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The Empirical Analysis of East German Fertility after Unification: An Update

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Abstract. German unification led to a drastic decline in the East German birth rate. Recent explanations of this phenomena point to the importance of an adjustment process of the East German pattern with often early births to the West German pattern with fairly late births. The paper presents an update on previous analyses of age specific birth rates, as well as a new micro-economic approach based on individual data. The empirical evidence presented in this paper supports the view that the sharp reduction in East German fertility is in fact part of an adjustment process towards West German fertility patterns.

Lechner, M., 2001. L'analyse de la fécondité en Allemagne de l'Est après l'unification: une mise à jour.

Résumé. L'unification de l'Allemagne a conduit à une fort déclin du taux de natalité en Allemagne de l'Est. Les explications récentes de ce phénomène montrent l'importance du processus d'ajustement de la fécondité de l'Est, avec souvent des naissances à un âge jeune, à celle de l'Ouest, avec des naissances à des âges plus avancés. Cet article présente une mise à jour des analyses antérieures des taux de fécondité par âge, ainsi qu'une nouvelle approche micro-économique basée sur des données individuelles. Les résultats de cet article confortent l'opinion selon laquelle la forte réduction de la fécondité en Allemagne de l'Est fait partie d'un processus d'ajustement au modèle de la fécondité de l'Allemagne de l'Ouest.

1. Introduction

In 1990 Germany was unified. Unification happened such that the West German institutional framework was almost completely transferred to the East. The demographic reaction of East German women to unification was immediate and drastic. Within a period of less than two years total fertility rates fell by about one half, and even in 1998 they were significantly below the already low West German level. Such a sudden and large drop was almost unique in German history. The only exception was World War I. The Economic Crisis of the 1930s, World War II, and the introduction of the contraception pill in the late 1960s and early 1970s were accompanied by large reductions in fertility. (Note that this is not a statement about causation.) However, none of these declines were of such an extent as the

one observed immediately after German unification. Similarly, when compared to other former COMECOM countries in transition, the extent and the speed of the reaction is unique.

Currently, there appear to be at least two major lines of argument why such an extreme behaviour may have occurred. The first set of explanations point out that rational East German individuals should adjust their fertility behaviour such that it is appropriate to the new institutional framework. From their own economic considerations as well as from the observable behaviour of West German women in similar ages, they should infer that the optimal ages to have children are now significantly higher than under the previous incentive system of the German Democratic Republic (GDR). Within this framework it appears very logical to have a drastic immediate reaction in period fertility, because of the stock of children inherited from their child-bearing history under the rules of the GDR. This reaction should flatten out the more generations come in that are unaffected or less affected by the old GDR incentive system. These arguments, that have been put forward and substantiated for example by Conrad, Lechner, and Werner (1996) and Lechner (1998), imply an adjustment to West German fertility levels from below. In the following we call this hypothesis the *convergence hypothesis*.

On the other hand, some authors – for example Schulz, Wagner, and Witte (1993) or Witte and Wagner (1995) – view this phenomenon as a temporary reaction to the uncertainties of the post-unification East German society and economy. Labour market conditions were bad indeed. The new relative price structure (including new wage levels) led to a considerable restructuring of industry, typically accompanied by mass lay-offs. Unemployment rose very fast and far above West German levels. Women were particularly affected. These problems could have made it very difficult for people to plan for a few years ahead as it appears necessary for making such important and irreversible decisions like having a child. However, if these uncertainties disappeared sufficiently fast, then this line of argument implies that the respective cohorts would make up for the previous postponement. Hence we should observe an overshooting of East German fertility rates. We will call these ideas the *postponement hypothesis*.

In the end the empirical evidence in this paper suggests that probably post-unification fertility is influenced by adjustment as well as postponement due to uncertainties, but that the former clearly dominates the latter.

In section two different fertility rates are analysed in different ways. This section is basically an update and extension of the results presented in a paper by Lechner (1998). In section three a new microeconometric approach to analyse fertility differences between different countries is proposed and applied to an East – West German comparison. Section four concludes and suggests further directions of research.

Table 1. Total period fertility rates (TFR) before and after German unification: an international comparison

	1989	1995		1989	1995
		OECD countries			
USA	2.1*	2.0	The Netherlands	1.5	1.5
Australia	1.9*	1.9	Japan	1.5*	1.5
Finland	1.8*	1.8	Austria	1.5*	1.4
United Kingdom	1.8	1.8	Portugal	1.5	1.4
Denmark	1.6	1.8	*West Germany*	1.4	1.4
Sweden	1.9	1.7	Greece	1.4	1.4
France	1.8	1.7	Spain	1.3	1.2
Belgium	1.6	1.6	Italy	1.3	1.2
Switzerland	1.6*	1.5			
		Countries in economic transition			
Poland	2.1	1.6	Latvia	2.0*	1.3
Hungary	1.8	1.6	Russia	2.0	1.3
Lithuania	2.0*	1.5	Czech Republic	1.9	1.3
Estonia	2.0*	1.4	Bulgaria	1.9	1.2
Ukraine	1.9*	1.4	*East Germany*	1.6	*0.8*
Belarus	1.9	1.4			

Sources: Pohl et al. (1992), Unicef (Nov. 1993), Walker (1995), Zakharov (1997).
* 1990.

2. Fertility Rates

2.1. An international perspective

Table 1 presents the total period fertility rates (TFR) of East and West Germany in an international perspective. Considering at first the year 1989, it becomes apparent that the West German TFR is generally fairly low compared to other OECD countries. Since demographic changes are very slow for these countries, the same holds for 1995. A more differentiated picture emerges for East Germany. In 1989 the GDR had the lowest TFR compared to former countries of the COMECON. Compared to the OECD countries that have on average lower rates than the COMECON countries, the GDR would be somewhere in the middle, comparable to Belgium or Switzerland.

The second part of Table 1 shows the TFR for several countries in transition. Fertility is declining for all of them. Although many of these declines are fairly considerable, none of them happened as fast and as accentuated as in East Germany and no other country reaches such low levels as East Germany. On the other hand, East Germany has experienced by far the fastest and most fundamental transition

process in terms of economic changes of all these countries. The remainder of Section 2 as well as Section 3 will argue that this is more than a coincidence.

2.2. THE GERMAN PERSPECTIVE

Figure 1 shows the total period fertility rates for East and West Germany. We observe a fairly parallel development until about 1974. From then on the West German rate fluctuates around a level of about 1.4. The East German rate shows a very specific behaviour. In 1975 a sudden upswing appeared. It seems very likely this turn is related to an incentive system favouring early births and early marriages that has been introduced in the GDR shortly before. After 1980 the rate shows a continuous decline until the GDR disappeared. Then, compared to the period 1975–1978, an opposite swing occurred between 1990 and 1992 after the West German incentive system has been introduced in the East. The West German system is less generous than the East German one and in particular favours later births. (See Lechner (1998) for a discussion of the different economic incentive systems and their expected impact on the timing of fertility.) Since 1994 period fertility is again increasing.

The part of Figure 1 to the right of the year 1997 shows an informed speculation (prediction) by postulating an East German adjustment process with cohort specific adjustment speeds using the same set of assumptions as suggested by Conrad et al. (1996, scenario 3).

A comparison of age specific fertility rates of East and West Germany (Figure 2) reveals that in the GDR of 1988 births occurred at considerable younger ages than in West Germany. Therefore, it is not surprising that the fall of age specific rates after unification was largest for the younger age groups. In 1994, four years after unification, period fertility rates for women younger than 24 years look remarkably similar to those of the same West German age group. Another three years later, this phenomenon can already be observed for all women younger than 27. Related to this finding is the fact that the right hand part of the distribution that collapsed completely in 1990–1992, is *recovering* and shifting towards the West German distribution. Nevertheless, even for 1997 the differences for the older age groups remain very substantial. Already at the age of 30 the East German birth rate is only 60% of the West German one. This share is falling even further for the following age groups. Despite of these large gaps compared to West Germany, however, the East German birth rates in 1997 are above their 1988 levels for women of age 29 or older.

The conclusion to be drawn from this development is clear-cut. Those cohorts not yet significantly affected by a potential GDR birth history show the same fertility pattern as West Germans of the same age. However, those cohorts that inherited a significant GDR birth history, i.e. births that are 'too early' for the new system, adjust in a very drastic way by reducing fertility to very low levels. This adjustment is still going on in 1997.

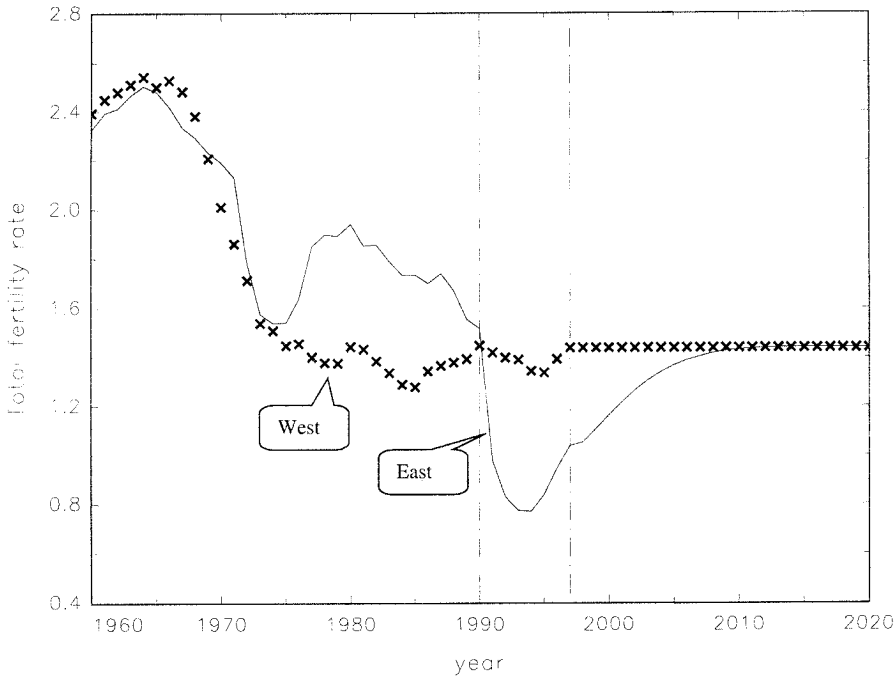

Figure 1. Total period fertility rates for East and West Germany.
Note: West: Area of former Federal Republic of Germany, including West Berlin. East: Area of former German Democratic Republic (including East Berlin).
Sources: Until 1996: Various issues of East and West German Statistical Yearbooks. 1997: Communication by the German Federal Statistical Office. After 1997: Estimated values according to scenario 3 given in Conrad et al. (1996). Because the data is updated the results differ to some extent from the results given there as well as from the newer results in Lechner (1998).

These findings support the *convergence hypothesis*. Although not impossible, it would be rather difficult to relate these findings to the *postponement hypothesis*.

Figure 3 strengthens this argument by looking at the problem from a slightly different angle. The figure shows completed fertility rates at different ages over time. Note that the figure is compiled in such a way that we switch from one cohort to the next when moving over time along the same line.

Starting at the top of the figure, we first consider the development of completed fertility rates at the age of forty (CFR40). This is almost identical to completed total fertility since births after the age of 40 are very rare. Before as well as after unification CFR40 for East Germany is above the West German CFR40. In 1990 the gap is fairly small, but during the period of drastically falling and subsequent low birth rates between 1990 and 1997 the East German CFR40 remains almost constant. With the West German CFR40 continuously falling, the gap between East and West German levels increases. Clearly these East German cohorts were subject

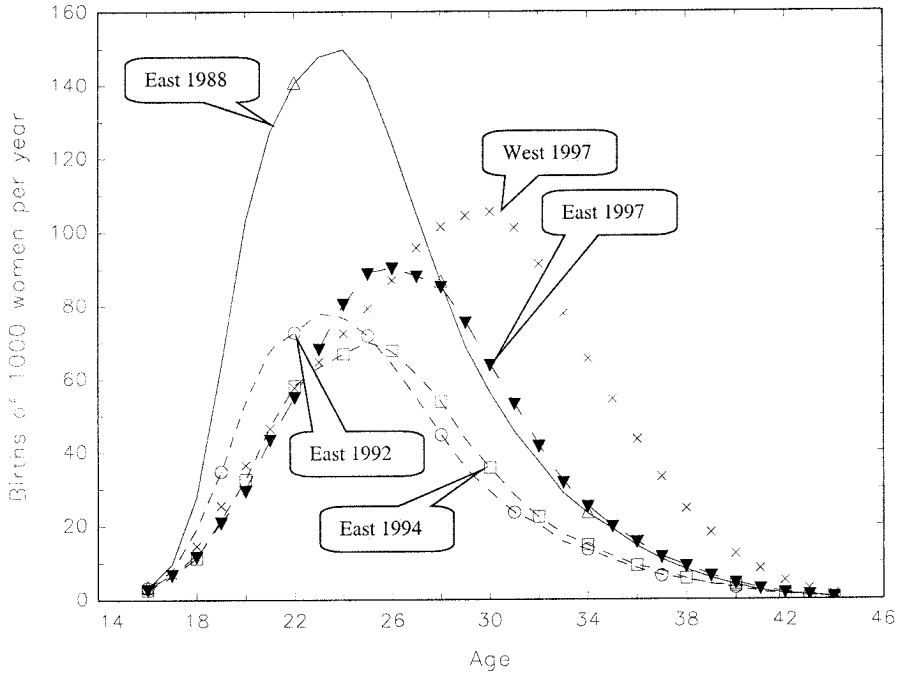

Figure 2. Age specific period fertility rates (births per 1000 women of respective age)
Note: See note below Figure 1.
The West German distribution for 1988 is omitted from Figure 2 for reasons of clarity. It lies a little to the left of the distribution of 1997, as the West German distribution is moving slowly to the right.

to the GDR early births incentive system and (almost) completed their fertility by 1990.

The story looks totally different for completed fertility at age 35 (CFR35). The closeness of the East German CFR35 and CFR40 in 1990 is just another way of making the previous point that in the GDR fertility was almost completed at the age of 35. The situation for West Germany is very different, since a lot of childbearing occurs after age 35. Therefore, the East-West differences are very large in 1990. In the following the CFR35 decreases for both parts of Germany. However, in 1997 the gap is narrowed considerably. This is coherent with the findings already obtained from analysing Figure 2. Those East German women that make up the CFR35 in 1997 are of age 28 in 1990, having still time to react. However, due to their past GDR birth history, adjustment could not be perfect anymore. Similar arguments apply for the CFR at younger ages. All gaps are very large in 1990 and become much smaller in 1997. Indeed the younger the women are in 1997, the smaller the gap in that year. In other words, the smaller the influence of the GDR birth history, the more complete is the convergence. For example, for age 25 there

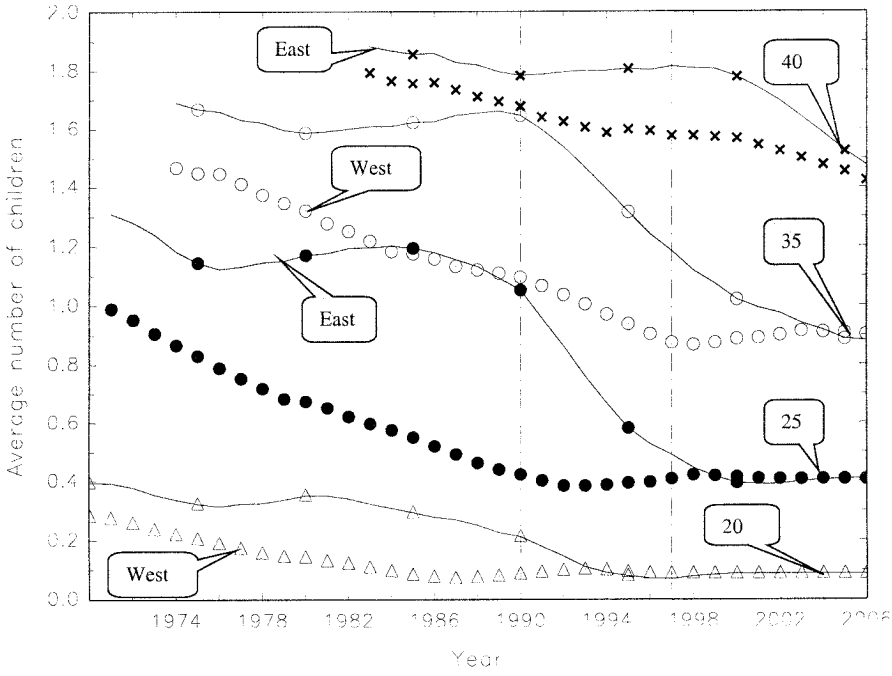

Figure 3. Accumulated fertility (average number of children) of women aged 20, 25, 30, and 40.
Note: The computations are based on age specific birth rates beginning in 1960. Hence, for older age groups the graphs start after 1970. See also note below Figure 1.

is only a very small gap in terms of CFR25 in 1997, whereas for women aged 20, this gap disappears already in 1993.

To summarise, from Figure 3 it is again obvious that the timing of births in the GDR was very different from the West German pattern. However, it appears that an adjustment process is going on that has already removed a considerable part of the differences. Finally, it should be mentioned that East German completed fertility for the different ages is never below West German levels. This is true even for 1997, although the period total fertility rates of East Germany have been drastically below the West German ones for the last seven years.

If we believe in the assumptions of the particular adjustment process suggested by Conrad et al. (1996; scenario 3), the group of women aged 28 achieve convergence in 1998, for age 35 the corresponding date would be about 2003, and complete convergence would be achieved in about 2007. It should be noted that until 1997 the adjustment model of these authors tended to slightly underestimate the speed of adjustment.

Before going into the details of a microeconometric analysis that tries to look at the *convergence* versus *postponement* hypotheses from a disaggregated point of view, it is worth noting that some demographic differences are still strikingly

large. One example are births out of wedlock. The share of such births has been traditionally high in East Germany. After unification it increased above 40% and is still increasing. In 1997 it reached 44.1% in East Germany compared to 10.7% in West Germany (Statistisches Bundesamt, 1999). That may be a legacy of the high East German divorce rates that peaked (in the end of the 1980s) at only two years after the beginning of a marriage (Bundesinstitut für Bevölkerungsforschung, 1999). The analysis of this feature as well as of demographic convergence in total – not just with respect to fertility – however remains an issue for future research.

3. A Microeconometric Analysis

The previous analysis revealed evidence suggesting that the large drop in birth rates is mainly due to an adjustment process. Most of the evidence came from a comparison of aggregated birth rates of East and West Germany. Although the evidence appeared to be fairly convincing, the aggregation process could still hide some sort of individual behaviour that had nothing to do with fertility adjustment. This is the so-called aggregation bias. One way to avoid false conclusions due to aggregation bias, is to not only consider individuals behaviour, but to base the empirical analysis also on observed individual data. Since such an analysis typically uses only a small fraction of the population, the disadvantage is the occurrence of sampling error. In contrast, the previous analysis of fertility rates was exact. However, if an econometric estimator is used that is unbiased for large samples and for which the effect due to sampling error can be computed, a so-called micro-econometric analysis could be a very sensible check for the conclusions based on aggregate data. It may also reveal additional insights because individual decisions of heterogeneous persons are observed. The information about the variation due to individual heterogeneity is typically completely lost in an aggregated analysis.

Following these lines of reasoning Lechner (1998) investigated the issues that are also the scope of this paper by using individual data from the German Socio-economic Panel (GSOEP). The approach of that paper was to estimate models for the dependence of the probability of birth on exogenous characteristics. These models have been estimated for East Germany and for West Germany separately. The second step of this approach was to simulate the mean birth rates that would have occurred in East Germany (using the estimated East German probabilistic response function) if the East Germans were endowed with West German characteristics (see below), and vice versa. The evidence obtained from this approach favoured by and large the idea of an adjustment process in explaining current birth rates in East Germany. A disadvantage of this (parametric) approach is that its validity depends on the correct specification of the conditional probability of birth (modelled with a probit). In particular the simulated responses are sensitive to any misspecification. Although the performed specification tests revealed no

substantial problem, they may have had low power particularly with respect to the estimation for East Germany, because the actual number of births that could be observed was fairly low (as expected, of course).

In this paper we use the same database as Lechner (1998), but choose a different approach that avoids the parametric estimation of conditional birth probabilities altogether. An additional advantage is that the underlying idea of this non-parametric approach is very intuitive. The question of interest is the same as before: How many births would we have observed after unification for the East German population, if that population would have had the same key characteristics as the West German population? The corresponding question is also asked for the West German population. In the sense of the hypotheses discussed in this paper, the key characteristics are age, birth history up to 1990, expectations in 1990, and worries in 1990.

Table 2 shows the variables used to describe these characteristics and gives some descriptive statistics for the East German and West German subsamples. It is fairly obvious that the distribution of the characteristics, in particular with respect to birth history, expectations, and worries, differ substantially and in the expected way.

To answer the question about what would have happened if the two groups would have had the same distribution of characteristics, and to assess the impact of these different characteristics, an econometric approach (estimator) called *matching on the propensity score* is used. The idea of that estimator is to obtain an answer to that question by comparing for example the birth rate of the East Germans with a specifically selected comparison group of West Germans that has the same distribution of characteristics. This approach is well known in the literature concerned with the evaluation of labour market programmes. For an overview see for example Heckman, LaLonde, and Smith (1999) and for an application and detailed description of a matching algorithm used to evaluate East German labour market programmes, see Lechner (1999a). The specific implementation used here is a special case of the estimator proposed in Lechner (1999b). The reader is referred to that paper for all technical details. The comparison group of West Germans (displayed in the left hand part of Table 3) is selected by choosing (matching) for each member of the East German sample exactly one member of the West German sample (with replacement) such that those characteristics that are under consideration are as similar as possible.[1]

Table 3 shows the results of these estimations. The columns headed East German characteristics relate to the comparison of the East German sample with selected West German comparison groups. The columns headed *West German characteristics* relate to the comparison of the West German sample with selected East German comparison groups. The selection (matching) is made by using the group of variables indicated in the first column. *Difference* denotes the difference between West German mean birth rates and East German birth rates. This is the effect of interest. *Std* denotes the standard deviation of the estimate of the

Table 2. Descriptive statistics of variables used in the estimations of the propensity scores

Variables	West Germany (mean in %)	East Germany (mean in %)
Age in 1990(A)		
19 and younger	9	9
20–23	15	10
24–27	22	16
28–31	18	23
32–35	20	22
36 and older (not used: reference group)	16	20
Birth history before unification (B)		
First birth in 1984	3	5
First birth in 1985	3	6
First birth in 1986	4	4
First birth in 1987	4	5
First birth in 1988	4	4
First birth in 1989	4	3
First birth in 1990	5	3
No children in 1990 (not used: reference group)	47	20
One child in 1990	24	31
Two children in 1990	21	39
Three and more children in 1990	8	9
Expectations in 1990 (E)		
Expect to lose job within next 2 years: certainly	1	10
Expect to lose job within next 2 years: probably	2	26
Expect to lose job within next 2 years: probably not (reference group)	64	58
Expect to lose job within next 2 years: certainly not	30	6
Partner expects to lose job within next 2 years: certainly	1	5
Partner expects to lose job within next 2 years: probably	1	18
Partner expects to lose job within next 2 years: certainly not	31	7
Worries in 1990 (W)		
Considerable worries about economy in general	22	36
Considerable worries about own economic situation	13	32
Considerable worries about environment	73	59
Considerable worries about peace	30	37
Considerable worries about own job	4	32
Partner has considerable worries about economy in general	13	30
Partner has considerable worries about EWS	9	23
Partner has considerable worries about environment	45	45
Partner has considerable worries about FRI	11	25
Partner has considerable worries about own job	4	25
Births 1991 – early 1995 (mean × 100)	28	12

Source: GSOEP 1990–1995.

Note: Women of age 16–43 (1990) who answered in all six waves. 1959 observations (West Germany including West Berlin: 1205, East Germany including East Berlin: 754). Note that the selection criteria differ slightly from the ones used in Lechner (1998). In 1995 births are only observed if they appear at the beginning of the year.

Table 3. Excess of average number of births in West Germany compared to East Germany 1991 to early 1995

Adjusted characteristics	East German characteristics				West German characteristics			
	Difference × 100	Std	*p*-val in %	Median |SB in %|	Difference × 100	Std	*p*-val in %	Median |SB in %|
No adjustment	16.0	2.0	0.0	–	16.0	2.0	0.0	–
Age (A)	12.6	2.8	0.0	0.0	14.0	2.3	0.0	0.0
A, birth history (B)	7.7	3.3	1.9	0.9	10.2	2.9	0.0	1.1
A, expectations (E)	14.3	5.4	0.9	2.9	9.6	3.5	0.6	0.3
A, E, worries (W)	10.9	7.9	16	3.7	12.9	3.7	0.0	4.1
A, B, E, W	2.8	7.4	71	7.4	10.0	4.0	1.2	2.8

Note: The columns headed *East German characteristics* relate to the comparison of the East German sample with selected West German comparison group. The columns headed *West German characteristics* relate to the comparison of the West German sample with selected East German comparison group. *Difference* denotes the difference between West German mean birth rates and East German birth rates. *Std* denotes the standard error of the estimate of the difference. *P-val* (*p*-value) is the significance level for that the hypothesis that the difference is zero is rejected. Median |SB in %| denotes the median percentage deviation of the variables used as components of the propensity score. Large values of this statistic indicate that the quality of the comparison group in terms of having the same marginal means for the characteristics than the first group is insufficient.

difference. *P*-val (*p*-value) is the corresponding significance level for which the hypothesis that the difference is zero is rejected. Median |SB in %| denotes the median percentage deviation of the variables used as components of the propensity score. Large values of this statistic indicate that the quality of the comparison group assessed in terms of having the same marginal means for the characteristics than the first group is insufficient.

Note that the right part of Table 3 is not really related to the basic question discussed in this paper, because the issue in this paper is what would have happened to the East German population, if their characteristics were more similar to the ones of West Germans. The right hand side of the table however answers the question what would have happened with the West Germans if they were more similar to the East Germans. The latter question is not at issue here, and that part of the table is only presented to give the reader a clue whether the same magnitude of effects appear in the West as well as in the East. The following discussion therefore concentrates entirely on the East German population.

The first row in Table 3 shows the raw difference that occurs when no adjustment to the comparison population is made. The difference in accumulated birth rates of 16% (West German rate: 28.1%; East German rate 12.1%) is as large as expected given the large differences in birth rates observed in the previous section. Once the unequal age distribution is accounted in the construction of the West German comparison group, the difference gets smaller (12.6%), because the rate

in the West German comparison group decreases to 24.7%. When we also impose the East German birth history before 1990 on the West German comparison group, their birth rates falls further to 19.8%, thus reducing the difference by a substantial amount to just 7.7%. On the other hand, if the West German comparison group is made similar with respect to age, expectations and worries, the birth rate falls as well, but only to 23%. The difference is 10.9%. However, the standard error that comes with this estimate suggests that it is imprecise and hence may give a quite misleading result. If we ignore the worries and take only expectations into account, the estimate is more precise, but without a reduction in birth rates at all. The last row in Table 3 suggests that age, birth history, expectations, and worries can explain almost all differences in birth rates between East and West Germany, thus leaving little for East German specific cultural, social or other factors. However, that value should be taken with care because sampling error is important and furthermore because the obtained West German comparison sample, supposed to be sufficiently similar in all these characteristics, is of questionable quality, which is indicated by the high value for the median of the standardised percentage bias (7.4%).

The conclusion that can be drawn from this microeconometric exercise is that birth history as a permanent factor is much more important than, perhaps, temporary differences in individual expectations for explaining differences in the occurrences and the number of births. Hence, this is again another piece of evidence in support of the hypothesis that a considerable part of the drop in East German fertility is due to an adjustment process towards West German fertility patterns.

4. Conclusions and Further Research

This paper added further evidence to the hypothesis that the dramatic fall of East German fertility can to a large extent be explained by an adjustment process from East German to West German fertility patterns. The microeconometric analysis still leaves some room for other, probably temporary, factors that can explain the drop. However, their impact appears to be clearly dominated by the ongoing adjustment.

This kind of analysis could be extended fruitfully in several ways. First of all, the micro-econometric part could be improved by using larger and possibly even more informative (in terms of birth history) samples than the GSOEP. With a larger sample match quality may not be a concern any more and the conclusions that can be drawn will be less prone to sampling error and hence more precise. More information would further allow to model certain characteristics more precisely.

Another possible line of research could be the combination of these findings about fertility in East Germany with further and more general investigations in the interrelation of other dimensions of demographic change and changing economic institutions in transition economies. This ambitious research programme could very fruitfully use individual data for the empirical analysis. However, in

terms of adequate econometric methods suitable to address these issues, there are considerable challenges ahead.

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Note

[1] Technically, it has been shown (i.e. Rosenbaum and Rubin, 1983) that it is sufficient when pairs are (almost) identical with respect to their conditional probability for being in the East or West German subsample conditional on the characteristics of interest (living in the East or West is the *treatment* in the language of that literature; the birth rate is the *outcome*). This conditional probability is called the propensity score. Here, a probit model of being in the East or West German sample is estimated. Note that when the characteristics change from one scenario to the next, the probit model has to be re-estimated with the new variables and new matches have to be found.

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