The Effect of the Business Cycle at College Graduation on Fertility

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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 graduation increases the transition rate to the first pregnancy among female graduates significantly. We find a stronger effect among older female graduates compared to younger ones. Further, the effect is strongest in the year two to four after graduation and then decreases over time. We also find a higher average number of children born to women who graduated in a recession.

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

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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 labour 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 unfavourable labour market trajectories. Further, a recession at birth and during childhood affects individual mortality later in life (e.g., van den Berg *et al.*, 2006). On the macro level recessions are also 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 and Andersson, 2013; Sobotka *et al.*, 2011) or respond differently to economic shocks. For instance, more highly-educated might postpone fertility in an economic downturn because they are more afraid of losing their jobs than the less educated. 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 labour market in economically bad times or do they use an economic downturn to start a family? Graduating in a recession might influence family formation decisions, for example, by affecting the income situation. Indeed most of the studies on the effects of the business cycle at graduating focus on labour market outcomes. For example, Oreopoulos *et al.* (2012), Altonji *et al.* (2014) or Kahn (2010) find significant adverse effects on earnings or job quality among male college graduates in North America. Recent evidence exploiting exogenous income shocks suggests a positive effect of income on fertility (Black *et al.*, 2013; Lindo, 2010). Thus, income insecurity induced by graduating in a recession might lead to fertility postponement among graduates. However, evidence on the relationship between labour market entry conditions and

parenthood is scarce. Hershbein (2012) does not find graduating from high school in a recession to affect the childbirth probability among women or men, though both sexes experience a temporary wage loss by leaving high school in a recession. Maclean *et al.* (2014) find that men who left school in an economic downturn are less likely to be married and to have children at age forty, whereas women are more likely to be divorced and to have children. Wolbers (2007) investigates the relationship between employment security and family formation of tertiary education graduates in different European countries. Based on 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 parents. Hashimoto and Kondo (2012) find a recession at labour market entry to decrease fertility among less-educated Japanese women, but to increase fertility among the higher educated ones. Kondo (2012) finds that bad labour 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 to long-run differences between the ones who experienced adverse labour market conditions and those who did not. In sum, a growing number of studies addresses how the business cycle at labour market entry affects individual life courses, but the evidence on its fertility effects is sparse and the results are mixed. We study fertility effects for Germany, which is an interesting case, because concerning the generosity of family policies Germany ranges in the middle between the Nordic countries (more generous) and the US and other English speaking countries (less generous) (Gornick and Meyers, 2003). Social policies might buffer economic uncertainties that could otherwise cause individuals to postpone their fertility decisions.

To our knowledge, ours is the first study to analyse the effect of graduating in a downturn on fertility using variation in the business cycle over a long period and focusing 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 labour market prospects decrease their job opportunities and increase economic and employment uncertainty and, thus, fertility decisions may be postponed. Alternatively, bad labour 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 increased rapidly over the past years in all OECD countries (OECD, 2013a), but 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 women have overtaken men in participation in tertiary education in recent years (OECD, 2008), these are alarming facts. We shed light on the question whether college graduates' fertility decisions depend on economic conditions at college graduation.

Our study is also 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, 2005b; Goldstein *et al.*, 2013; Karaman Örsal and Goldstein, 2010; Sobotka *et al.*, 2011). Our study sheds light on the effects of the business cycle on fertility decisions from a micro perspective.

We use survey data from the 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 a stronger effect among older female graduates compared to younger ones. In contrast, transitions to fatherhood are not affected. Further, the effect among women is strongest in the year two to four after graduation and then decreases over time. We also find a higher average number of children born to women who graduated in a recession. Finally, we also address potential mechanisms and find (mostly non-significant) suggestive evidence of a worsened career start of those graduating in a recession.

Theoretical Considerations: Economic Conditions and Fertility

Because economic circumstances form the basic conditions for life, studying the role of economic conditions for fertility has a long tradition. Already Malthus (1798) stated that fertility needs a secure economic foundation. Economic recessions lead to more fragile labour 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 labour 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 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 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 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. Theoretically, their response to economic downturns is not straightforward because there are several reasons for a decrease in fertility as well as for an increase their fertility.

For three reasons this group may respond to economic downturns by *postponing* fertility. First, graduates usually are labour market outsiders without substantial labour 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. Leaving the labour market outsiders position behind will take longer during a recession, 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 job opportunities to become less. Highly-educated individuals, in particular, are likely to show a high labour force attachment and should thus react rather sensitively to losing job opportunities due to childrearing. 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, 2013) and Del Bono *et al.*, 2012 show that job loss due to plant closure decreases fertility.

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 hit by economic downswings because jobs for the low-skilled are often affected first (Sobotka *et al.*, 2011). Second, recent research finds that bad labour 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). Therefore, to circumvent bad labour market conditions, postponing labour market entry through fertility might be an option. Third (and related to the second point), opportunity costs of children for highly-educated individuals are high, but lower in bad economic conditions, when the labour 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 childrearing 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.

We expect some 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. On the one hand, the effect could increase over time, e.g., if the labour 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 previous studies suggest that the effects of labour market entry conditions fade away after several years, we would assume that fertility effects become also weaker (e.g., Oreopoulos *et al.*, 2012).

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 have less time left to postpone having a child. 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.

Finally, we address whether potential tempo effects translate into a quantum effect of fertility. Even if individuals change the timing of their fertility, 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 to decrease during the Great Recession in Europe. Thus, a bad economy at graduation might affect completed fertility.

Data and Method

Data

We use data from the adult sample (Starting Cohort 6 – Adults -Adult Education and Lifelong Learning, doi:10.5157/NEPS:SC6:3.0.0.) of the National Educational Panel Study (NEPS). The NEPS has been initiated to study the determinants and the consequences of education on the individual level (see also Blossfeld *et al.*, 2011).[1] The NEPS data have the advantage of providing a long observation period (covering graduations between 1970 and 2008) 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 labour 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. 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 as van den Berg *et al.* (2006). To disentangle secular trends from cyclical variation of the unemployment rate (provided by the German Federal Employment Agency), we applied the Hodrick-Prescott filter as van den Berg *et al.* (2006), which decomposes the unemployment rate into a trend and a cyclical component (see Fig. 1).[2] We chose a Hodrick-Prescott filter smoothing parameter λ of 100 in our main specification, which is a common value for yearly observations.[3] We built a dummy variable being one if

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

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

[3] 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.

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 1). 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 most observations we have information on the country of graduation but not on a deeper level. Only of around a third of the sample, data on the federal state of graduation is available.[4] Thus, our identification relies strongly on temporal variation of the economic conditions at graduation. Although an analysis that uses variation over time *and* space can be very powerful, for the following two reasons we believe that our main empirical design nevertheless allows us drawing conclusions on the effect of interest. First, although Fig. A.1 suggests some subnational heterogeneity of the business cycle, once accounting for state population sizes, Fig. 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 on the state level weighted by state population size. Second, we expect the national economic condition 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 labour market shocks. These results suggest that rather the national economy than the regional matters for highly-qualified individuals. Analysing regional mobility of individuals who graduated from a German university in 2007, Krabel and Flöther (2012) 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 towards the use of any 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 support that local shocks to some extent are absorbed by migration and that rather the national economy than the regional affects labour market

[4] 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.

outcomes among college graduates. Nevertheless, using the small sample of individuals whose state of graduation is available we will show that our results are qualitatively robust when measuring the regional business cycle.

Out of 11,932 individuals in the sample 2,991 had a university degree. We excluded 578 individuals born in East Germany, because the majority of them studied (at least partly) in the former communist German Democratic Republic. We dropped 334 individuals who already had at least one child when they graduated, and eight individuals with missing year of birth or ambiguous information on education. We excluded 75 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 92 individuals who were interviewed in the year of graduation or the year thereafter for the last time. We dropped eight individuals who were born after 1985 or before 1944 and 83 individuals who graduated before 1970 or after 2008 to avoid small birth and graduation cohorts in our data. Finally, to reduce heterogeneity we dropped 49 individuals whose (partners') pregnancy started in the year of graduation and 85 individuals who were either younger than 22 years or older than 35 years at graduation. Our final sample contains 726 women and 953 men. 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 build the month of conception by subtracting nine months from the month of birth.

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 rate to parenthood (Adsera, 2005a; Hashimoto and Kondo, 2012; Skirbekk *et al.*, 2004). Using duration analysis allows us to analyse data 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:

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

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):

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

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.

Note that besides age, X_1 contains the trend of the unemployment rate at graduation, age at graduation (squared) 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 their year of graduation. If individuals do so, then δ will still be unbiased if they do *not* take into account their labour market opportunities, i.e. if they time their degree according to their fertility plans but independently of the labour market situation. Second, booms and busts may absorb different individuals from universities. On the one hand, for instance,

ambitious individuals may speed up studies at the beginning of a boom to enter the labour 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 labour 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 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, for example 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 behaviour. 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 in terms of several relevant variables including duration of studies and high school graduation degree. Furthermore, following Oreopoulos *et al.* (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 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 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.

Results

Before turning to the estimation results, we present selected descriptive statistics. To strengthen our line of 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 those not graduating in an economic downturn

Descriptive Statistics

In our sample women were on average 25.3 and men 26.3 years old when they graduated (Table 1). Women are younger at graduation most likely because of military or social service which was compulsory for young men but not for women and lasted between nine and 20 months during our observation period. 65.8% of the observed women and 57.7% of the observed men graduated from a university as opposed to an applied science university. Note that in earlier years of our observation period, when the unemployment rate was lower, more men than women graduated from university (not shown) and, thus, the trend unemployment rate was 7.6% on average in the years in which women in our sample graduated and slightly lower in the years men left university (7.4%). Around 55% of our sample graduated in a downturn.

Figure 2 depicts that almost 70% of both, female and male graduates, have at least one child 14 years after graduation. The graphs show that the cumulated transition rate to the first child of treated women is above the rate of untreated women, suggesting that women who graduate in a downturn have a faster transition to the first birth over several years after graduation. In contrast, treated males' cumulated transition rate to fatherhood is slightly below that of their untreated counterparts in the first eight years after graduation.

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 standard errors are clustered at the level 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 (Grade Point Average). 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. 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 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.

Main Estimation Results

Turning to the estimation results, we find 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 63% ((exp(0.491)-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 6.8% per year (not shown), this effect means an increase to a transition rate to first parenthood of 11.1% per year. The second result is that men do not respond to the business cycle in terms of their fatherhood timing.

Beside our main specification 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 of 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 business cycle 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.

Sensitivity

In this section, we assess the sensitivity of our results and show that our main results are robust towards several checks (Table A.2). First, we used a predicted year of graduation instead of the observed similarly to Oreopoulos *et al.* (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 decreases and just misses the 10% significance level, our main finding seems qualitatively robust. Second, 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 Table 2), birth cohort dummies (1960s; 1970s and 1980s; with 1940s and 1950s as reference) and the duration of studies. By including these variables, the main effect among women becomes somewhat larger, but in general, the results do not change considerably. 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 towards using the GDP as a measure of the business cycle. Moreover, we use the continuous HP cycle as measure of the strength of the business cycle instead of a binary downturn indicator and find a positive significant effect on the transition rate to the

first pregnancy for women as expected. Sixth, instead of the downturn indicator based on the national unemployment rate, now we use an average of the downturn indicators on state level weighted by the state population size (as plotted in Fig. A.2) to approximate the probability of a downturn in the state of graduation. The results do not change considerably. Finally, based on the subsample of which the state of graduation is available we show that our results are qualitatively robust towards using a downturn indicator based on the state level unemployment rate. Note that precision of these estimates suffers because the sample size drops to around a third.

Time-Varying Effect

In the model used so far we assumed the effect of the business cycle at graduation on fertility as being constant over time since graduation. 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. [5] These findings are qualitatively robust towards using alternative time intervals (Table A.3).

Effect Heterogeneity by Age at Graduation

To account for differences by age of graduation, we interact the downturn indicator with a dummy variable indicating age at graduation below 25 years (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 127%. These results are qualitatively robust using 23, 25, 26 or 27 as threshold age (not

[5] We used Wald-Tests to assess differences between coefficients (Table A.4). The results of these tests suggest, e.g., that the treatment effect is significantly different in the first year compared to the next interval.

shown). We also tested for effect heterogeneity by birth cohort but cannot reject the null-hypothesis of no effect difference between birth cohorts.[6]

Quantum Effect

Our analysis 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 cut-off age).

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 do find positive effects for older female graduates: women who graduated in a downturn aged above 24 years on average had significantly more children at ages 35 and 45 (Table 6). For example, women of this age group who had graduated in a downturn on average had 0.385 more children at age 45. Against a baseline of 1.27, this marginal effect amounts to an increase of around 30%.[7]

Potential Mechanisms

Because individuals often decide simultaneously about labour market participation and fertility, we investigated the labour market entry situation of the ones who graduated in a downturn and the ones who graduated in better times.[8] More specifically, we explored whether the fertility effect we have found for women comes along with a decreased employment probability and increased unemployment incidences in the first three years of potential post-university work experience by contrasting the shares in different employment status between the treated and the controls. Additionally, we ran regressions of the binary status indicator at monthly level on the treatment dummy and included control variables. We present the results in Figures 3, 4 and 5 separately for women and men and for two different age groups ($< / \geq 25$ years at graduation).

We find, first, graduating in a recession comes along with somewhat higher monthly unemployment probabilities for men and women in the year after graduation. However, these

[6] Results are available on request.

[7] Note, however, that these results are based on the sample of women who already had turned 40 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.

[8] Because the information is surveyed retrospectively making measurement errors - especially regarding employment spells far in the past - more likely, we interpret our findings with caution. Nevertheless, individuals likely use the graduation date as an anchor event to remember the subsequent years. Therefore, we are optimistic about the data quality regarding the employment information.

differences are not statistically significant for women and only significant for men in some of the months (Figure 3). Second, the only group whose monthly fulltime employment probabilities are decreased due to a recession at career start is older male graduates: here we find fulltime employment significantly reduced throughout the first year after graduation (Figure 4). Third, we find that the probability of holding a job that requires a university degree is slightly (but not significantly differently from zero) lower among older female recession graduates compared to their non-recession counterparts. Further, for older male graduates we find clearly reduced monthly probabilities of holding an adequate job during the first post-graduation year (Figure 5). These differences might indicate that graduating in a recession reduces job quality.

To test whether any monthly differences added up to significant differences within yearly intervals we ran additional regressions (Table 7). Again, the dependent variable is a binary status indicator at monthly level. For women, within the first two years after graduation, neither did we find any significant differences in the fulltime employment probability, nor in the unemployment probability, nor in the probability of holding an education adequate job. However, in the third year, older female recession graduates are significantly more likely unemployed than boom graduates. For men, our results indicate, first, that graduating in a recession increases the unemployment probability in the first year after graduation. Second, older male recession graduates are on average 7.9%-points less likely fulltime employed in the first year of potential experience and on average 13.2%-points less likely in an adequate job. Against baselines of 61% and, respectively, 62% these are economically significant effects. Finally, in our sample, men who graduated in a recession catch up with their counterparts after the first year in terms of the three employment outcomes we have analysed. In other words, we do not find evidence for longer run effects for men.

In sum, our data do not clearly support the hypothesis of a worsened career start that may have induced the fertility effect among older female graduates. Nevertheless, we find some suggestive evidence that labour market entries of male university graduates in a recession are harmed in terms of job quality in the year after graduation.

Conclusion

Graduating from university in a downturn may affect family formation. 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. Using survey data from Germany we explored these hypotheses. Germany is an interesting case to study, because birth rates for the past decades have been particularly low.

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 first parenthood. We do not find consistent evidence for 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. 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 did not find effects to differ by birth cohort, among women the age at graduation matters: younger women did not change their fertility behaviour 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. Furthermore, we addressed the quantum effect of graduating in worse times and found that woman who graduated at age 25 or older on average had more children at age 45 compared to the counterparts who graduated in better economic times.

Might the fertility effect for women have been driven by a worsened career start? To address this question we analyse the probabilities of being unemployed, of being fulltime employed, and of holding a degree adequate job by the business cycle at graduation. The evidence suggests that older male graduates' career start might have been harmed in terms of job quality. These results are qualitatively in line with Altonji *et al.* (2014). Yet, the differences we have found were not significantly different from zero for women. Therefore, future research might readdress this question, potentially based on data that are more powerful regarding employment histories.

Our findings are qualitatively in line with Kondo (2012) who finds bad labour market conditions in youth for women relative to men to speed up entry into first motherhood. In contrast to our evidence, she does not find these temporal effects to translate into a quantum effect for women by their mid-thirties. Moreover, our findings are in contrast to Hershbein (2012) who does not find evidence that graduating high school in a recession affects the first childbirth probability of women in the years after having left school. However, whereas Hershbein (2012) studies high school graduates, in our analysis we focused on college

graduates. Maclean *et al.* (2014) find that men who left school in an economic downturn are less likely to have children at age forty, whereas women are more likely to be divorced and to have children. However, these results are driven by the responses of low-skilled individuals. Hashimoto and Kondo (2012) show that fertility reactions to downturns at the time of labour market entry differ by educational status. Our findings are qualitatively in line with their finding that a recession at labour 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 recession 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, women leaving school in a bad economy might reconcile home production and work, what might protect them from career stress leading to bad health.

Our findings suggest that highly-qualified labour market entrants do not primarily base their fertility choices upon economic security and income considerations. These results are in contrast, e.g., to findings by Black *et al.* (2013) and Lindo (2010) who find a positive income effect on fertility. Our results indicate that female university graduates, instead, rather 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. What might explain these results? First, 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 among them than among the groups investigated in other studies. Second, country specific social policies might explain why we did not find evidence of an income effect for university graduates in Germany: for example compared to the US, Germany has not only more generous social policies targeted at families with small children (e.g., Gornick and Meyers, 2003), but also is the unemployment benefit system in Germany more generous than in the US (e.g., Martin, 1996). These policies might contribute to buffering economic uncertainties that could otherwise reduce fertility.

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 labour 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 for university graduates in Germany that highly-qualified men do not respond to adverse labour market entry conditions. In contrast, highly-qualified women on average have a higher fertility compared to their counterparts who entered the labour market in economically better times.

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Tables and Figures

Table 1: Summary Statistics of Control Variables

	Women		Men	
Age at graduation (in years)	25.3	(2.4)	26.3	(2.4)
University degree (in %)	65.8		57.7	
Trend unemployment rate (in %)	7.6	(2.0)	7.4	(2.2)
Downturn at graduation (in %)	57.2		55.0	
Number of observations	726		953	

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

Table 2: Sample Means of Graduation Cohorts by Treatment Status

	Women			Men		
	Treated	Control	P-value of t-test	Treated	Control	P-value of t-test
Own profession:						
Industry	0.04	0.05	0.33	0.26	0.23	0.43
Science and technique	0.09	0.10	0.69	0.17	0.15	0.32
Administration (private sector)	0.18	0.18	0.91	0.15	0.14	0.58
Health, social sector, education	0.43	0.41	0.62	0.17	0.18	0.82
Arts and social science	0.18	0.18	0.94	0.10	0.13	0.24
Parental profession:						
F: Employee (white collar)	0.41	0.41	0.94	0.44	0.41	0.45
F: Civil servant	0.25	0.22	0.26	0.16	0.19	0.19
F: Self employed	0.19	0.23	0.24	0.19	0.19	0.87
M: Not employed	0.36	0.31	0.32	0.30	0.28	0.75
M: Employee (blue collar)	0.08	0.06	0.24	0.16	0.13	0.14
M: Employee (white collar)	0.41	0.45	0.36	0.40	0.42	0.47
Age at graduation (in years)	25.46	25.11	0.30	26.33	26.25	0.79
University[a]	0.70	0.60	0.00	0.55	0.60	0.12
High School Diploma GPA[b]	2.34	2.29	0.45	2.30	2.35	0.41
Duration of studies (in months)	57.24	54.12	0.13	59.55	57.81	0.38
N(persons)	415	311		524	429	

Notes: Standard errors are clustered at the year of graduation. [a]Reference category: applied university. [b] Due to missing values sample size reduces to 486 (women) and 563 (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	0.491**	(0.163)	0.069	(0.142)
Trend unemployment rate	-0.244**	(0.088)	-0.161*	(0.069)
Current downturn	0.067	(0.072)	0.092	(0.066)
Current trend unemployment rate	0.133	(0.092)	0.096	(0.071)
Log years after graduation	1.311***	(0.121)	1.139***	(0.084)
Age	1.730**	(0.605)	0.164	(0.466)
Age squared	-0.031**	(0.012)	-0.001	(0.009)
University	0.125	(0.165)	-0.012	(0.147)
Constant	-31.415***	(7.752)	-10.117	(6.153)
μ_2	4.295*	(1.975)	3.464***	(0.256)
Logit coeff. of p(μ_2)	0.841***	(0.138)	0.738***	(0.160)
BIC	3,063		4,257	
AIC	2,989		4,180	
N(persons)	726		953	
N(years)	6,056		8,325	

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

Table 4: Time-varying Effects

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	-0.016	(0.240)	0.146	(0.199)
Downturn * year 2-4	0.600***	(0.152)	0.121	(0.140)
Downturn * year 5-7	0.474*	(0.205)	-0.034	(0.200)
Downturn * year >7	-0.190	(0.294)	0.135	(0.264)
Trend unemployment rate	-0.108	(0.082)	-0.165*	(0.071)
Current trend unemployment rate	0.045	(0.088)	0.099	(0.072)
Current downturn	0.121†	(0.074)	0.073	(0.068)
Log years after graduation	1.201***	(0.150)	1.170***	(0.108)
Age	1.260*	(0.563)	0.145	(0.461)
Age squared	-0.023*	(0.011)	-0.001	(0.009)
University	-0.025	(0.158)	-0.007	(0.150)
Constant	-34.241***	(7.112)	-9.944	(6.103)
μ_2	13.652***	(2.415)	3.508***	(0.250)
Logit coeff. of $p(\mu_2)$	1.123***	(0.162)	0.729***	(0.165)
BIC	3,076		4,282	
AIC	2,982		4,184	
N(persons)	726		953	
N(years)	6,056		8,325	

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

Table 5: Effect Heterogeneity by Age at Graduation

	Women		Men	
	Coeff.	S.E.	Coeff.	S.E.
Downturn * Age at Grad< 25	0.155	(0.219)	-0.249	(0.364)
Downturn * Age at Grad≥ 25	0.820***	(0.232)	0.031	(0.148)
Age < 25	0.642†	(0.360)	-0.415	(0.336)
Trend unemployment rate	-0.217*	(0.089)	-0.121†	(0.069)
Current downturn	0.073	(0.073)	0.100	(0.066)
Current trend unemployment rate	0.099	(0.096)	0.059	(0.069)
Log years after graduation	1.365***	(0.128)	1.145***	(0.090)
Age	2.062**	(0.740)	-0.694	(0.735)
Age squared	-0.037**	(0.014)	0.013	(0.013)
University	0.067	(0.165)	-0.041	(0.150)
Constant	-36.579***	(10.037)	20.73	(10.219)
μ_2	4.339*	(1,958)	3.646***	(0.267)
Logit coeff. of p(μ_2)	0.841***	(0.141)	0.820***	(0.165)
N(persons)	726		950	
N(Years)	6,056		8,325	

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 * Age at Graduation $<$ 25 vs. Downturn * Age at Graduation $\geq$ 25: women -0.665*(0.31), men -0.28(0.373).
†p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001

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.
	Women					
<25 years	-0.088	(0.161)	-0.007	(0.154)	-0.146	(0.170)
R^2	0.013		0.027		0.020	
Baseline	1.49		1.70		1.68	
N(persons)	241		214		177	
≥25 years	0.241*	(0.112)	0.189	(0.150)	0.385*	(0.160)
R^2	0.100		0.069		0.062	0.100
Baseline	0.91		1.25		1.27	
N(persons)	351		305		211	
	Men					
<25 years	-0.036	(0.180)	0.157	(0.192)	0.271	(0.177)
R^2	0.045		0.038		0.046	
Baseline	1.22		1.43		1.55	
N(persons)	189		175		156	
≥25 years	0.088	(0.069)	-0.021	(0.095)	-0.015	(0.142)
R^2	0.079		0.059		0.027	
Baseline	0.84		1.34		1.46	
N(persons)	642		568		434	

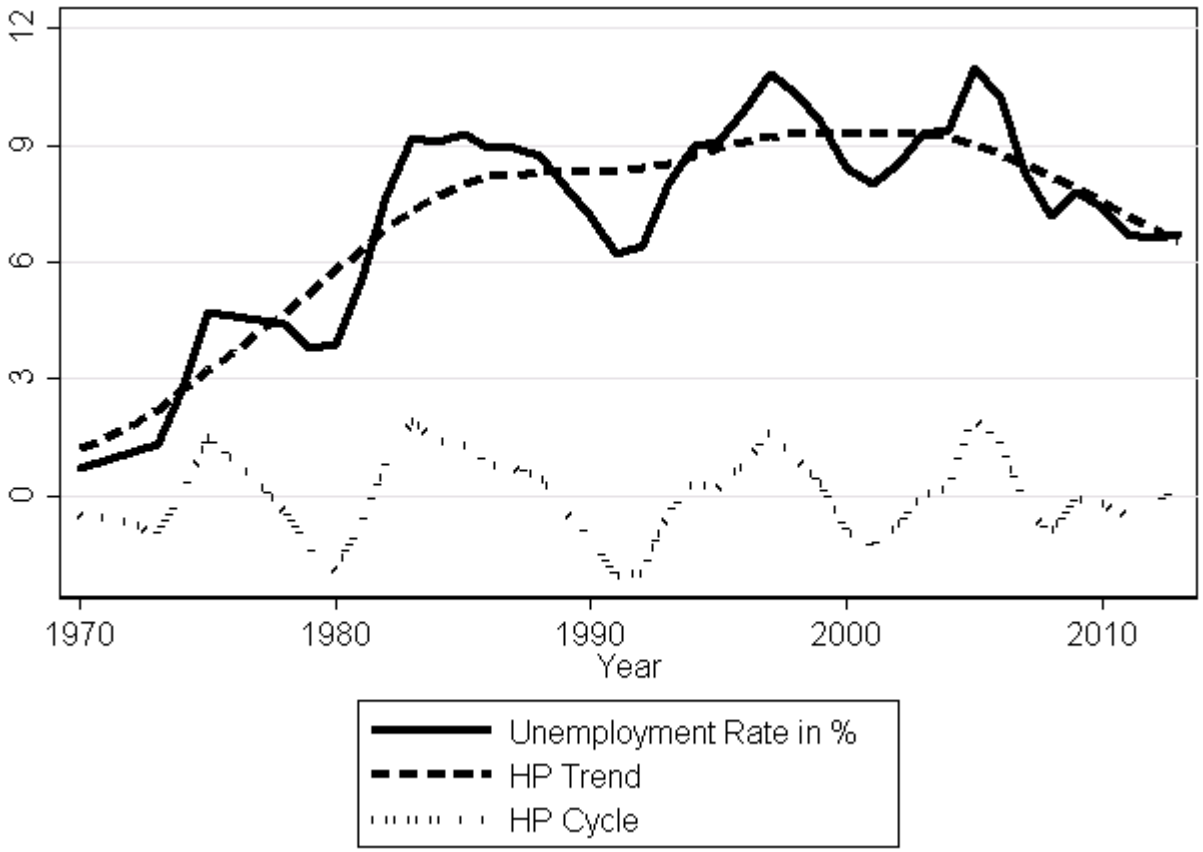
Notes: Table lists coefficient of the dummy variable *downturn* of OLS regressions of number of children born to an individual at a given age for the subsample of individuals below and, respectively, above / equal 25 years at graduation. Baseline: mean number of children of control group (i.e. persons who graduated in upturn). Further control variables (not shown): unemployment rate trend at graduation, age at graduation, age at graduation squared, university, professional dummies, graduation decade dummies. Standard errors are clustered by year of graduation.
†p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001

Table 7: Graduation in a Downturn and Employment Outcomes

	Graduated age <25 years						Graduated age ≥25 years					
Years after Graduation	1		2		3		1		2		3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
	Women											
Unemployment	0.033	(0.027)	-0.012	(0.020)	0.016	(0.019)	0.005	(0.032)	0.004	(0.014)	0.038*	(0.018)
Baseline	0.04		0.04		0.04		0.12		0.04		0.03	
Fulltime Employment	-0.003	(0.057)	0.006	(0.049)	0.028	(0.054)	-0.002	(0.041)	0.002	(0.034)	0.030	(0.037)
Baseline	0.54		0.54		0.62		0.44		0.55		0.61	
Adequate Employment	-0.027	(0.065)	0.022	(0.059)	0.044	(0.055)	-0.045	(0.045)	-0.057	(0.047)	-0.047	(0.051)
Baseline	0.51		0.54		0.68		0.46		0.60		0.72	
Share of Spells Missing	0.10		0.03		0.07		0.09		0.04		0.07	
	Men											
Unemployment	0.033†	(0.020)	0.000	(0.006)	0.008	(0.012)	0.041†	(0.020)	0.004	(0.016)	0.018	(0.013)
Baseline	0.04		0.01		0.01		0.08		0.03		0.03	
Fulltime Employment	-0.012	(0.080)	0.017	(0.080)	-0.015	(0.063)	-0.079*	(0.037)	-0.025	(0.036)	-0.014	(0.042)
Baseline	0.60		0.68		0.74		0.61		0.68		0.73	
Adequate Employment	-0.037	(0.085)	-0.027	(0.095)	-0.058	(0.067)	-0.132**	(0.043)	-0.034	(0.034)	-0.017	(0.035)
Baseline	0.55		0.63		0.73		0.62		0.67		0.74	
Share of Spells Missing	0.07		0.06		0.05		0.07		0.03		0.04	

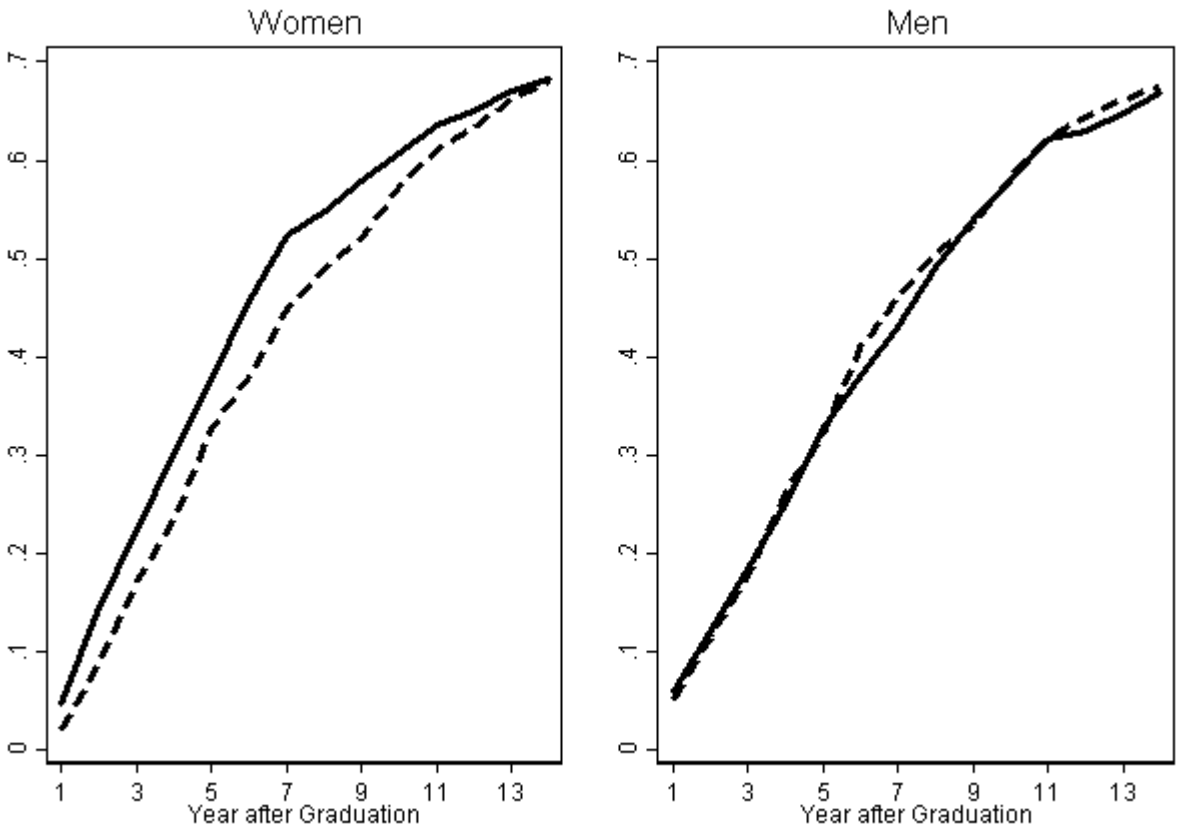
Notes: Table lists coefficient of the dummy variable *downturn* of OLS regressions. Dependent variable is an indicator of being unemployed/ fulltime employed/adequately employed in the year 1/2/3 after graduation. Adequate employment refers to jobs that require a university degree. Results are presented 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

Fig. 1: Unemployment Rate over Time (West Germany)



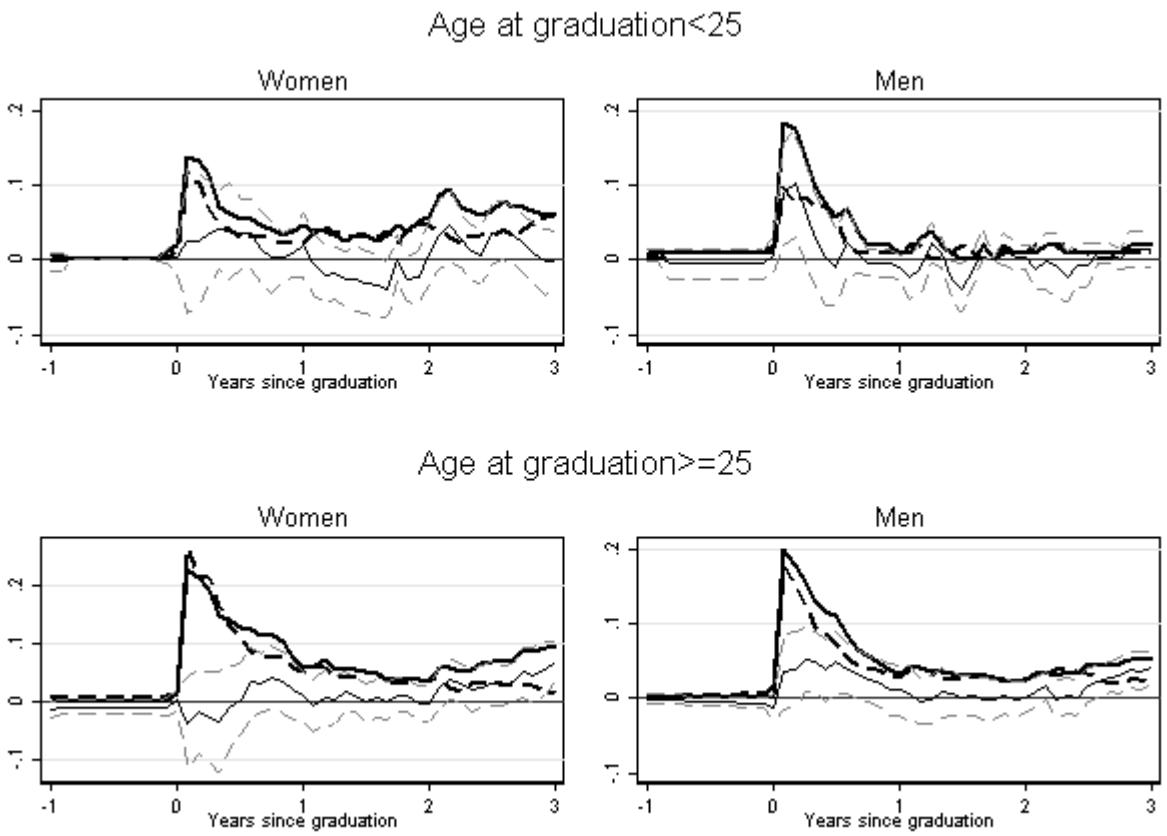
Notes: Hodrick-Prescott filtered trend (HP trend) and deviation of unemployment from trend (HP cycle).
Source: Data from Germany Federal Employment Agency.

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



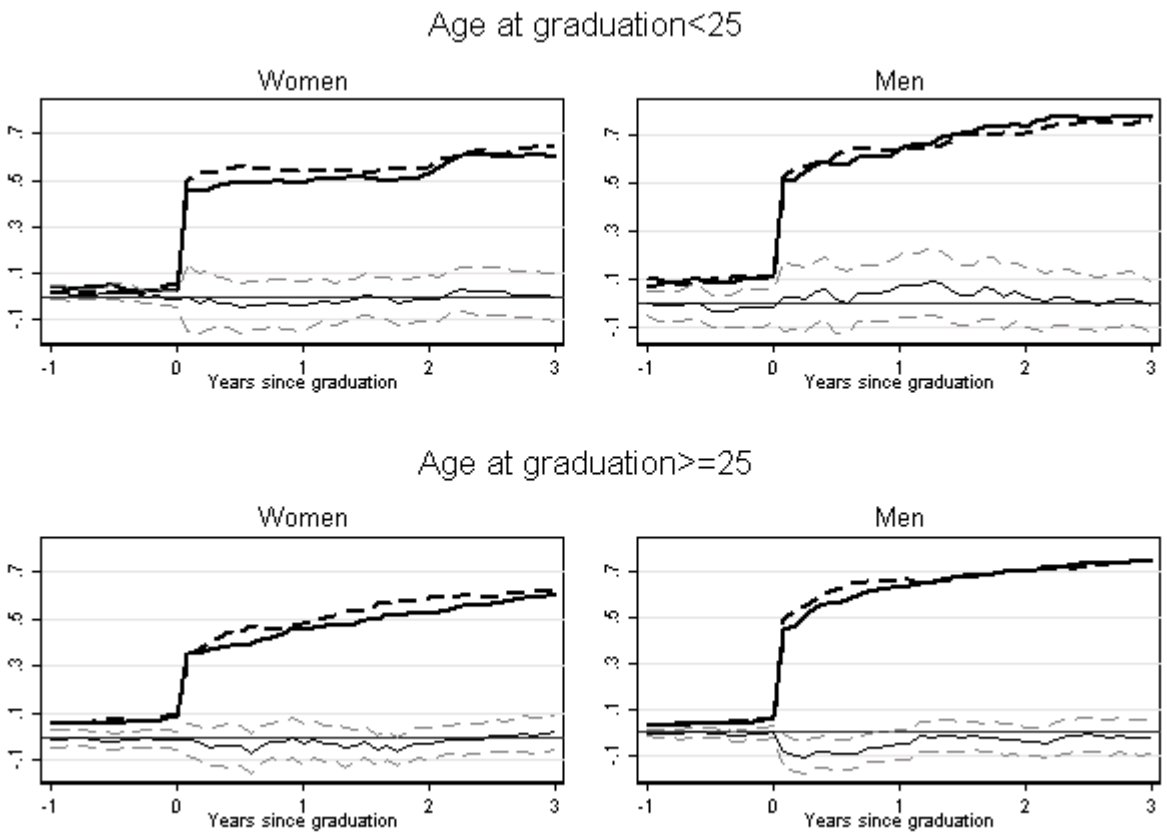
Notes: Solid (dashed) lines indicate cumulated transition rate to first pregnancy after graduation for treated (controls), with treatment being graduation in a downturn.

Fig. 3: Graduating in a Downturn and Unemployment



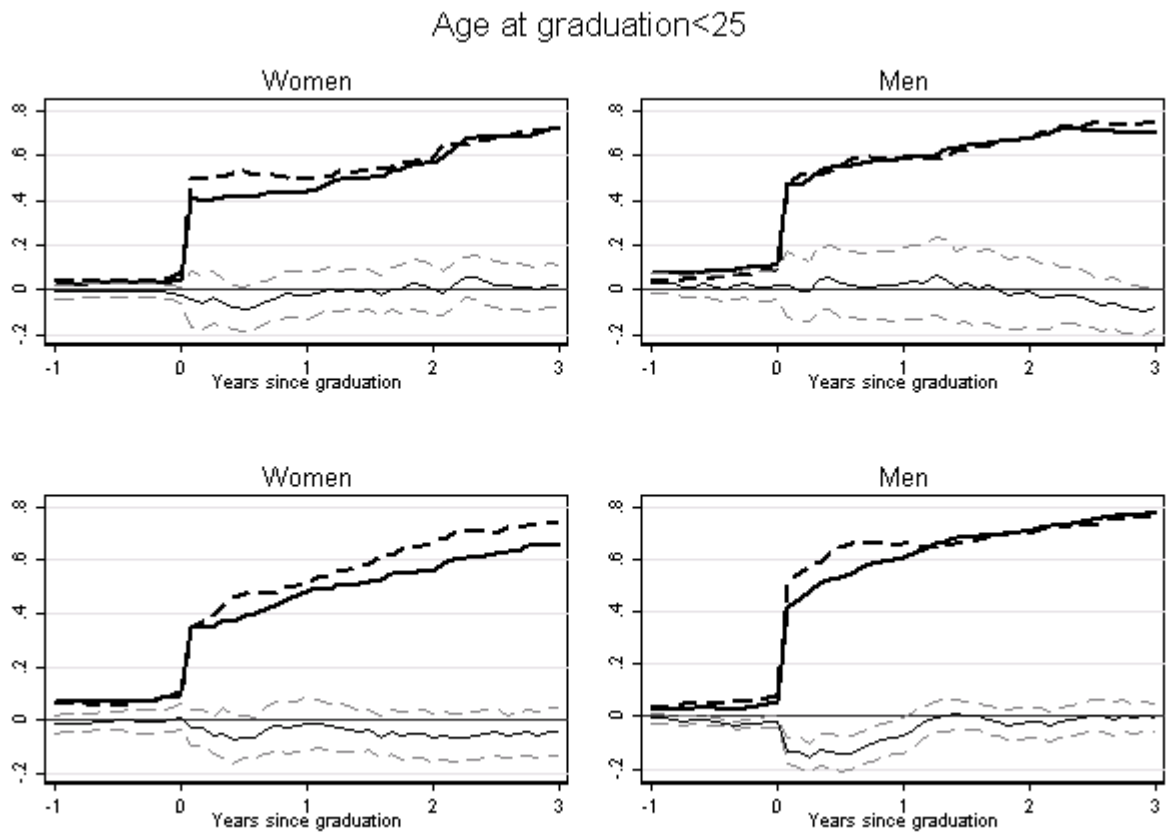
Notes: Solid (dashed) lines indicate shares of full-time employed after graduation for treated (controls) and marginal effects (thin solid line) of graduating in a downturn from regressions of monthly unemployment status on treatment indicator and controls (age at graduation, age at graduation squared, dummies: graduation in 1970-1979; graduation 1980-1989; university degree; graduation calendar quarter) with 90%- confidence bounds.

Fig. 4: Graduating in a Downturn and Fulltime Employment



Notes: Solid (dashed) lines indicate shares of full-time employed after graduation for treated (controls) and marginal effects (thin solid line) of graduating in a downturn from regressions of monthly fulltime employment status on treatment indicator and controls (age at graduation, age at graduation squared, dummies: graduation in 1970-1979; graduation 1980-1989; university degree; graduation calendar quarter) with 90%- confidence bounds.

Fig. 5: Graduating in a Downturn and Adequate Employment



Notes: Solid (dashed) lines indicate shares of unemployed after graduation for treated (controls) and marginal effects (thin solid line) of graduating in a downturn from regressions of monthly adequate employment status on treatment indicator and controls (age at graduation, age at graduation squared, dummies: graduation in 1970-1979; graduation 1980-1989; university degree; graduation calendar quarter) with 90%- confidence bounds. Adequate employment refers to jobs that require a university degree.

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.
						Women						
Downturn y-2	0.118	-0.163										
Downturn y-1			0.297*	-0.151								
Downturn y					0.491**	-0.163						
Downturn y+1							0.340*	-0.151				
Downturn y+2									0.085	-0.157		
Downturn y+3											-0.026	-0.164
Controls	Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	6,056		6,056		6,056		6,056		6,056		6,056	
N(persons)	726		726		726		726		726		726	
						Men						
Downturn y-2	0.018	-0.124										
Downturn y-1			0.08	-0.132								
Downturn y					0.069	-0.142						
Downturn y+1							0.002	-0.145				
Downturn y+2									0.016	-0.127		
Downturn y+3											0.015	-0.128
Controls	Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	8,325		8,325		8,325		8,325		8,325		8,325	
N(persons)	950		950		950		950		950		950	

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

Table A.2: Sensitivity Analyses

Model	S1: Predicted year of graduation		S2: + control variables		S3: HP filter: λ=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.
							Women							
Downturn	0.215	(0.154)	0.563**	(0.197)	0.381*	(0.161)	0.265†	(0.159)	0.154*	(0.068)	0.428*	(0.177)	0.469	(0.435)
Controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	6053		6053		6056		6056		6056		6056		1940	
N(persons)	725		725		726		726		726		726		236	
							Men							
Downturn	-0.053	(0.143)	0.025	(0.171)	0.089	(0.136)	-0.108	(0.136)	0.038	(0.062)	0.177	(0.163)	-0.228	(0.301)
Controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
N(years)	8,264		8,264		8,325		8,323		8,325		8,325		3,354	
N(persons)	944		944		950		950		950		950		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). Bootstrapped standard errors are stratified by year of graduation and clustered by individual.
†p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001

Table A.3: Sensitivity Analysis: Alternative Time Intervals of Time-varying Effect of Graduating in a Downturn on Fertility

	Women				*Men*			
Model	A		B		A		B	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Downturn * year 1	0.044	(0.235)	0.037	(0.241)	0.175	(0.203)	0.151	(0.201)
Downturn * year 2-3	0.680***	(0.155)	0.691***	(0.153)	0.155	(0.149)	0.159	(0.148)
Downturn * year 4-6	0.472*	(0.192)			0.011	(0.172)		
Downturn * year >6	0.248	(0.283)			-0.043	(0.250)		
Downturn * year 4-7			0.459*	(0.193)			-0.011	(0.174)
Downturn * year >7			-0.218	(0.288)			0.137	(0.254)
Log years after	1.247***	(0.155)	1.243***	(0.151)	1.215***	(0.115)	1.175***	(0.110)
Controls	Yes		Yes		Yes		Yes	
BIC	3,081		3,075		4,283		4,282	
AIC	2,987		2,981		4,185		4,184	
N(Years)	6,056		6,056		8,325		8,325	
N(persons)	726		726		950		950	

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

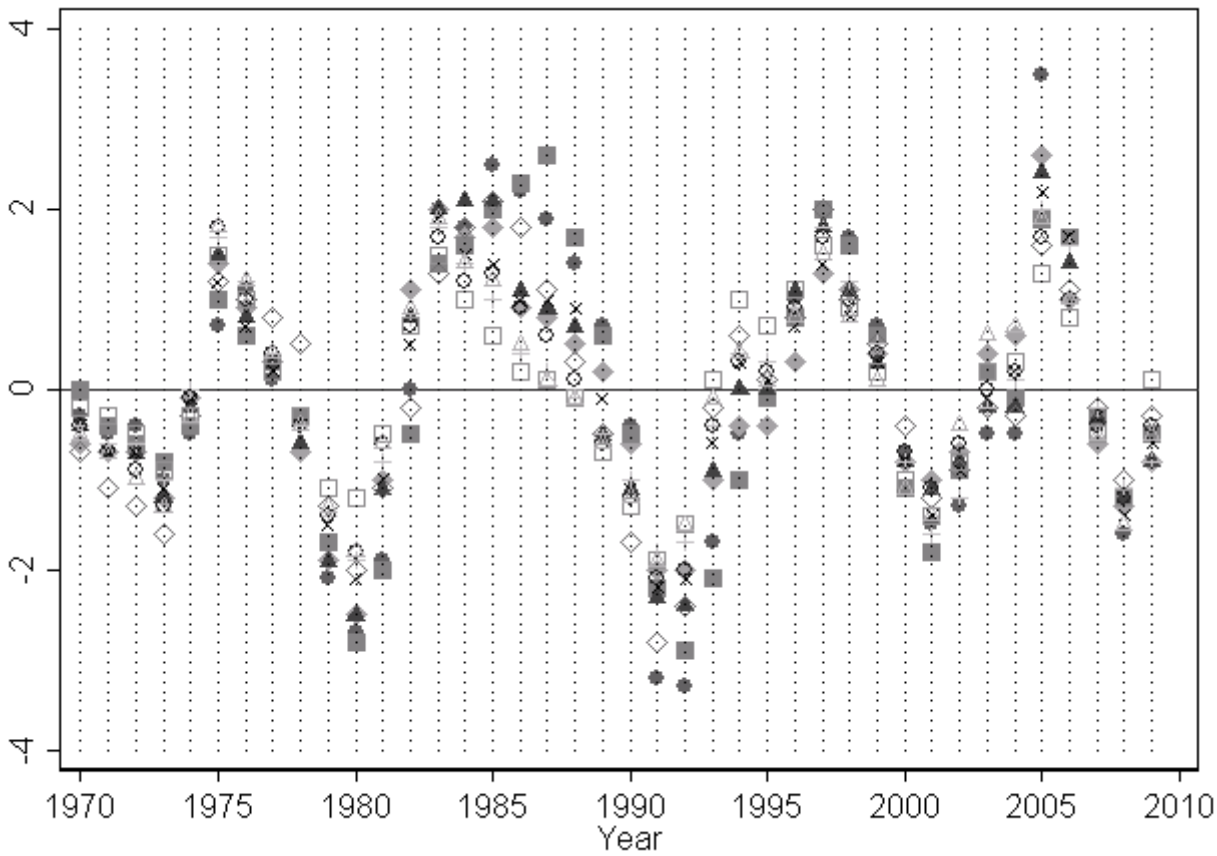
Table A.4: Wald-Tests of Differences in Coefficients

	Downturn * year 2-4		Downturn * year 5-7		Downturn * year >7	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Women						
Downturn * year 1	-0.616*	(0.242)	-0.490	(0.305)	0.174	(0.385)
Downturn * year 2-4			0.126	(0.137)	0.790**	(0.243)
Downturn * year 5-7					0.664***	(0.192)
Men						
Downturn * year 1	0.024	(0.201)	0.179	(0.254)	0.011	(0.306)
Downturn * year 2-4			0.155	(0.136)	-0.014	(0.208)
Downturn * year 5-7					-0.169	(0.153)

Notes: Wald-Tests of differences in coefficients are based on the model presented in Table 4.
†p ‹ .10; *p ‹ .05; **p ‹ .01; ***p ‹ .001

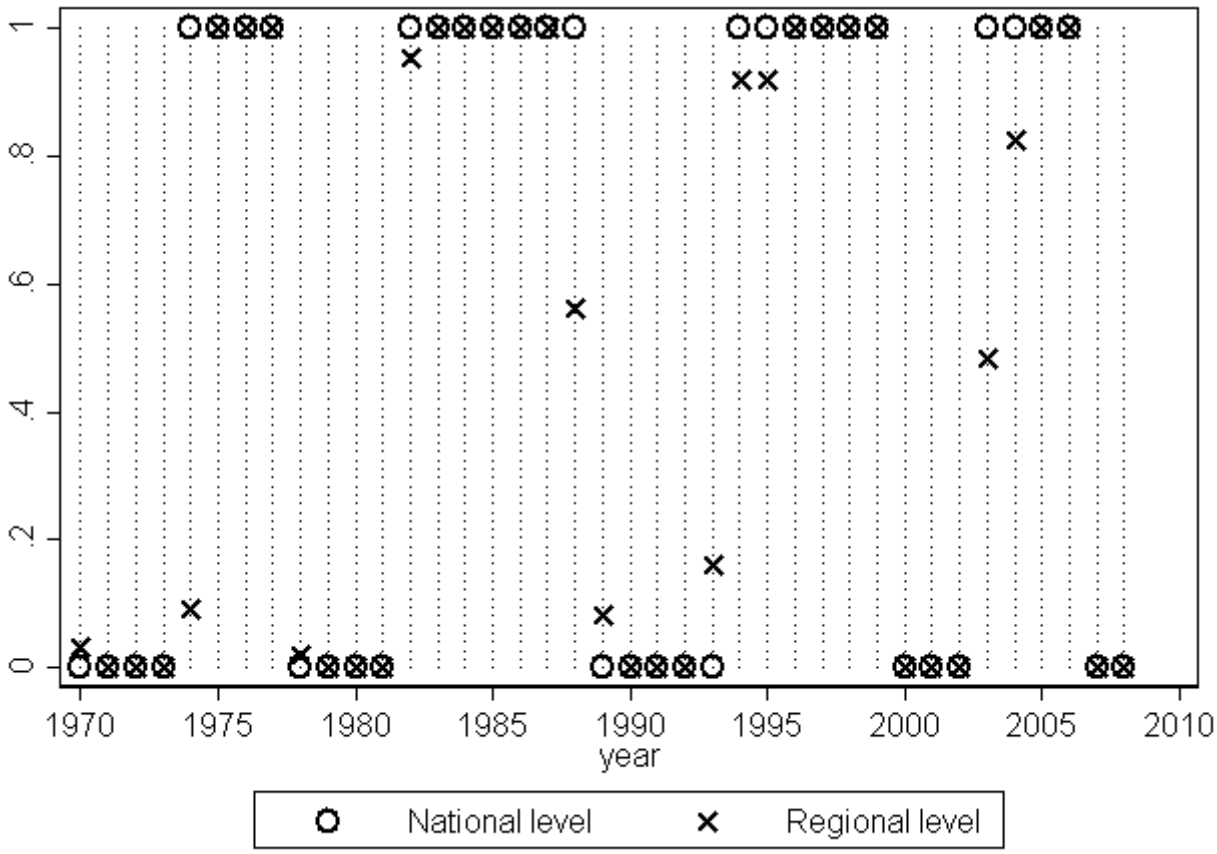
Notes: Figure depicts Hodrick-Prescott filtered cyclical component of state unemployment rate. Economic downturn: cyclical component > 0.

Fig. A.1: Regional Business Cycles



Source: Data from Federal Employment Agency

Fig. 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