The Effect of the Business Cycle at College Graduation on Fertility

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Short Abstract

We study whether the business cycle at college graduation affects fertility decisions among university graduates in the years after graduation. Do graduates postpone parenthood when entering the labor market in economically bad times or do they use an economic downturn to start a family? We answer this question using German survey data of the National Educational Panel Study (NEPS) covering a long observation period of over 30 years. We use duration analysis and estimate the effect of graduating in a downturn on entering the first parenthood. We find that the business cycle at graduation affects female fertility but not male fertility. Graduating in a downturn increases the transition rate to the first pregnancy among women significantly. The effect is strongest in the years two to four after graduation and then decreases over time.

Keywords: Business cycle, fertility, duration analysis
JEL codes: D10, J10, J13

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Introduction

We study the effect of the macroeconomic situation in the year of college graduation on the fertility decisions of college graduates. Knowing about potential long-lasting effects of economic downturns has become even more important since the Great Recession hit the global economy in late 2008.

Research shows that recessions can have long-lasting effects for different socio-demographic groups. Not only do more individuals lose their job in a recession, but also long-run adverse effects of job loss on earnings during recessions are stronger than if one loses a job in better times (Davis & von Wachter, 2011). Among young individuals a recession downturn can weaken the labor market entry position: Oreopoulos, von Wachter, and Heisz (2012) show that graduation in an economic downturn reduces future earnings among male graduates. Further, a recession at birth and during childhood affect individual mortality later in life (e.g., van den Berg, Lindeboom, & Portrait, 2006). Finally, recessions are accompanied by lower average fertility (e.g., Goldstein et al., 2013).

The effect of economic conditions on fertility differs between socio-economic groups, because some groups are more likely hit by a downturn than others (Goldstein et al., 2013; Kreyenfeld & Andersson, 2013; Sobotka, Skirbekk, & Philipov, 2011) or respond differently to economic shocks. E.g., the higher-educated might postpone fertility more likely due to an economic downturn because they are more afraid of losing their jobs than the lower-educated are. As a result, a recession may widen the socioeconomic gap in fertility by reducing birth rates among better educated (Sobotka, Skirbekk, & Philipov, 2011). Thus, while economic downturns are found to influence economic and demographic outcomes, more research on subgroup specific responses is needed to understand the mechanisms *how* they affect individual behavior.

We focus on college graduates in Germany. College graduates are a group of young and highly-educated individuals at the beginning of their careers, who have not reached their social status in permanent employment yet. Bad labor market prospects decrease their job opportunities and increase economic and employment uncertainty and, as a consequence, fertility decisions may be postponed. Alternatively, bad labor market prospects at graduation might even increase fertility through decreased opportunity costs of having a child. Overall, theory cannot make a clear prediction on the sign of the effect.

We use German survey data from the National Educational Panel Study (NEPS) to shed light on the question of whether bad labor market prospects at graduation affect fertility decisions after graduation. We do not only consider the timing of the first birth but also the

number of children at different ages. Covering a long observation period of over 30 years, we investigate the impact of the business cycle in the year of college graduation on the (partner's) probability of becoming pregnant in the years after graduation.

Our study contributes to the literature in (at least) three ways. First, it is related to the literature on the relationship between the business cycle and fertility. So far, that relationship has been documented primarily on the macro level. Most of the recent evidence suggests a pro-cyclical pattern of fertility , i.e. birth rates decrease as economic conditions worsen (e.g., Adsera, 2005; Goldstein et al., 2013; Karaman Örsal & Goldstein, 2010; Sobotka, Skirbekk, & Philipov, 2011 for an overview). Our study sheds light on the effects of the business cycle on fertility decisions from a micro perspective.

Second, our study adds to the yet scarce empirical evidence on the effect of economic conditions at graduation on the subsequent life course. Most of the related studies focus on labor market outcomes. E.g., Oreopoulos, von Wachter, and Heisz (2012), Altonji, Kahn, and Speer (2013) or Kahn (2010) find significant adverse effects on earnings or job quality among male college graduates in North America. Further studies investigate, e.g., health (Maclean (2013)) or family formation after graduating in a recession (e.g., Hershbein, 2012, Kondo, 2012, or Hashimoto & Kondo (2012)). Evidence on the relationship between labor market entry conditions and parenthood is scarce. Hershbein (2012) does not find graduating from high school in a recession to affect fertility among women or men, though both sexes experience a temporary wage loss by graduating in a recession. Wolbers (2007) investigates the relationship between employment security and family formation of school-leavers in different European countries in a cross-national perspective. He finds that high unemployment among tertiary education graduates is associated with a lower likelihood of leaving the parental home, getting married and becoming parents. Hashimoto & Kondo (2012) find a recession at labor market entry to decease fertility among less-educated Japanese women, and at the same time to increase fertility among the higher educated ones. Kondo (2012) finds that bad labor market conditions between the ages of 18 and 20 years accelerate the entry into marriage and to fertility among women (but not among men). Further, marriage status and fertility at age 35 are not significantly affected by experiencing a recession between age 18 and 20. In sum, the evidence on the effect of the business cycle at labor market entry on fertility is sparse and results are mixed.

The third contribution is related to our specific population of university graduates. While fertility in Germany has been below the replacement level for several decades and the total fertility rate decreased to 1.4 in 2010 (Federal Statistical Office of Germany, 2013b),

fertility is even lower among higher-educated women with a lower average number of children and a higher share of childless women (Federal Statistical Office of Germany, 2013a). Aiming to understand that particularly low fertility among the highly-educated, we shed light on their fertility decision depending on economic conditions at labor market entry.

We find that a downturn in the business cycle at graduation increases the transition rate to the first pregnancy among female graduates significantly. The effect is strongest in the years two to four after graduation and then decreases over time. In contrast, transitions to fatherhood are not affected by the business cycle at graduation. Finally, we show that on average every fourth "unlucky" woman in our sample who graduated in a downturn had one more child at the age of 45 years compared to the "luckier" counterpart who left college in economically better times.

Theoretical Considerations: Economic Conditions and Fertility

Malthus (1798) already stated that fertility needs a secure economic foundation. Since economic circumstances form the basic conditions for life, studying the role of economic conditions for fertility has a long tradition. Economic recessions lead to more fragile labor market conditions, which come along with lower job stability, higher unemployment and lower labor demand. In other words, for individuals economic recessions imply less income and more uncertainty about their future employment and income situation. E.g. Hofmann & Hohmeyer (2013) show that perceived economic uncertainty (caused by a labor market reform) leads to fertility postponement among couples in Germany. However, whether economic downturns decrease or increase fertility is an open question. On the one hand, economic downturns reduce income and are thus likely to have a negative effect on the demand for children (income effect). On the other hand, fertility often comes along with lower earnings, particularly for women. These foregone earnings are lower during economic recessions than in better times because earnings opportunities worsen in recessions. Therefore, the opportunity costs of having children are lower during recessions. Thus, economic downturns can also have a positive effect on fertility (substitution effect). While most of the recent empirical studies suggest a pro-cyclical pattern of fertility, the effect of economic conditions on fertility depends on the subgroup and circumstances, and likely varies by educational attainment (see, e.g., Goldstein et al., 2013; Sobotka, Skirbekk, & Philipov, 2011). As our sample consists of college graduates, we are studying a group of comparatively young and highly-educated individuals. Theoretically, their response to economic downturns is not straightforward because there are several reasons arguing for a decrease in fertility as

well as several reasons why they should increase their fertility in response to an economic downturn. For three reasons this group may respond to economic downturns by *decreasing* fertility. First, graduates usually are labor market outsiders: They do not have a job before graduation but usually first have to find one (Wolbers, 2007). During recessions it will take a graduate longer to find a job, but once having eventually found a job, it will be more often temporary and less secure than jobs of individuals with longer tenure. Therefore, graduates might intend to find a stable job first, to which they can return after parental leave, before becoming pregnant. Leaving the labor market outsiders position behind will take longer during a recession and, thus, it makes a postponement of fertility decisions likely. Second, college graduates are usually young enough to have some scope for postponing fertility decisions. Third, forward-looking individuals will take reduced flexibility due to children (e.g., regarding regional mobility or working time) into account and, as a consequence, they expect job opportunities to become less. Highly-educated individuals are likely to show a high labor force attachment and should thus react rather sensitively to losing job opportunities due to childrearing. For example, empirical evidence shows that higher-educated individuals respond with a (temporary) reduction in fertility to economic uncertainties. Kreyenfeld & Andersson (2013) find that fertility tends to be lower during unemployment periods among highly educated women and men in Germany and Denmark, but not among less educated. Furthermore, Kreyenfeld (2010) finds that highly educated women tend to postpone parenthood when subject to employment uncertainties, whereas those with low levels of education often respond to these situations by becoming mothers. A common explanation for this observed pattern is that lower-educated women with restricted options in the labor market might more readily choose an "alternative career" of being a mother and do not respond to employment uncertainties with their fertility. Career-minded women, in contrast, who may not find it attractive to become a housewife, are more likely to postpone fertility decisions in times of economic and employment uncertainty and time their fertility such that motherhood and employment can be reconciled. For these reasons high-educated women who graduate in a recession may postpone the fertility decision.

However, other reasons may lead to no response or even an *increase* of fertility due to graduating in a recession. First, highly-skilled individuals are often less hit by economic downswings because jobs for the low-skilled are often affected first (Sobotka, Skirbekk, & Philipov, 2011). Second, recent research finds that bad labor market entry conditions of college graduates have persistent negative effects on career outcomes, such as earnings and wages (see Altonji, Kahn, & Speer, 2013; Kahn, 2010; Oreopoulos, von Wachter, & Heisz,

2012). One explanation is that unlucky graduates start to work for lower paying employers (Oreopoulos, von Wachter, & Heisz, 2012). Therefore, to circumvent bad labor market conditions, postponing labor market entry through fertility might be an option. Third, opportunity costs of children for highly educated individuals are high, but lower in bad economic conditions, when the labor demand is lower and graduates do not have to fear losing job opportunities. Lower opportunity costs particularly hold for women who were the persons mainly responsible for childrearing in our observation period. Lower opportunity costs also hold for individuals who do not (yet) hold a job, because finding a job in a recession is harder than in a boom.

Taken together, the overall effect of economic conditions on fertility decisions of graduates is unclear a priori. For men, for whom opportunity costs of children are on average smaller than for women, the negative effects of economic downturns on the transition to parenthood could outweigh the positive effects. Therefore, a pro-cyclical effect of fertility for men is likely. For women, the effect is less clear given the reduced opportunity costs of child rearing in recessions.

Besides the main effect of graduating in an economic downturn on fertility, we expect some effect heterogeneity. First, the effect of economic conditions on the timing of parenthood may depend on the duration that has passed after graduation. On the one hand, the effect could increase over time, e.g., if the labor market performance increasingly worsens due to a bad career start. Alternatively, the effect may as well be stronger in the first years after graduation and then diminish over time. As some previous studies (e.g., Oreopoulos, von Wachter, & Heisz, 2012) suggest that the effects of labor market entry conditions fade away after several years, we would assume that fertility effects become also weaker.

Second, there might be effect heterogeneity by birth cohort. Our long observation period of over 30 years covers socioeconomic change including an increase of the share of women graduating from college. As a result, the selection of female graduates may have changed and, therefore, the effect of a recession at graduation on fertility may vary by birth cohort. Furthermore, the role of women in the labor market has changed considerably, e.g., female employment increased and the male breadwinner model has become less predominant. Thus, economic conditions affecting the labor market situation of women might have become more important for their fertility decisions. Because of their increased participation in the labor market, we expect later born cohorts to have a stronger fertility response to graduating in a recession than earlier born cohorts.

A final aspect we want to address is whether potential tempo effects translate into a quantum effect of fertility. Even if individuals postpone their fertility decisions in response to bad economic conditions, this does not necessarily imply that they will have less children in the end, especially when economic recessions are of short duration (Sobotka, Skirbekk, & Philipov, 2011). Testa & Basten (2012) find lifetime fertility intentions to decrease during the Great Recession in Europe. Thus, a bad economy at recession might have a quantum effect on fertility.

Data and Method

Data

We use data from the National Educational Panel Study (NEPS).[1] The NEPS has been initiated to study the determinants and the consequences of education on the individual level. The NEPS data are a combination of six panel cohorts that start at different stages of life and are followed over time. We use the adult sample (Starting Cohort 6 – Adults -Adult Education and Lifelong Learning, doi:10.5157/NEPS:SC6:3.0.0.) in our analysis (see Blossfeld, von Maurice, & Schneider, 2011 for further information on the NEPS). The NEPS data have the advantage of providing a long observation period (covering college graduates between 1970 and 2008) as well as very detailed information on the educational attainment and educational history of individuals.

Our data only contain information on the country of graduation but not on the federal state, i.e. we cannot use regional variation of the economic conditions at graduation. However, we expect the national economic condition to be more relevant to college graduates than regional conditions. E.g., Wozniak (2010) shows that college graduates in the U.S. are geographically more mobile than less-educated individuals and are more likely to migrate in response to regional labor market shocks. These results suggest that it is rather the national economy than the regional that matters for highly qualified individuals. Kahn (2010) and Oreopoulos, von Wachter, and Heisz (2012) use the regional as well as the national unemployment rate in their analyses. Oreopoulos, von Wachter, and Heisz (2012) find their results to be robust towards the use of the regional or the national unemployment rate. Kahn (2010) finds more significant effects in the national regressions than in the state regressions (with the exception of the instrumented state wage regressions). These results also suggest

[1] The NEPS data collection is part of the Framework Program for the Promotion of Empirical Educational Research, funded by the German Federal Ministry of Education and Research and supported by the Federal States.

that local shocks are absorbed by migration and that it is rather the national economy than the regional that affects labor market outcomes among college graduates.

We are interested in the labor market prospects in the year of graduation. We use the unemployment rate (provided by the German Federal Employment Agency) to calculate the business cycle indicator. One might want to compare graduates of years with high unemployment to graduates of years with a low unemployment rate. This approach, however, will not identify the effect of interest, because a period of low unemployment rate - as in Germany in the 1960s and beginning of the 1970s - may be accompanied by period specific factors, such as social norms, which we will refer to as secular trends. To disentangle secular trends from cyclical variation of the unemployment rate, we applied the Hodrick-Prescott filter as van den Berg, Lindeboom, and Portrait (2006), which decomposes the unemployment rate into a trend and a cyclical component (see Figure 1).[2] Over our observation period (from 1970 until 2009), we observe an extreme increase of the trend of unemployment rate from below 3 percent in the early 1970s to above 12 percent in the late 1990s and early 2000nds. However, we are most interested in the effect of the cyclical component of the unemployment rate (in the year of graduation) on fertility, which we will exploit in our empirical analysis below. Because we are interested in cyclical variation, we built a dummy variable being one if the unemployment rate in a given year is above its trend (*downturn*). Figure 1 also shows that over the past 50 years each decade experienced years of economic downturns.

Figure 1 about here

Out of 11,932 individuals in the NEPS adult sample we kept 3,075 graduates with a degree from a university or an applied university. We dropped 594 individuals (around 19 percent of the graduate sample) who started their studies before 1991 and were born in East Germany. We dropped 371 individuals (around 12 percent of the graduate sample) who already had at least one child when they graduated, and 39 individuals of whom either year of birth or start of studies was missing, or who had ambiguous information on education. We excluded 93 individuals without German citizenship who were more likely to have graduated outside Germany than German citizens were. We dropped 92 individuals who we did not observe for at least two years after graduation to ensure that pregnancies were recorded (by corresponding births). We dropped 8 individuals who were born after 1985 to exclude very small birth cohorts and 79 individuals who graduated before 1970 or after 2008 to avoid small graduation cohorts in our data. Finally, to reduce heterogeneity we dropped 53 individuals

[2] We calculate the Hodrick-Prescott filtered time unemployment time series using a tool provided by Yvan Lengwiler (University of Basle).

whose (partners') pregnancy started in the year of graduation and 113 individuals who were either younger than 22 years or older than 35 years at graduation. Our final sample contains 619 women and 824 men. In our main specification we control for age, a dummy for East Germany (after 1990), and the type of degree achieved (university or university of applied science). We present estimations separately for men and women. Our main outcome of interest is the duration from graduation until the first pregnancy and we right-censor the durations at age 45. We build the month of conception by subtracting nine months from the month of birth.

Method

In the main part of the empirical analysis we use duration analysis to estimate the causal effect of graduating in an economic downturn on the transition to first parenthood. We use a discrete time proportional hazard model with unobserved heterogeneity where the hazard rate of individual *i* in year *t* is given by:

$$h_{it} = \Pr(T_i = t | T_i \geq t) = f(\beta_0, X_i, DT_{grad}, yafter_t, v_i)$$

with T_i being the duration (in years) from the year of graduation to transition of the first own or partner's pregnancy for women and men, respectively. The hazard rate h_{it} is defined as the probability of becoming pregnant in year *t* conditional on not having become a parent before. We model h_{it} as being a function of the baseline hazard β_0, of observed characteristics *X,* of an indicator of having graduated in an economic downturn *(DT_{grad}),* of a time-varying variable measuring the (log) years after graduation ($yafter_t$), and of unobserved time-constant heterogeneity (v_i). In our application we can imagine v to capture, e.g., family or career orientation. Note that allowing for unobserved heterogeneity is important, because dynamic sorting over time will reduce the sample in later years to those who have decided against having children in earlier years. Thus, in later years individuals who never wanted children will be overrepresented. Because the desire to become a parent is an unobserved variable in our data, dynamic sorting may lead to biased estimates not only of the duration dependence parameters, but potentially of all other variables in the model (see van den Berg, 2001).

We estimate h_{it} using a complementary logit model with the unobserved heterogeneity specified as *z* mass points (μ_z) as suggested by Heckman & Singer (1984):

$$h_{it} = 1 - \exp(-\exp(\mu_z + \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2t} + \delta DT_{gradt} + \gamma \log(yafter_t)))$$

β_0 is the baseline hazard parameter, β_1 and β_2 are coefficients vectors of the control variables and γ is the duration dependence parameter. The probability (p_z) of belonging to group μ_z is specified using a multinomial logit model.

Note that besides log age, X_1 contains the trend of the unemployment rate at graduation, age at graduation (squared), a dummy variable for East Germany and graduation at a university. To control for the contemporary business cycle, X_2 contains the trend of the unemployment rate in year *t* and a dummy indicator on whether year *t* experiences an economic downturn. We include further individual specific control variables as a sensitivity check and present the results below. The coefficient of interest is δ. δ identifies the effect of the downturn at graduation on the transition rate to the first child. We will also refer to δ as the treatment effect.

To yield an unbiased estimate of δ, we have to assume that the business cycle in the year of graduation is exogenous to the fertility decision. In other words, we assume that there is no unobserved heterogeneity between graduation cohorts. Because individuals can time their exit from university to a certain degree this assumption may be threatened. Specifically, for the following three reasons unobserved heterogeneity between cohorts could arise: First, individuals may time their exit from university according to their fertility plans which will influence the year in which they graduate. If individuals do so, then δ will still be unbiased if they do *not* take into account their labor market opportunities, i.e. if they plan finishing their degree earlier or later according to their fertility plans but independently of the labor market situation. Second, booms and busts may absorb different individuals from universities. On the one hand, e.g., ambitious individuals may speed up studies at the beginning of a boom to enter the labor market when prospects are good. Thus, when the economy begins to enter a downturn most ambitious (mature) students will have left university and this might leave less ambitious individuals leaving in a downturn. On the other hand, individuals may as well postpone their exit from university in a downturn aiming at entering the labor market in more prosperous times. Yet, δ will only be biased if these considerations are taken jointly with fertility decisions or if unobserved variables influence both the graduation timing decision and the fertility decision. One potential candidate for such an unobserved variable could be *career orientation* and we will return to this threat to validity below. Third, downturns may even influence college entry decisions. This may also lead to unobserved differences between graduation cohorts (and thus to a biased estimate of δ) if the college entry year determines the year of graduation, e.g. by a predetermined study curriculum. Nevertheless, because at the time of college entry individuals cannot foresee the business cycle at graduation, such

differences between cohorts arising from selective college entry are most unlikely correlated with later life fertility behavior. Thus, it is not plausible that selective college entry will bias our estimates of δ.

To assess our assumption of homogeneity of the graduation cohorts, below we show that the downturn cohorts do not statistically differ from their luckier counterparts in terms of several relevant variables including duration of studies and high school graduation degree. Furthermore, following Oreopoulos, von Wachter, and Heisz (2008) we will present a sensitivity analysis using the business cycle of the predicted year of graduation to assess whether selective college graduation might bias our results.

The results of the duration analysis will shed light on the question whether graduation in a downturn affects the transition rate to the first pregnancy. To investigate whether graduation in a downturn affects the number of children, i.e. to assess the quantum effect, we will also estimate regression models using the number of children as dependent variables. We report bootstrapped standard errors stratified by year of graduation and clustered by individuals.

Results

Before we turn to the estimation results we present selected descriptive statistics and we will provide evidence that those individuals who graduate in an economic downturn do not differ systematically from those not graduating in an economic downturn to strengthen our line of argumentation that graduating in a recession is an exogenous event.

Descriptive Statistics

In our sample women were on average 24.9 and men 25.8 years old when they graduated (Table 1). This – statistically significant - difference is probably because of military or social service which was compulsory for young men but not for women and lasted between 9 and 20 months during our observation period. Only a small part of the sample graduated in East Germany (after 1990; remember that we drop East German graduates before 1991): 2.0 percent of the female and 1.4 percent of the male sample. 67.2 percent of the observed women and 58.2 percent of the observed men graduated from a university as opposed to an applied science university (which is the reference category). The trend unemployment rate was 9 percent on average in the years in which women in our sample graduated and slightly, but statistically significantly, lower (8.6 percent) in the years men left university. However, this difference seems to be driven by cohort effects (not shown): in earlier years of our

observation period, when the unemployment rate was lower, more men than women graduated from university. Around 55 percent of our sample graduated in a downturn.

Table 1 about here

Figure 2 depicts the cumulated transition rate to the first child by treatment status. The graphs show that the cumulated transition rate among treated women is outside the 95 percent confidence bounds of the rate among untreated women, suggesting that women who graduate in a downturn have a significantly higher fertility over several years after graduation. In contrast, treated males cumulated transition rate to fatherhood is below that of their untreated counterparts. However, these differences are not statistically significant.

Figure 2 about here

Selectivity of the Year of Graduation

We present t-tests of differences of means between treatment and control groups to test for selectivity of the year of graduation. The results listed in Table 2 show that individuals who received their degree in a downturn do not differ significantly from their counterparts who graduated in economically better times in terms of age at start of studies, duration of studies, field of studies, parental profession, and high school diploma GPA. Among the treated we find significantly more women with a university degree than among the controls. Given that students at universities can time their year of graduation more flexibly than students at applied universities, this correlation is somewhat surprising. However, note, first, that even with random assignment the likelihood of balancing all observed variables is not zero and, second, we will control for differences between graduates from universities and graduates from applied universities in our estimations below. In sum, we are confident that the assumption of (conditional) exogeneity of the business cycle in the year of graduation holds.

Table 2 about here

Estimation Results

Turning to the estimation results our first finding is that women have a significantly higher transition rate to a pregnancy if they graduate in a year of an economic downturn than if they had graduated in an economically more prosperous year. The effect amounts to a 67.5

percent ((exp(0.516)-1)*100) increase of the transition rate to the first pregnancy. The second result is that men do not respond to the business cycle in terms of their fatherhood timing. Furthermore, we tested whether any of the business cycles in the six years around graduation (from two years before until three years after) affected the transition rate into the first pregnancy. Results are presented in Table A.1 for women and in Table A.2 for men. We found that for women not only the business cycle in the year of graduation but also the business cycle in the year after graduation influences the fertility probability. In contrast, neither the business cycle before nor after these two years seems to matter regarding the timing of the first pregnancy in our sample. For men, the business cycle in none of the years before or after graduation matters for their fatherhood timing. Overall, we have to reject the hypothesis that men graduating in an economic downturn postpone fatherhood. However, our results support the hypothesis that for women the opportunity cost effect is more important than for men.

Table 3 about here

Time-varying Effect

The model used so far treated the effect of the business cycle at graduation on fertility as being constant over time since graduation. This may not be a plausible assumption. To relax this assumption empirically and to investigate whether the effect changed over time, we introduced interaction terms between the treatment indicator *downturn* and duration dependence dummy indicators (of 1, 2 to 4, 5 to 7, and 8 and more years after graduation). Results presented in Table 4 show that for men the effect of graduating in a downturn is not significantly different from zero in any of the years. For women, in contrast, the effect of the downturn at graduation on fertility is not significantly different from zero in the first year after graduation. Yet, two to four years after graduation the female treated group has a significantly higher probability of becoming pregnant compared to the controls. This significant effect decreases over time and we do not find treated and control women to differ in their pregnancy rate after seven years after graduation.[3] These findings are robust towards using alternative time intervals (Table A.4).

Table 4 about here

[3] We used Wald-Tests to assess differences between coefficients. The results of these tests are presented in Table A.3 and suggest, e.g., that the treatment effect is significantly different in the first year compared to the next interval.

Effect heterogeneity between cohorts

Examining a long observation period, we may find that individuals born earlier in our observation period responded differently to labor market prospects at graduation than individuals born in later years. To account for such effect heterogeneity between cohorts, we vary the treatment dummy with two dummies indicating the cohort of birth (born before or in 1960, and born after 1960). The results presented in Table 5 suggest that women born in or before 1960 indeed responded less strongly to an economic downturn at graduation than women born later. Tough the results of Wald-tests of difference in coefficients suggest, that the responses are not statistically significant, in fact we find the response of the earlier born not to be statistically significant from zero. For men, in contrast, again no significant effects occur for any subgroup.

Sensitivity

In this section we will assess the sensitivity of our results and show that our main results are robust towards several checks. Results are presented in the Appendix (Table A.5 and Table A.6). First, we used a predicted year of graduation instead of the observed similarly to Oreopoulos, von Wachter, and Heisz (2008). To predict the year of graduation we used the month of college entry and added five (university) and, respectively, four (applied university) years. Though the coefficient becomes smaller and just misses the 10 percent significance level, our main finding seems qualitatively robust. Second, we dropped individuals who were older than 27 years at graduation to reduce heterogeneity among graduates and we find - though the effect among women decreases – that our main results are robust. Third, we tested whether our results are robust towards different specifications by adding dummies indicating the own professional field and parental professional field (as described in more detail in Table 2), birth cohort dummies (1960s; 1970s and 1980s; with 1940s and 1950s as reference) and the duration of studies. We find that inclusion of these variables does not change the results considerably. Fourth, using the Hodrick-Prescott filter, so far we set lambda parameter equal 100 calculating the trend of the unemployment rate. The results listed in Table 5 show that using lambda parameter of 500 does not affect the results. Finally, the results are also robust towards using the GDP as a measure of the business cycle.

Quantum effect

Our analysis concentrated on the timing of the first birth so far. Now we turn to the question whether treated individuals had a higher completed fertility to shed light on the

quantum fertility effect of graduating in an economic downturn. In this step, we use OLS regressions to estimate the effect of graduation in a downturn on the total number of children born to an individual between college graduation and age 30, 35, 40 and 45 years. We find a positive effect of graduating in a downturn on the number of children born to a woman, yet, again no differences between treated and control men (Table 6). We find the effect for women to be significant at age 30, which is on average five years after graduation. While in the course of their thirties, treated and control women are not significantly different from each other, at the age of 45 years treated women have on average 0.24 children more than their counterparts who graduated in economically better times. Note, however, that these results are based on the sample of women who had already turned 45 by the time they were interviewed. Therefore, we cannot rule out that this result is driven by cohort differences. Nevertheless, because we found that later born cohorts have a stronger fertility response than earlier cohorts, completed fertility may be affected even more than the results presented in this subsection suggest.

Table 6 about here

Conclusion

This study presents empirical evidence on the effect of graduating in a downturn on fertility among female and male college graduates in Germany. For women, the theoretical prediction on the effect is ambiguous, because economic uncertainty may decrease fertility, or, alternatively, lower opportunity costs may lead to higher fertility. For men, in contrast, we expected a decreased transition to fatherhood due to graduating in a downturn, because of a prevailing effect of higher economic uncertainty.

Examining an observation period of over more than 30 years, we apply duration analysis and estimate the effect of graduating in an economic downturn on the transition rate to the first child. We do not find significant effects among men. In contrast, women who graduated in a downturn speed up entry into motherhood. This result is qualitatively robust to several sensitivity checks we performed. The differences between unlucky women, i.e. women who graduated in worse economic circumstances, and their luckier counterparts are highest in the years two to four after graduation and fade out after seven years. Furthermore, we found that women born in the 1960s and later responded somewhat stronger than women born earlier, but the difference was not statistically significant. We also addressed the quantum effect of graduating in worse times and found that the average number of children

born to a woman measured at the age of 45 was 0.24 children higher among the treated than among the untreated for a sample of women who were at least aged 45 by the time of their last interview.

Our findings are qualitatively in line with the findings in Hashimoto & Kondo (2012) who show that a recession at labor market entry increases fertility among higher educated women in Japan. The authors assume that for higher-educated women the substitution effect prevails, whereas for the lower-educated the income effect is stronger (where they had found decreased fertility due to a career start in a recession). Future research may shed further light on effect heterogeneity by education to deepen the knowledge on the socio-economic gap in fertility.

Our findings can also be related to the evidence on health effects of leaving school in a recession. Maclean (2013) finds long-term adverse health effects of leaving school in a bad economy for men, whereas women graduating in a recessions show fewer depressive symptoms at age 40. As causal channels behind these findings she assumes that worse career outcomes after leaving school in a bad economy are associated with worse health among men. In contrast, after leaving school in a bad economy, women might reconcile home production and work, what might serve as a protection from career stress leading to bad health. We did not analyze how graduating in a recession affected employment histories among individuals in our sample, because the employment history of individuals was surveyed retrospectively in our data making measurement errors - especially regarding spells that lay far in the past - more likely. It may be a pathway for future research to jointly model labor market status and fertility – potentially based on administrative data - to understand whether women substitute labor supply by home production more likely when they graduate in a recession.

Our results suggest that bad labor market entry opportunities do not only influence the fertility timing among women, but they also have an accumulative effect on completed fertility. Nevertheless, because we could not rule out that these effects on completed fertility were driven by the behavior of older cohorts, readdressing this question when data are available for later born cohorts is a first fruitful pathway for future research.

Our study adds to the yet scarce evidence on the effect of the business cycle at the time of graduation on later life outcomes. Because most of the studies focus on young men and on labor market outcomes (e.g., Kahn, 2010; Oreopoulos, von Wachter, & Heisz, 2012), our results are an important contribution to the literature.

In sum, we show that high-qualified men do not respond to adverse labor market entry conditions. In contrast, high-qualified women on average have a higher fertility compared to their counterparts who entered the labor market in economically better times. These findings suggest that for high-qualified female labor market entrants it is the channel of decreased opportunity costs in an economic downturn (as opposed to negative effects of lower income or higher economic insecurity) that dominantly influences the fertility decision.

References

Adsera, A. (2005). Vanishing Children: From High Unemployment to Low Fertility in Developed Countries. American Economic Review, 95, 189-193.

Altonji, J. G., Kahn, L. B., & Speer, J. D. (2013). Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success, Working Paper 2013 (pp. 1-73).

Blossfeld, H.-P., von Maurice, J., & Schneider, T. (2011). The National Educational Panel Study: need, main features, and research potential. Zeitschrift für Erziehungswissenschaft, 14, 5-17.

Davis, S. J., & von Wachter, T. M. (2011). Recessions and the Costs of Job Loss, Prepared for the Brookings Papers on Economic Activity.

Federal Statistical Office of Germany. (2013a). Daten zu Geburten, Kinderlosigkeit und Familien Ergebnisse des Mikrozensus 2012 Tabellen zur Pressekonferenz am 07. November 2013 in Berlin. Wiesbaden: Federal Statistical Office of Germany.

Federal Statistical Office of Germany. (2013b). Statistical Yearbook. Germany Extract Chapter 2. Population, families, living arrangements 2012. Wiesbaden: Federal Statistical Office of Germany.

Goldstein, J. R., Kreyenfeld, M., Jasilioniene, A., & Karaman Örsal, D. D. (2013). Fertility reactions to the 'Great Recession' in Europe: Recent evidence from order-specific data. Demographic Research, 29, 85-104.

Hashimoto, Y., & Kondo, A. (2012). Long-term effects of labor market conditions on family formation for Japanese youth. Journal of the Japanese and International Economies, 26, 1-22.

Heckman, J., & Singer, B. (1984). A method for minimizing the impact of distributional assumptions in econometric models for duration data. Econometrica, 52, 271-320.

Hershbein, B. J. (2012). Graduating High School in a Recession: Work, Education, and Home Production. The B.E. Journal of Economic Analysis & Policy, 12, 1-29.

Hofmann, B., & Hohmeyer, K. (2013). Perceived Economic Uncertainty and Fertility: Evidence From a Labor Market Reform. Journal of Marriage and Family, 75, 503-521.

Kahn, L. B. (2010). The long-term labor market consequences of graduating from college in a bad economy. Labour Economics, 17, 303-316.

Karaman Örsal, D. D., & Goldstein, J. R. (2010). The Increasing Importance of Economic Conditions on Fertility, MPIDR Working Paper 14/2010. Rostock: Max Planck Institute for Demographic Research.

Kondo, A. (2012). Gender-specific labor market conditions and family formation. Journal of Population Economics, 25, 151-174.

Kreyenfeld, M. (2010). Uncertainties in female employment careers and the postponement of parenthood in Germany. European Sociological Review, 26, 351-366, doi:310.1093/esr/jcp1026.

Kreyenfeld, M., & Andersson, G. (2013). Socioeconomic Differences in the Unemployment and Fertility Nexus: A Comparison of Denmark and Germany, MPIDR Working Paper 8/2013. Rostock: Max Planck Institute for Demographic Research.

Maclean, J. C. (2013). The health effects of leaving school in a bad economy. Journal of Health Economics, 32, 951-964.

Malthus, T. R. (1798). An essay on the principles of population. Oxford: Oxford University Press.

Oreopoulos, P., von Wachter, T. M., & Heisz, A. (2008). The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates, IZA Discussion Paper 3578. Bonn: Institute for the Study of Labor.

Oreopoulos, P., von Wachter, T. M., & Heisz, A. (2012). The Short- and Long-Term Career Effects of Graduating in a Recession. American Economic Journal: Applied Economics, 4, 1-29.

Sobotka, T., Skirbekk, V., & Philipov, D. (2011). Economic recession and fertility in the developed world. Population and Development Review, 37, 267-306. doi: 210.1111/j.1728-4457.2011.00411.x.

Testa, M. R., & Basten, S. (2012). Have lifetime fertility intentions declined during the “Great Recession”? (pp. 1-42): Wittgenstein Centre for Demography and Global Human Capital & Vienna Institute of Demography, Vienna, Austria; Department of Social Policy and Intervention, University of Oxford, UK.

van den Berg, G. J. (2001). Duration models: Specification, identification and multiple durations. In J. J. Heckman & E. Leamer (Eds.), Handbook of Econometrics (Vol. 5, pp. 3381-3460): Elsevier.

van den Berg, G. J., Lindeboom, M., & Portrait, F. (2006). Economic Conditions Early in Life and Individual Mortality. The American Economic Review, 96, 290-302.

Wolbers, M. H. J. (2007). Employment Insecurity at Labour Market Entry and Its Impact on Parental Home Leaving and Family Formation: A Comparative Study among Recent

Graduates in Eight European Countries. International Journal of Comparative Sociology, 48, 481-507.

Wozniak, A. (2010). Are College Graduates More Responsive to Distant Labor Market Opportunities? The Journal of Human Resources, 45, 944-970.

Tables and Figures

Table 1: Descriptive Statistics of Control Variables

	Women	Men
Age at graduation (in years)	24.9 (2.3)	25.8 (2.4)
East Germany (in %)	2.0	1.4
University degree (in %)	67.2	58.2
Trend unemployment rate (in %)	9.0 (2.4)	8.6 (2.7)
Downturn at graduation (in %)	54.4	55.5
N	701	955

Notes: Standard deviation of continuous variables in parentheses.

Table 2: Sample Means of Graduation Cohorts by Treatment Status

	Women			Men		
	Treated	Control	P-value	Treated	Control	P-value
Duration of studies (in months)	57.47	56.11	.46	59.47	58.35	.50
Own profession:						
Industry	.04	.05	.75	.26	.24	.56
Science and technique	.09	.11	.53	.17	.15	.59
Administration (private sector)	.17	.18	.7	.16	.13	.30
Health. social sector education	.43	.39	.33	.16	.20	.14
Arts and social science						
Parental profession:	.18	.19	.81	.10	.12	.38
F: Employee (white collar)	.43	.4	.5	.45	.42	.45
F: Civil servant	.24	.21	.46	.16	.18	.44
F: Self employed	.19	.23	.19	.19	.19	.84
M: Not employed	.34	.30	.26	.29	.29	.99
M: Employee (blue collar)	.08	.06	.24	.14	.14	.85
M: Employee (white collar)	.44	.45	.84	.42	.41	.68
Age at graduation (in years)	25	24.88	.51	25.86	25.71	.35
University	.70	.64	.09	.56	.61	.14
High School Diploma GPA*	2.34	2.27	.23	2.3	2.35	.32
N	701			955		

Notes: *Due to missing values sample size reduces to 467 (women) and 566 (men) for t-test of this variable.

Table 3: Effect of Graduation in an Economic Downturn on Timing of First Parenthood

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn	0.516***	(0.162)	-0.036	(0.127)
Trend unemployment rate	-0.061	(0.070)	-0.121**	(0.049)
Current downturn	0.017	(0.078)	0.048	(0.068)
Current trend unemployment rate	-0.024	(0.071)	0.049	(0.052)
Log years after graduation	1.349***	(0.134)	1.123***	(0.090)
Age	1.157*	(0.645)	0.559	(0.432)
Age squared	-0.020	(0.013)	-0.009	(0.008)
East Germany	0.329	(0.596)	0.016	(0.833)
University	0.027	(0.175)	-0.049	(0.135)
Constant	-23.820***	(8.129)	-15.320***	(5.714)
M2	4.306***	(1.119)	3.590***	(0.798)
Logit coeff. of p(M2)	0.833***	(0.143)	0.799***	(0.149)
BIC	2961		4274	
AIC	2881		4189	
N(obs)	701		952	
N(years)	5812		8422	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

* p < .1, ** p< .05, *** p < .01

Table 4: Time-varying Effects

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	-0.095	(0.242)	-0.133	(0.196)
Downturn * year 2-4	0.674***	(0.152)	0.019	(0.127)
Downturn * year 5-7	0.406*	(0.219)	-0.076	(0.162)
Downturn * year >7	-0.283	(0.325)	0.114	(0.242)
Trend unemployment rate	-0.096	(0.066)	-0.130***	(0.049)
Current trend unemployment rate	0.041	(0.073)	0.058	(0.051)
Current downturn	0.032	(0.077)	0.049	(0.069)
Log years	1.198***	(0.141)	1.088***	(0.111)
Age	1.019*	(0.594)	0.545	(0.415)
Age squared	-0.018	(0.012)	-0.008	(0.008)
East Germany	0.370	(0.677)	0.014	(0.770)
University	-0.024	(0.154)	-0.039	(0.140)
Constant	-32.986***	(8.110)	-15.061***	(5.461)
M2	15.529***	(3.815)	3.567***	(0.239)
Logit coeff. of p(M2)	1.116***	(0.182)	0.772***	(0.159)
BIC	2956		4299	
AIC	2863		4194	
N(Years)	5.812		8.422	
N(Obs.)	701		952	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

* p < .1, ** p< .05, *** p < .01

Table 5: Effect Heterogeneity between Birth Cohorts

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn * Born ≤ 1960	0.451	(0.337)	-0.332	(0.228)
Downturn * Born > 1960	0.524***	(0.189)	0.042	(0.161)
Born ≤ 1960	-0.035	(0.091)	-0.062	(0.057)
Born > 1960	0.235	(0.396)	0.464	(0.342)
Trend unemployment rate	0.007	(0.077)	0.031	(0.066)
Current downturn	-0.018	(0.077)	0.037	(0.052)
Current trend unemployment rate	1.349***	(0.132)	1.123***	(0.096)
Log years after graduation	1.138*	(0.676)	0.639	(0.421)
Age	-0.020	(0.013)	-0.010	(0.008)
Age squared	0.315	(0.632)	-0.062	(0.735)
East Germany	0.021	(0.167)	-0.039	(0.137)
University	-23.902***	(8.455)	-17.092***	(5.547)
Constant	4.329***	(0.355)	3.791***	(0.309)
M2	0.834***	(0.142)	0.855***	(0.162)
Logit coeff. of p(M2)	-0.072	(0.383)	-0.375	(0.289)
BIC	2978		4190	
AIC	2885		4289	
N(Years)	5,812		8,422	
N(Obs.)	701		952	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Bootstrapped standard errors are stratified by year of graduation and clustered by individual. Results of Wald-Tests (differences between coefficients; their standard errors are in parentheses): Downturn * Born ≤ 1960 vs. Downturn * Born > 1960: women -0.072 (0.383); men 0.375 (0.289).

* p < .1, ** p< .05, *** p < .01

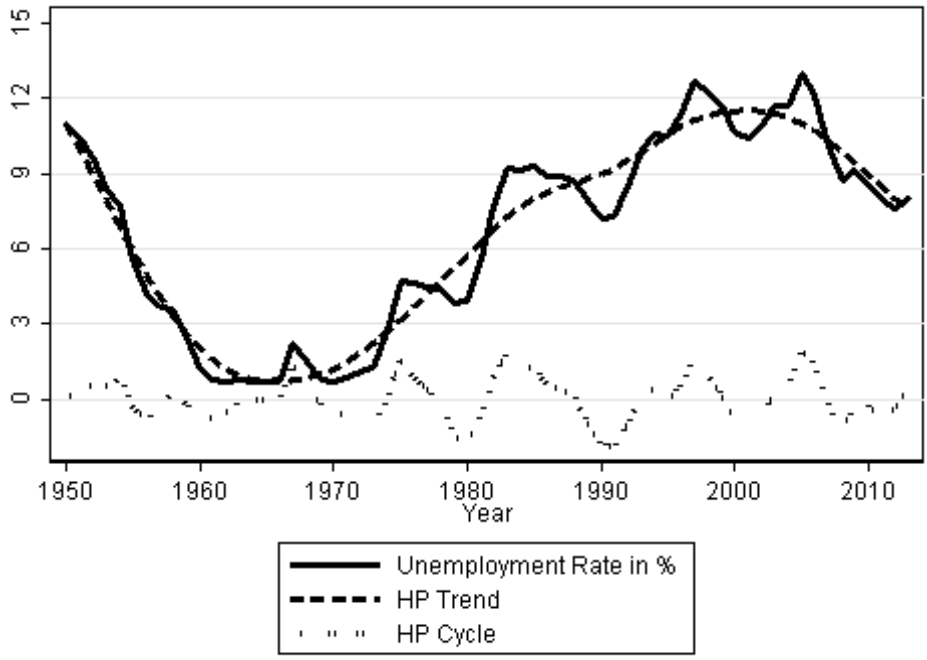
Table 6: Effect of Graduating in a Downturn on Number of Children at Different Ages

Age in years	30		35		40		45	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Women:	0.167**	(0.064)	0.128	(0.095)	0.144	(0.095)	0.244*	(0.130)
R^2	0.140		0.123		0.096		0.071	
N(obs)	645		566		472		349	
Men:	-0.088**	(0.035)	0.021	(0.066)	0.065	(0.078)	0.079	(0.086)
R^2	0.126		0.087		0.058		0.037	0.126
N(obs)	911		825		727		567	

Notes: Table lists coefficient of the dummy variable *downturn* of OLS regressions of number of children born to an individual at a given age. Further control variables (not shown): unemployment rate trend at graduation, age at graduation, age at graduation squared, East Germany, university, professional dummies, graduation decade dummies. Standard errors are clustered by year of graduation.

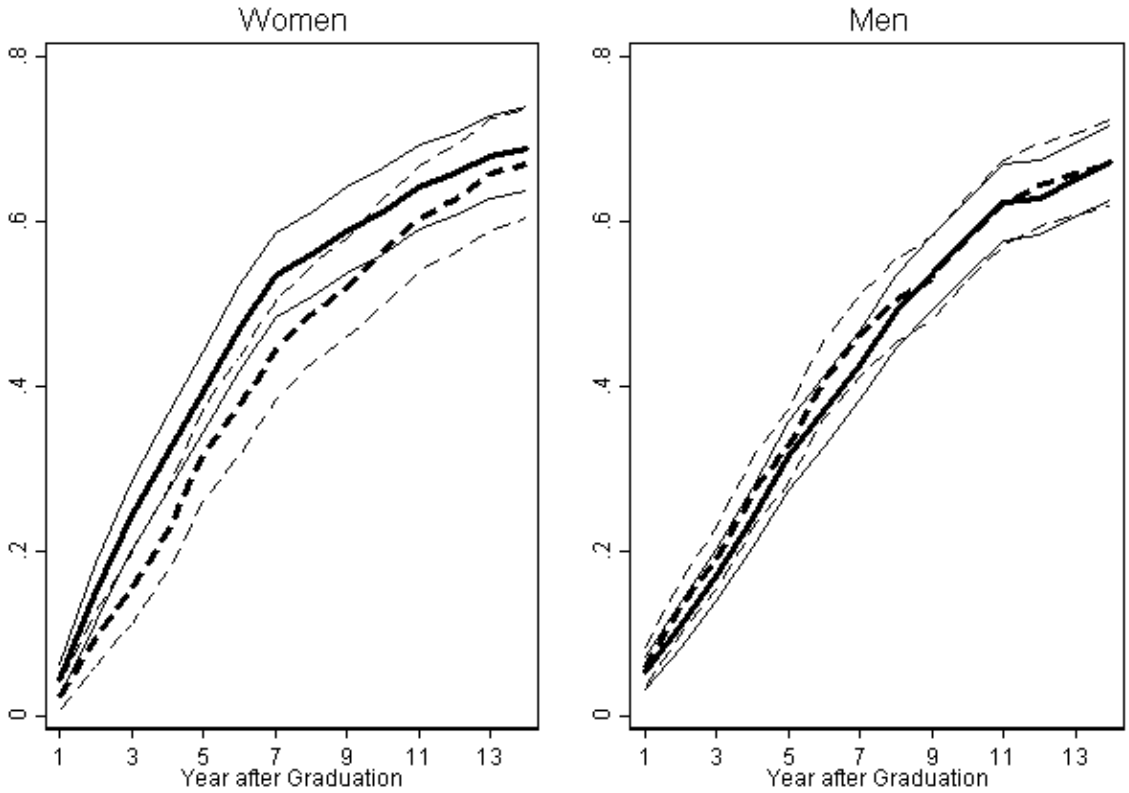
** p < .1, ** p< .05, *** p < .01*

Figure 1: Unemployment rate over time



Notes: Hodrick-Prescott filtered trend (HP trend) and deviation of unemployment from trend (HP cycle).

Figure 2: Transition to First Pregnancy After Graduation:
Cumulated Transition Rate by Treatment Status



Notes: Solid (dashed) lines indicate cumulated transition rate to first pregnancy and 95% confidence bounds of transition to first pregnancy after graduation for treated (controls), with treatment being graduation in a downturn. Standard errors are bootstrapped (500 replications).

Appendix

Table A 1: Effect of Economic Downturn on Fertility (Women) – Different Specifications

	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Trend y-2	-0.102*	(0.059)										
Trend y-1			-0.116*	(0.066)								
Trend y					-0.061	(0.070)						
Trend y+1							-0.025	(0.081)				
Trend y+2									0.026	(0.092)		
Trend y+3											0.133	(0.102)
Downturn y-2	0.040	(0.180)										
Downturn y-1			0.172	(0.160)								
Downturn y					0.516***	(0.162)						
Downturn y+1							0.301*	(0.169)				
Downturn y+2									0.109	(0.181)		
Downturn y+3											-0.237	(0.173)
Current downturn	-0.042	(0.080)	-0.027	(0.079)	0.017	(0.078)	-0.018	(0.080)	-0.014	(0.080)	0.022	(0.079)
Current trend	0.013	(0.070)	0.013	(0.072)	-0.024	(0.071)	-0.045	(0.079)	-0.093	(0.080)	-0.197**	(0.080)
Log years	1.303***	(0.145)	1.344***	(0.140)	1.349***	(0.134)	1.277***	(0.144)	1.290***	(0.144)	1.432***	(0.133)
Age	1.300*	(0.668)	1.286*	(0.686)	1.157*	(0.645)	1.069*	(0.650)	0.940	(0.680)	0.796	(0.705)
Age squared	-0.023*	(0.013)	-0.023*	(0.014)	-0.020	(0.013)	-0.019	(0.013)	-0.017	(0.013)	-0.014	(0.014)
East Germany	0.541	(0.670)	0.562	(0.666)	0.329	(0.596)	0.458	(0.690)	0.480	(0.646)	0.373	(0.621)
University	0.152	(0.180)	0.173	(0.181)	0.027	(0.175)	0.087	(0.181)	0.036	(0.177)	0.019	(0.176)
Constant	-25.198***	(8.443)	-25.077***	(8.589)	-23.820***	(8.129)	-22.348***	(8.169)	-20.922**	(8.449)	-19.323**	(8.752)
M2	4.109**	(1.611)	4.131***	(1.116)	4.306***	(1.119)	4.282***	(1.531)	4.643***	(1.206)	4.787***	(1.153)
logit coeff. of p(M2)	0.786***	(0.162)	0.762***	(0.155)	0.833***	(0.143)	0.871***	(0.159)	0.905***	(0.156)	0.870***	(0.142)
BIC	2974		2973		2961		2970		2974		2971	
AIC	2894		2893		2881		2890		2894		2891	
N(years)	5812		5812		5812		5812		5812		5812	
N(obs)	701		701		701		701		701		701	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Trend: trend of unemployment rate. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

** p < .1, ** p< .05, *** p < .01*

Table A 2: Effect of Economic Downturn on Fertility (Men) - Different Specifications

	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Trend y-2	-0.117***	(0.041)										
Trend y-1			-0.125***	(0.044)								
Trend y					-0.121**	(0.049)						
Trend y+1							-0.102*	(0.055)				
Trend y+2									-0.092	(0.061)		
Trend y+3											-0.093	(0.067)
Downturn y-2	0.176	(0.122)										
Downturn y-1			0.057	(0.127)								
Downturn y					-0.036	(0.127)						
Downturn y+1							-0.140	(0.125)				
Downturn y+2									-0.128	(0.122)		
Downturn y+3											0.018	(0.133)
Current downturn	0.051	(0.069)	0.047	(0.068)	0.048	(0.068)	0.057	(0.068)	0.070	(0.068)	0.071	(0.068)
Current trend	0.050	(0.049)	0.057	(0.050)	0.049	(0.052)	0.026	(0.055)	0.013	(0.057)	0.007	(0.058)
Log years	1.114***	(0.092)	1.117***	(0.090)	1.123***	(0.090)	1.143***	(0.091)	1.165***	(0.091)	1.180***	(0.089)
Age	0.494	(0.419)	0.519	(0.432)	0.559	(0.432)	0.592	(0.430)	0.502	(0.421)	0.555	(0.444)
Age squared	-0.007	(0.008)	-0.008	(0.008)	-0.009	(0.008)	-0.009	(0.008)	-0.008	(0.008)	-0.009	(0.008)
East Germany	-0.046	(0.776)	0.009	(0.816)	0.016	(0.833)	0.044	(0.821)	0.030	(0.784)	-0.026	(0.839)
University	-0.032	(0.135)	-0.044	(0.136)	-0.049	(0.135)	-0.054	(0.134)	-0.035	(0.134)	-0.037	(0.135)
Constant	-14.688***	(5.503)	-14.909***	(5.768)	-15.320***	(5.714)	-15.710***	(5.769)	-14.386**	(5.605)	-15.070**	(5.863)
M2	3.603***	(0.525)	3.594***	(0.989)	3.590***	(0.798)	3.641***	(1.082)	3.577***	(0.875)	3.554***	(1.094)
logit coeff. of p(M2)	0.809***	(0.141)	0.798***	(0.145)	0.799***	(0.149)	0.819***	(0.150)	0.792***	(0.148)	0.775***	(0.154)
BIC	4270		4273		4274		4273		4275		4277	
AIC	4186		4188		4189		4189		4190		4193	
N(years)	8422		8422		8422		8422		8422		8422	
N(obs)	952		952		952		952		952		952	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Trend: trend of unemployment rate. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.* p < .1, ** p< .05, *** p < .01

Table A 3: Wald-Tests of Differences in Coefficients

Women	Downturn * year 2-4		Downturn * year 5-7		Downturn * year >7	
Downturn * year 1	-0.768***	(0.244)	-0.501*	(0.300)	0.189	(0.381)
Downturn * year 2-4			0.268*	(0.161)	0.957***	(0.276)
Downturn * year 5-7					0.689***	(0.215)
Men	Downturn * year 2-4		Downturn * year 5-7		Downturn * year >7	
Downturn * year 1	-0.152	(0.204)	-0.057	(0.235)	-0.247	(0.283)
Downturn * year 2-4			0.095	(0.124)	-0.095	(0.194)
Downturn * year 5-7					-0.190	(0.166)

Notes: Wald-Tests of Differences in Coefficients are based on the model presented in Table 4.
* p < .1, ** p< .05, *** p < .01

Table A.4 Sensitivity Analysis: Alternative Time Intervals of Time-varying Effect of Graduating in a Downturn on Fertility

Model	Women						Men					
	TV-1		TV-2		TV-3		TV-1		TV-2		TV-3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	-0.063	(0.243)	0.629	(0.386)	0.616	(0.397)	-0.133	(0.197)	-0.136	(0.222)	-0.109	(0.222)
Downturn * year 2-3	0.780***	(0.159)	0.472***	(0.176)			0.004	(0.142)	-0.149	(0.160)		
Downturn * year 4-6	0.417**	(0.187)	0.315*	(0.182)			-0.036	(0.140)	-0.006	(0.140)		
Downturn * year >6	-0.058	(0.326)	0.098	(0.311)			-0.026	(0.220)	0.219	(0.210)		
Downturn * year 2-4					0.448***	(0.162)					-0.099	(0.132)
Downturn * year 5-7					0.299	(0.210)					0.039	(0.162)
Downturn * year >7					-0.031	(0.333)					0.382	(0.245)
Trend	-0.079	(0.069)	-0.197***	(0.064)	-0.210***	(0.068)	-0.124***	(0.047)	-0.213***	(0.051)	-0.233***	(0.051)
Current trend	0.021	(0.073)	0.165**	(0.073)	0.180**	(0.076)	0.054	(0.050)	0.173***	(0.054)	0.192***	(0.054)
Current downturn	0.014	(0.078)	-0.087	(0.081)	-0.074	(0.080)	0.053	(0.069)	0.017	(0.071)	-0.003	(0.072)
Year 2-3			1.938***	(0.345)					1.013***	(0.179)		
Year 4-6			2.279***	(0.350)					1.325***	(0.194)		
Year >6			2.503***	(0.404)					1.488***	(0.251)		
Year 2-4					1.960***	(0.352)					1.096***	(0.172)
Year 5-7					2.406***	(0.373)					1.367***	(0.213)
Year >7					2.446***	(0.428)					1.509***	(0.269)
Log years	1.244***	(0.143)					1.101***	(0.109)				
Age	1.020*	(0.610)	1.020**	(0.515)	1.015**	(0.500)	0.558	(0.417)	0.612	(0.382)	0.572	(0.388)
Age squared	-0.018	(0.012)	-0.018*	(0.010)	-0.018*	(0.010)	-0.009	(0.008)	-0.010	(0.007)	-0.009	(0.007)
East Germany	0.377	(0.574)	0.386	(0.632)	0.391	(0.591)	0.016	(0.751)	-0.013	(0.628)	-0.005	(0.641)
University	-0.023	(0.151)	-0.008	(0.148)	-0.001	(0.148)	-0.049	(0.137)	-0.049	(0.126)	-0.043	(0.129)
Constant	-23.623***	(7.878)	-27.491***	(6.514)	-28.877***	(6.440)	-15.272***	(5.478)	-15.058***	(5.108)	-14.647***	(5.162)
Ms	6.112**	(2.677)	9.750***	(1.409)	11.188***	(1.560)	3.581***	(0.254)	3.079***	(0.596)	3.169***	(0.366)
logit coeff. of p(M2)	1.071***	(0.161)	1.193***	(0.241)	1.211***	(0.285)	0.801***	(0.162)	0.837***	(0.266)	0.807***	(0.235)
BIC	2,969		2,992		2,989		4,301		4,352		4,351	
AIC	2,869		2,879		2,875		4,195		4,232		4,232	
N(Years)	5,812		5,812		5,812		8,422		8,422		8,422	
N(Obs.)	701		701		701		952		952		952	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Trend: trend of unemployment rate. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.
** p < .1, ** p< .05, *** p < .01*

Table A5: Sensitivity Analyses for Women

Model	S1: Predicted year of graduation		S2: W/o age >27 years at graduation		S3: + control variables		S4: lambda=500		S5: GDP as business cycle measure	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Trend	-0.058	(0.061)	0.018	(0.081)	-0.021	(0.112)	-0.070	(0.076)	0.369**	(0.152)
Downturn	0.231	(0.151)	0.348**	(0.156)	0.575***	(0.173)	0.438***	(0.163)	-0.019	(0.076)
Current trend	-0.020	(0.077)	-0.092	(0.093)	-0.038	(0.091)	-0.017	(0.077)	-0.001*	(0.000)
Curr. downt.	-0.012	(0.080)	-0.016	(0.086)	0.028	(0.086)	0.011	(0.076)	1.320***	(0.123)
Log years	1.339***	(0.146)	1.360***	(0.158)	1.477***	(0.175)	1.338***	(0.129)	1.202*	(0.628)
Age	1.101*	(0.636)	-0.442	(1.717)	1.432**	(0.671)	1.140*	(0.660)	-0.021*	(0.012)
Age squared	-0.019	(0.013)	0.012	(0.035)	-0.025*	(0.013)	-0.020	(0.013)	0.334	(0.598)
East Germany	0.470	(0.675)	0.343	(0.664)	0.319	(0.714)	0.332	(0.707)	0.138	(0.166)
University	0.085	(0.175)	-0.041	(0.203)	0.208	(0.240)	0.062	(0.159)	0.004	(0.057)
Constant	-22.814***	(8.034)	-4551	(20.532)	-27.215***	(9.161)	-23.460***	(8.290)	-23.741***	(7.889)
M2	4.134**	(2.069)	4.616***	(1.550)	4253	(3.227)	4.308***	(0.769)	4.264***	(0.932)
logit coeff. of p(M2)	0.778***	(0.157)	0.985***	(0.170)	0.770***	(0.169)	0.831***	(0.145)	0.827***	(0.143)
BIC	2,972		2,671		3,072		2,965		2,964	
AIC	2,892		2,593		2,899		2,885		2,884	
N(years)	5,809		5,156		5,809		5,812		5,812	
N(obs)	700		616		700		701		701	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Trend: trend of unemployment rate. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

* p < .1, ** p< .05, *** p < .01

Table A6: Sensitivity Analyses for Men

Model	S1: Predicted year of graduation		S2: W/o age >27 years at graduation		S3: + control variables		S4: lambda=500		S5: GDP as business cycle measure	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Trend	-0.095**	(0.042)	-0.113**	(0.057)	-0.135	(0.084)	-0.125**	(0.049)	-0.136	(0.126)
Downturn	-0.106	(0.133)	-0.016	(0.148)	-0.080	(0.157)	-0.040	(0.125)	0.030	(0.067)
Current trend	0.020	(0.048)	0.034	(0.060)	0.053	(0.066)	0.055	(0.051)	-0.001***	(0.000)
Curr. downt.	0.041	(0.069)	-0.003	(0.075)	0.034	(0.070)	0.046	(0.066)	1.089***	(0.089)
Log years	1.140***	(0.092)	1.168***	(0.102)	1.135***	(0.111)	1.121***	(0.090)	0.491	(0.409)
Age	0.594	(0.473)	1.015	(1.621)	0.667	(0.489)	0.561	(0.419)	-0.007	(0.008)
Age squared	-0.009	(0.009)	-0.019	(0.033)	-0.010	(0.009)	-0.009	(0.008)	0.082	(0.738)
East Germany	0.069	(0.839)	0.115	(0.899)	-0.068	(0.901)	0.010	(0.756)	-0.036	(0.130)
University	-0.078	(0.136)	-0.080	(0.149)	0.083	(0.169)	-0.042	(0.135)	0.042	(0.040)
Constant	-15.871**	(6.402)	-20270	(19.681)	-16.605**	(6.578)	-15.379***	(5.502)	-13.692**	(5.427)
M2	3.771**	(1.501)	3.417***	(0.314)	3.703***	(1.317)	3.596***	(0.247)	3.696***	(0.263)
logit coeff. of p(M2)	0.853***	(0.150)	0.819***	(0.185)	0.850***	(0.161)	0.797***	(0.148)	0.865***	(0.148)
BIC	4,237		3,538		4,348		4,274		4,269	
AIC	4,152		3,455		4,165		4,190		4,184	
N(years)	8,,361		7,022		8,361		8,422		8,422	
N(obs)	946		766		946		952		952	

Notes: Table contains coefficients of discrete time mixed proportional hazard model with unobserved heterogeneity (two mass points). Dependent variable: probability of first pregnancy in year *t*. Independent variables measured in year of graduation if not stated otherwise. Trend: trend of unemployment rate. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

* p < .1, ** p< .05, *** p < .01