CEDI

Working Paper No. 06-06

Does Economic Uncertainty Affect the Decision to Bear Children? Evidence from East and West Germany

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July 2006

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July 30, 2006

Abstract:

During their social, political and economic transition, the countries of Central and Eastern Europe experienced significant economic uncertainty. Many of these countries also experienced sharply falling fertility rates. There have been some suggestions that that these two phenomena are linked, i.e., that uncertainty has an impact of the decision to bear children. But the strength and nature of this relationship has not been examined carefully. This paper demonstrates the existence of such a link at the micro level using two different types of uncertainty measures based on GSOEP data from Eastern (and for comparison purposes also Western) Germany for the years 1992-2002. The results suggest that employment uncertainty (but not financial uncertainty) was considerably greater in Eastern Germany during its post-reunification transition than in Western Germany and had a highly nonlinear effect on the likelihood of childbirth. We also show that this uncertainty may have contributed significantly to the sharp drop in East Germany's total fertility rate in the immediate aftermath of the reunification.

Keywords: Falling fertility, Uncertainty, Germany, Reunification

JEL codes: J13, J22, D81

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1. Introduction

In the development literature the relationship between uncertainty and fertility has received considerable attention, but primarily with respect to long-term uncertainties concerning disability and mortality. In this context, it was argued that, when uncertainty is modest or treatable as in developed countries, there might be little need for many children, but when uncertainty is great and largely untreatable as in rural areas of developing countries, its effect on fertility could be positive as long as help from children would be perceived to reduce these uncertainties (Leibenstein, 1957, 1978; Cain, 1980, 1981; Nugent, 1985). This suggests a possible nonlinearity in the relationship. Theoretical explanations such as those involving substitution and income effects have been used to explain some such nonlinearities as for example those with respect to infant mortality. To the extent that insurance markets and other means of reducing risks may be more developed (and more easily accessed by those at higher levels of income) primarily only when these risks are high may also help explain such nonlinearities, with respect to not only uncertainty but also the level of income.

However, while the evolution of financial markets and welfare states that insure their citizens against the ill-effects of life course events like major illnesses, disability and death have made it easier to hedge against such sources of long term uncertainty, short and medium term uncertainties abound. For example, insurance against crop loss and unemployment are usually far harder to obtain because of their inherent vulnerability to adverse selection and moral hazard than these other kinds of insurance. Uncertainties concerning retaining (or finding) employment would seem especially common and problematic. An individual facing the possibility of job loss (or a low probability of finding a job) faces at least a few choices, each of which might affect her life differently, and yet the outcome associated with which would not be revealed until well into the future. To use the terminology of Johnson-Hanks (2004), this individual faces both the *uncertainty of means* and the *uncertainty of ends*. The former pertains to the uncertainty inherent whether the objective of maximising lifetime utility would be enhanced by remaining in the work force or alternatively by dropping out and becoming dependent on spouse, family or state. On the other hand, the latter

concerns the uncertainty of outcomes after the decision is taken, given at the decision stage one's assessment of the alternatives were based merely on expectations about the probability distributions of future outcomes. Since it is never possible to completely hedge against future events, we believe it is the uncertainty of means that is more likely to affect fertility decisions.

Ironically, these uncertainties of means may be higher in industrialised welfare states than in developing economies, especially under the competitive pressures of globalization. In developing countries substance needs dictate that most people have to keep searching for jobs irrespective of the probability of finding jobs, implying that shocks may have little effect on time allocation. In countries with well-developed welfare states, however, adverse employment shocks might well result in sharp changes in time allocations since unemployment spells may not affect income but allow time allocations to be changed drastically during the unemployment spell or more generally over the medium term.

From a theoretical perspective, it is easy to see that such short and medium term uncertainties may affect potentially life-altering decisions like conceiving (and giving birth to) a child. In the neoclassical economics framework of Becker (1976), for example, we can treat a child as a normal good whose "consumption" would depend on the relative size of the substitution and income effects associated with a change in a parent's expected earnings. Given any market wage rate, if there should be greater uncertainty about the possibility of retaining employment, such that the expected wage rate were to decline, the substitution effect should induce the parent to have a child, while the income effect would make her more hesitant about having one. Since the relative importance of these two effects could vary with the extent of this uncertainty, the relationship between the likelihood of having a child and the extent of employment related uncertainty could quite plausibly be non-linear or non-monotonic.

We can also reach the same conclusion using other theoretical paradigms. For example, since childbirth is an irreversible process, one can think of the event of conceiving a child as exercising a

real option. To the extent that postponing the exercise of this real option would save enough resources that would otherwise be spent on the child as to outweigh the expected financial losses arising from the likelihood of unemployment, an individual could be expected to postpone giving birth to a child. This view has been formalised by Ranjan (1999), and is consistent with the generally accepted relationship between uncertainty and any form of irreversible economic activity (Dixit and Pindyck, 1994). But it is contradicted by Friedman, Hechter and Kanazawa (1994) who argue that, in fact, people facing a number of different types of uncertainties might actually decide to have children which forces them on to a path of relative certainty that is reinforced by the formal and informal rights and obligations that accompany parenthood. They argue that such a choice is even more likely to be made if these individuals have little control over the forces that expose them to other forms of uncertainty, a classification that fits well the uncertainty regarding employment that is driven by industry-wide or country-wide economic shocks. Once again, therefore, the theoretical relationship between uncertainty and the likelihood of childbirth becomes obscure.

The empirical literature, too, is not very helpful in disentangling the relationship between uncertainty and childbirth. To begin with, macro and micro evidence about this relationship are inconsistent with each other. For example, Kohler and Kohler (2002) noted that the early transition period in Russia was characterized by a negative relationship between uncertainty and fertility at the macro level but often by a positive one at the micro level. The micro-level evidence also is somewhat inconsistent across studies. Many studies discuss the possible causal and negative link between uncertainty and childbirth, often in the context of the transition economies of Central and Eastern Europe (e.g., Sobotka, Zeman and Kantorova, 2003; Philipov, Speder and Billari, 2005) where the marco-level negative relationship has been observed. Yet, few of these studies have actually included a measure of uncertainty in their empirical models. To the extent that these studies have included any direct measure of, or proxies for, uncertainty at all, most have been based on past experience of the individuals involved. .

For example, Chase (2003) demonstrated the presence of a negative relationship between employment-related uncertainty and the likelihood of childbirth in the context of Czech Republic and Slovakia using as his measure of employment uncertainty a dummy variable for having changed jobs in the four years prior to the study. Since one can easily conceive of circumstances in which someone who had changed jobs might have less uncertainty about the future than someone who had not changed jobs, such backward-based measures may be of dubious relevance to the future and hence far less than ideal for fertility and marriage decisions for which current and immediate future conditions may be most relevant.

Johnson-Hanks (2004) and both Kurz et al. (2001) and Bernardi et al. (2006) are exceptions in that they make greater use of subjective perceptions of uncertainty. The former study demonstrated that giving (educated) women more choices (and hence more options to be uncertain about) exposed women in Cameroon to more uncertainty of means (and ends as well) than their uneducated counterparts, such that the *hazard* of a second birth was reduced. It did not, however, use a direct measure of uncertainty, and neither did it distinguish this effect empirically from the Beckerian opportunity cost explanation for the role of education on fertility.

Kurz et al. (2001) made use of the GSOEP data for the 1984-98 period to examine the hypothesis that employment-related insecurity might affect the time it takes to enter into marriage and first birth after completing schooling for both males and females in Germany. Their proxies for employment insecurity were the type of job contract, full-time vs. part-time and permanent vs. fixed term, and the type of employer (self, government or other). In the case of females, the job category with the most significant (negative) effect on marriage and first birth was a "in-school" occupation, representing a return to school after having started employment. The effect of part-time was positive, that of self-employment negative and that of unemployment positive but not significant. For males, however, unemployment and self-employment had negative effects on both of these dependent variables but the part-time and fixed term types of contracts had no significant influences. These results were seemingly somewhat inconsistent with the uncertainty hypothesis and the results rather mixed,

perhaps on account of the fact that employment status itself does not always reflect the degree of uncertainty associated with remaining employed in the foreseeable future. This is especially of significance to unemployed people, some of whom typically have much higher probability of finding employment in the short run than others. In our opinion, therefore, constructing in single index of uncertainty that captures the individuals' perceptions about employment-related uncertainty might be more promising.

Bernardi et al. (2006) did develop qualitative measures of employment and other uncertainties and tried to identify which uncertainties seemed to play the most important role in educational, partnership and fertility decisions. Although based on only tiny samples, they showed that the same kinds of uncertainty could have different influences on *attitudes* toward marriage and children (but not actual marriage and fertility decisions) in different socio-cultural conditions (between East and West Germany). These conclusions were based on tiny samples of interviews (16 in West Germany and 13 in Eastern Germany).

In this paper, we aim to add some clarity to the evidence available about the relationship between uncertainty and the likelihood of childbirth using the more forward-looking subjective measures of uncertainty. Specifically, we construct two measures of the uncertainty of means type, namely, economic- and employment-related uncertainties, that could have different impacts on an individual's decision to conceive a child, and examine their impact on the likelihood of childbirth. We have already discussed the different ways in which employment-related uncertainty might affect the decision to have a child. The possible relationship between financial uncertainty and the likelihood of having a child can be traced back to Easterlin (1980). If an individual's (presumably stable) aspirations exceed her current financial situation, Easterlin had argued, she is less likely to get married and have children, and vice versa.[1]

We use the exogenously given historical event of German reunification as the context for our analysis. As we have argued below, while the precipitous decline in the East German total fertility

rate (TFR) has been examined in earlier research, our analysis makes an additional and substantive contribution to this literature by explicitly linking uncertainty to the decision of conceiving a child based on relatively long panels. In addition, we compare the behaviour of East Germans and West Germans in the post-reunification period, and that of pre-unification West Germans with post unification ones. Our results indicate that (a) the likelihood of childbirth is influenced by the employment related uncertainty of the female but not that of her partner (or the father of the child), (b) other factors like age and education of the female, the number of pre-existing children in the household, and wealth also affect this likelihood, and (c) the behavioural differences between post-reunification East and West Germans is more noticeable than those between pre- and post-reunification West Germans.

The rest of the paper is organised as follows: In Section 2, we discuss some of the earlier research about the fertility decline in post-reunification East Germany, and provide further details about our empirical strategy. In Section 3, we present the empirical strategy and the regression specification. In Section 4, we discuss the data used in the analysis, and highlight some differences between East and West Germany. In Section 5, we report and discuss our empirical results. Section 6 concludes.

2. Brief Review of the Relevant Literature

Eastern Germany (the former German Democratic Republic) experienced a precipitous decline in TFR in the immediate aftermath of the reunification of Eastern and Western Germany, from around 1.5 in 1990 to 0.8 in 1994 (Conrad, Lechner and Werner, 1996; Lechner, 1998, 2001; Kreyenfeld, 2000, 2003; Sobotka, 2002). While it has recovered since then, by 2000 the TFR for East Germany had increased to only 1.21, below not only the pre-reunification TFR but also the West German TFR of 1.41 (Stark and Kohler, 2004). While considerable controversy has arisen over both whether this fall was only temporary (based on spacing of children along a timeline) or permanent and whether it was due to the rise in uncertainty or to other factors like convergence in tastes and environmental conditions to those of Western Germany, these issues have not been fully resolved.

In an early attempt to explain this sharp drop in the fertility rate, Witte and Wagner (1995) used data from the German Socio-Economic Panel (GSOEP) for the years 1990 through 1992 to show that (1) fairly substantial percentages of women of child-bearing age were concerned with such uncertainties, and (2) those women with concerns for their personal economic situation had lower probabilities of having any, but especially a first, birth after reunification than before when these concerns would have been much weaker. Although, quite naturally, the extent of such concerns varied considerably across the population and the sample, they did not control for other factors that would likely affect fertility. Also, given the early date of this innovative study, its authors were unable to examine the experience since the middle of 1992.

Another relatively early study suggesting the relevance of increased economic uncertainty to the fertility decline in Eastern Germany is Adler (1997). This study placed emphasis on the rise of female unemployment in Eastern Germany and the decline of child and maternal support from the state, both contributing to increased financial uncertainty. Adler, however, did not make use of micro-level data on either uncertainty or fertility, suggesting instead that the aggregate relation between the rising economic uncertainty and falling fertility was due to collective behaviour in the form of abstinence from marriage and childbirth, representing a kind of social protest against the institutional changes lowering women's independence and security.

Kreyenfeld (2003) examined the relative merits of the two plausible explanations for the sharp decline in East German TFR in the aftermath of the reunification: (a) as a response to the drastic socio-economic changes experienced by East Germans in the immediate aftermath of reunification, and the associated uncertainty (e.g., Witte and Wagner, 1995; Conrad, Lechner and Werner, 1996), and (b) as a temporary aberration, and that it would eventually rise and converge with the West German TFR over time. Using micro-census data to compare the childbirth patterns of the 1961-70 cohorts, Kreyenfeld found that while East Germans were likely to have their first child at a younger age than their West German counterparts, the former were less likely to have a second child. In other

words, while the overall TFR of East and West Germans are closer now than they were immediately after reunification, there is no reason to believe that there would be convergence in the foreseeable future. While this analysis, therefore, is sympathetic to the first of the two hypotheses that links economic uncertainty with reduction in TFR, Kreyenfeld does not explicitly link the two in her largely descriptive analysis. Although limited to a few interviews and attitudes instead of actual behavior, the aforementioned also rather descriptive study by Bernardi et al. (2006) came down somewhere in between. They admitted a connection in East Germany between the very considerable employment-related uncertainty and the initial fall in fertility, but then argued that recovery in fertility rates was due to a rather carefree attitude with family and friends as a priority despite continuing high uncertainty about employment.

It is evident that much of the discussion about the decline in TFR witnessed in East Germany after reunification has taken place in the broad context of a possible decline in the German population, and its consequences, in the medium to long run. As a consequence, much of the attention of the researchers has been focussed on issues like long term trends in TFR, the time to first and second births, and attitudes concerning priorities in life among income, family and stability. However, except for the early study by Witte and Wagner (1995), there has been little attempt to directly test in a quantitative way the impact of economic uncertainty on the decision to have a child. Kurz et al.'s (2001) study too focus on first birth, and the more general framework of Bernardi et al. (2006) is limited by its small sample size.[2] This is the lacuna in the literature that we address in this paper.

3. Empirical Strategy

As we have explained earlier in the paper, we aim to address the limited question as to whether economic uncertainty has an impact on the decision to bear a child. The long run implication of such uncertainty is not obvious. For example, economic uncertainty may induce a person to postpone childbirth for a year. At the end of the year, she may re-evaluate the circumstances, and take afresh the decision as to whether to have a child or to postpone childbirth even further. If the economic

uncertainty were to persist over a long period of time, such that childbirth would be postponed a number of times, uncertainty may affect the lifetime fertility of the person, on account of biological constraints that affect the likelihood of childbirth after some threshold age for both women and men. But this is not guaranteed; if the source of the uncertainty is eliminated after a while, the person may have the desired or optimal number of children over the rest of her lifetime.

We have already noted that, in the absence of perfect foresight for all *ex ante* choices made by an individual, uncertainty of means (based on expected outcomes of the various options) is more likely to impact the likelihood of childbirth than uncertainty of ends (concerning the probability distribution of the actual outcomes after the stochastic shocks have been realized). The uncertainty of means is essentially a short run phenomenon, one that is resolved in the medium to long run, one way or another. For example, a potential parent is much more likely to base her decision to have or not have a child on factors like current or immediately foreseeable finance- and employment-related problems than on the prospect of an oil price-induced deep recession fifteen years into the future. If she loses her job in period *t*, she has to decide whether to keep looking for a job or to drop out of the labour force altogether. However, in the medium run, she either finds a job (or has a high probability of finding one) or she comes to the conclusion that she is unlikely to find a job that meets her basic requirements, and therefore drops out of the labour force. In other words, in the medium run, the uncertainty of ends remains but the uncertainty of means disappears.

More importantly, for the period-specific decision on having a child in that period the impact of this uncertainty is not cumulative. When the aforementioned person loses her job in period *t*, she may be uncertain about her employment prospects and this uncertainty may have an impact on her decision to have (or not have) a child in the same period. But, when she re-evaluates her situation in period *t+1*, her decision about conceiving a child is much more likely to be based on her state in that period *t+1* than on her state in period *t*. This does not mean that the uncertainty in period *t* would not have an effect on the number of children she has in her lifetime. All it suggests is that the discernible impact of uncertainty in any time period is likely to be on the *contemporaneous* likelihood of having

a child. The impact of this kind of uncertainty on the lifetime fertility of the person is likely to be much weaker.

In keeping with this argument, we build on the methodology of Chase (2003) who estimated the impact of employment-related uncertainty on the contemporaneous likelihood of having a child. Chase used a probit model. Since in our case we have panel data; we use a random effects probit model to explain variations across the sample women of the designated age groups in the binary variable childbirth.[3] The use of the random effects probit model might seem quite different from the duration or hazard models used so commonly in fertility analysis. These models are especially common in trying to estimate the time between first union and first birth, or alternatively between the first and second births. In fact, however, the duration of any such interval can be calculated as follows from separate annual probabilities of giving birth in the interim years as captured by the probit model for each of four periods, P_1, P_2, P_3, P_4:

$$\text{Expected Duration} = 1P_1 + 2\,(1-P_1)P_2 + 3\,(1-P_1)(1-P_2)P_3 + 4\,(1-P_1)(1-P_2)(1-P_3)P_4$$

The two approaches, therefore, are closely related. Indeed, the probit model may be somewhat more general since it allows the probabilities of a birth (P_t) to change over time whereas in the conventional duration model the values of P_t are constant over time so that:

$$\text{Expected Duration} = 1P + 2\,(1-P)P + 3\,(1-P)^2 P + 4\,(1-P)^3 P = 1/P$$

It is evident that the random effects probit model, in which the probability in any time period t is going to be affected by the period t-specific uncertainty and other factors, is not only consistent with the intuitive relationship between uncertainty (of means) and fertility decision, it is econometrically more suitable for our purposes as well. Therefore, the dependent variable in our regression specification is the birth of a child in a given time period, and the key explanatory variables are the employment uncertainty of the potential mother and her partner and the household financial uncertainty as perceived by the former.

In keeping with Sobotka (2004), we also control for a number of personal characteristics of the potential parents, and of the households as follows:

Age of female parent: We have the reasonable prior that the relationship between age and likelihood of childbirth is non-linear; the likelihood increases initially with age, and declines beyond some threshold.

Adults in the household: The number of adults in the household – with a single parent at one extreme and a multigenerational household at the other – may have an impact on the likelihood of having a child through the currency of informal childcare. Our prior, therefore, is that, other things remaining the same, an increase in the number of adults in the household will raise the likelihood of childbirth.

Children in the household: While adults in the household are likely to ease the time constraint facing a parent, pre-existing children would affect the parent's time and budget constraints adversely. Hence, the likely relationship between the number of pre-existing children in a household and the likelihood of someone from that household having a child is negative.

Education: Education increases both the opportunity cost of a woman's time, as well as her lifetime earning potential. While the higher opportunity cost of time, and the resultant substitution effect, can reduce the likelihood of childbirth, the income effect is likely to have the opposite impact. Hence, the impact of education on this likelihood remains an open empirical question.

The education of a potential male parent, however, is likely to have an unequivocally positive impact on the likelihood of childbirth. A male parent with a higher education, and hence a higher earnings potential, will have a strong income effect, but is unlikely to face the dilemma associated with the substitution effect.

Household wealth: Household wealth can ease both the budget and time constraints facing a potential parent, and can therefore increase the likelihood of childbirth. If we think of a child as a

normal good, the impact of wealth on the number of children is positive as well. Hence, our prior is a positive relationship between household wealth and the likelihood of having a child.

3. Data

The data used to carry out such a test was obtained from the aforementioned GSOEP that is collected annually. The first round of the survey was conducted in 1984 and was applied to a sample of 5921 households and individuals in the Federal Republic of Germany (i.e., West Germany). Since then, each year the respondents are asked to respond to questions concerning demographic features, income and social security benefits, education, health and labor market experience, and expectations about the future. Beginning in 1990, however, households in the former German Democratic Republic (East Germany) were included. The sample size of the survey has increased over time, to some 6800 households and 13,000 individuals in recent years (Haisken-Denew and Frick, 2000). While 365 out of 375 women in our East German sample were married, well over 90 percent of the women in the West German sample were married as well.

INSERT Table 1 about here.

The summary statistics for East and West Germany are reported in Table 1. We make the reasonable assumption that childbirth is most likely to occur to women who are in the 18-45 age group, at least to the extent that childbirth is planned such that uncertainty can have an impact on childbirth. Our sample, therefore, is restricted to women in the 18-45 age group. The data for East Germany corresponds to the 1992-2001 period. For West Germany, we report the data for both for the corresponding period, and the pre-reunification 1985-91 period. We also report the West German statistics for the overall 1985-2001 period. The summary statistics indicate the following:

The Dependent Variable: Incidence of childbirth

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The precipitous decline in the East German TFR in the post reunification period is evident from the very low incidence of childbirth in the East German sample. Indeed, the incidence of childbirth in East Germany during the 1992-2001 period was about a tenth of the incidence in West Germany for both the 1985-91 and the 1992-2001 periods. The incidence of childbirth in East Germany increases sharply if the sample is restricted to 18-30 year olds, to 0.08, but even that is less than half the West German incidence of 0.18 for the corresponding age group. The East German incidence declines sharply to below 0.005 for women above the age of 35, five years ahead of their West German counterparts. Given the reasonable assumption that women above the age of 35 have at least one child, our statistics are consistent with Kreyenfeld's (2003) finding that East German women are less likely to make the transition to a second child than West German women.

The Uncertainty Measures

Next we turn to our two measures of uncertainty, employment uncertainty and financial uncertainty. It is these measures that allow us to measure the effects of uncertainty on fertility.

Employment uncertainty: The employment-related uncertainty indexes are constructed from two questions in the GSOEP questionnaires. If a person is employed, she is asked how confident she is about her job security. The possible responses are *very concerned*, *somewhat concerned* and *not concerned at all*. If the person is unemployed at the time of the survey, on the other hand, and is looking for employment, she is asked how confident she is about finding a new job. The possible responses are *easy*, *difficult* and *almost impossible*. We use this range of responses to these two questions to construct a 6-point score for each respondent representing her probability of being unemployed in the foreseeable future. In addition, we assume that if a person is not a participant in the labor force at the time of the survey, her likelihood of finding a job is low, and hence we automatically assign to her the highest score of 6. In keeping with our earlier discussion, it is easy to see that the *uncertainty* related to employment is highest for intermediate scores of 3 or 4, and lowest for the scores of 1 and 6.While one could easily think of other dimensions of job security and quality (such as self-employment, contract choice, and type of employer) that might be relevant to

fertility, Tolke and Diewald (2003) showed that unemployment spells were among the few that significantly affected delays in the transition to fatherhood among males.

Consistent with the consistently higher rate of unemployment experienced in Eastern Germany since 1990, the values of these probabilities of unemployment for the period 1992-2001 were considerably higher for the Eastern Germans in the samples than for the Western Germans, and especially so for men. In both cases, however, the average probability of unemployment was higher for women than for men. These results are consistent with both existing literature on the differences in the employment and earnings potential of men and women (Darity and Mason, 1998; Stanley and Jarrell, 1998), and the greater vulnerability of women to unemployment in post-reunification East Germany (Bonin and Euwals, 2001).[4]

Since we do not know the exact functional form that maps *unemployment probabilities* into *uncertainty scores*, it is not possible to say anything very definite about the relative employment-related uncertainties of East and West German men and women. Nevertheless, since the probabilities are mostly near the middle of the range of possible values, it would appear likely that the differences in unemployment probabilities map into corresponding uncertainty differences.

Financial uncertainty: Using a GSOEP question about the extent of concern that an individual has about financial solvency, we construct a 3-point scale for financial uncertainty. Each respondent is asked how confident she is about the household's financial prospects. The possible responses are *very concerned*, *somewhat concerned* and *not concerned at all*. Using the responses to this question, we have created a 3-point measure of the uncertainty score for a household's financial status that is increasing in the level of uncertainty. As can be seen in Table 1, in this case, East German women of all age groups were less worried about the financial solvency of their households than were West German women. However, this could be attributable to the lesser importance of financial assets in East German households.

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The Control Variables:

Age of female parent: The average age of the women in the East German sample is almost 37, about 3.5 years older than the West German women during the same 1992-2001 period.

Household members: The difference between the number of adults in an average East and West German households in our sample is not statistically significant. A closer look at the distribution of the adult members across households reveals that nearly 25 percent of East German but under 10 percent of West German households had three or more adults living within the same household. This accounts for the slightly higher average for East German households.

East German households also had more children, on average, than West German households, even though, once again, the difference is not statistically significant. In other words, while an average East German woman was likely to have had access to greater informal care for her children from other adult household members, this advantage may have been (more than) offset by the presence of greater number of children in the East German households.[5]

Education: Consistent with the popular wisdom about some of the beneficial aspects of socialism, East German women are, by and large, more educated than West German women, when education is measured as a categorical variable that captures the level of education relative to primary school. This measure of education is believed to be more meaningful than years of education because of the step (or threshold) function character of the impact of education on lifetime earnings (Pritchett, 2001). However, this does not necessarily suggest that an average East German woman has greater earning potential than an average West German woman since the education obtained in pre-unification East Germany may not fit post-unification skill requirements. In other words, the impact of a East German woman's education on the likelihood of childbirth is not obvious.

Unlike women, sample East German men are not better educated, on average, than their West German counterparts.

Household wealth: In the absence of detailed information about financial wealth of a household, economists often use information about the family home as proxy for wealth. The problem with this proxy, of course, is that house quality is heterogeneous, and hence neither the size of the house nor other characteristics like number of rooms can fully account for a household's wealth. However, its use is rather standard and hence we use it as a proxy for household wealth in our analysis.[6] Our data suggest that the size of home of an average West German household is 6-17 percent larger than that of an average East German household. There is also evidence that the East-West difference in the size of homes is higher for the older age groups than for the younger ones, despite the fact that the number of adults and children residing in an average household is roughly the same for East and West Germany for these age groups. This adds to our confidence that the size of home may serve as at least a crude proxy for the non-human wealth of the household, and is unlikely to be endogenous to household size.

The descriptive statistics are, by and large, consistent with the popular wisdom about German economic conditions, especially the East-West differences. In the following section, we turn to the empirical estimates of the relationships between the two types of uncertainty and other factors and the probability of childbirth in East and West Germany.

4. Regression Results

The marginal effects generated from the random effects probit model for the full sample are reported in Tables 2 and 3. In Table 2, we report the regression estimates for the East and West German samples of all women who are in the 18-45 age group. We then take into account the possibility that education and childbirth are simultaneously determined such that the former is not necessarily an exogenous explanatory variable for women who are in the age group when college and university education is most likely to be part of their choice set. We, therefore, re-estimate our model for women in the 25-45 age group, treating 25 as a reasonable age when formal education would be

completed for most. The marginal effects associated with these estimates are reported in Table 3. The marginal effects reported in the two tables are remarkably similar, and hence we discuss those reported in Table 2 alone.

INSERT Tables 2 and 3 about here.

The results are as follows:

Age of female parent: The likelihood of childbirth decreases monotonically with the age of a woman in East Germany, while in West Germany we observe the more stylised inverted-U shape relationship between the two variables. Once again, this is by and large consistent with the results of Kreyenfeld (2003). However, the absence of a quadratic relationship between a woman's age and likelihood of childbirth in East Germany brings into question the popular hypothesis about the postponement of childbirth, and calls for a more careful examination of this hypothesis.

Household members: The number of adults in a household does not affect childbirth in either East or West Germany. However, this likelihood decreases with the number of children in a household. The impact of children on the likelihood of childbirth is sharper in West Germany than in the East, perhaps highlighting differences in attitudes about the time and financial requirements of childcare.

Education: In keeping with the popular perception, a woman's education does have an impact on the likelihood of childbirth. However, our result suggests that the income effect associated with higher lifetime earnings dominates the substitution effect associated with higher opportunity cost of the woman's time. The nearly 50 percent drop in the impact of education on the likelihood of childbirth among West German women, between 1985-91 and 1992-2001, also indicates that during the 1990s, the impact on the income effect was more than the impact on the substitution effect. The much higher impact of education in East Germany, as compared with the West, on the other hand, is

consistent with the lower average earnings and, therefore, the higher marginal impact of income, in the East.

The potential male parent's education level, and hence earnings potential, does not have any noticeable impact on the likelihood of childbirth.

Uncertainties: A household's worries about its finance do not have an impact on its likelihood of having a child. This result may be an artefact of the relatively short (3-point) scale on which this worry is measured, thereby not allowing significant variations across households. However, employment related uncertainties matter in the context of childbirth. The relationship between the likelihood of childbirth and a woman's likelihood of being unemployment is quadratic; the likelihood of childbirth decreases initially, as a woman experiences higher probability of unemployment, and the likelihood of having a child increases once again beyond some threshold level of the probability of unemployment. In other words, the likelihood of childbirth is the lowest when the probability of unemployment is in the middle of the 1-6 scale, i.e., when employment-related uncertainty is the highest (see endnote 4).

It should be noted that both the negative, and, subsequently, the positive, impact of employment related uncertainty is much higher for East German households than for West German households. The initial negative impact of about –0.60 is especially sharp, and more than times higher than the corresponding impact of –0.10 for West German households in the 1992-2001 period. At the same time, the impact of the probability of unemployment on the likelihood of childbirth did not change significantly for West Germans between 1985-91 and 1992-2001. This is consistent with the "macro" observation that while West German TFR was stable across the pre- and post-reunification periods, the East German TFR more than halved in the immediate aftermath of the reunification, as the employment related uncertainties set in. In part, the much higher impact of the uncertainty in East Germany may reflect the East-West difference in the labour force participation rate of women.[7] The much higher positive impact of the positive quadratic term for East German households is also

consistent with the "macro" observation that after 1994 the East German TFR rose rapidly again to narrow the gap with the West German TFR, presumably as the passage of time reduced employment related (and other) uncertainty that was precipitated by the reunification.

Because of the low incidence of births among the sample women, having as large a sample as possible is crucial for obtaining statistically significant results. Nevertheless, since the results presented in Tables 2 and 3 include both married and unmarried women, as a robustness test, in Table 4 we present the parallel results when the sample is limited to married women of the 25-45 age group. This has two additional desirable effects: (1) removing both an important unobserved variable and the possibility of specification bias arising from the possible endogeneity of marriage in the analysis of fertility, and (2) more completely limiting the number of children in the household to the wife's own children.

INSERT Table 4 about here

As was the case with Tables 2 and 3, there is not much difference between the results for the full sample in either Table 2 or 3 on the one hand and those for the married sample in Table 4. Even with the smaller sample, the same nonlinearity in the effect of the wife's probability of unemployment can be for both East and West German women, which is consistent with the uncertainty explanation wherein greater uncertainty about employment results in lower incidence of childbirth The effects of the wife's education are also equally strong and positive, especially in the Eastern Germany sample, while the effects of the husband's education are positive and significant only in the case of Western Germans. There is a slight difference in that the effect of the wife's age is somewhat weaker in the married sample, especially for the East Germans. A more important difference is that now the number of children in the household more closely approximates the number of own children in the household, the effect of this variable is more strongly negative.

5. Discussion and Concluding Views

The study could usefully be extended in several ways. First, data permitting, it would be nice to add more control variables, such as religion, more details about location. Second, and again data permitting, it would be desirable to include other aspects of uncertainty, such as job quality, type of employer, and to have a more direct and continuous measure of employment than the index we have constructed here. Third, alternative functional forms could be used.

Nevertheless, in so far as we have been able to go with the available data, in our analysis, using the German reunification as an exogenous event that altered the perceptions of Germans about the probability of retaining (or finding) employment and about financial viability of their households in general, especially in the East, we have successfully demonstrated that employment-related uncertainty (as captured by the nonlinearity in the effect of the probability of unemployment) may have a statistically significant impact on the likelihood of childbirth. We have also shown this finding to be robust both to the imposition of exclusions by age and marital status on the sample size and to changes in specification. An important question that remains unanswered is whether this statistical significance translates into an economically meaningful impact of such uncertainty on TFR.

In order to provide at least a crude answer to this question, we conduct the following exercise: Using the estimated marginal effects for East German women (of -0.60 for the linear term and 0.10 for the quadratic term),[8] for a woman starting with an above-average unemployment probability index (e.g., of 3) an increase of 1 (to 4) would have a small positive effect ($\approx$ 0.10) on the probability of a birth as the effect of the positive quadratic term would almost exactly offset the effect of the negative linear term.[9] The same increase for a woman with an initially below-average unemployment probability index (e.g., from 1.5 to 2.5) would exert a more noticeable (negative) influence of the probability of childbirth ($\approx$ -0.20). At a still higher initial value (e.g., 4), the increase would result in an *increase* in the probability of childbirth by about 0.3. Given that, by definition, a probability of

any event lies within zero and one, changes in the likelihood of employment, and the corresponding change in the uncertainty regarding employment, could have altered the likelihood of having a child by as much as a quarter or a third. In other words, the impact of uncertainty on the likelihood of childbirth is not only statistically significant but also economically meaningful.

Our analysis and results call attention to the need for greater precision in measuring the probabilities of unwanted outcomes via more detailed survey questions and at the same time greater care in relating these measures to measures of uncertainty. We believe this to be a worthwhile challenge for future research in this area.

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Table 1
Descriptive statistics (Means and Standard Deviations)
for Samples of East and West German Women

	East	West		
	1992-2001	1985-2001	1985-91	1992-2001
Childbirth incidence	0.015	0.10	0.11	0.10
	(0.12)	(0.31)	(0.31)	(0.31)
Age (f)	36.92	32.96	32.37	33.44
	(4.81)	(6.07)	(5.34)	(5.87)
Number of adults in household	2.37	2.10	2.11	2.08
	(0.63)	(0.36)	(0.39)	(0.34)
Number of children in household	1.46	1.17	1.11	1.20
	(0.87)	(1.04)	(1.01)	(1.06)
Education (f)	2.12	2.00	1.96	2.03
	(0.40)	(0.58)	(0.59)	(0.57)
Size of home	91.17	102.07	97.92	105.58
	(32.20)	(36.73)	(33.83)	(38.81)
Worries about finance (f)	1.85	2.22	2.25	2.19
	(0.58)	(0.64)	(1.84)	(0.63)
Probability of uUnemployment index (f)	2.63	2.58	2.70	2.48
	(1.53)	(1.77)	(1.84)	(1.70)
Education (m)	2.14	2.16	2.15	2.16
	(0.41)	(0.55)	(0.54)	(0.57)
Probability of unemployment index (m)	2.13	1.78	1.72	1.76
	(1.07)	(1.13)	(1.06)	(1.08)

Note: The values within parentheses are standard deviations.

Table 2
Determinants of Childbirth: Age 18-45
(East and West Germany)

	East		West			
	1993-2001		**1985-2001**		**1985-92**	**1993-2001**
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 2**	**Model 2**
Age (f)	- 0.33 *	- 0.32 *	0.36 ***	0.35 ***	0.31 ***	0.44 ***
	(0.18)	(0.18)	(0.03)	(0.03)	(0.05)	(0.06)
Age square (f)	0.00	0.00	- 0.007 ***	- 0.007 ***	- 0.006 ***	- 0.008 ***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of adults in household	- 0.53 $^\nabla$	- 0.52	- 0.03	- 0.02	0.06	- 0.05
	(0.37)	(0.37)	(0.10)	(0.10)	(0.13)	(0.16)
Number of children in household	- 0.16 $^\nabla$	- 0.16 $^\nabla$	- 0.16 ***	- 0.16 ***	- 0.12 ***	- 0.16 ***
	(0.11)	(0.11)	(0.02)	(0.02)	(0.03)	(0.03)
Education (f)	0.45 **	0.55 **	0.17 ***	0.14 ***	0.21 ***	0.09 *
	(0.19)	(0.22)	(0.03)	(0.03)	(0.05)	(0.04)
Size of home	0.00	0.00	0.001 ***	0.001 ***	0.002 ***	0.001 **
	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	(0.00)
Worries about finance (f)	- 0.60	- 0.60	- 0.08	- 0.09	- 0.28	0.08
	(0.67)	(0.68)	(0.15)	(0.15)	(0.23)	(0.22)
Worries about finance square (f)	0.10	0.10	0.02	0.02	0.06	- 0.01
	(0.18)	(0.18)	(0.03)	(0.03)	(0.05)	(0.05)
Probability of unemployment index (f)	- 0.59 **	- 0.57 **	- 0.10 **	- 0.10 **	- 0.06	- 0.13 *
	(0.26)	(0.26)	(0.05)	(0.05)	(0.07)	(0.07)
Probability of unemployment index (f) square	0.10 ***	0.10 ***	0.03 ***	0.02 ***	0.02 **	0.03 **
	(0.03)	(0.03)	(0.00)	(0.00)	(0.01)	(0.01)
Education (m)		- 0.19		0.08 **	0.04	0.10 **
		(0.23)		(0.03)	(0.05)	(0.04)
Probability of unemployment index (m)		- 0.32		- 0.002	- 0.12	0.05
		(0.28)		(0.05)	(0.08)	(0.08)
Probability of unemployment index (m) square		0.05		0.001	0.01	- 0.003
		(0.04)		(0.00)	(0.01)	(0.01)

Log likelihood	- 138.65	- 137.18	- 3820.59	- 3817.59	- 1704.71	- 1896.06
P(Wald chi-sq)	0.00	0.00	0.00	0.00	0.00	0.00
Nobs	2347	2287	13025	13025	5669	6602
Ngroups	375	375	2397	2397	1757	1576

Note: 1. The values within parentheses are standard errors.

    2. ***: 1% level of significance; **: 5% level of significance, *: 10% level of significance, ∇: 11-15% level of significance

Table 3
Determinants of Childbirth: Age 25-45 (East and West Germany)

	East		West			
	1993-2001		1985-2001		1985-92	1993-2001
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 2**	**Model 2**
Age (f)	- 0.47 **	- 0.47 **	0.30 ***	0.29 ***	0.17 *	0.45 ***
	(0.22)	(0.22)	(0.06)	(0.06)	(0.09)	(0.09)
Age square (f)	0.005	0.005	- 0.006 ***	- 0.006 ***	- 0.004 ***	- 0.008 ***
	(0.003)	(0.003)	(0.001)	(0.00)	(0.001)	(0.001)
Number of adults in household	- 0.56	- 0.55	- 0.05	- 0.04	0.01	- 0.04
	(0.38)	(0.38)	(0.10)	(0.10)	(0.14)	(0.16)
Household of children in household	- 0.15	- 0.16	- 0.19 ***	- 0.18 ***	- 0.16 ***	- 0.16 ***
	(0.11)	(0.11)	(0.02)	(0.02)	(0.03)	(0.03)
Education (f)	0.45 **	0.55 **	0.20 ***	0.18 ***	0.024 ***	0.13 **
	(0.19)	(0.22)	(0.03)	(0.04)	(0.05)	(0.05)
Size of home	0.002	0.002	0.001 ***	0.001 ***	0.002 **	0.001 **
	(0.002)	(0.002)	(0.00)	(0.00)	(0.001)	(0.00)
Worries about finance (f)	- 0.50	- 0.49	- 0.02	- 0.03	- 0.29	0.17
	(0.71)	(0.72)	(0.07)	(0.17)	(0.27)	(0.24)
Worries about finance (f) square	0.06	0.06	0.01	0.01	0.06	- 0.03
	(0.19)	(0.20)	(0.04)	(0.04)	(0.06)	(0.05)
Probability of unemployment index (f)	- 0.60 **	- 0.57 **	- 0.12 **	- 0.12 **	- 0.10	- 0.13 *
	(0.27)	(0.27)	(0.05)	(0.05)	(0.08)	(0.08)
Probability of unemployment index (f) square	0.10 ***	0.10 ***	0.03 ***	0.03 ***	0.03 ***	0.03 **
	(0.03)	(0.03)	(0.008)	(0.001)	(0.01)	(0.01)
Education (m)		- 0.20		0.09 **	0.08	0.07
		(0.23)		(0.04)	(0.06)	(0.05)
Probability of unemployment index (m)		- 0.22		- 0.001	- 0.15	0.08
		(0.29)		(0.06)	(0.10)	(0.09)
Probability of unemployment index (m) square		0.03		- 0.001	0.01	- 0.007
		(0.04)		(0.01)	(0.01)	(0.01)
Log likelihood	- 130.98	- 129.77	- 3289.33	- 3286.54	- 1391.72	- 1698.15

P(Wald chi-sq)	0.00	0.00	0.00	0.00	0.00	0.00
Nobs	2333	2273	11836	11836	4991	6131
Ngroups	375	275	2236	2236	1591	1487

Note: 1. The values within parentheses are standard errors.

2. ***: 1% level of significance; **: 5% level of significance, *: 10% level of significance, ∇: 11-15% level of significance

Table 4
Determinants of Childbirth of Married Women: Age 25-45
(East and West Germany, Married Women)

	East	West Germany	
	1992-2001	**1984-91**	**1992-2001**
Age (f)	- 0.0716	0.1930 *	0.3126 ***
	(0.3430)	(0.1157)	(0.1060)
Age (f) square	- 0.0011	- 0.0048 ***	- 0.0064 ***
	(0.0052)	(0.0017)	(0.1669)
Number of adults in the household	- 0.2491	0.0283	- 0.0472
	(0.3634)	(0.1424)	(0.1669)
Number of children in the household	- 0.2793 **	- 0.2135 ***	- 0.2017 ***
	(0.1363)	(0.0418)	(0.0365)
Education (f)	0.4750 **	0.2868 ***	0.1963 ***
	(0.2445)	(0.0625)	(0.0545)
Size of the home	0.0039	0.0010	0.0011
	(0.0028)	(0.0011)	(0.0007)
Worries about household finances (f)	- 0.7638	- 0.3780	0.0368
	(0.7635)	(0.2928)	(0.2621)
Worries about household finances (f) squared	0.1208	0.0804	- 0.0004
	(0.2108)	(0.0673)	(0.0598)
Probability of unemployment index (f)	- 0.5292 *	- 0.0770	- 0.1489 *
	(0.2966)	(0.0910)	(0.0881)
Probability of unemployment index (f) squared	0.0970 **	0.0312 **	0.0299 **
	(0.0406)	(0.0138)	(0.0140)
Education of spouse (m)	- 0.1411	0.0994	0.1014 *
	(0.2501)	(0.0684)	(0.0534)
Probability of unemployment index (m)	- 0.2969	- 0.1537	0.0663
	(0.3163)	(0.1087)	(0.0982)
Probability of unemployment index (m) squared	0.0526	0.0170	- 0.0038
	(0.0526)	(0.0183)	(0.1067)
σ	0.0009	0.4263	0.3396
	(1.2365)	(0.0810)	(0.0683)
ρ	8.32e-07	0.1537	0.1034
	(0.0022)	(0.0494)	(0.0373)
Log likelihood	- 114.99	- 1221.15	- 1501.20
Wald chi-squared (Prob > chi-squared)	54.36 (0.00)	238.23 (0.00)	285.92 (0.00)
Nobs	2182	4594	5573
Ngroups	365	1483	1346

Endnotes

[1] Note that Easterlin's view, by definition, emphasizes the *subjective* notion of financial well being, thereby making it easier to measure this form of uncertainty using survey data.

[2] Although not focused on either East Germany or the decline in fertility, another relevant study that does relate labor market instabilities with fertility (in particular fatherhood) is that of Tolke and Diewald (2003). This study examines the effects on duration from first employment of West German males to partnership and fatherhood of unemployment spells, part-time work, non-permanent labor contracts, self-employment and other job characteristics. They show that a few of these measures, most prominently unemployment spells, delay the transition to fatherhood whereas several others do not. The study did not examine the relevance of the male's partner's employment status and other characteristics..

[3] Other examples of the use of probit to model the impact of short-term phenomena like realizable tax benefits can be found in the economics and literature. See, for example, Dickert-Conlin and Chandra (1999) and Philipov, Speder and Billari (2005).

[4] By 1995, 36 percent of the East German women who were employed prior to reunification lost employment, the corresponding figure for East German men being 23 percent.

[5] Note that the willingness of a woman to bear a child in period t is likely to be determined more by the number of children she has had until that point in time than the number of children in the household itself. However, the time and budget constraints effectively facing the woman would depend on *all* the children in the household, as opposed to the number of children she herself has had in the past. Hence, we control for all children in each household, and not the number of children of the women themselves. Since the two are highly correlated, we could not do both.

[6] In addition, space can have a significant impact on household formation, and when too small, can adversely affect decisions to bear children. Housing space is considered to be among the main reasons for low TFR in Spain and Italy (Lesthaeghe and Moors, 2000).

[7] According to Bonin and Euwals (2001), prior to reunification, the labor force participation rate of East German women was nearly 80 percent. This rate of participation was comparable only to those in Scandinavian countries, and much higher than the labor force participation rate of women in West Germany where the negative impact of laws governing maternity leave and income taxation of couples is well established (Strøm and Wagenhals, 1991; Spahn et al., 1994). This trend persisted after the reunification, despite a significant decline in employment opportunities facing East German woman in the aftermath of reunification. In 2000, 72 percent of the women in East Germany were labor force participants, the corresponding figure for West Germany being 62 percent.

[8] These parameter values are quite close to the three obtained for the East European women in Tables 2-4.

[9] The overall (marginal) impact of employment uncertainty is -0.90 (= -0.60×3 + 0.10×9) when the level of uncertainty is 3. When this uncertainty level rises to 4, the overall (marginal) impact changes to -0.80 (= -0.60×4 + 0.10×16). The impact of a unity change in employment uncertainty, therefore, is -0.10. The other numbers reported in this paragraph can be similarly obtained.