



The Effect of the Business Cycle at College Graduation on Fertility

Barbara Hofmann
University of Mannheim and Institute for Employment Research (IAB)

Katrin Hohmeyer
Institute for Employment Research (IAB)

(September 2015)

LASER Discussion Papers - Paper No. 89

(edited by A. Abele-Brehm, R.T. Riphahn, K. Moser and C. Schnabel)

Correspondence to:

Dr. Barbara Hofmann, L7, 3-5, 68131 Mannheim, Germany, Email:
barhofma@mail.uni-mannheim.de.

Abstract

We investigate whether a downturn at college graduation affects fertility among graduates in the years after graduation. Using survey data of the German National Educational Panel Study covering more than 30 years observation period, we find that a recession at graduation affects female fertility but not male. A downturn at college graduation increases the transition rate to the first pregnancy among female graduates significantly. This effect is driven by female graduates aged 25 or older at graduation. Further, the effect is strongest two to four years after graduation and then decreases over time. We do not find an effect of graduating in a downturn on completed fertility.

Author note

Acknowledgements: We thank Martha J. Bailey, Audra Bowlus, Kory Kroft, Regina T. Riphahn, Aloysius Siow and Cordula Zabel, and participants of the ESPE 2015, EPC 2014, PAA Annual Meeting 2014, RC28 spring meeting 2014, EEA 2014, Espanet Annual Conference 2014, seminars at the University of Nuremberg, at the University of Western Ontario, at the University of Toronto and the IZA/SOLE Transatlantic Meeting 2014 for very helpful comments. Any errors are ours.

1. Introduction

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-economic 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 and von Wachter, 2011). Among young individuals a recession can weaken the labor market entry position: Oreopoulos *et al.* (2012) show that graduation in an economic downturn reduces future earnings among male graduates. Moreover, Leist *et al.* (2013) find that economic recessions during working age come along with lower cognitive functioning in older age, possibly through more unfavorable labor market trajectories. Further, a recession at birth and during childhood affects individual mortality later in life (e.g., van den Berg *et al.*, 2006). Recessions are also accompanied by lower average fertility. E.g., Goldstein *et al.* (2013) for European countries and Currie and Schwandt (2014) for U.S. birth records show that a higher unemployment rate at age 20 to 24 *ceteris paribus* not only reduces the number of conceptions but also increases the number of women childless at age 40. In contrast, the authors did not find the unemployment rate experienced at older ages to reduce fertility (Currie and Schwandt, 2014).

The effect of economic conditions on fertility can differ between socio-economic groups, because some groups are more severely hit by a downturn than others (Goldstein *et al.*, 2013; Kreyenfeld and Andersson, 2014; Sobotka *et al.*, 2011) or respond differently to economic shocks. More highly-educated women might postpone fertility in an economic downturn because they are more afraid of career interruptions if losing their jobs than the less educated. Recent evidence shows that women reduce fertility after job displacement and that this effect is driven by higher skilled women (Del Bono *et al.*, 2012). Therefore, a recession may widen the socioeconomic gap in fertility by reducing birth rates among better educated

(Sobotka *et al.*, 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 behind.

We study the effect of graduating in a recession on fertility among college graduates in Germany. Do graduates postpone parenthood when entering the labor market in economically bad times or do they use an economic downturn to start a family? Our study contributes to the literature in at least three ways. First, we shed light on the effect of the business cycle on fertility decisions from a micro perspective. So far, the relationship between the business cycle and fertility 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, 2005b; Goldstein *et al.*, 2013; Karaman Örsal and Goldstein, 2010; Sobotka *et al.*, 2011). Second, to our knowledge, we are the first to present evidence on the effect of the business cycle at graduation on fertility for a European country. The existing evidence is on the U.S. and on Japan, but effects might differ between countries because, for example, social policies might buffer economic uncertainties that could cause individuals to postpone fertility without these policies. We study fertility effects for Germany, which ranges in the middle between the Nordic countries (more generous) and the US and other English speaking countries (less generous) (Gornick and Meyers, 2003). Third, we can exploit more variation over time than the previous studies, because our observation period spans graduations from 1970 to 2010.

The evidence on the relationship between labor market entry conditions and parenthood is limited with mixed results. For our analysis most relevant are four studies that use variation over time.¹ Hershbein (2012) does not find graduating from high school in a recession (between 1976 and 1983) to affect the childbirth probability among women or men in the

¹ Other studies base identification on cross-national variation. For example, Wolbers (2007) investigates the relationship between employment security and family formation of tertiary education graduates in different European countries using cross-sectional data. He finds that high unemployment among graduates is associated with a lower likelihood of leaving the parental home, getting married and becoming a parent.

U.S., though both sexes experience a temporary wage loss due to leaving high school in a recession. Based on U.S. data of 21 graduation cohorts, Maclean et al. (2015) find that men who left school in an economic downturn are less likely to be married and to have children at age 45, whereas women are more likely to have children. Using 20 graduation cohorts, Hashimoto and Kondo (2012) find that a recession at labor market entry decreases fertility among less-educated Japanese women, but increases fertility among the higher educated ones. Based on data of the birth cohorts 1960 to 1970 in the U. S., Kondo (2012) finds that bad labor market conditions for women relative to men between the ages of 18 and 20 years accelerate the entry into marriage and to fertility among women in the short run. Nevertheless, she does not find evidence that these effects translate into long-run differences between the ones who experienced adverse labor market conditions and those who did not. In contrast to the previously mentioned studies, we focus on college graduates. 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, thus, 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.

Studying college graduates' fertility is important, because participation in higher education has increased rapidly over the past years in all OECD countries (OECD, 2013a) and women with higher education have fewer children than the less educated (d'Addio and Mira d'Ercole, 2005). In Germany, the birth rate has been below the replacement level for several decades (OECD, 2013b). Also in Germany, fertility is lowest among the highly-educated women who have the lowest average number of children and stay most often childless (Federal Statistical Office of Germany, 2013). Particularly because currently women are overtaking men in participation in tertiary education (OECD, 2008), these facts are alarming.

We shed light on the question of whether college graduates' fertility decisions depend on economic conditions at graduation.

We use survey data from the German National Educational Panel Study (NEPS), which cover a long 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. Moreover, we do not only consider the timing of the first birth but also the number of children at different ages.

We find that a downturn in the business cycle at graduation accelerates the transition rate to the first pregnancy among female graduates significantly. We find this effect to be driven by female graduates aged 25 years or above at graduation. Further, the effect among women is strongest two to four years after graduation and then decreases over time. We do not find effects to differ by graduation cohort nor do we find a higher average number of children born to women who graduated in a recession. Additionally, we address potential mechanisms and find suggestive evidence of a worsened career start in the first year after graduation among men and women graduating in a recession at age 25 years or above but not among younger graduates.

2. Theoretical Considerations: Economic Conditions and Fertility

Because economic circumstances form the basic conditions for life, studying their role for fertility has a long tradition. Already Malthus (1798) stated that fertility needs a secure economic foundation. This view has been challenged since the 1960s, when Gary Becker introduced the price of having children into economic fertility models (Hotz *et al.*, 1997). Today, standard household economic models predict both, positive income effects as well as negative opportunity cost effects in an economically prosperous environment.

On the one hand, economic recessions lead to more fragile labor market conditions and thus imply for individuals less expected income and more uncertainty about their future

employment and income situation. For example, Hofmann and Hohmeyer (2013) show that perceived economic uncertainty (caused by a labor market reform) leads to fertility postponement among couples in Germany. In line with these findings, recent evidence exploiting exogenous income shocks suggests a positive effect of income on fertility (Black *et al.*, 2013; Lindo, 2010). Further, economic downturns reduce earnings (see, e.g., Davis and von Wachter, 2011; Schmieder *et al.*, 2010 for evidence on the adverse effects of job loss in recessions) and are thus likely to have a negative effect on the demand for children (income effect).

On the other hand, fertility is correlated with foregone earnings which 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 may 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 studied, and likely varies by educational attainment (see, e.g., Goldstein *et al.*, 2013; Sobotka *et al.*, 2011).

Our sample consists of college graduates, who are a group of comparatively young and highly-educated individuals. For three reasons this group may respond to economic downturns by *postponing* fertility. First, graduates usually are labor market outsiders without substantial labor market experience. In other words, they first have to find a job after graduation. 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. Recessions may prolong how long graduates are outsiders, which 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 fewer job opportunities in general, and in particular, in a recession. Highly-educated individuals, in particular, are likely to show a high labor force attachment and should thus react rather sensitively to losing job opportunities due to child-rearing. Empirical evidence shows that higher-educated unemployed individuals are relatively less likely to have children compared to lower-educated unemployed (e.g., Kreyenfeld, 2010; Kreyenfeld and Andersson, 2014) and that the negative effect of job loss due to plant closure on fertility is strongest among highly skilled women (Del Bono *et al.*, 2012).

However, other reasons may lead to no fertility response or even an *increase* in fertility due to graduating in a recession. First, highly-skilled individuals are often less affected by economic downswings because jobs for the low-skilled are often affected first (Sobotka *et al.*, 2011). Second, recent research finds that bad labor market entry conditions of college graduates have persistent negative effects on career outcomes, such as wages (see Altonji *et al.*, 2014; Kahn, 2010; Oreopoulos *et al.*, 2012). One explanation is that unlucky graduates start to work for lower paying employers (Oreopoulos *et al.*, 2012). Alternatively, the matches between jobs and employees might be poorer during recessions (Bowlus, 1995). 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 labor demand is lower and graduates do not have to fear losing job opportunities. Lower opportunity costs particularly hold for women, who were mainly responsible for child-rearing in our observation period, as well as 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 for men is

likely. For women, the effect is less clear given the reduced opportunity costs of child-rearing in recessions.²

We expect heterogeneity of the effect of graduating in an economic downturn on fertility. First, the effect of economic conditions on the timing of parenthood may depend on the duration that has passed after graduation. The effect could increase over time, e.g., if the labor market performance increasingly worsens due to a bad career start. The effect could as well be stronger in the first years after graduation and then diminish over time. Because previous studies suggest that the effects of labor market entry conditions fade away after several years (e.g., Oreopoulos *et al.*, 2012), we assume that fertility effects become also weaker.

Second, the effect of graduating in a downturn on fertility might vary with age at graduation, particularly for women. In contrast to younger female graduates, older ones might be more likely in a stable partnership and have less time left to postpone having a child. Thus, they might be more likely to have made up their mind on their fertility intentions. As a result, older female graduates might perceive a higher drop in opportunity costs due to a downturn than younger ones do and respond stronger than younger ones.

Third, later graduation cohorts might have a different fertility response to graduating in a recession than earlier cohorts. On the one hand, female labor market participation increased considerable over our observation period (see Figure 1). As a result, economic conditions affecting the labor market situation might have become more important for fertility decisions. On the other hand, university education – especially among females – was also on the rise (see also Figure 1) and perhaps among the later graduation cohorts female university graduates were the ones most career oriented. As a result, average career orientation decreases with increasing graduation shares and, thus, later graduation cohorts could as well have a weaker response than earlier cohorts.

² Note that only if female and male graduates of the same year mate, we expect the same effects for both.

Finally, we address whether potential effects on the timing of children translate into an effect on the number of children. Even if individuals change their fertility timing, this does not necessarily imply that they will have more or less children in the end, especially when economic recessions are of short duration (Sobotka *et al.*, 2011). Nevertheless, Testa and Basten (2012) find lifetime fertility intentions decreased during the Great Recession in Europe. Thus, a bad economy at graduation may affect completed fertility.

3. Data and Method

3.1. Data

This paper uses data from the first five waves of the National Educational Panel Study (NEPS): Starting Cohort Adults, 10.5157/NEPS:SC6:5.1.0. The NEPS has been initiated to study the determinants and the consequences of education on the individual level (see also Blossfeld *et al.*, 2011).³ It comprises a sample of working-age individuals living in Germany who were born between 1944 and 1986. The NEPS data have the advantage of providing a long observation period (covering graduations between 1970 and 2010) as well as very detailed information on the individual educational attainment and history.

The goal of our study is to estimate the effect of the labor market prospects in the year of graduation on fertility. To achieve this, one might want to compare graduates of years with high unemployment to those with a low unemployment rate. This approach, however, does not identify the effect of interest. Over our observation period, the unemployment rate increases from below 3% in the early 1970s to above 10% in the late 1990s and early 2000s (Figure 2). Thus, a period of low unemployment - as in the early 1970s - may be accompanied by period specific factors (secular trends), such as social norms. Therefore, we use the cyclical component of the unemployment rate. To disentangle secular trends from cyclical

³ From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

variation of the unemployment rate, we applied the Hodrick-Prescott filter as van den Berg et al. (2006), to decompose the unemployment rate into a trend and a cyclical component (see Figure 2).⁴ We chose a Hodrick-Prescott filter smoothing parameter λ of 100 in our main specification, which is a common value for yearly observations.⁵ We construct a dummy variable equal to one if the unemployment rate in a given year is equal to or above its trend (*downturn*). Since 1970 each decade experienced years of economic downturns (Figure 2). The major advantage of this approach is that time trends are accounted for by disentangling the cyclical component of the unemployment rate from its trend component. Thus, any differences in fertility between graduates that our model attributes to the business cycle cannot be explained by time trends.

For only around 40 % of our sample are data on the federal state of graduation available.⁶ Thus, our main identification relies on temporal variation of the economic conditions at graduation. Nevertheless, we show that our results are robust when using the regional business cycle after having imputed the missing state of graduation (30 % through the residence history and the residual 30% through the state of residence at the interview).⁷

⁴ We calculate the Hodrick-Prescott filtered unemployment time series using a tool provided by Yvan Lengwiler (University of Basel).

⁵ The smoothing parameter refers to the trade-off between the closeness of the trend to the observed values and the smoothness of the trend. In a robustness check, we set λ equal to 500.

⁶ The NEPS adult sample consist of two subsamples: the sample of the previous ALWA ('Arbeiten und Lernen im Wandel') study conducted in 2007 and 2008 (Kleinert *et al.*, 2011) and a sample for the NEPS (Skopek, 2013). The information on the federal state of the university is only available for the second sample and for individuals of the first sample who graduated after their ALWA interview and reported their university degree to the NEPS.

⁷ Besides the introduction of measurement error by imputing the state of graduation, the national business cycle might be a reliable and more relevant measure. First, although Figure A.1 suggests some subnational heterogeneity of the business cycle, once accounting for state population sizes, Figure A.2 shows that in many years a clear majority of the population experienced either a downturn or an upturn. We present a robustness check below using an average of the business cycle indicators at the state level weighted by state population size. Second, we expect the national economic conditions to be more relevant to college graduates than regional conditions. For example, 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 for highly-qualified individuals rather the national than the regional economy matters. Analysing regional mobility of individuals who graduated from a German university in 2007, Krabel and Flöther (2014) found that around two out of five graduates left the state and – although the regional business cycle was not explicitly analysed - that regional characteristics such as urbanization and wage level affected mobility choices. Kahn (2010), Oreopoulos et al. (2012) and Altonji et al. (2014) use the regional as well as the national unemployment rate in their analyses. Oreopoulos et al. (2012) and Altonji et al. (2014) find their results to be robust to the use of any unemployment rate. Kahn (2010) finds more significant effects in the national

Out of 17,140 individuals in the sample 4,360 had a university degree. We excluded 818 individuals born in East Germany, because the majority of them studied (at least partly) in the former communist German Democratic Republic. We dropped 428 individuals who already had at least one child when they graduated, and 29 individuals with missing year of birth or ambiguous information on education. We excluded 120 individuals without German citizenship, first, because their home countries' economy might have been more important to them than the German business cycle and, second, because of (partly large) fertility differences between German individuals and individuals from other countries. To ensure that pregnancies were recorded (by corresponding births), we dropped 121 individuals who were interviewed in the year of graduation or the year thereafter for the last time. We dropped 39 individuals who were born after 1985 or before 1944 and 83 individuals who graduated before 1970 or after 2010 to avoid small birth and graduation cohorts in our data. Finally, to reduce heterogeneity we dropped 64 individuals whose (partners') pregnancy started in the year of graduation and 132 individuals who were either younger than 22 years or older than 35 years at graduation. Our final sample contains 1,098 women and 1,421 men. Table A.3 depicts the cohort sizes of the analysis sample. In our main specification we control for age and the type of degree achieved (university or university of applied science). We present results 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 construct the month of conception by subtracting nine months from the month of birth.

3.2. Method

We use duration analysis to estimate the causal effect of graduating in an economic downturn on the transition to first parenthood. Duration analysis is often used to model the transition

regressions than in the state regressions (with the exception of the instrumented state wage regressions). These results indicate that local shocks are absorbed to some extent by migration and that the national economy rather than the regional affects labor market outcomes among college graduates.

rate to parenthood (Adsera, 2005a; Hashimoto and Kondo, 2012; Skirbekk *et al.*, 2004).

Using duration analysis allows us to analyze spells until they are censored. In other words, we do not need to restrict our sample to individuals who are observed for a fixed duration of interest. We use a discrete time proportional hazard model with unobserved heterogeneity where the hazard rate of individual i in year t is given by:

$$h_{it} = \Pr(T_i = t | T_i \geq t) = f(\beta_0, X_t, X_i, DT_{grad}, yafter_t, v_i) \quad (1)$$

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 unobserved 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 and Singer (1984):

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

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 and μ_1 is normalized to equal zero.

Note that besides age, X_1 contains the trend component of the unemployment rate at graduation as well as a dummy indicating graduation after 1990 (with before as reference category) to capture the secular trends. Further we control for the age at graduation (squared) and a dummy indicator of graduation at a university (with applied university as reference category). 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 (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 no unobserved heterogeneity between graduation cohorts exists. 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 their year of graduation. 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 time their degree 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, 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 enters a downturn, most ambitious (mature) students will have left university, which 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 (Messer and Wolter, 2010). 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 return to this threat to validity below. Third, downturns may even influence college entry decisions. This might be the case because more people enroll in colleges under weaker economic conditions (e.g., Dellas and Sakellaris, 2003). 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. This was not the case for Germany in our observation period. Furthermore, because at the time of (potential) college entry individuals cannot foresee the business cycle at graduation, such differences between graduation cohorts arising from selective college entry are most unlikely correlated with later life fertility intentions. Thus, it is not plausible that selective college entry biases 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 concerning several relevant variables including duration of studies and high school graduation degree. Furthermore, following Oreopoulos et al. (2008) we 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 shed light on the question of 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, we 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 for the duration models, and analytic standard errors clustered by year of graduation for the regression models.

4. Results

4.1. Descriptive Statistics

Before turning to the estimation results, we present selected descriptive statistics on our sample. Women were on average 25.5 years old and men 26.3 years old when they graduated (Table 1). Women are younger at graduation most likely because military or social service was compulsory in Germany for young men but not for women and lasted between nine and 20 months during our observation period. About two thirds of the observed women (68.1%) and more than half of the observed men (58.9%) graduated from a university as opposed to an applied science university.⁸ In earlier years of our observation period, when the unemployment rate was lower, more men than women graduated from university and, thus, the trend unemployment rate was 7.7% on average in the years in which women in our sample graduated and slightly lower in the years men left university (7.4%). 56.6% of our female sample graduated in a downturn and 49.4% of our male sample.

Almost 70% of both, female and male graduates, have at least one child 14 years after graduation (Figure 3). The cumulated transition rate to the first child of treated women is above the rate of untreated women, suggesting that women graduating in a downturn have a faster transition to the first birth over several years after graduation. In contrast, the treated males' cumulated transition rate to fatherhood is almost identical to or in some of the years slightly below that of their untreated counterparts.⁹

To strengthen our argumentation that graduating in a recession is an exogenous event, we also illustrate that those individuals graduating in an economic downturn do not differ systematically from others. We present T-tests of differences of means between treatment and control groups to test for selectivity of the year of graduation (Table 2). The results 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,

⁸ In Germany, the curricula at universities of applied science are usually shorter and more practically oriented than at universities.

⁹ As an additional graphic check we present the shares of female graduates who were mothers four years after graduation plotted against the cycle component of the unemployment rate (Figure A.3). An OLS regression suggests a significant positive correlation, which corroborates the descriptive results for women presented in Figure 3.

duration of studies, most field of studies, paternal profession, and high school diploma GPA (Grade Point Average). Yet, we also find some variables not to be balanced. For example, among the treated we find significantly more women with a university degree (as opposed to a degree from a university of applied science) than among the controls, and among males vice versa, that is, a higher share of the graduates were university graduates in a boom compared to a downturn. In a downturn, the share of males graduating in the field of science and technique was larger than in a boom. Note, first, that even with random assignment the likelihood of balancing all observed variables is not zero and, second, we control for differences between graduates from these two types of universities in our estimations below. Most notably, we do not find significant differences in the duration of studies between treated and controls. In sum, we are confident that the assumption of (conditional) exogeneity of the business cycle in the year of graduation holds.

4.2. Main Estimation Results

Turning to the main estimation results, we find that women who graduated in a year of an economic downturn have a significantly higher transition rate to a pregnancy than if they had graduated in an economically more prosperous year (Table 3). The effect amounts to a 38% ($(\exp(0.320)-1)*100$) increase of the transition rate to the first pregnancy. Against a baseline transition rate of those who left university in an upturn of 6.6% per year (not shown), this effect means an increase to a transition rate to first parenthood of 9.1% per year. Men in contrast do not respond to the business cycle in terms of their fatherhood timing.¹⁰

¹⁰ Additionally, 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. We expected the business cycle in any other year around graduation would have a weaker influence than the one in the year of graduation. We found that for women not only the business cycle in the year of graduation but also – yet to a smaller extent – the one in the year after graduation influences the fertility probability (Table A.1). 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.

4.3. Time-Varying Effect

To investigate whether the effect of the business cycle at graduation on fertility changes over time, we introduced interaction terms between the treatment indicator *downturn* and duration dummy indicators (of 1, 2 to 4, 5 to 7, and 8 and more years after graduation). Results show that for men the effect of graduating in a downturn is not significantly different from zero in any of the years (Table 4). Although not significantly in the first year, two to four years after graduation female treated have a significantly higher probability of becoming pregnant than the controls. The effect decreases over time and we do not find treated and control women to differ in their pregnancy rate more than seven years after graduation.¹¹ These findings are qualitatively robust to using alternative time intervals (Table A.4).

4.4. Heterogeneity by Age at Graduation and between Graduation Cohorts

To account for differences by age of graduation, we interact the downturn measure with two dummy variables indicating age at graduation below 25 years and above 24 years, respectively (Table 5). While there are no significant findings for men, older graduates drive our main findings for women: whereas the younger ones do not respond to a downturn at graduation, among graduates above age 24 years, a downturn at graduation increased the transition rate to a pregnancy significantly by 77%. These results are qualitatively robust using 23, 25, 26 or 27 as threshold age (not shown).

To study effect heterogeneity between graduation cohorts of our long observation period, we vary the treatment dummy with two dummies indicating having graduated before or in the 1990, and respectively, after 1990. The results suggest that women who graduated after 1990 responded somewhat stronger to an economic downturn at graduation than women who graduated earlier (Table 5). Nevertheless, the results of Wald-tests of difference in

¹¹ We used Wald-Tests to assess differences between coefficients (Table A.2). The results of these tests suggest, e.g., that the treatment effect is significantly different in the first year compared to the next interval.

coefficients do not support the hypothesis that the responses between cohorts are indeed of different sizes. For men, again significant effects occur for neither group.

4.5. Number of Children

Our analysis has concentrated on the timing of the first birth so far. Now we use OLS regressions to estimate the effect of graduation in a downturn on the number of children born to an individual between college graduation and age 35, 40 and 45 years. Because of the large differences between younger and older female graduates, we perform our regressions based on subsamples split by age (using 24 years as the cut-off age). We keep in mind that the subsample of respondents who were at least 45 years old at the time of the interview consists to 80 % of individuals (not shown) who graduated before 1991 (compared to around 50% in the full sample).

While graduating in a downturn neither affects the number of children a woman has who graduated below 25 years of age, nor men of both age groups have, we find positive effects for older female graduates: women who graduated in a downturn at age 25 years or older, on average, had significantly more children at ages 35 (Table 6). Women of this age group who had graduated in a downturn on average had 0.19 more children at age 35. Against a baseline of 0.81, this marginal effect amounts to an increase in the number of children at age 35 of around 23%.¹² We do not find an effect on the number of children at later ages. In other words, in our sample, completed fertility was not affected by having graduated in a downturn. Nevertheless, we cannot exclude that completed fertility is affected among later graduation cohorts.

4.6. Sensitivity

¹² Note, however, that these results are based on the sample of women who already had turned 45 years by the time they were interviewed. Therefore, we cannot rule out that this result is driven by cohort differences. Yet, remember, we did not find evidence for effect heterogeneity by cohorts in the duration analysis models.

We assessed the sensitivity of our results and have found that our main results are robust to several checks (Table A.5). First, we used a predicted year of graduation instead of the observed year similarly to Oreopoulos et al. (2008). To predict the year of graduation, we added five (university) and, respectively, four (applied university) years to the month of college entry. Though the coefficient decreases (0.206), our main finding is robust. Second, we tested whether our results are robust to different specifications by adding dummies indicating the own professional field and parental professional field (as described in Table 2), birth cohort dummies (1960s; 1970s and 1980s; with 1940s and 1950s as reference) and the duration of studies. The results do not change. Third, using λ of 500 instead of 100 to calculate the trend of the unemployment rate does not affect the results. Fourth, the results are also robust to using the GDP as a measure of the business cycle. Moreover, if we use the continuous HP cycle (controlling for its polynomials of degree two and three) as measure of the strength of the business cycle instead of a binary downturn indicator, we find a positive significant effect of the continuous business cycle measure on the transition rate to the first pregnancy for women as expected. Sixth, if instead of the downturn indicator based on the national unemployment rate, we use an average of the downturn indicators on state level weighted by the state population size (as plotted in Figure A.2) to approximate the probability of a downturn in the state of graduation, the results do not change considerably. Finally, we show that our results are qualitatively robust to using a downturn indicator based at the state level unemployment rate.¹³

4.7. Potential Mechanisms – Employment and Partnership Outcomes

Because individuals often decide simultaneously about their labor market participation and fertility, we investigated the labor market entry situation of graduates in the first year of

¹³ Remember that we had to impute 30% of the missing state of graduation information using the residence history and another 30% using the state of residence at the interview, which most likely introduces measurement error. Therefore, we do not use state level variation in the main analysis.

potential post-university work experience. More specifically, we ran regressions within quarterly intervals of a binary employment indicator (of fulltime, and respectively, adequate employment) at monthly level on control variables and on the treatment dummy.¹⁴ We present the results separately for women and men and for two different age groups ($< / \geq 25$ years at graduation) in Table 7.

First, we do not find that the fulltime employment probability among women was harmed by graduating in a recession. Second, among older male graduates, we find a significantly lower fulltime employment probability due to a recession at career start in the very start: summed up over a quarterly interval, the effect amounts on average to a 7.7%-points decrease of the fulltime employment probability. Against baselines of 69% this is an economically significant effect. Third, we find that the probability of holding a job that requires a university degree (*adequate* employment, hereafter) in the first quarter of the post-graduation year is by 8.1% lower among older female recession graduates compared to their non-recession counterparts. For older male graduates the monthly probabilities of holding an adequate job are also reduced during the first post-graduation year and amounts to a 7.1%-points decrease average over the first three months after graduation, which from a baseline of 67% is a sizeable increase. These differences indicate that graduating in a recession might reduce job quality which is in line with the evidence presented by Altonji *et al.* (2014), Kahn (2010) and Oreopoulos *et al.* (2012).¹⁵

Finally, we did not find evidence on the marital status or the cohabitation status to be affected by the business cycle at graduation. Although the data suggest that female recession graduates are somewhat more likely to be married than their counterparts of women who had graduated in better times (among both age groups), these differences are neither significantly different from zero (Table 7). Thus, the fertility effect we have presented does not seem to

¹⁴ To align seasonal variation we consider the first full calendar year (starting in January) after graduation.

¹⁵ Note that we are not aware of a study using German data to investigate the effect of college graduation in a downturn on labor market outcomes.

have been caused by an increased probability of being married or move in together with a partner within the first year after graduation.

5. Conclusion

Graduating from university in a downturn may affect fertility. Because those with tertiary education have on average the fewest children, understanding the determinants of their fertility choices is important. For women, the theoretical prediction is ambiguous, because economic uncertainty and lower expected income may decrease fertility, or, alternatively, lower opportunity costs may lead to higher fertility. For men, in contrast, we expected a slower transition to fatherhood due to graduating in a downturn, because of prevailing higher economic uncertainty and lower expected income.¹⁶ Using survey data from Germany we explore these hypotheses. For the past decades the birth rates have been particularly low in Germany, which makes it even more important to understand the determinants of fertility. Our study advances on the literature by enriching it with evidence from a European country and by exploiting a longer observation period than previous studies. Further, we do not only shed light on immediate short-term effect on fertility (referred to as tempo effect in the fertility literature), but also consider the number of children at later ages (quantum effect).

Examining an observation period of more than 40 years, we apply duration analysis and estimate the effect of graduating in an economic downturn on the transition rate to first parenthood. Women who graduated in a downturn speed up entry into motherhood. This result is qualitatively robust to several sensitivity checks. The differences between 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. While we do not find effects to differ by graduation cohort, among women the age at graduation matters: younger

¹⁶ Moreover, the business cycle might influence the individual stress level and decrease fertility as a biological outcome (as opposed to a decision based outcome). Thus, our results might understate the size of the substitution effect.

women do not change their fertility behavior significantly due to the business cycle at graduation. In contrast, the fertility increase that we observed after graduation in a downturn was purely driven by older female graduates. Heterogeneous results by age groups were also found, for example, by Currie and Schwandt (2014). Furthermore, we find that women who graduated at age 25 or older on average had more children at age 35 compared to the counterparts who graduated in better economic times, but we do not find an effect on the number of children at later ages.

Our study adds to the yet scarce evidence on the effect of the business cycle at the time of graduation on later life outcomes. Most of the studies, however, focus on young men and on labor market outcomes (e.g., Kahn, 2010; Oreopoulos *et al.*, 2012). Our results contribute to a broader understanding of how adverse conditions at career start shape life courses. In sum, we show that female university graduates in Germany who face adverse labor market entry conditions on average have a faster transition to motherhood compared to their counterparts who entered the labor market in economically better times.

Might the fertility effect for women have been driven by a worsened career start? To address this question we analyzed the probabilities of being fulltime employed and of holding a degree adequate job by the business cycle at graduation. The evidence suggests that older graduates' career start might have been harmed in terms of job quality. These results are qualitatively in line with Altonji *et al.* (2014). Future research might readdress this question, for example, by exploring wages. Finally, the fertility effect among older women was not accompanied by a significantly increased probability of being married or of cohabiting with a partner in the first year after graduation.

We find that female university graduates take advantage of lower opportunity costs in an economic downturn compared to economically more prosperous times and, as a result, speed up transitions to motherhood. Compared to other socio-demographic groups, university graduates have a higher expected income and a lower risk of unemployment. Thus, economic

uncertainty might be lower which may be the reason why an income effect did not dominate the opportunity cost effect.

References

- Adsera, A. (2005a). 'Education and health of women and children. Vanishing children: From high unemployment to low fertility in developed countries', *AEA Papers and Proceeding*, vol. **95(2)**, pp. 189-193.
- Adsera, A. (2005b). 'Vanishing Children: From High Unemployment to Low Fertility in Developed Countries', *American Economic Review*, vol. **95(2)**, pp. 189-193.
- Altonji, J. G., L. B. Kahn and J. D. Speer (2014). 'Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success', NBER working papers 20531, Cambridge, MA: National Bureau of Economic Research.
- Black, D. A., N. Kolesnikova, S. G. Sanders and L. J. Taylor (2013). 'Are Children “normal”?', *The Review of Economics and Statistics*, vol. **95(1)**, pp. 21-33.
- Bowlus, A. J. (1995). 'Matching Workers and Jobs: Cyclical Fluctuations in Match Quality', *Journal of Labor Economics*, vol. **13(2)**, pp. 335-350.
- Currie, J. and H. Schwandt (2014). 'Short- and long-term effects of unemployment on fertility', *Proceedings of the National Academy of Sciences*, vol. **111(41)**, pp. 14734–14739.
- d’Addio, A. C. and M. Mira d’Ercole (2005). 'Trends and determinants of fertility rates in OECD countries: The role of policies', OECD Social, Employment and Migration Working Papers No. 15, Paris: OECD.
- Davis, S. J. and T. M. von Wachter (2011). 'Recessions and the Costs of Job Loss', *Brookings Papers on Economic Activity*, vol. **Fall 2011**, pp. 1-72.

- Del Bono, E., A. Weber and R. Winter-Ebmer (2012). 'Clash of career and family: Fertility decisions after job displacement', *Journal of the European Economic Association*, vol. **10(4)**, pp. 659-683.
- Dellas, H. and P. Sakellaris (2003). 'On the Cyclicity of Schooling: Theory and Evidence', *Oxford Economic Papers*, vol. **55(1)**, pp. 148-172.
- Federal Statistical Office of Germany (2013). 'Geburtentrends und Familiensituation in Deutschland 2012', Wiesbaden: Federal Statistical Office of Germany.
- Goldstein, J. R., M. Kreyenfeld, A. Jasilioniene and D. D. Karaman Örsal (2013). 'Fertility reactions to the 'Great Recession' in Europe: Recent evidence from order-specific data', *Demographic Research*, vol. **29(4)**, pp. 85-104.
- Gornick, J. C. and M. K. Meyers (2003). *Families That Work: Policies for Reconciling Parenthood and Employment*, New York: Russell Sage Foundation.
- Hashimoto, Y. and A. Kondo (2012). 'Long-term effects of labor market conditions on family formation for Japanese youth', *Journal of the Japanese and International Economies*, vol. **26(1)**, pp. 1-22.
- Heckman, J. and B. Singer (1984). 'A method for minimizing the impact of distributional assumptions in econometric models for duration data', *Econometrica*, vol. **52(2)**, pp. 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*, vol. **12(1)**, pp. 1-29.
- Hofmann, B. and K. Hohmeyer (2013). 'Perceived Economic Uncertainty and Fertility: Evidence From a Labor Market Reform', *Journal of Marriage and Family*, vol. **75(2)**, pp. 503-521.

- Hotz, V. J., J. A. Klerman and R. J. Willis (1997). 'The economics of fertility in developed countries', in (Rosenzweig, M. R. and O. Stark Eds.), *Handbook of population and family economics*, pp. 275-347, Amsterdam: Elsevier.
- Kahn, L. B. (2010). 'The long-term labor market consequences of graduating from college in a bad economy', *Labour Economics*, vol. **17(2)**, pp. 303-316.
- Karaman Örsal, D. D. and J. R. Goldstein (2010). 'The Increasing Importance of Economic Conditions on Fertility', MPIDR Working Paper 14/2010, Rostock: Max Planck Institute for Demographic Research.
- Kleinert, C., B. Matthes, M. Antoni, K. Drasch, M. Ruland and A. Trahms (2011). 'ALWA – New Life Course Data for Germany', *Journal of Applied Social Science Studies*, vol. **131(4)**, pp. 625-634.
- Kondo, A. (2012). 'Gender-specific labor market conditions and family formation', *Journal of Population Economics*, vol. **25(1)**, pp. 151-174.
- Krabel, S. and C. Flöther (2014). 'Here Today, Gone Tomorrow? Regional Labour Mobility of German University Graduates', *Regional Studies*, vol. **48(10)**, pp. 1609–1627.
- Kreyenfeld, M. (2010). 'Uncertainties in female employment careers and the postponement of parenthood in Germany', *European Sociological Review*, vol. **26(3)**, pp. 351-366, .
- Kreyenfeld, M. and G. Andersson (2014). 'Socioeconomic Differences in the Unemployment and Fertility Nexus: A Comparison of Denmark and Germany', *Advances in Life Course Research*, vol. **21**, pp. 59-73.
- Leist, A. K., P. Hessel and M. Avendano (2013). 'Do economic recessions during early and mid-adulthood influence cognitive functions in older age?', *Journal of epidemiology and community health*, vol. **68(2)**, pp. 151-158.
- Lindo, J. (2010). 'Are Children Really Inferior Goods?: Evidence from Displacement-Driven Income Shocks', *The Journal of Human Resources*, vol. **45(2)**, pp. 301-327.

- Maclean, J. C., R. Covington and A. Sikora Kessler (2015). 'Labor Market Conditions at School-Leaving: Long-run Effects on Marriage and Fertility', Department of Economics Temple University Working Paper 15-08.
- Malthus, T. R. (1798). *An essay on the principles of population*, Oxford: Oxford University Press.
- Messer, D. and S. C. Wolter (2010). 'Time-to-Degree and the Business Cycle', *Education Economics*, vol. **18**(1), pp. 111-123.
- OECD (2008). 'Higher Education to 2030. Volume 1: Demography. Chapter 10: The Reversal of Gender Inequalities in Higher Education: An On-going Trend'.
- OECD (2013a). 'Education at a Glance 2013: OECD Indicators', OECD Publishing, <http://dx.doi.org/10.1787/eag-2013-en>.
- OECD (2013b). 'OECD Factbook 2013. Economic, Environmental and Social Statistics. Fertility.', <http://dx.doi.org/10.1787/factbook-2013-en>: OECD Publishing.
- Oreopoulos, P., T. M. von Wachter and A. Heisz (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., T. M. von Wachter and A. Heisz (2012). 'The Short- and Long-Term Career Effects of Graduating in a Recession', *American Economic Journal: Applied Economics*, vol. **4**(1), pp. 1-29.
- Schmieder, J. F., T. v. Wachter and S. Bender (2010). 'The long-term impact of job displacement in Germany during the 1982 recession on earnings, income, and employment.', IAB-Discussion Paper, 01/2010, Nuremberg: Institute for Employment Research.
- Skirbekk, V., H.-P. Kohler and A. Prskawetz (2004). 'Birth Month, School Graduation, and the Timing of Births and Marriages', *Demography*, vol. **41**(3), pp. 547-568.

- Skopek, J. (2013). 'Data Manual Starting Cohort 6. Adult Education and Lifelong Learning. Release 3.0.1', NEPS Data Center.
- Sobotka, T., V. Skirbekk and D. Philipov (2011). 'Economic recession and fertility in the developed world', *Population and Development Review*, vol. **37(2)**, pp. 267-306.
- Testa, M. R. and S. Basten (2012). 'Have lifetime fertility intentions declined during the “Great Recession”?', 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 (Heckman, J. J. and E. Leamer Eds.), *Handbook of Econometrics*, pp. 3381-3460: Elsevier.
- van den Berg, G. J., M. Lindeboom and F. Portrait (2006). 'Economic Conditions Early in Life and Individual Mortality', *The American Economic Review*, vol. **96(1)**, pp. 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*, vol. **48(6)**, pp. 481-507.
- Wozniak, A. (2010). 'Are College Graduates More Responsive to Distant Labor Market Opportunities?', *The Journal of Human Resources*, vol. **45(4)**, pp. 944-970.

Tables and Figures

TABLE 1. Summary Statistics of Control Variables.

	Women	Men
Age at graduation (in years)	25.5 (2.5)	26.3 (2.4)
University degree (in %)	68.1	58.9
Trend unemployment rate (in %)	7.7 (1.9)	7.4 (2.2)
Downturn at graduation (in %)	52.6	53.7
Graduated after 1990 (in %)	56.6	49.4
Number of observations	1,098	1,421

Notes: Standard deviation of continuous variables in parentheses. Source: German National Educational Panel Study (NEPS:SC6:5.1.0). Sample of university graduates and graduates of applied universities. Own calculations.

TABLE 2. Sample Means of Graduation Cohorts by Treatment Status.

	Women		P-value of T- test	Men		P-value of T- test
	Treated	Control		Treated	Control	
<i>Own profession:</i>						
Industry	0.04	0.05	0.39	0.25	0.22	0.30
Science and technique	0.10	0.08	0.46	0.18	0.14	0.08
Administration (private sector)	0.18	0.16	0.41	0.15	0.15	0.82
Health. social sector. education	0.42	0.41	0.76	0.18	0.21	0.52
Arts and social science	0.17	0.21	0.10	0.10	0.13	0.14
<i>Parental profession:</i>						
F: Employee (white collar)	0.42	0.43	0.69	0.44	0.43	0.83
F: Civil servant	0.23	0.21	0.34	0.17	0.20	0.14
F: Self employed	0.21	0.21	0.96	0.19	0.19	0.90
M: Not employed	0.36	0.29	0.16	0.31	0.30	0.73
M: Employee (blue collar)	0.08	0.05	0.06	0.15	0.12	0.13
M: Employee (white collar)	0.41	0.46	0.21	0.39	0.42	0.35
Age at graduation (in years)	25.53	25.40	0.67	26.44	26.24	0.49
University ^a	0.71	0.65	0.04	0.56	0.62	0.05
High School Diploma GPA ^b	2.34	2.28	0.33	2.30	2.36	0.38
Duration of studies (in months) ^c	56.90	54.14	0.13	59.78	57.68	0.25
N(persons)	577	521		763	658	

Notes: Standard errors are clustered at the year of graduation. ^aReference category: applied university. ^b Due to missing values sample size reduces to 519 (women) and 612 (men) for this variable. ^c Due to missing values sample size reduces to 1,097 (women) and 1,414 (men) for this variable.

Source: NEPS:SC6:5.1.0

TABLE 3. Effect of Graduation in an Economic Downturn on Timing of First Parenthood.

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn	0.320*	(0.125)	-0.059	(0.115)
Trend unemployment rate	-0.033	(0.071)	-0.092	(0.058)
Current downturn	0.019	(0.067)	0.036	(0.057)
Current trend unemployment rate	-0.034	(0.069)	0.069	(0.053)
Log years after graduation	1.230***	(0.096)	1.131***	(0.075)
Age	1.233*	(0.595)	0.506	(0.447)
Age squared	-0.023†	(0.012)	-0.008	(0.008)
University	-0.064	(0.132)	-0.102	(0.114)
Graduated after 1990	-0.176	(0.156)	-0.293*	(0.142)
Constant	-25.437***	(7.513)	-14.883*	(5.873)
μ_2	5.540***	(0.499)	3.598***	(0.205)
Logit coeff. of $p(\mu_2)$	0.811***	(0.106)	0.615***	(0.117)
AIC		4351		6113
BIC		4266		6024
N(persons)		1,098		1,421
N(years)		9,379		12,814

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.

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Source: NEPS:SC6:5.1.0

TABLE 4. Time-varying Effects of Graduation in an Economic Downturn on Timing of First Parenthood.

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	0.209	(0.196)	-0.237	(0.169)
Downturn * year 2-4	0.545***	(0.130)	0.079	(0.118)
Downturn * year 5-7	0.368*	(0.155)	-0.178	(0.151)
Downturn * year >7	-0.234	(0.241)	-0.084	(0.226)
Trend unemployment rate	-0.043	(0.068)	-0.097†	(0.057)
Current trend unemployment rate	-0.023	(0.069)	0.076	(0.055)
Current downturn	0.063	(0.068)	0.041	(0.057)
Log years after graduation	1.317***	(0.116)	1.130***	(0.094)
Age	1.186*	(0.526)	0.521	(0.445)
Age squared	-0.022*	(0.010)	-0.008	(0.008)
University	-0.109	(0.126)	-0.104	(0.114)
Graduated after 1990	-0.168	(0.148)	-0.294*	(0.140)
Constant	-34.496***	(6.832)	-15.093**	(5.783)
μ_2	15.162***	(1.643)	3.621***	(0.213)
Logit coeff. of $p(\mu_2)$	0.890***	(0.128)	0.630***	(0.133)
BIC		4349		6136
AIC		4249		6024
N(persons)		1,098		1,421
N(years)		9,379		12,814

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.

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Source: NEPS:SC6:5.1.0

TABLE 5. Effect Heterogeneity between Graduation Cohorts and Age at Graduation.

	Women		Men		Women		Men	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Downturn * Age at Grad < 25	0.059	(0.179)	-0.291	(0.277)				
Downturn * Age at Grad ≥ 25	0.570**	(0.195)	-0.013	(0.128)				
Downturn * Graduation > 1990					0.447**	(0.164)	0.001	(0.143)
Downturn * Graduation ≤ 1990					0.201	(0.188)	-0.110	(0.165)
Age < 25	0.409	(0.289)	-0.051	(0.289)				
Trend unemployment rate	-0.031	(0.071)	-0.071	(0.059)	-0.023	(0.074)	-0.090	(0.059)
Current downturn	0.019	(0.068)	0.043	(0.057)	0.015	(0.068)	0.035	(0.057)
Current trend unemployment rate	-0.034	(0.070)	0.056	(0.054)	-0.038	(0.071)	0.068	(0.054)
Log years after graduation	1.246***	(0.099)	1.130***	(0.079)	1.234***	(0.098)	1.137***	(0.078)
Age	1.341†	(0.685)	0.139	(0.651)	1.221*	(0.605)	0.506	(0.453)
Age squared	-0.024†	(0.013)	-0.001	(0.012)	-0.022†	(0.012)	-0.008	(0.009)
University	-0.112	(0.131)	-0.106	(0.116)	-0.077	(0.134)	-0.102	(0.114)
Graduation after 1990	-0.172	(0.156)	-0.324*	(0.142)	-0.338	(0.223)	-0.359†	(0.200)
Constant	-27.589**	(8.933)	-9.863	(8.926)	-25.231***	(7.635)	-14.889*	(5.953)
μ_2	5.789***	(1.078)	3.682***	(0.218)	5.532***	(0.498)	3.601***	(0.208)
Logit coeff. of $p(\mu_2)$	0.815***	(0.106)	0.646***	(0.125)	0.809***	(0.107)	0.608***	(0.118)
N(persons)	1,098		1,421		1,098		1,421	
N(Years)	9,379		12,814		9,379		12,814	

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 * Graduation ≤ 1990 vs. Downturn * Graduation > 1990: women -0.247 (0.249); men -0.110 (0.209). Downturn * Age at Graduation < 25 vs. Downturn * Age at Graduation ≥ 25: women -0.511† (0.274), men -0.278 (0.305).

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Source: NEPS:SC6:5.1.0

TABLE 6. Effect of Graduating in a Downturn on Number of Children at Different Ages.

Age in years (when fertility measured)	35		40		45	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<i>Women</i>						
<25 years	0.102	(0.119)	0.055	(0.111)	-0.018	(0.099)
R ²	0.006		0.031		0.023	
Baseline	1.37		1.60		1.60	
N(persons)	337		300		250	
≥25 years	0.190*	(0.077)	0.136	(0.096)	0.018	(0.147)
R ²	0.093		0.07		0.052	
Baseline	0.81		1.12		1.23	
N(persons)	530		450		335	
<i>Men</i>						
<25 years	-0.079	(0.134)	0.107	(0.172)	0.13	(0.188)
R ²	0.038		0.033		0.038	
Baseline	1.25		1.44		1.55	
N(persons)	263		244		223	
≥25 years	0.039	(0.056)	0.017	(0.076)	0.045	(0.090)
R ²	0.08		0.059		0.037	
Baseline	0.84		1.30		1.44	
N(persons)	974		859		695	

Notes: Table lists coefficient of the dummy variable *downturn* of OLS regressions of number of children born to an individual at a given age for the subsample of individuals below and, respectively, above / equal 25 years at graduation. Baseline: mean number of children of control group (i.e. persons who graduated in upturn). Further control variables (not shown): unemployment rate trend at graduation, age at graduation, age at graduation squared, university, graduation decade dummies. Standard errors are clustered by year of graduation.

†p < .10; *p < .05; **p < .01; ***p < .001

Source: NEPS:SC6:5.1.0

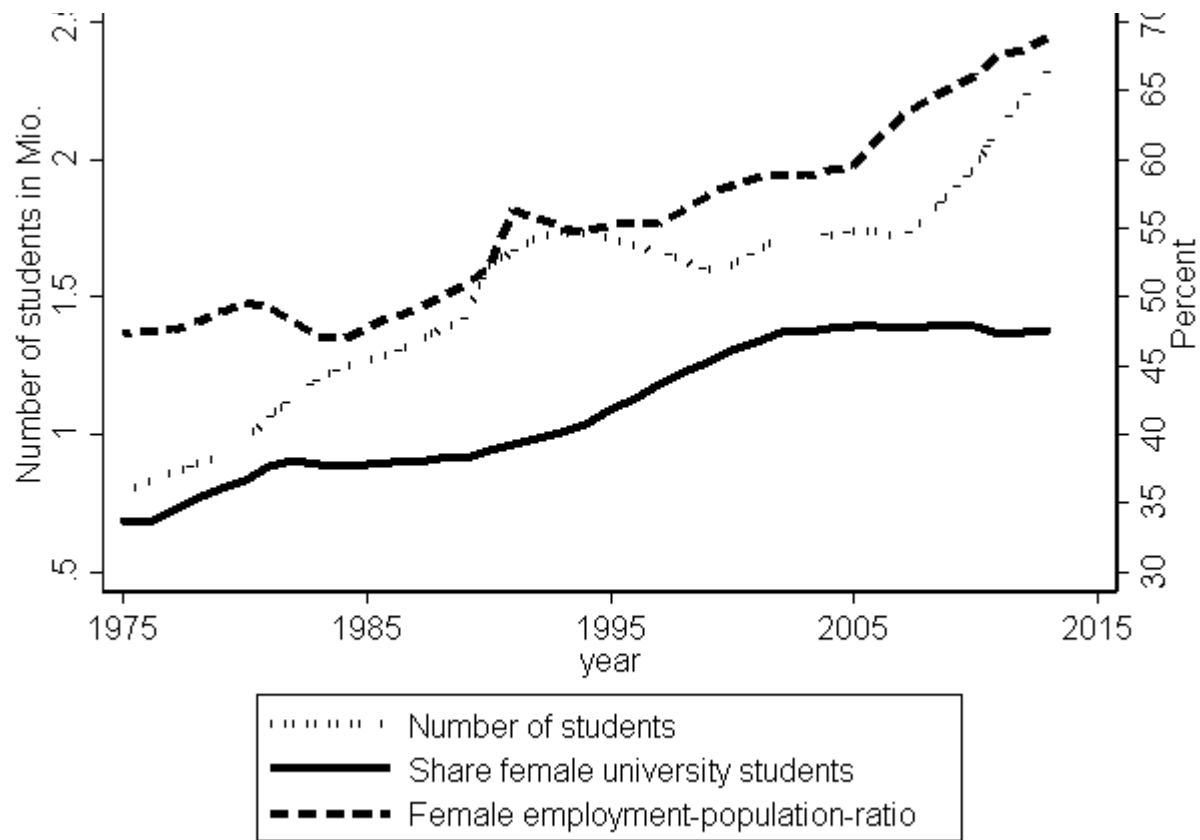
Table 7. Graduation in a Downturn and Short-Term Employment and Partnership Outcomes.

Quarters after Graduation	Graduated age <25 years				Graduated age ≥25 years											
	1		2		3		4		1		2		3		4	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<i>Women</i>																
Fulltime Employment	0.006	(0.050)	0.016	(0.052)	0.025	(0.052)	0.021	(0.058)	-0.011	(0.037)	-0.026	(0.033)	-0.017	(0.035)	-0.007	(0.038)
Baseline	0.57		0.58		0.58		0.58		0.49		0.53		0.55		0.57	
Adequate Employment	-0.044	(0.052)	-0.034	(0.053)	-0.017	(0.056)	-0.015	(0.062)	-0.081*	(0.039)	-0.090*	(0.040)	-0.083*	(0.039)	0.035	(0.025)
Baseline	0.58		0.59		0.59		0.61		0.53		0.58		0.61		0.63	
Marital Status	0.018	(0.026)	0.036	(0.032)	0.039	(0.034)	0.044	(0.034)	0.035	(0.025)	0.030	(0.029)	0.027	(0.029)	0.044	(0.031)
Baseline	0.12		0.14		0.17		0.18		0.14		0.17		0.18		0.19	
Cohabitation	-0.025	(0.037)	-0.024	(0.040)	-0.013	(0.038)	-0.004	(0.036)	0.01	(0.043)	0.012	(0.041)	0.014	(0.042)	0.009	(0.039)
Baseline	0.36		0.38		0.41		0.42		0.34		0.35		0.38		0.39	
<i>Men</i>																
Fulltime Employment	-0.030	(0.055)	-0.023	(0.058)	-0.038	(0.056)	-0.03	(0.054)	-0.077†	(0.039)	-0.042	(0.039)	-0.027	(0.038)	-0.027	(0.035)
Baseline	0.60		0.61		0.65		0.67		0.69		0.70		0.71		0.72	
Adequate Employment	-0.061	(0.057)	-0.063	(0.056)	-0.071	(0.059)	-0.05	(0.057)	-0.073†	(0.042)	-0.050	(0.040)	-0.032	(0.035)	-0.032	(0.033)
Baseline	0.58		0.58		0.61		0.63		0.67		0.68		0.68		0.69	
Marital Status	-0.016	(0.016)	-0.032	(0.020)	-0.019	(0.023)	-0.035	(0.030)	0.009	(0.022)	0.002	(0.023)	-0.011	(0.026)	0.003	(0.026)
Baseline	0.10		0.14		0.16		0.18		0.15		0.18		0.21		0.22	
Cohabitation	0.038	(0.050)	0.024	(0.047)	0.036	(0.049)	0.016	(0.051)	0.041	(0.025)	0.028	(0.025)	0.018	(0.027)	0.019	(0.026)
Baseline	0.18		0.19		0.22		0.24		0.29		0.32		0.34		0.36	

Notes: Table lists coefficient of the dummy variable downturn of OLS regressions. Dependent variable is an indicator of being fulltime employed/adequately employed/married/cohabiting in the first calendar year after graduation within quarterly intervals. Adequate employment refers to jobs that require a university degree. Results are presented separately for the subsample of individuals below and, respectively, above / equal 25 years at graduation. Further control variables (not shown): unemployment rate trend at graduation, age at graduation, age at graduation squared, university, graduation calendar quarter dummies, graduation decade dummies. Standard errors are clustered by year of graduation. †p < .10; *p < .05; **p < .01; ***p < .001

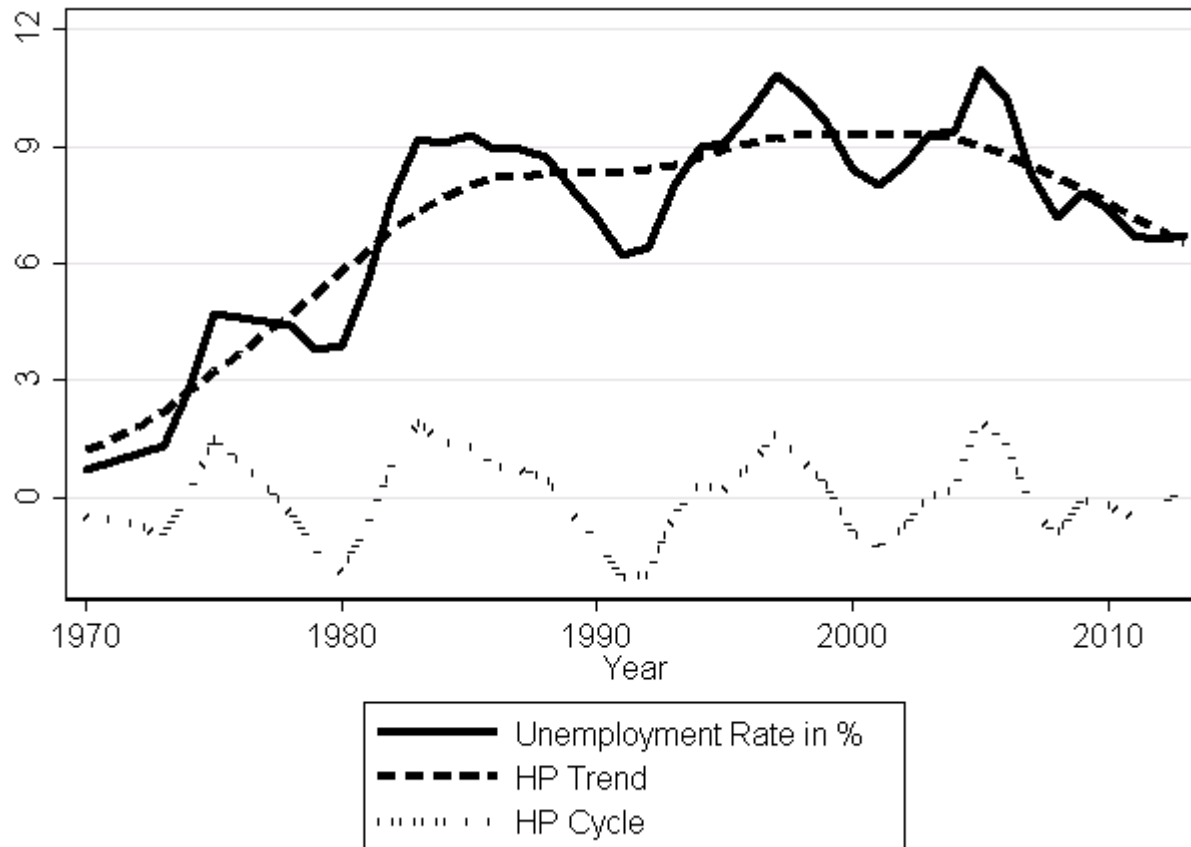
Source: NEPS:SC6:5.1.0 & NEPS-SC6-ADIAB

FIGURE 1. Female University and Labor Force Participation in Germany over Time.



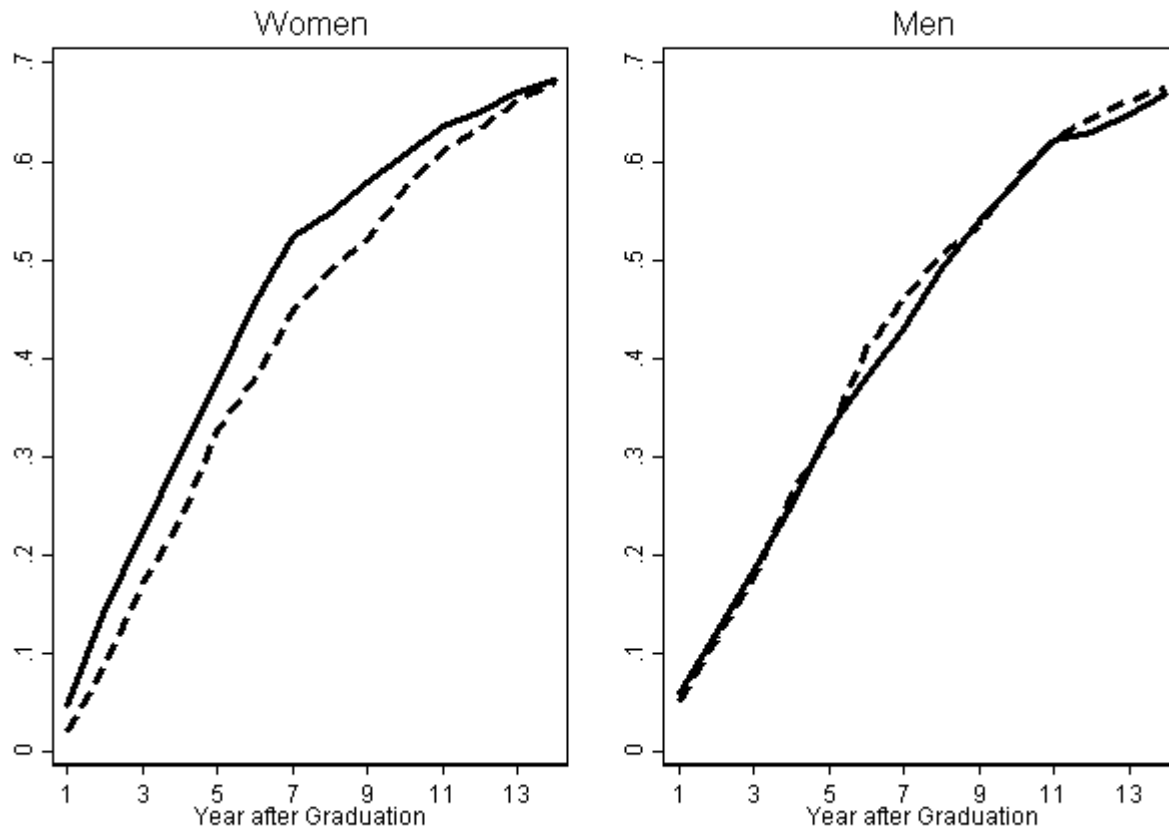
Notes: Employment-population-ratio of women aged 15 to 64 years, source: OECD.Stat. Number of students and share of female university students in winter term (until 1989: West Germany), source: German Federal Statistical Office.

FIGURE 2. Unemployment Rate over Time (West Germany).



Notes: Hodrick-Prescott filtered trend (HP trend) and deviation of unemployment from trend (HP cycle). Source: Data from Germany Federal Employment Agency.

FIGURE 3. Transition to First Pregnancy After Graduation: Cumulated Transition Rate by Treatment Status.



Notes: Solid (dashed) lines indicate cumulated transition rate to first pregnancy after graduation for treated (controls), with treatment being graduation in a downturn. Source: Data from Federal Employment Agency and NEPS. Own calculations.

Appendix

TABLE A.1. Effect of Economic Downturn on Fertility – Different Specifications.

	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<i>Women</i>												
Downturn y-2	0.052	(0.147)										
Downturn y-1			0.011	(0.129)								
Downturn y					0.320*	(0.125)						
Downturn y+1							0.242†	(0.125)				
Downturn y+2									0.128	(0.128)		
Downturn y+3											-0.040	(0.136)
Controls	Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	9,379		9,379		9,379		9,379		9,379		9,379	
N(persons)	1,098		1,098		1,098		1,098		1,098		1,098	
<i>Men</i>												
Downturn y-2	-0.062	(0.113)										
Downturn y-1			0.010	(0.112)								
Downturn y					-0.059	(0.115)						
Downturn y+1							-0.026	(0.118)				
Downturn y+2									0.127	(0.115)		
Downturn y+3											0.147	(0.128)
Controls	Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	12,814		12,814		12,814		12,814		12,814		12,814	
N(persons)	1,421		1,421		1,421		1,421		1,421		1,421	

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 . Further control variables: trend of unemployment in year of graduation and in current year, current downturn, (log) years after graduation, age and age squared at graduation, East Germany, university (reference: applied university). Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

†p < .10; *p < .05; **p < .01; ***p < .001

Source: NEPS:SC6:5.1.0

TABLE A.2. Wald-Tests of Differences in Coefficients.

	Downturn * year 2-4		Downturn * year 5-7		Downturn * year >7	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<i>Women</i>						
Downturn * year 1	-0.336†	(0.183)	-0.160	(0.227)	0.443	(0.286)
Downturn * year 2-4			0.176	(0.109)	0.779***	(0.197)
Downturn * year 5-7					0.602***	(0.166)
<i>Men</i>						
Downturn * year 1	-0.316†	(0.165)	-0.059	(0.186)	-0.153	(0.250)
Downturn * year 2-4			0.257**	(0.099)	0.163	(0.172)
Downturn * year 5-7					-0.095	(0.145)

Notes: Wald-Tests of differences in coefficients are based on the model presented in Table 4.

†p < .10; *p < .05; **p < .01; ***p < .001

Source: NEPS:SC6:5.1.0

TABLE A.3. Cohort sizes.

year	male	female
1970	18	13
1971	13	10
1972	28	10
1973	23	11
1974	31	16
1975	29	13
1976	31	11
1977	32	24
1978	36	19
1979	34	27
1980	34	24
1981	28	25
1982	42	26
1983	32	27
1984	37	35
1985	49	28
1986	35	33
1987	38	33
1988	44	30
1989	48	27
1990	56	34
1991	49	26
1992	41	32
1993	50	27
1994	35	39
1995	57	43
1996	43	40
1997	39	21
1998	37	30
1999	32	30
2000	36	31
2001	19	28
2002	22	23
2003	37	22
2004	26	19
2005	32	29
2006	25	28
2007	31	39
2008	33	50
2009	32	43
2010	27	22

Source: NEPS:SC6:5.1.0

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

Model	<i>Women</i>				<i>Men</i>			
	A		B		A		B	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	0.168	(0.191)	0.215	(0.194)	-0.251	(0.172)	-0.268	(0.172)
Downturn * year 2-3	0.569***	(0.138)	0.589***	(0.136)	0.061	(0.127)	0.068	(0.126)
Downturn * year 4-6	0.382**	(0.148)			-0.041	(0.134)		
Downturn * year >6	0.028	(0.236)			-0.245	(0.194)		
Downturn * year 4-7			0.398**	(0.146)			-0.083	(0.138)
Downturn * year >7			-0.233	(0.243)			-0.037	(0.222)
Log years after	1.280***	(0.113)	1.322***	(0.115)	1.133***	(0.096)	1.099***	(0.094)
Controls	Yes		Yes		Yes		Yes	
BIC		4,368		4,358		6,136		6,138
AIC		4,260		4,251		6,025		6,027
N(Years)	9,379		9,379		12,814		12,814	
N(persons)	1,098		1,098		1,421		1,421	

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 . Further control variables: trend of unemployment in year of graduation and in current year, current downturn, age and age squared at graduation, university (reference: applied university). Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

†p < .10; *p < .05; **p < .01; ***p < .001

Source: NEPS:SC6:5.1.0

TABLE A.5. Sensitivity Analyses.

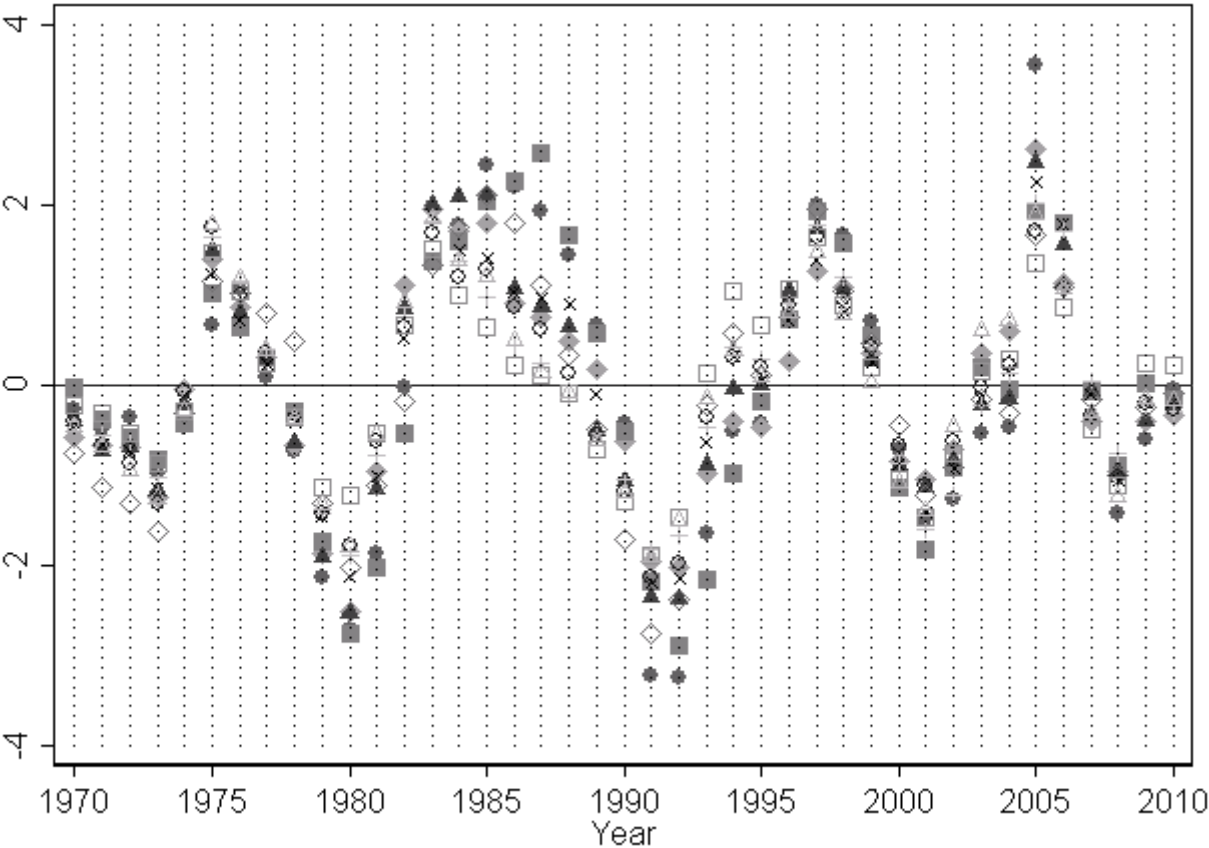
Model	S1: Predicted year of graduation		S2: + control variables		S3: HP filter: $\lambda=500$		S4: GDP as business cycle measure		S5: Continuous HP cycle as business cycle measure		S6: Downturn indicator based on state business cycle		S7: Sample with graduation federal state	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
<i>Women</i>														
Downturn	0.206†	(0.121)	0.321*	(0.135)	0.281*	(0.127)	0.256*	(0.121)	0.384**	(0.119)	0.235†	(0.138)	0.226†	(0.127)
Controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	9,375		9,375		9,379		9,379		9,379		9,379		8,742	
N(persons)	1,097		1,097		1,098		1,098		1,098		1,098		1,050	
<i>Men</i>														
Downturn	-0.154	(0.118)	-0.057	(0.130)	-0.020	(0.113)	-0.036	(0.116)	-0.086	(0.114)	0.060	(0.124)	0.076	(0.122)
Controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	12,743		12,743		12,814		12,814		12,814		12,814		12,168	
N(persons)	1,414		1,414		1,421		1,421		1,421		1,421		1,364	

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. Further control variables: trend unemployment rate, current trend unemployment rate, current downturn, (log) years after graduation, age and age squared at graduation, university (reference: applied university), dummy graduated after 1990. Bootstrapped standard errors are stratified by year of graduation and clustered by individual.

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

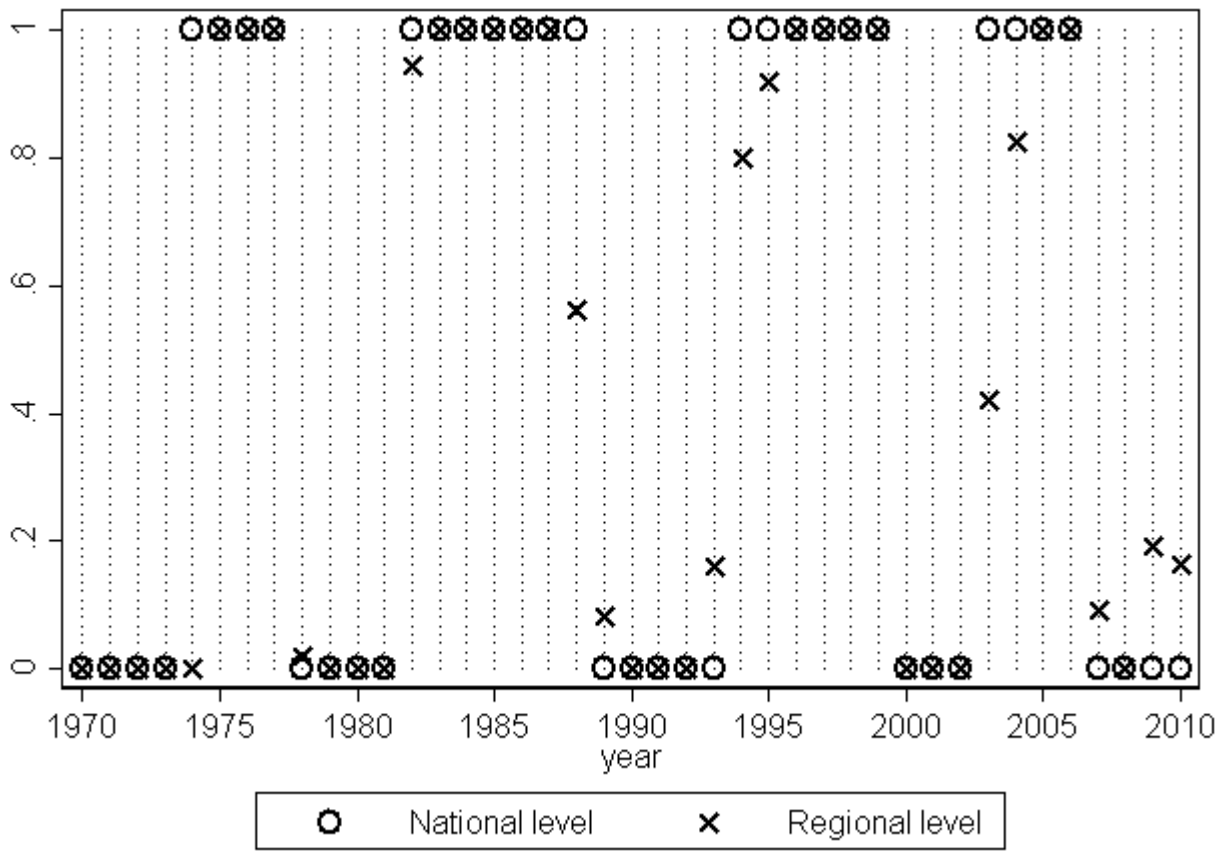
Source: NEPS:SC6:5.1.0

FIGURE A.1. Regional Business Cycles.



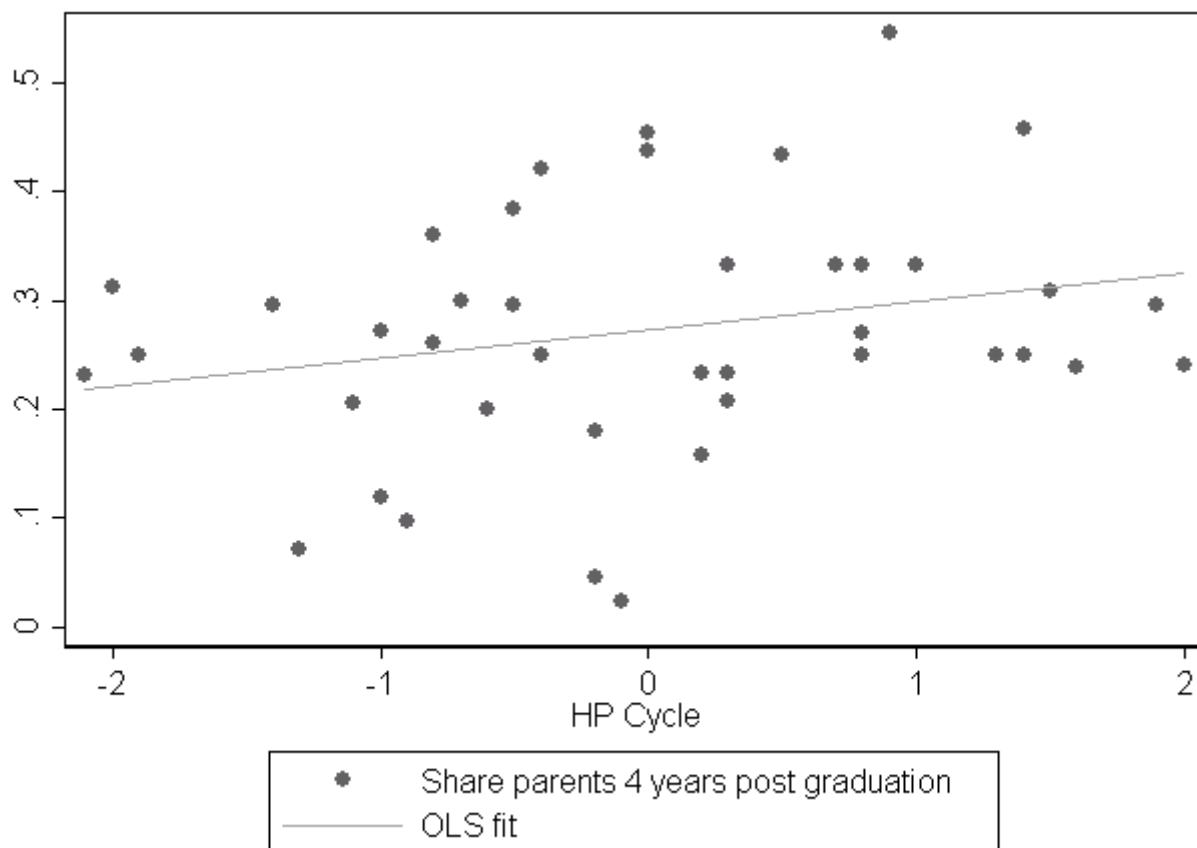
Notes: Figure depicts Hodrick-Prescott filtered cyclical component of state unemployment rate. Economic downturn: cyclical component > 0. Source: Data from Federal Employment Agency

FIGURE A.2. Average State Level Downturn Indicators.



Notes: National level (West Germany): dummy variable of economic downturn used in main analysis. Regional level: average of state level downturn indicators weighted by population size. Source: Data from Federal Employment Agency

FIGURE A.3. Variation of Female Fertility among College Graduates over the Business Cycle.



Notes: Dots depict shares of female graduates of a cohort who were mothers after four years after graduation plotted along the Hodrick Prescott cycle component of the unemployment rate. Line depicts OLS fit from a regression of the yearly share on the HP cycle (beta: 0.026 and robust standard error: 0.013). Source: Data from Federal Employment Agency and NEPS. Own calculations.