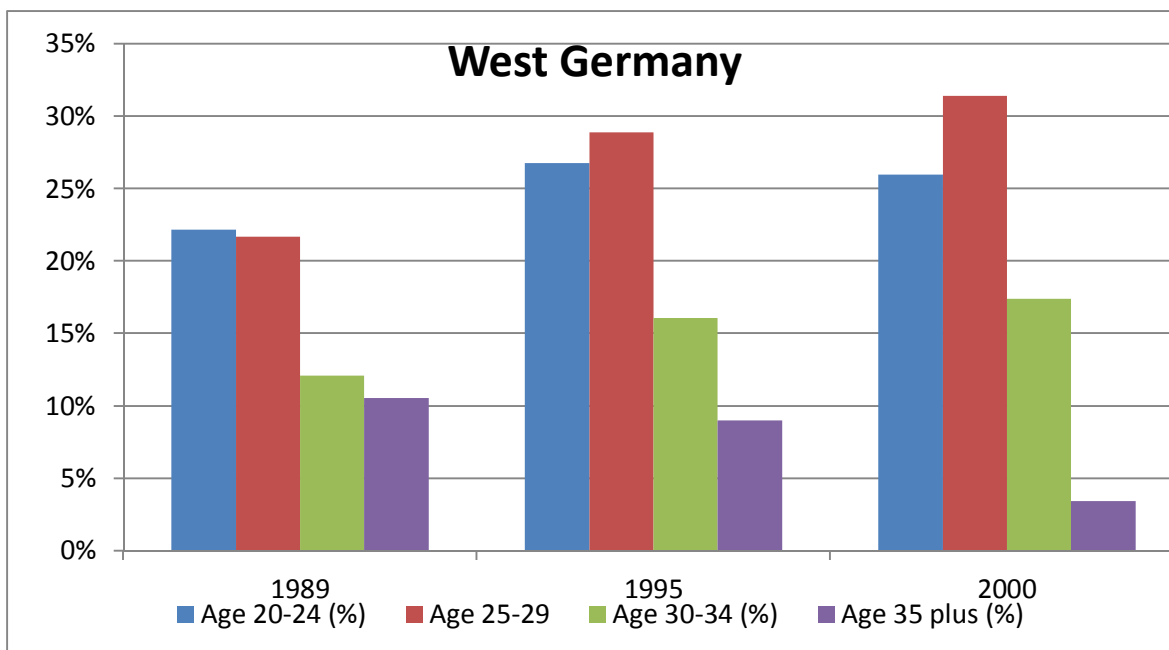
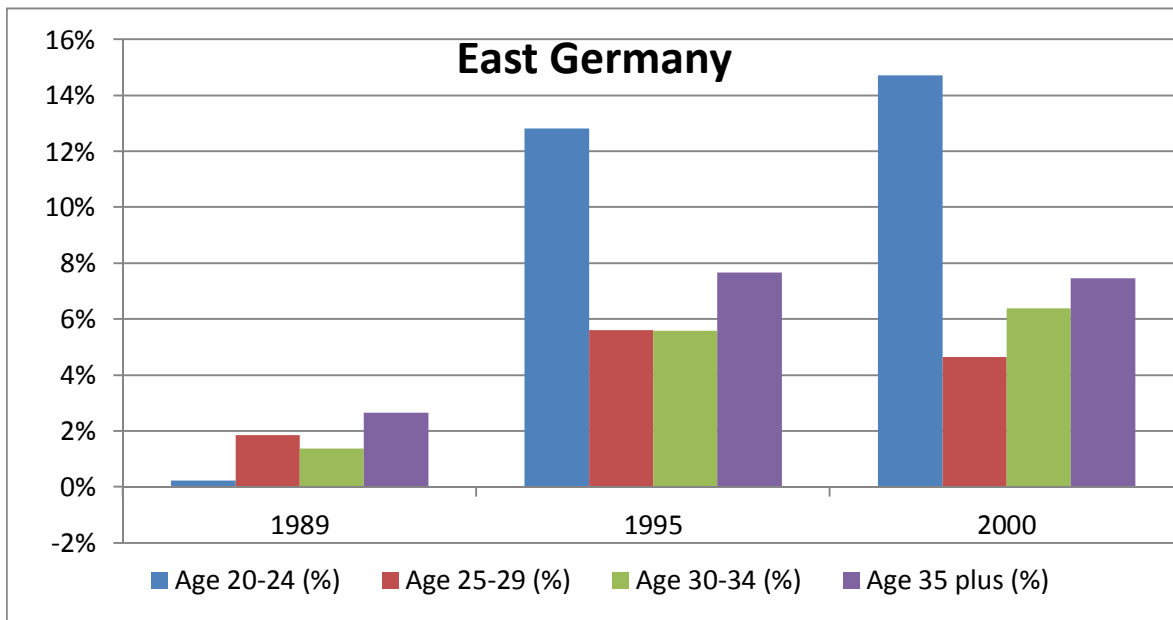


**Figure 6: Evolution of Skill Differentials among East German Women**



*Notes:* The figure shows the evolution of monthly real wages (adjusted for selection into employment; see data description) of East German women relative to the low-skilled wages of women in 1989 (which are set to 100). We distinguish between three skill groups: the low-skilled are those without a high school or vocational degree. Medium-skilled women have at most a high school or vocational degree, while high-skilled women have a tertiary degree. Data for 1989 are averages for 1989 and 1990 (pre-unification). Data for 1995, 2000 and 2005 are averages for 1994-1996, 1999-2001 and 2004-2006 respectively.

**Figure 7: Wage Penalty for Child Birth at Different Ages**



*Notes :* The figure shows the average wage penalty over the next 15 years when a woman in East or West Germany has a child in the age interval indicated (relative to having no child at any age). The wage penalties are based on a Mincerian wage regression which is run separately for East and West Germany and for the pre-unification period (1989), the early transition years (1990-1994) and later years (1995-1999 and 2000-2004). Control variables include potential experience and potential experience squared, indicators for the skill group, the interactions between skill group and the experience profile. Furthermore, indicators whether a child was born at a certain age (20-24, 25-29, 30-34 and 35 and above) are included as well as interactions with the experience profile and the skill groups to allow wage penalties to vary across skill groups and for different experience levels.

**Table A1: TFR and Tempo-Adjusted TFR in Germany**

	East Germany		West Germany	
	TFR	Adj. TFR	TFR	Adj. TFR
1980-1985	1.82	1.83	1.37	1.62
1986-1990	1.53	1.91	1.40	1.50
1991-1995	0.87	--	1.39	1.50
1996-2000	1.06	1.51	1.41	1.55
2001-2005	1.26	1.57	1.38	1.62

*Notes :* The table reports the total fertility rate, i.e. the sum of age-specific fertility rates in each year for women between age 18 and 45. The adjusted fertility rate employs the method by Bongaarts and Feenstra (1998) to adjust for tempo effects using the birth order and age of the mother. Adjusted TFR in East Germany between 1986 and 1990 are based on the years 1986-1988, the adjusted TFR for 1996-2000 are available for 1997-2000 only.

*Source :* Human Fertility Database (2013); Luy and Pötsch (2010)

Figure A1: Mean Age at First Birth in East and West Germany

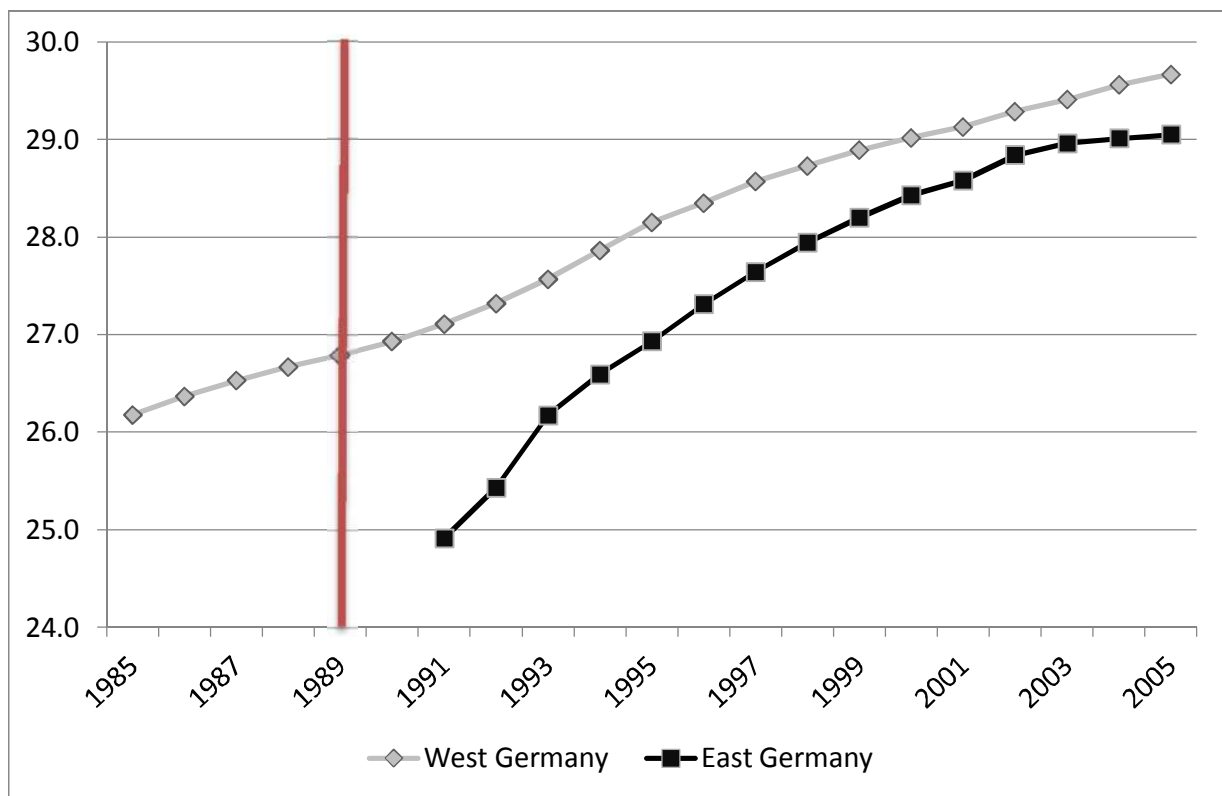
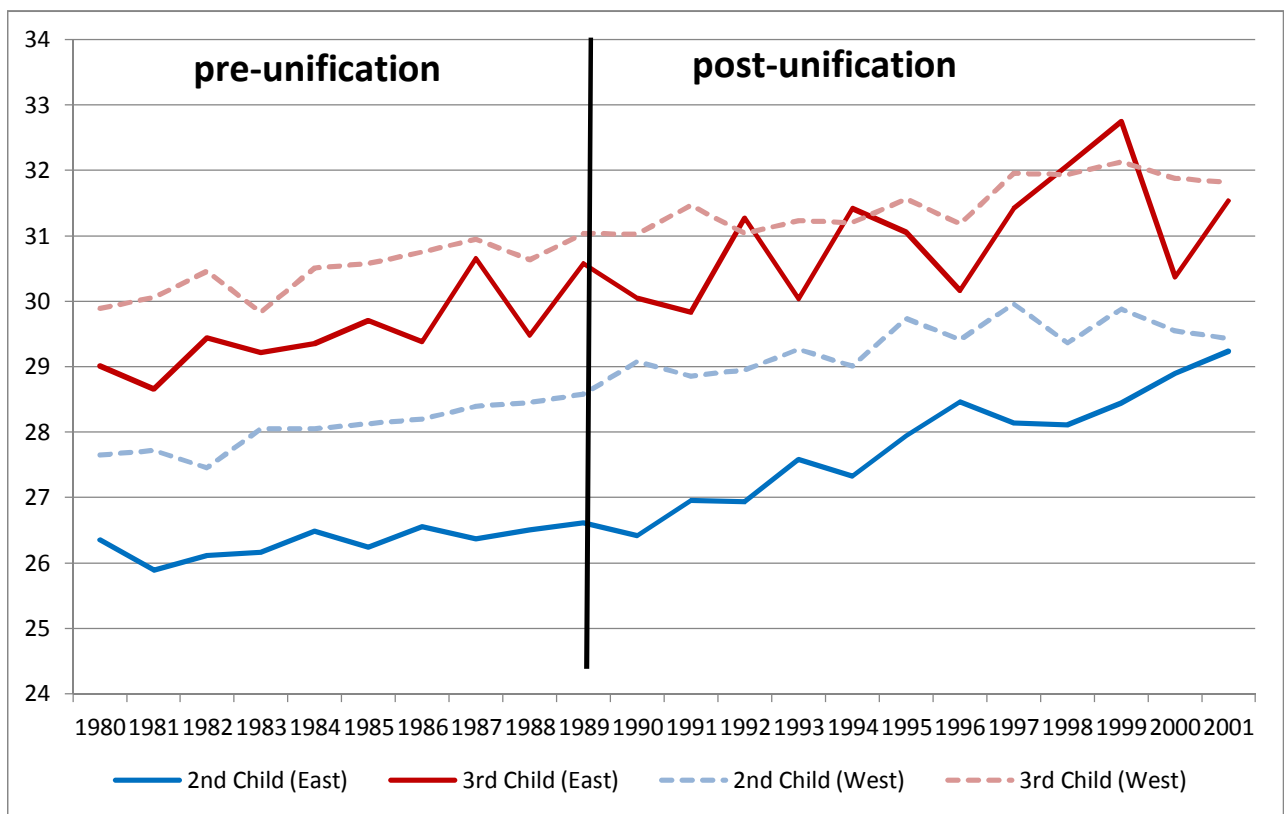
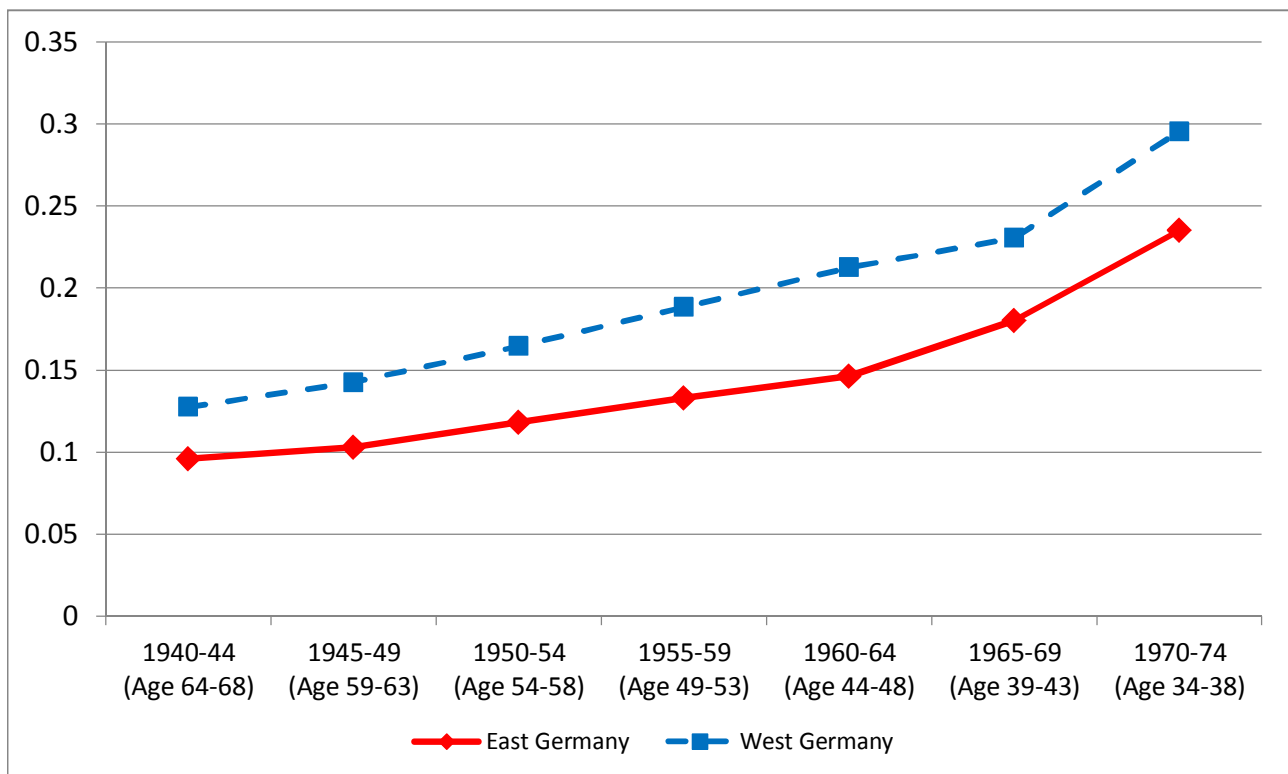


Figure A2: Mean Age at Higher-order Births in East and West Germany





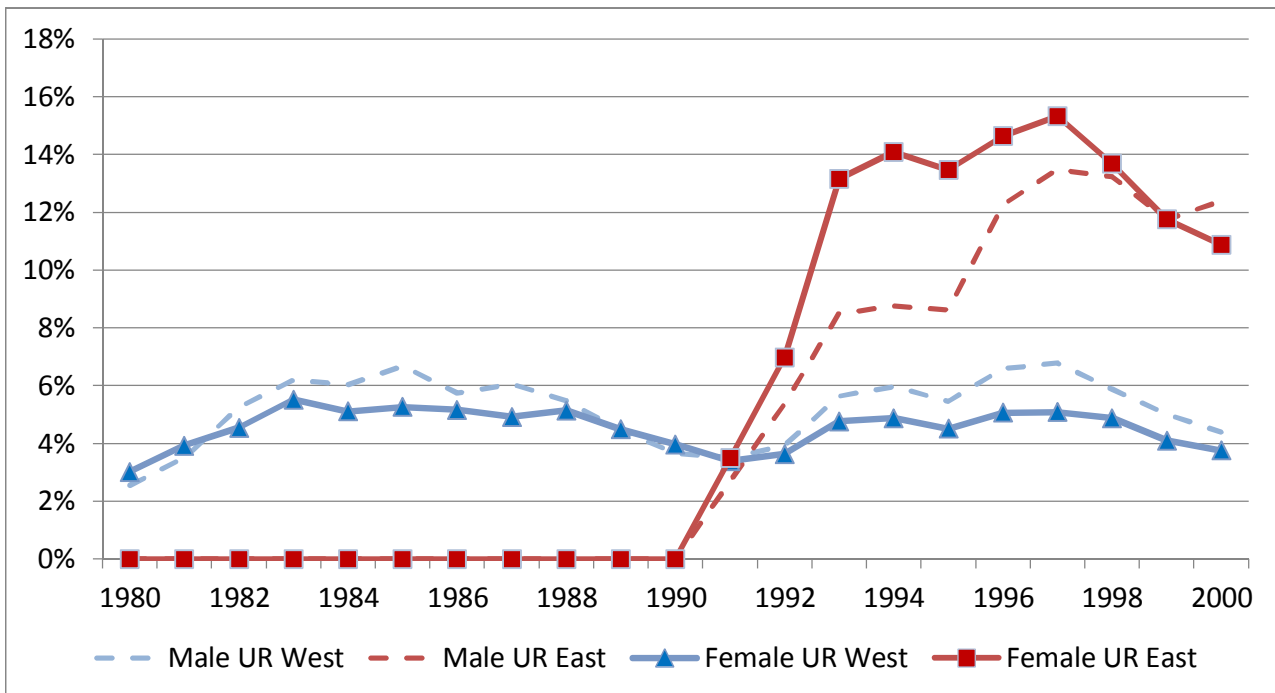
**Figure A3: Share of Women without Children in 2008 by Cohort**



Notes : The Micro Census in 2008 reports the total number of children ever born. East Germany refers here to current residence in East Germany.

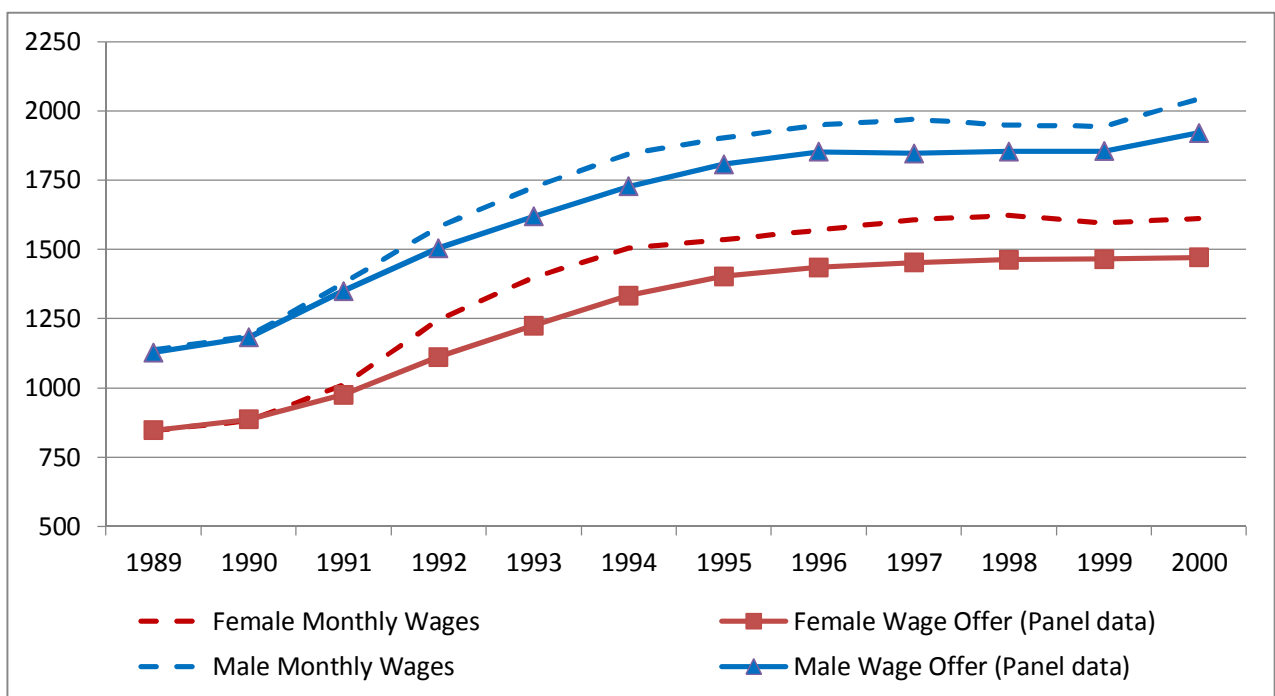
Source : Micro Census (2008)

**Table A4: Unemployment Rates in East and West Germany between 1980 and 2000**



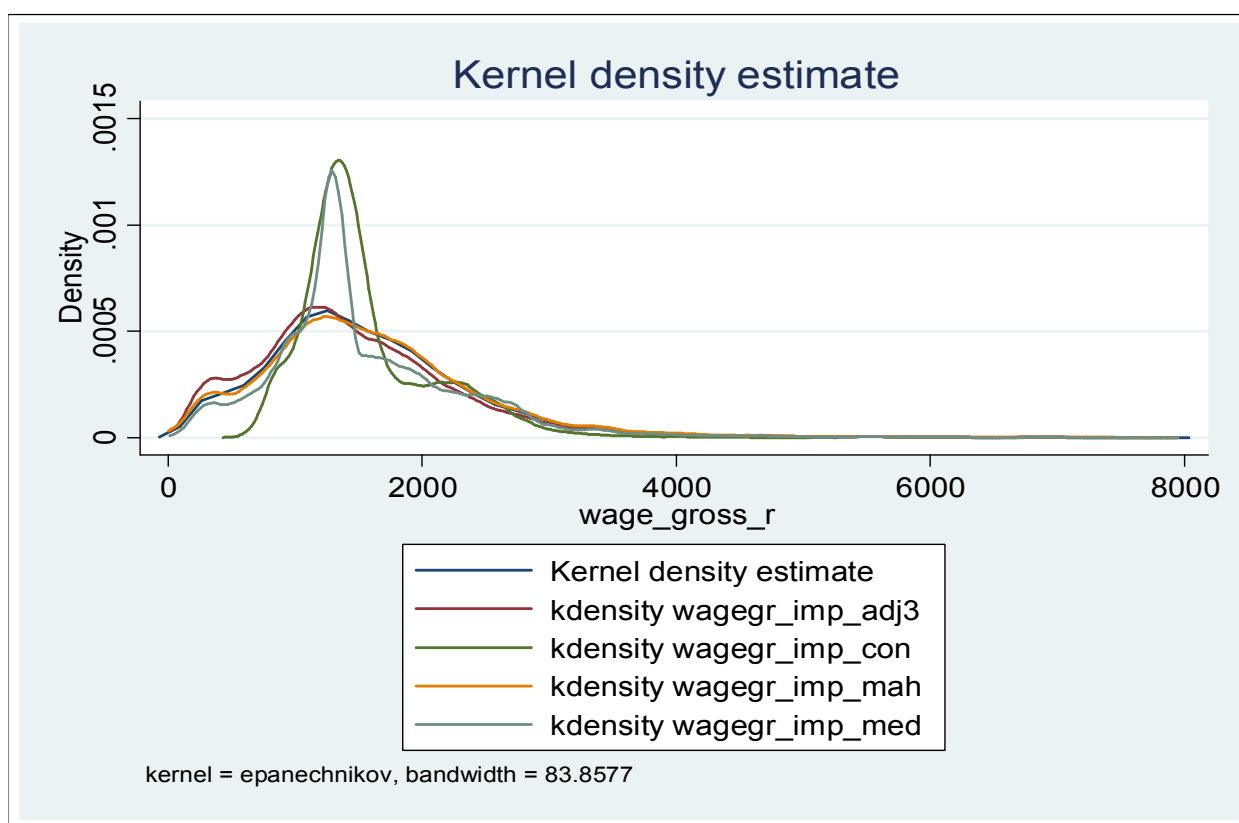
Sources : Social security records (SIAB)

**Table A5: Average Wage Growth in East Germany between 1989 and 2000**



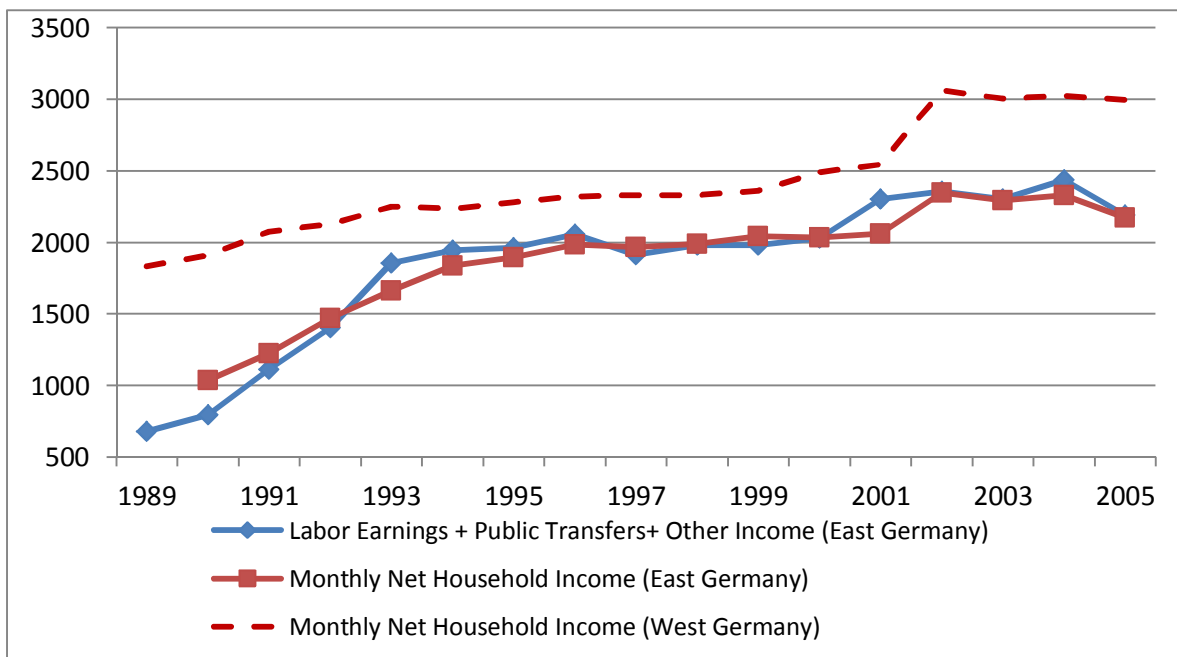
Sources : German Socio-Economic Panel

Figure A6: Kernel Density Estimates of Monthly Real Wages using Different Imputation Techniques



Notes : The figure shows kernel density estimates of actual and imputed monthly real wages for East German women. The imputation methods are: exploiting the panel structure to assign wages (wagegr\_imp\_adj3), using a control function approach (wagegr\_imp\_con), using a matching approach (wagegr\_imp\_mah) and using median restrictions (wagegr\_imp\_med).

**Figure A7: Evolution of Household Income in East and West Germany**



*Notes :* The figure shows data on net monthly household income from 1990 to 2005 and an alternative calculation of net household income as the sum of labor earnings, public transfers and other income (e.g. rental income or other capital income).