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Do You Dare? The Effect of Economic Conditions on Entrepreneurship among College Graduates

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Abstract

I estimate the effect of business cycle conditions on the decision to enter entrepreneurship after college graduation. I proxy for economic conditions at the field of study level, constructed from industry growth rates which I weight to fields of study using employees' industry - college major distribution. This enables to control for unobserved differences between graduation cohorts such as technological change or shifts in cohort composition. Using administrative survey data for Germany, I find that a one percentage point increase in employment growth in the year of graduation raises entry into entrepreneurship by about 30% in the first year after graduation. The effect halves in the second year and is close to zero in the third and fourth year after graduation. Interestingly, exit from entrepreneurship decreases slightly, which suggests that the additional entrepreneurs are fairly stable in the first years after entry. Taken together, my results imply that "lucky" graduation cohorts are persistently more likely to enter and persist in entrepreneurship than "recessionary" cohorts, at least during the first four years after graduation that I examine. My results have relevant implications for policy measures such as startup subsidies, since entrepreneurship is commonly acknowledged as a central source of job creation and economic dynamism.

Keywords: Entrepreneurship, Business Cycles, Higher Education, Occupational Choice, Firm Entry

JEL Classification: L26, E32, I23, J23, J24, M13

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1 Introduction

How does the decision to start a firm vary over the business cycle? While business cycle conditions are well known to affect the economic activity of existing firms (e.g. Moscarini and Postel-Vinay, 2012; Fort et al., 2013), their causal effect on firm creation is poorly understood. This lack of robust evidence is surprising, given that entrepreneurship is commonly acknowledged as a central source of job creation and economic dynamism (Decker et al., 2014). One main reason is that it is difficult to find a controlled setting in which potential entrepreneurs are quasi-randomly exposed to varying economic conditions.

I address this gap by analyzing the individual decision to enter into and exit out of entrepreneurship in the first years after graduation from college in Germany.[1] College graduates represent about 30% of all entrepreneurs, and they are four times more likely than individuals with other professional education to own a firm with more than 50 employees (table 1).[2] Therefore, they constitute a relevant pool of potential entrepreneurs which are disproportionately likely to grow large and contribute to productivity growth and job creation.[3]

At the time of graduation, individuals enter the full-time labor market and choose for the first time between paid employment and starting a firm. I examine how this decision is affected by economic conditions at graduation that are specific to each graduate's field of study.[4] A main advantage is that the specific conditions are arguably unanticipated at enrolment when students select their field. While students may select their field partly based on a general assessment of their employment prospects, they are hardly able to anticipate the specific conditions they will encounter four to six years later at gradua-

[1] My proxy for entrepreneurship is individual level self-employment, which is an early and broad measure of entrepreneurship, since it includes owners of firms of all sizes, including sole proprietors.

[2] Source: German Micro Census. The statistics refer to a sample of employed aged 30 to 60 and are averaged over 2003-2011.

[3] In a recent paper, Levine and Rubinstein (2016) show a positive link between human capital and the likelihood that a self-employed incorporates her firm. They further document that incorporated self-employed are more likely to engage in activities demanding a high degree of nonroutine cognitive skills, such as creativity, analytical flexibility, and generalized problem-solving. These skills are viewed as closely aligned with the Schumpeterian conception of entrepreneurship.

[4] I approximate economic conditions with industry employment growth, mapped to the field of study level using employees' industry - college major distribution.

tion.[5] In a series of robustness checks, I demonstrate that there is indeed no empirical association between student enrolment and field-specific economic conditions in the year of graduation. After controlling for fixed cohort and field effects, I thus obtain exogenous variation in economic conditions at graduation. This identification strategy is closely related to Kahn (2010); Oreopoulos, von Wachter and Heisz (2012) and Altonji, Kahn and Speer (2016), who study the effect of regional business cycle conditions on college graduates' initial earnings path in paid employment.

The effect of changing business cycle conditions on graduates' decision to start a firm is a priori ambiguous. The startup decision is determined by the relative utility from returns to self-employment, compared to the outside options paid employment and unemployment (Lucas, 1978; Kihlstrom and Laffont, 1979).[6] Adverse economic conditions affect the returns from both self-employment and paid employment. On the one hand, lower aggregate demand and higher demand uncertainty decrease the expected level and increase the expected volatility of returns as self-employed. These expected returns need to cover the initial costs of starting a firm, such as capital costs which are at least partially irreversible.[7] Further, costs of capital may rise during recessions due to decreases in bank lending (Siemer, 2014).

On the other hand, a recession's potentially adverse effect on the labor market may lead to declining earnings in paid employment for college graduates (e.g. Kahn, 2010; Oreopoulos, von Wachter and Heisz, 2012). This makes self-employment relatively more attractive. The impact of economic conditions on the start-up decision will depend on the relative magnitude of these two effects, as well as on their perception by the graduate.

Apart from the immediate effect at graduation, initial economic conditions may affect cohorts' subsequent pattern of entry into and exit from self-employment. In particular,

[5] In Germany, the average student completes a Bachelor's degree in 4 years and a Master's or Diploma degree in 5 to 6 years (Statistisches Bundesamt, 2014).

[6] In a related theoretical analysis, Parker (1997) models the effect of aggregate risk on the self-employment choice in a setting where the returns of both self-employment and paid employment are uncertain. Then, the expected effect of business cycle conditions (modeled as changes in aggregate risk) depends on the specific assumptions of its impact in the two sectors.

[7] Note that various types of capital adjustment costs tend to complicate entering on a very small scale and subsequently adjusting the size of the business (Cooper and Haltiwanger, 2006).

graduates from "recessionary" cohorts may delay the investment decision involved in firm entry in order to wait for information about market conditions (Pindyck, 1991). This mechanism may lead to a subsequent reversal of the initial effect.

To obtain empirical evidence on these effects, I use data from the main German administrative population survey (Micro Census) on college cohorts of the years 2003 to 2010. Because the survey contributes to official government statistics, response to most questions is mandatory, which implies high response rates. I analyze entry into and exit out of self-employment in the first four years after graduation as a function of changes in economic conditions in 42 fields of study. I construct field of study specific growth rates from national industry employment growth, which I map into the field of study level using a time-invariant industry distribution of college graduates.[8] The approach relies on the idea that students obtain field of study specific knowledge which prepares them for employment in a particular set of related industries (Liu, Salvanes and Sørensen, 2016). This makes them susceptible for business cycle variation in these industries. To illustrate the approach, figure 1 shows the industry distribution of graduates, aggregated to 9 broad industry sectors, for the 8 largest fields of study. For example, while 45% of graduates from computer science work in the IT sector, only small shares of graduates from other fields do. In consequence, economic conditions of graduates from computer science will be disproportionately affected by conditions in the IT sector. I approximate economic conditions with industry employment growth, since it reflects changes in both business opportunities and labor demand.

The empirical analysis results in the following main findings: first, a one percentage point increase in employment growth at graduation raises entry into self-employment by about 30% relative to the mean in the first year and about 20% in the second year after graduation. This effect is economically significant and reasonable, given and average yearly number of entrants of about 3% among recent graduates. This finding suggests

[8]This measure is closely related to the mapping of national industry employment growth to the state level based on the state industry composition, which was first proposed by Bartik (1991) with the aim of identifying changes in local labor demand.

that college graduates perceive business opportunities as more cyclical than labor market conditions. Another interpretation of the procyclical entry behavior is that college graduates do not view entrepreneurship as an outside option in times of adverse labor market conditions, but as an opportunity of which the payoffs are strongly affected by macroeconomic factors at start up.

Second, economic conditions at graduation have no significant effect on entry in the third and fourth year after graduation. The pattern of coefficients allows for two possible interpretations: on the one hand, initial increases in entry do not occur at the cost of subsequent entry, but indicate additional entry at the cohort level. On the other hand, graduates who decided to take up paid employment due to adverse economic conditions at graduation seem to stick to their initially taken occupational choice. A possible reason is occupational experience that cannot be fully transferred from paid employment to self-employment (Evans and Leighton, 1989; Taylor, 1999).

Third, contemporaneous economic conditions in the subsequent years after graduation have no effect on entry. This underlines that the graduates' self-employment decision is influenced mainly by economic conditions at graduation, rather than by correlated following shocks. This finding is in line with Oreopoulos, von Wachter and Heisz (2012), who find long lasting negative effects of initial adverse conditions on college graduates' earnings even when controlling for subsequent business cycle conditions.

Finally, exit out of self-employment among all graduates is negatively affected in the third year after graduation and insignificant in all other years. Together with the procylical variation of entry into self-employment, this result suggests that college cohorts which graduate under favorable economic conditions are more likely to be self-employed and that this effect persists at least during the first four years after graduation that I examine.

Given that such "missing generations" of entrants are likely to have adverse effects on subsequent job growth during recoveries (Siemer, 2014; Pugsley and Sahin, 2014; Sedlácek, 2015), my finding of a procyclical effect of economic conditions on entry into entrepreneur-

ship has relevance for the design of startup subsidies.[9] In particular, it may be desirable to add a countercyclical element to startup subsidies for promising entrepreneurs, in order to specifically support individuals who would otherwise be tipped into (lasting) paid employment by temporary adverse economic conditions.

The structure of the paper is as follows. The next section describes links to the literature. Section 3 explains the econometric framework and illustrates the data. Section 4 contains the empirical results and shows that they are robust to a number of alternative explanations. Section 5 concludes.

2 Related literature

My analysis mainly relates to three strands of literature. These three strands concern the effect of aggregate economic conditions on the individual-level decision to enter into entrepreneurship, on firm-level entry rates and on college graduates' outcomes in paid employment. In the following section I will show that my analysis helps to reconcile partially contradictory results of the first two strands of literature and offers closely related complementary evidence to the third strand of literature.

First, a large set of studies investigates macroeconomic determinants of the individual decision to take up entrepreneurship. The empirical evidence on the association between the business cycle and self-employment is mixed. Using a panel of 23 OECD countries, Blanchflower (2000) explores the relationship between the national share of self-employed and the unemployment rate, finding both positive and negative associations for subsets of countries. Based on similar data, Koellinger and Thurik (2012) find that the national unemployment cycle tends to positively predict the national self-employment cycle, while there is no association between national GDP and self-employment.

Closest to my paper, Yu, Orazem and Jolly (2014) focus on entrepreneurial entry

[9]Start-up subsidies mostly aim at alleviating financial constraints when entering entrepreneurship (e.g. Jensen, Leth-Petersen and Nanda, 2015; Adelino, Schoar and Severino, 2015) and income risk in case of early failure (Hombert et al., 2014). Solid evidence on its effectiveness is scarce and results depend much on the specific design of the considered intervention (See e.g. Lelarge, Sraer and Thesmar, 2010).

by college graduates. The authors use an alumni survey of a US university to estimate the effect of the unemployment rate at graduation on entrepreneurship. In line with my results, the authors find a procyclical variation of entry in the first years after graduation. One limitation for a causal interpretation of the previous type of studies are unobserved confounders such as national or local policies spurring both self-employment and economic activity.

I contribute to this literature mainly by proposing a novel identification approach of the effect of aggregate economic conditions on entrepreneurship. Rather than investigating cyclical patterns of self-employment in the general population, I focus on college graduates in their first years after graduation. They form a well-defined pool of prospective entrepreneurs, whose composition is arguably exogenous to aggregate economic conditions. My empirical specification allows me to control for cohort, year and field of study fixed effects, thereby holding constant unobserved confounding effects such as shifts in labor supply preferences, technological change or policy shifts. Further, because the year of graduation constitutes a reference year in which a large share of graduates decides about starting a firm, I can investigate whether business cycle conditions create systematic patterns of delay or pre-dating of entrepreneurial entry.

A second strand of related literature uses firm level data to investigate the cyclicality of entry and exit by employer firms. In this literature firm entry is measured as the first appearance of an establishment or firm with at least one employee in the data. Unlike individual level self-employment, this measure of start-up activity accounts for growing small-scale entrants only after they hired their first employee. Using various data sources and business cycle measures, this literature finds clear support of a procyclical association between the entry of employer establishments and different indicators of aggregate economic conditions (see e.g. Pugsley and Sahin (2014) for the entire US private sector and Lee and Mukoyama (2015) for the US manufacturing sector). This procyclical variation of entry by employer firms contrasts with the countercyclical variation of entry into entrepreneurship typically found in the mentioned studies of individual level self-

employment.

My findings for college graduates contribute help to reconcile these different results. As shown in table 1, college graduates are more likely than the general population to start firms that eventually become large, which typically involves irreversible investments at an early stage. The returns from such investments are likely to be procyclical due to fluctuations in demand and capital costs. The same applies to entrepreneurs starting an employer firm or hiring a first employee, rationalizing the procyclical variation observed in the employer firm data. By contrast, the countercyclical variation of individual self-employment often found in the entrepreneurship literature may be largely driven by necessity entrepreneurs who generally do not hire but aim at earning a subsistence income (Schoar, 2010; Hurst and Pugsley, 2011). In consequence necessity entrepreneurs are more likely to have been pushed into entrepreneurship by the countercyclical risk of unemployment (Lamballais Tessensohn and Thurik, 2012; Fairlie et al., 2015).

Third, my paper is related to the literature that investigates the role of cohort effects in the labor market. Early contributions include Baker, Gibbs and Holmstrom (1994) who find lasting effects of aggregate conditions in the year of hiring by a particular firm on workers' wages. More recently, a series of studies investigated the effect of adverse labor market conditions on college graduates' early career outcomes (Kahn, 2010; Oreopoulos, von Wachter and Heisz, 2012; Altonji, Kahn and Speer, 2016). They find consistent evidence that entering the labor market during a recession leads to declines in graduates' earnings which last up to 10 years. The initial effect is driven partially by decreased wages and partially by a reduced ability to find full-time work. The persistence of the earnings effect stems both from imperfect mobility towards better paying employers and a slow cohort wage growth within firms. Liu, Salvanes and Sørensen (2016) find that a large part of the long-term earnings loss is explained by a countercyclical mismatch between college graduates' skills acquired during their studies and the skills demanded by hiring industries.

My paper expands this literature to the entrepreneurial entry decision and shows

that entry is also procyclically affected by economic conditions. The procyclical effect on entrepreneurship is likely to increase the number of graduates who search for paid employment during recessions and decrease it during expansions. This contributes to the earnings effect documented in this literature. Further, in line with the consistently found high persistence of the earnings effect, I show that initial effects on the probability of entering self-employment do not reverse. Together with the unchanged propensity of exit from self-employment, this induces lasting cohort-level differences in the propensity of being an entrepreneur.

3 Empirical strategy and data

3.1 Empirical model

The growth measure I estimate the effect of initial business cycle conditions faced by a college graduation cohort on the decision to become self-employed. Business cycle conditions affect the entrepreneurial entry decision of graduates through changes in the value of both business opportunities and employment opportunities. For identification of the effect of economic conditions, I exploit the fact that fields of study prepare college students for a set of typical employer industries. Graduates who work in an industry which does not demand the skills that they acquired during their studies face considerable earnings losses (Liu, Salvanes and Sørensen, 2016). Building on these costs of skill mismatch, I make use of variation in aggregate economic conditions at the field of study level. To this end, I calculate the industry employment shares of recent graduates from a given field of study as an empirical measure of the relative importance of each industry for a field of study. I then use these shares as weights to build a measure of field of study economic conditions by mapping industry employment growth to the field of study level:

$$growth_{fc} = \sum_j w_f^j \times employment\, growth_{jc}$$

where f indexes one of 42 fields of study, c year of graduation (cohort) and j one of 37 2-digit industry groups spanning all industry sectors. The variable $employment\,growth_{jc}$ denotes the year-on-year growth of the number of employees at the industry level. The variable w_f^j indicates the time-invariant share of graduates up to five years after graduation with field of study f who work as paid employee in industry j (averaged over the sample period). I describe the sample with which the weights are calculated in section 3.2.

This empirical measure proxies for changes in economic conditions in industries which are closely related to each field of study. I focus on employment growth as a proxy for economic conditions because college graduates decide about entering entrepreneurship based on changes in both business and employment opportunities. Unlike GDP growth or the unemployment rate, employment growth proxies for both product market conditions and conditions in the related labor markets.

The construction of the measure builds on Bartik (1991), who isolates local labor demand changes by mapping national industry employment growth to the local level using weights that reflect the local industry composition.[10] Since no field of study accounts for the large majority of employment in a particular industry (appendix table B.1) and *recent* college graduates account for only a small share of overall employment, the constructed proxy is arguably unaffected by recent graduates' labor supply.[11]

The empirical variation in the constructed proxy stems from the combination of differences in the industry composition across fields of study on the one hand and differences in employment growth across industries on the other. To illustrate differences in the industry composition across fields, figure 1, panel (a), shows industry employment shares of German graduates up to five years after graduation, separately for the eight largest fields of study. For example, the information and communication technology (IT) sector attracts about 45% of graduates from computer science, but much smaller shares of grad-

[10]Related measures have been widely used as instrumental variables. See e.g. Moretti (2010); Notowidigdo (2011); Bertrand, Kamenica and Pan (2015).

[11]Unlike Bartik (1991), I cannot exclude the focal field of study from industry employment growth because I rely on publicly available industry employment growth data rather than data at the level of field of study - industry cells. Estimating field-industry employment from micro-data yields estimates that are too noisy due to small sample size and industry classification changes.

uates from other fields. Therefore, the approximated economic conditions of graduates from computer science will be disproportionately affected by employment growth in the IT sector.

Panel (b) of figure 1 shows the differences in employment growth across industry sectors. The sample period covers two economy-wide downturns in 2003-2005 and 2009-2010 and a period of expansion in 2006-2008. While the first downturn followed the bursting of the dot-com bubble, the second recession in 2009-2010 was caused by the global financial crisis. The most cyclical sectors are manufacturing, construction and the service sectors, while the public sector and finance and real estate show little cyclical variation (see also Burda and Hunt, 2011).

This sectoral business cycle variation translates into rich variation in the constructed field level proxy, which I illustrate for the eight largest fields of study in figure 2. As expected, changes in economic conditions in fields such as engineering and computer science are strongly influenced by the growth of the manufacturing and IT sectors, respectively. In contrast, subjects with a large share of employment in the public sector such as law exhibit little cyclical variation.

To the best of my knowledge, I am the first who uses a Bartik measure at the field of study level as explanatory variable. The only study with a related approach is Altonji, Kahn and Speer (2016), who map industry-occupation unemployment rates to the field level and use this measure as dependent variable in an investigation of its cyclical association with the national unemployment rate.

Baseline model specification Using repeated cross-sectional data, I follow cohorts of college graduates over time. Cohorts are defined by year of graduation from college. The baseline model specification is as follows:

$$y_{ifct} = \sum_{n=1}^{4} \beta_{e_n} growth_{fc} \times e_n + \theta_f + \mu_n + \chi_c + \phi_t + X'_{ifct}\gamma + \epsilon_{ifct}. \quad (1)$$

The dependent variable y_{ifct} is entry into or exit out of self-employment for individual

i from graduation cohort c observed in year t with a major in field of study f. The main explanatory variable is the constructed proxy for field-specific economic conditions in the year of graduation, $growth_{fc}$. It is interacted with e_n, which is a set of indicator variables for the first four years n after graduation. The resulting four interactions measure the effect of a change in economic conditions in the year of graduation on entry and exit, depending on the graduate's number of years of potential labor market experience.

Tracking cohorts of graduates from different fields over time allows controlling for unobservable experience, cohort and time fixed effects. Fixed effects for years of potential work experience since graduation μ_n control for the regular evolution of the probability of entry and exit in the first years after graduation. Cohort fixed effects χ_c capture unobserved secular trends and changes in cohort characteristics which lead to permanent shifts of cohorts' self-employment paths. Examples include changes in cohort size or labor supply preferences. Calendar year fixed effects ϕ_t control for macro shocks that synchronously but temporarily move all cohorts off their paths.

Since potential experience is calculated as the difference between the calendar year and the year of graduation, cohort effects, year effects and experience effects cannot be separately identified without an additional restriction (Heckman and Robb, 1985). Because I am mainly interested in the effect of field-cohort specific economic conditions and not the coefficients of fixed effects, I follow Oreopoulos, von Wachter and Heisz (2012) in simply dropping one additional cohort effect from the regression.[12]

Additional covariates are field of study fixed effects and individual characteristics. Field effects θ_f account for permanent unobserved field characteristics such as student characteristics and conditions in related industries. The set of individual level controls X_{ifct} include dummy variables for gender, for having children in the year of graduation, foreign nationality and a dummy which indicates whether the individual graduated from a university or a university of applied sciences. While most traditional German universities have a strong focus on research and theory-based teaching, universities of applied sciences

[12] Alternatively restricting year effects to sum to zero and to be orthogonal to a linear time-trend as suggested by Deaton (1997) leads to identical results.

concentrate on teaching job-related skills. In order to keep with the terminology used in the related literature, I refer to universities as "colleges".

Standard errors are clustered at the field of study level to account for unrestricted error correlation within 42 fields of study, such as serial correlation.

Given the inclusion of experience, cohort, time and field of study fixed effects, the four estimated β coefficients measure changes to the regular path of entry into and exit from self-employment in the first four years after graduation. The identifying variation results from national employment growth in typical employer industries of each field of study, with industry growth being mapped to the field level based on the average employment distribution of graduates as explained above. I interpret the variation in employment growth as a measure of economic fluctuations that is driven by a combination of cyclical demand shocks in related industries that affect both product market and labor market conditions. From the perspective of college graduates, the proxy measures the combined cyclical change in both business opportunities and job finding prospects.

Dynamic specification College graduates' decision to enter or exit entrepreneurship is not only affected by economic conditions in the year of graduation but also by subsequent business cycle shocks. Therefore, the estimates of the specification above measure the combined effect of economic conditions at graduation *and* correlated subsequent conditions. Stated differently, the previous specification may capture the fact that a bad year is likely to be followed by another bad year. In an alternative model specification I also estimate the effect of economic conditions at graduation, net of subsequent business cycle shocks. To this purpose, I additionally control for the contemporaneous effect of field-specific growth in each year after graduation:

$$y_{ifct} = \sum_{n=1}^{4} \beta_{c,e_n} growth_{f,c} \times e_n + \sum_{n=1}^{4} \beta_{c+n} growth_{f,c+n} \times e_n + X'_{ifct}\gamma + \theta_f + \mu_n + \chi_c + \phi_t + \epsilon_{ifct}. \tag{2}$$

In this specification, the added second summation interacts field-specific economic conditions in each of the first four years after graduation, $growth_{f,c+n}$, with a dummy variable for each of the first four years after graduation, e_n.[13] The interaction disaggregates the effect of contemporary growth by years of potential labor market experience.

Identification The model estimates can be interpreted as causal effect of field-specific economic conditions as long as these are unrelated to the field-cohort composition of graduates' unobservable characteristics, conditional on experience, cohort, time and field fixed effects.

There are two particular channels which may create an association of the field-cohort composition with the business cycle. First, individuals may selectively enroll into fields of study if they are able to successfully anticipate field-specific *changes* in economic conditions at graduation. Such anticipation is unlikely, since university education takes several years to complete and business cycle conditions in employer industries vary considerably over time. Second, the cohort composition may bed endogenous in field business cycle conditions at graduation if students strategically postpone or pre-date their graduation to avoid negative earnings effects. While pre-dating graduation is mostly practically infeasible, postponement needs to be weighed against forgone earnings.

In section 4.2, I substantiate the identifying assumption by demonstrating that there is indeed no empirical association between economic conditions on the one hand and student enrolment and graduation on the other hand.

3.2 Data and descriptive statistics

Data source and regression sample I use repeated cross sectional micro data from a comprehensive and large German population survey, the Micro Census. The survey provides several advantages for the purposes of my study: first, it contains information on higher education such as field of study and year of graduation, as well as detailed

[13] Note that $growth_{f,c+n}$ may also be written $growth_{ft}$.

labor market related information. Second, the data is of particular high quality, which is reflected in low non-response rates (response to most questions is legally required) and high comparability of items across survey waves.[14] Finally, the survey is comparably large. Its yearly coverage of between 600,000 and 700,000 individuals (about 1% of the German population) enables to combine individual level outcomes with rich variation in economic conditions at the field of study - cohort level.[15]

I work with data from the survey years 2003 to 2011, since consistent information on college education is available only from 2003 onward. Graduation cohorts are defined by year of graduation from college. I use an unbalanced sample of graduates in the first through fourth calendar year after graduation from cohorts 2003 to 2010. The results hold when using a balanced sample of cohorts 2003-2007 in which all graduates can be observed during the first four years after graduation (table B.2). The main estimation sample includes college graduates who obtain their degree when aged 23 to 32.[16] Further, I drop graduates from PhD programs[17] and fields of study which are closely linked to the primary or public sector.[18] Finally, I drop all individuals who do not respond to all of the survey questions used to construct the used variables. This leads to a regression sample of 20407 graduates in 42 fields of study. Note that the sample includes unemployed, inactive and graduates enrolled in post-graduate education because labor force participation and post-graduate education are affected by the business cycle.

[14]The Micro Census contributes to many official national and EU-level statistics such as the EU Labor Force Survey.

[15]I use the Scientific Use File which contains a 70% sub-sample. See the data appendix A for details.

[16]I exclude very young and old graduates since these are likely to be special cases who either pursued exceptionally short programs or obtained multiple degrees.d 83% of all college graduates obtain their college degree in the used age range.

[17] Note that during the sample period German universities replaced diploma programs with bachelor and master programs, which lead to a decrease in average college duration because not all bachelor graduates move on to a postgraduate degree. However, there is no reason to expect any systematic relationship with the economic conditions in a field's related industries because the timing of degree replacement was mostly determined by long-lasting administrative procedures at the state and university level.

[18]I use a classification of fields of study as provided by the German Statistical Office. See appendix A for further documentation. Appendix table A.2 lists all used field of study.

Construction of the main variables The main dependent variables are constructed as follows. I define entry into self-employment as being self-employed in period t and having been a worker or unemployed in $t-1$ (12 months ago). Exit is defined as being a worker or unemployed in t and having been self-employed in $t-1$. Self-employed are individuals that are (partial) owners of a firm to which they dedicate most of their employment activity. Self-employed individuals may own employer or non-employer firms. The employment status in $t-1$ is asked retrospectively.[19] I code helping family members as workers, but the results are insensitive to this categorization. Table 2 shows sample means of the two main dependent variables in the first four years after graduation. The probability of entry into self-employment in a given year after graduation is highest in the first year (3.6%) and averages to 2.6% in the first four years. The probability of exiting self-employment in a given year is roughly constant at 0.7%.

Mapping industry employment to the field level The above described construction of field-specific employment growth involves a mapping of national industry employment growth to the field of study level. To this purpose, I construct time-invariant field-industry employment weights from the Micro Census data on recent college graduates. I use employment information of graduates in years one to five after graduation, to focus on graduates' typical first employment industries and base the weights on employees rather than all employed because entry into and exit out of self-employment are the outcome variables.[20] As in the regression sample, I restrict the sample to those who obtained their degree aged 23 to 32 and drop PhD graduates. Unlike in the regression sample, I drop individuals in post-graduate education in order to exclude students working alongside their studies. I use graduates surveyed in waves 2008 to 2011 (graduation cohorts 2003-2010), since these waves contain industry information classified by NACE rev. 2. The main advantages of this classification over NACE rev. 1.1 are that it enables a match to administrative industry employment data up to 2014 and provides a finer classification

[19] See appendix A for information on response rates.
[20] The results are not sensitive to either of these restrictions.

of the service sector, which accounts for a large share of high skilled employment.[21] This leads to a weighting sample of 14251 observations.

Administrative industry employment data I take industry employment data from the official publications of the German Statistical Office (Statistisches Bundesamt, 2015, table 3.2.14). It is based on administrative records on the number of employees and is published at the level of 2-digit NACE rev. 2 industries. Because otherwise the number of college graduates in some industry - field of study cells of the weighting matrix is small, I pool adjacent 2-digit NACE rev. 2 industries.[22] This leads to a set of 37 industries. The results are very similar when using the original industry classification (appendix table B.9).

4 Results

4.1 Main results

Entry into entrepreneurship As discussed in the introduction, the effect of economic conditions on the decision to become self-employed is ex-ante ambiguous, since economic booms may increase the value of both business and labor market opportunities. Table 3 shows the corresponding empirical results of model 1. The coefficients reported in column 1 indicate a statistically significant positive effect of field-specific employment growth in the year of graduation on entry into self-employment in the first and second year after graduation. The estimates imply that a one percentage point increase in employment growth leads to a 1.1 and 0.5 percentage point increase (sign. at 1% and 10%) in the probability of entry in the first and second year after graduation, respectively. These effects correspond to substantial relative increases of 32% and 24% over the respective sample means of 3.6% in the first and 2.1% in the second year after graduation. The

[21] The results are similar when creating a set of consistent NACE 1.1 - NACE 2 industry groups and constructing the weighting matrix for individuals surveyed in years 2003-2011 (table B.10).

[22] The joined industries are 1-3, 16-18, 19-20, 22-23, 24-25, 29-30, 31-33, 35-37, 45-47, 49-53, 58-59, 64-66, 77-79, 90-93, 94-97.

coefficients are unchanged when additionally controlling for gender, foreign nationality, children at graduation and the type of university. This suggests that potential changes in the composition of graduates with respect to these characteristics have no effect on the decision to start a firm.

This result implies that from the perspective of college graduates, expected net returns from self-employment vary more strongly over the business cycle than initial earnings in paid employment. Improving market conditions seem to "pull" college graduates into self-employment (Meager, 1992). This result is in line with the positive association between self-employment by the highly educated and local vacancy rates found by Svaleryd (2015) and the well-established procyclical business cycle variation of the number of new employer firms (Chatterjee and Cooper, 1993; Campbell, 1998; Lee and Mukoyama, 2015). The result suggests that highly educated prospective entrepreneurs mainly look for business opportunities which require initial nonreversible investments, rather than small-scale self-employment targeted at providing subsistence income in the long-run. The effect of cyclical demand (Moreira, 2015; Adelino, Ma and Robinson, 2016) and capital availability (Siemer, 2014) on initial investments and growth prospects may then induce the procyclical entry behavior. Taken together, entrepreneurial activity of college graduates is therefore best characterized as opportunity entrepreneurship (Schoar, 2010; Hurst and Pugsley, 2011).

The coefficient estimates for the effect of economic conditions at graduation on entry in the third and fourth year after graduation are economically small and fail standard significance tests. This implies that the entrepreneurial decision in the third and fourth year after graduation is not sensitive to initial business cycle conditions. The pattern of coefficients allows for two interpretations. First, the entry increase in the first and second year does not occur at the cost of a subsequent entry decrease, such as pre-dating of planned entrepreneurship that would have taken place anyway. If this was the case, the coefficient on initial growth should have been significantly negative in the third and fourth year. Second, graduates who decided not to enter due to adverse conditions at graduation

are not more likely to enter in the immediately following periods. This "lock-in" in the initially chosen occupational sector may be due to occupational experience which cannot be fully transferred from paid employment to self-employment. This was also documented in cross-sectional data by Evans and Leighton (1989), who find that the return to wage experience in self-employment is lower than in wage work and lower than the return to self-employment experience in self-employment. Similarly, Taylor (1999) documents that previous time spent in paid employment increases survival in self-employment less than previous time spent in self-employment.

As discussed in section 3, the previous estimates capture not only the effect of economic conditions at graduation but also the combined effect of economic conditions and correlated influences a certain cohort faces over its life cycle, such as a prolonged recession. By directly controlling for contemporaneous growth rates, however, I can isolate the effect of economic conditions at the time of graduation from the effect subsequent business cycle conditions on the entry and exit decision (model 2). The results in column 3 show that growth in years one to four after graduation has no effect on contemporaneous entry into entrepreneurship. When controlling for subsequent growth in our main specification, the coefficients on growth in the year of graduation are very similar to the baseline specification (column 4). I obtain analogous results when I alternatively allow for lagged effects of subsequent growth or include a full set of interacted field-year fixed effects (appendix table B.8). The result underlines that economic conditions at graduation are much more important for the decision to become self-employed than business cycle conditions later in the career. The result is in line with the effects of initial and later economic conditions on the size of firms (Moreira, 2015) and earnings of college graduates (Oreopoulos, von Wachter and Heisz, 2012).

Exit from entrepreneurship In another set of estimations, I evaluate the effect of economic conditions on graduation cohorts' probability to exit from self-employment during the first four years after graduation. As in the entry regressions, I use a sample of

all college graduates in the first years after graduation.[23] Given the procyclical effect on entry into self-employment and assuming that economic conditions at graduation did not systematically affect the stock of self-employed that entered before graduation, the results can be interpreted as change in the probability of failure during the first four years after graduation among college graduates that entered self-employment after graduation.

Column 1 of table 4 refers to the baseline model (i.e. without controls for subsequent growth and without individual covariates). A one percentage point increase in field-specific employment growth in the year of graduation leads to a 0.28 percentage point decrease in exit from self-employment in the third year after graduation (sign. at 5%). Coefficients on the other years after graduation are negative but do not reach statistical significance. The effect in the third year after graduation corresponds to a 30% relative decrease, given the sample mean of 0.7% (as a share of all graduates). Contemporaneous growth has a negative effect on exit in years three and four after graduation (column 3). Adding controls for contemporaneous growth to the estimation of effects of initial economic conditions (model 2) does not significantly change the effect of initial growth (column 4), which points towards a low correlation of economic conditions over time.

There are two mechanisms which may drive this result. The first mechanism is changes in the composition of entering entrepreneurs, such as a procyclical shift towards higher entrepreneurial ability and ambitions which may lead to lower exit rates. The evidence on such cyclical composition changes is mixed. In line with my results, individual level survey data on new self-employed in 22 OECD countries shows that the share of those who indicate to have started their business because they saw a profitable business opportunity rather than seeing entry into self-employment as the only option for work decreases during recessions (Lamballais Tessensohn and Thurik, 2012). On the contrary, firm level data on US employer firms indicates that firms started during recessions are on average more productive and more concentrated in sectors that require a greater amount of technical skill

[23]The repeated cross-sectional data structure and lack of reliable retrospective data on the year of entry into the current self-employment activity prevent me from explicitly analyzing effects of economic conditions on survival of the newly self-employed.

than firms started during economic expansions (Moreira, 2015). The second mechanism is that favorable initial conditions positively influence the businesses' subsequent ability to grow, conditional on the composition of the entering entrepreneurs. Potential mechanisms are faster demand accumulation via the building of a customer base (Moreira, 2015; Foster, Haltiwanger and Syverson, 2016) and weaker financial constraints (Chodorow-Reich, 2014; Siemer, 2014) affecting capital accumulation.

Taken together, the results on entry and exit suggest a procyclical increase in self-employment among college graduates during the first four years after graduation.

4.2 Sensitivity analysis

Robustness The model estimates can be interpreted as causal effect of field-specific economic conditions as long as these conditions are unrelated to the field-cohort composition of graduates' unobservable characteristics, conditional on experience, cohort, time and field fixed effects. In this section, I will discuss two mechanisms which may lead to endogeneity of the cohort composition in economic conditions.

First, students may choose their field of study in anticipation of economic conditions at graduation. This would require that on the one hand prospective students base their field choice to a large extent on expected earnings differences between fields, rather than their tastes and abilities. Recent evidence for France and the US shows that while expected earnings are a small but statistically significant determinant of the college major choice, heterogeneous preferences for particular fields are the dominant determinant (Arcidiacono, 2004; Beffy, Fougère and Maurel, 2012; Wiswall and Zafar, 2015). On the other hand, given the inclusion of field and cohort fixed effects, selection on changes in earnings expectations over the business cycle requires the successful anticipation of changes in field-specific economic conditions at graduation. The large over-time variation of field-specific conditions (figure 2, panel b) and the fact that university education in Germany takes about 4-6 years to complete suggests that the anticipation of economic conditions

at graduation is difficult.[24]

In table 3, I showed that the main estimates remain unchanged when including four observable individual characteristics which account for important aspects of the composition of the graduation cohorts: gender, foreign nationality, the presence of children at graduation and the type of university. Table 5 presents direct estimates of the effect of field-specific growth on these four variables, in order to test for systematic changes with respect to these characteristics and correlated unobservables. The estimates in the first row of table 5 suggest that growth at graduation has no statistically or economically significant effect on the observable characteristics of the graduation cohort. Also the effect of lagged growth, which proxies partially for economic conditions at enrolment and just before the actual graduation, is mostly insignificant and economically small.

To test explicitly for selective enrolment, I regress the number and composition with respect to gender and nationality on field growth in the year of enrolment and future growth rates.[25] Since there is no information on enrolment in the Micro census data, I rely on publicly available administrative data at the level of fields of study (see appendix A.3 for details). The results in table 6 document a significant positive effect of *current* growth in a field's related industries on the number of enrolled first year students, indicating that students select into fields partly based on currently observed employment growth in related employer industries. There is no correlation, however, with *future* growth rates, suggesting that students have difficulties in anticipating economic conditions at graduation. Similarly, the share of females and foreigners among first year students is not significantly associated with future field-specific growth. Related evidence on the selection of college majors based on current business cycle conditions have been found by Blom, Cadena and Keys (2015), who show that students shift to higher-return college majors when economic conditions are worse at age 20.

In line with these results, controlling for lagged economic conditions, economic con-

[24] In Germany, the average student completes a Bachelor's degree in 4 years and a Master's or Diploma degree in 5 to 6 years (Statistisches Bundesamt, 2014).

[25] Gender and nationality are the only two available characteristics.

ditions at age 19 (the typical enrolment age in Germany) or the field-specific cohort size directly in the entry and exit models leaves the main coefficients unchanged (appendix table B.3). Furthermore, the main estimates are not sensitive to controlling for linear field of study trends (appendix table B.4). This implies that first year students do not select their field based on anticipated long-run trends in industry conditions related to the field. Note that once enrolled, students may also change to another field of study in response to economic conditions. Changes beyond closely related fields of study, however, require starting over in the first year - again essentially ruling out any selection on economic conditions at graduation. Changing to a closely related field, which also usually requires taking several additional courses, does not allow to react to business cycle conditions either, since related fields are subject to similar business cycle variation due to a similar employer industry structure.

A second mechanism that may lead to endogeneity of the field-cohort composition to economic conditions is strategic timing of graduation. Students close to graduation may systematically move forward or postpone their graduation date in order to avoid adverse initial economic conditions. Predating graduation is unlikely because of the above described difficulties in anticipating field-specific economic conditions and the fact that it is often infeasible to spontaneously reorganize a college curriculum. The benefit of postponing graduation in response to observed adverse economic conditions at planned graduation has to be weighed against the opportunity cost of forgone earnings.

Information on the students' age at graduation allows to empirically investigate such selective timing of graduation. If it occurred, growth in a given year would probably change the age structure of current and future graduation cohorts. Regressions of graduates' age on field-specific current and lagged growth show no indications of such optimizing behavior (table 7). Indeed, growth at graduation has no economically or statistically significant effect on graduates' age. Consequently, directly controlling for a quadratic polynomial in age at graduation or dummy variables for graduating older than 28 or younger than 25 does not change the main estimates either (appendix table B.5). This

is in line with Oreopoulos, von Wachter and Heisz (2012), who also find no evidence of strategic timing of graduation dates.

Specification checks Next, I document that my results are not driven by selective migration. Wozniak (2010) shows that US college graduates are more likely to migrate to US states which experience positive labor demand shocks. Analogously, young and highly educated international migrants might select Germany as their destination country based on current national demand shocks in industries related to their college education. This would affect the field-cohort composition of young college degree holders. To explore whether this mechanism affects my results, I exclude foreigners who immigrated less than 2 years before graduation from the estimation sample. This restriction ensures that migrants in this restricted sample chose their field of study before migration and are subject to the here considered business cycle variation at graduation. The results remain qualitatively unchanged (table B.6, columns 3-4).

In a final set of regressions, I verify the robustness of my results to the use of alternative industry growth measures. As shown in table B.7, columns 1-2, the results are quantitatively similar when using deviations from long-term trends in the number of employed. To separate the cyclical component of the time-series, I use the conventional Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997).[26] As in the main specification, an increase in the detrended number of employees by its interquartile range leads to rise in the probability of entry in the year after graduation by about 30% relative to the mean.

Further, I obtain very similar results when using the HP-filtered cyclical component of the logarithm of total hours worked (table B.7, columns 3-4). While employment growth constitutes the extensive margin of labor adjustment, changes in hours worked additionally account for adjustments along the intensive margin. Intensive margin labor adjustments featured prominently in German employers' reaction to the 2008-09 economic recession (Burda and Hunt, 2011). The similarity of the empirical results across the various business cycle measures indicates that graduates adjust their entry behavior in response to broadly

[26]Following Ravn and Uhlig (2002), I set the smoothing parameter of the annual data to 6.25.

perceived industry conditions, which all used measures seem to capture.

5 Conclusion

In this paper, I estimate the effect of economic conditions on college graduates' decision to enter entrepreneurship. For identification I make use of the fact that graduates' field of study specific knowledge prepares for employment in particular industries. This enables me to proxy for field of study level business cycle variation using weighted employment growth in closely related employer industries. I find a significant procyclical effect of economic conditions at graduation on entry into entrepreneurship in the first and second year after a cohort's graduation, but no effect on entry in later years. Interestingly, there is no contemporaneous effect of growth in later years, which demonstrates that college graduates' entrepreneurial decisions are mostly influenced by economic conditions at the time of graduation. Exit from entrepreneurship is slightly countercyclical, which points towards persistent effects on cohort-level entrepreneurship. The results suggest that college graduates perceive the value of business opportunities as more cyclical than labor market conditions.

Given the central role of entrepreneurs for job creation and productivity growth, the results are relevant for policies promoting entrepreneurship. In particular, it may be desirable to add a countercyclical element to startup subsidies in order to prevent "missing generations" of promising entrepreneurs.

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6 Figures and tables

Table 1: Share of self-employed with firm of a given size, by professional education

	No college	College
Worker	89.3	82.2
Self-employed	10.7	17.8
with firm size		
1-5	*8.6*	*12.5*
6-49	*2.0*	*4.9*
50+	*0.1*	*0.4*

Notes: The table shows shares of self-employed with a firm of a given size among all employed aged 30-65, by professional education. Firm size refers to the number of employed, including the owner. Data: German Micro Census, pooled over 2003-2009. Survey weights used.

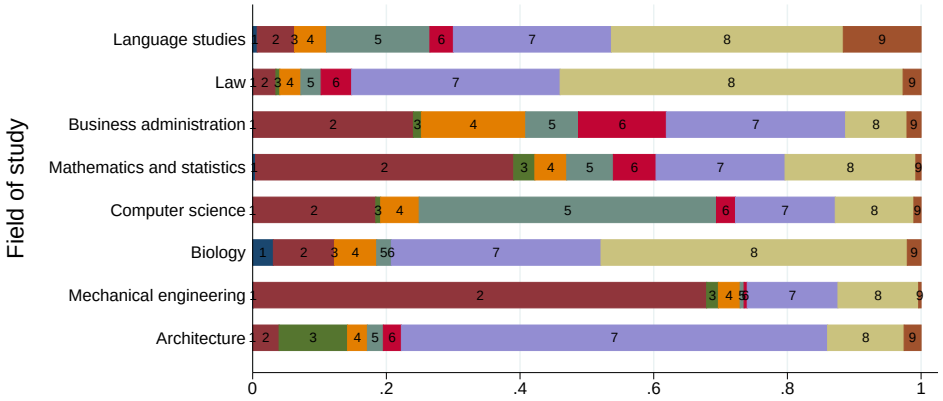
Table 2: Means of dependent variables by years since graduation

Years since graduation	1	2	3	4	Total
	mean	mean	mean	mean	mean
Entry	0.036	0.021	0.021	0.026	0.026
Exit	0.006	0.007	0.007	0.006	0.007
Observations	6456	5720	4604	3627	20407

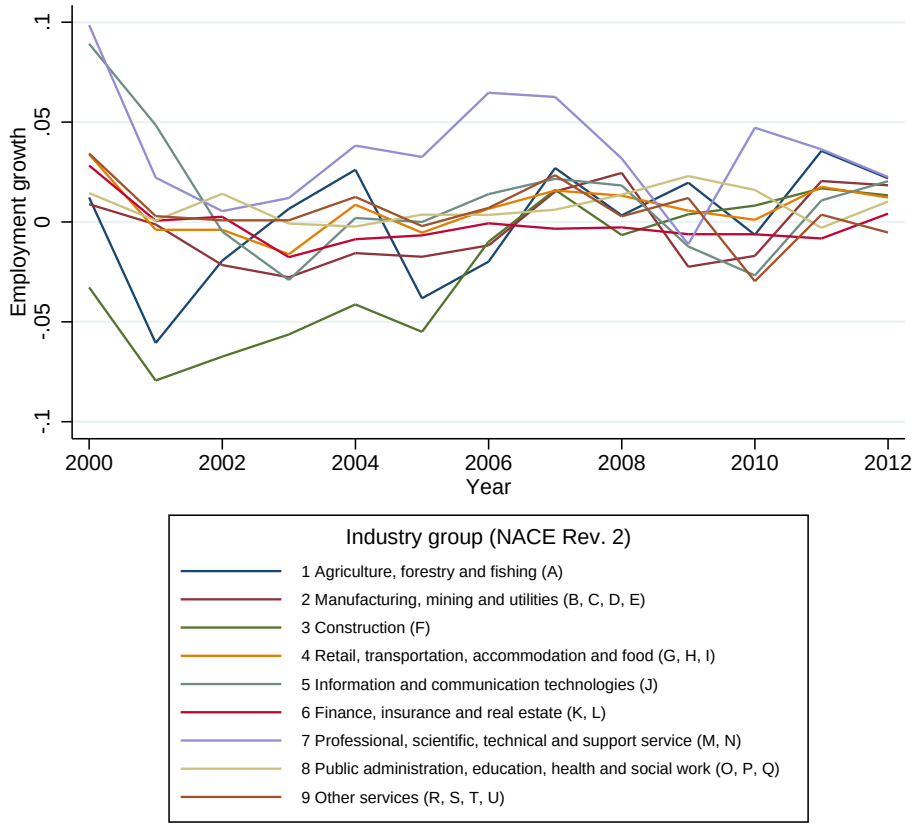
Notes: The table shows sample means of the two main dependent variables *entry* and *exit* in each of the first four years after graduation. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Sample: College graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011.

Figure 1: Sectoral distribution of the 8 largest fields and annual growth by sectors

(a) Industry distribution for the 8 largest fields of study



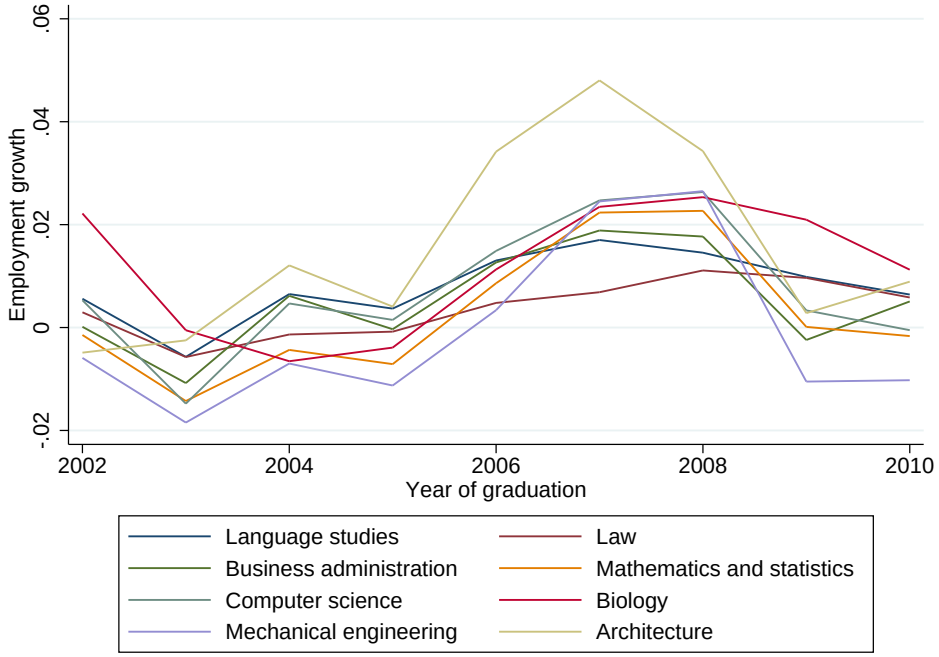
(b) Employment growth by broad industry groups



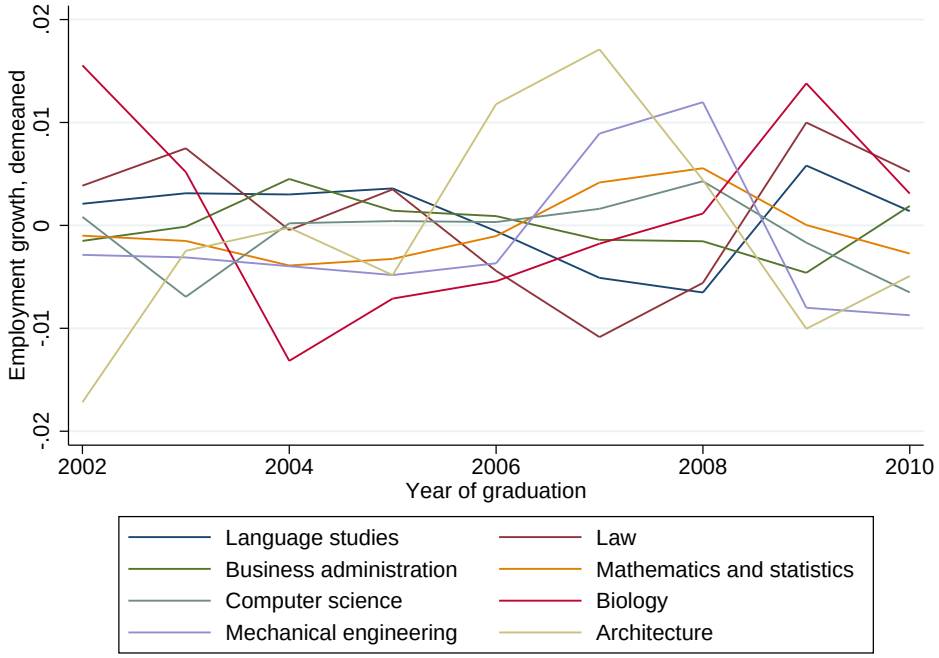
Notes: Panel (a) illustrates the industry distribution of college graduates from the 8 largest fields of study. The used 2-digit NACE Rev. 2 industries are joined into 9 groups for illustrative purposes. The calculation is based on college graduates in paid employment in years 1-5 after graduation *(weighting sample)*. Data: German Micro Census. Panel (b) shows the annual growth of the number of workers by industry groups. Data: German Statistical Office (Statistisches Bundesamt, 2015, Fachserie 18, Reihe 1.4, table 3.2.14).

Figure 2: Annual growth rate for the 8 largest fields of study

(a) Actual growth rate



(b) Growth rate, demeaned



Notes: The upper panel shows the yearly growth rate of the number of employees for the 8 largest fields of study. The lower panel shows the growth rate net of year and field of study fixed effects. The growth rate is constructed from annual growth of the number of employees at the 2-digit NACE rev. 2 industry level, weighted to fields of study using the average industry-field distribution for graduates in paid employment in years 1 to 5 after graduation.

Table 3: The effect of economic conditions on entry into entrepreneurship

Dependent variable:	Entry			
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0113***	0.0112***		0.0121***
	(0.0036)	(0.0036)		(0.0034)
$growth_{fc} \times e_2$	0.0050*	0.0050*		0.0064**
	(0.0028)	(0.0028)		(0.0026)
$growth_{fc} \times e_3$	-0.0017	-0.0017		-0.0001
	(0.0027)	(0.0027)		(0.0029)
$growth_{fc} \times e_4$	-0.0018	-0.0018		-0.0007
	(0.0041)	(0.0041)		(0.0037)
$growth_{f,c+1} \times e_1$			0.0048	0.0020
			(0.0046)	(0.0036)
$growth_{f,c+2} \times e_2$			0.0052	0.0061
			(0.0043)	(0.0039)
$growth_{f,c+3} \times e_3$			0.0047	0.0056
			(0.0038)	(0.0038)
$growth_{f,c+4} \times e_4$			-0.0020	0.0012
			(0.0030)	(0.0036)
FE	yes	yes	yes	yes
Covariates	no	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: In this table, I provide linear probability model estimates for the effect of economic conditions in the year of graduation on entry into entrepreneurship. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs, from cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 4: The effect of economic conditions on exit from entrepreneurship

Dependent variable:	Exit			
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	-0.0012	-0.0012		-0.0015
	(0.0014)	(0.0014)		(0.0016)
$growth_{fc} \times e_2$	-0.0016	-0.0016		-0.0014
	(0.0010)	(0.0010)		(0.0010)
$growth_{fc} \times e_3$	-0.0028**	-0.0028**		-0.0028**
	(0.0013)	(0.0013)		(0.0013)
$growth_{fc} \times e_4$	-0.0022	-0.0023		-0.0017
	(0.0018)	(0.0018)		(0.0018)
$growth_{f,c+1} \times e_1$			-0.0006	-0.0007
			(0.0012)	(0.0011)
$growth_{f,c+2} \times e_2$			0.0010	0.0006
			(0.0009)	(0.0008)
$growth_{f,c+3} \times e_3$			-0.0022*	-0.0027**
			(0.0012)	(0.0013)
$growth_{f,c+4} \times e_4$			-0.0027*	-0.0025*
			(0.0014)	(0.0015)
FE	yes	yes	yes	yes
Covariates	no	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: In this table, I provide linear probability model estimates for the effect of economic conditions in the year of graduation on entry into entrepreneurship. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs, from cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 5: Evidence on the correlation between economic conditions and the composition of graduation cohorts

	(1)	(2)	(3)	(4)
	Female	Foreign nat.	Children at grad.	Full univ.
$growth_{fc}$	-0.0090	0.0075	-0.0003	0.0033
	(0.0066)	(0.0055)	(0.0037)	(0.0075)
$growth_{f,c-1}$	-0.0034	0.0079	-0.0028	0.0005
	(0.0039)	(0.0065)	(0.0034)	(0.0062)
$growth_{f,c-2}$	0.0013	-0.0037	0.0091**	0.0059
	(0.0049)	(0.0079)	(0.0039)	(0.0063)
$growth_{f,c-3}$	-0.0095**	0.0003	0.0008	-0.0041
	(0.0037)	(0.0037)	(0.0021)	(0.0042)
$growth_{f,c-4}$	0.0024	0.0034	-0.0045*	-0.0040
	(0.0035)	(0.0032)	(0.0023)	(0.0063)
Mean depvar	0.434	0.128	0.069	0.631
FE	yes	yes	yes	yes
Covariates	no	no	no	no
Observations	20407	20407	20407	20407

Notes: In this table, I provide linear probability model estimates on the association between economic conditions in the year of graduation and cohort composition. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs, from cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. $Foreign\,nat.$ is 1 for individuals with no German nationality, 0 else. $Children\,at\,grad.$ is one if children born before graduation live in the same household, 0 else. $Full\,univ.$ is 1 for traditional research universities and 0 for applied universities. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. FE: Fixed effects for field of study and cohort. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 6: Evidence on the correlation between economic conditions and enrolment into fields of study

Dependent variable:	Log number enrolled		Share female		Share foreign	
	(1)	(2)	(3)	(4)	(5)	(6)
$growth_{ft}$	0.0457**		0.0006		-0.0026*	
	(0.0186)		(0.0015)		(0.0014)	
$growth_{f,t+1}$	0.0001		-0.0010		-0.0002	
	(0.0077)		(0.0010)		(0.0015)	
$growth_{f,t+2}$	-0.0022		0.0002		0.0025	
	(0.0152)		(0.0009)		(0.0024)	
$growth_{f,t+3}$	0.0051		-0.0003		0.0005	
	(0.0163)		(0.0011)		(0.0016)	
$growth_{f,t+4}$	0.0034	0.0153	-0.0007	-0.0006	0.0024	0.0012
	(0.0122)	(0.0126)	(0.0010)	(0.0011)	(0.0018)	(0.0013)
$growth_{f,t+5}$	0.0079	0.0100	-0.0015	-0.0016	0.0029	0.0023
	(0.0154)	(0.0108)	(0.0016)	(0.0014)	(0.0018)	(0.0015)
Mean depvar			0.458	0.458	0.170	0.170
FE	yes	yes	yes	yes	yes	yes
Covariates	no	no	no	no	no	no
Observations	418	418	418	418	418	418

Notes: In this table, I provide linear probability model estimates on the association between field of study specific enrolment and economic conditions. I use aggregate data on 38 fields of study in years 1998-2008, compiled from administrative records by the German Statistical Office. Observations are weighted by cell-size. $growth_{ft}$ denotes annual industry growth in the number of employees in the year of enrolment, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{f,t+n}$ indicates growth n years after enrolment. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. FE: Fixed effects for field of study and year of enrolment. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 7: Evidence on strategic timing of graduation from college

	(1)	(2)	(3)
	Age at grad.	Aged $\geq$ 28 at grad.	Aged $\leq$ 25 at grad.
$growth_{fc}$	-0.0500	-0.0084	0.0026
	(0.0362)	(0.0076)	(0.0081)
$growth_{f,c-1}$	-0.0363	-0.0054	0.0012
	(0.0326)	(0.0059)	(0.0069)
$growth_{f,c-2}$	0.0143	-0.0010	0.0087
	(0.0352)	(0.0071)	(0.0098)
$growth_{f,c-3}$	-0.0042	-0.0016	-0.0021
	(0.0204)	(0.0044)	(0.0039)
$growth_{f,c-4}$	-0.0148	-0.0013	0.0055
	(0.0255)	(0.0053)	(0.0055)
Mean depvar	26.495	0.308	0.386
FE	yes	yes	yes
Covariates	no	no	no
Observations	20407	20407	20407

Notes: In this table, I provide linear probability model estimates on the association between economic conditions in the year of graduation and the age at graduation. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs, from cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. *Age at grad.* is the age in the year of graduation. $Age \geq 28\, at\, grad.$ is 1 if the individual is aged 28 or above at graduation, 0 else. $Age \leq 25\, at\, grad.$ is 1 if the individual is aged 25 or less at graduation. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. FE: Fixed effects for field of study and cohort. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

A Data appendix

A.1 Micro Census data

The Micro Census is a household survey sampling 1% of the German population.[27] I use the Scientific Use File which contains a 70% sub-sample of the households in the Micro Census.[28] The sampling frame of the survey comprises all persons living in Germany who have a right of residence. Households are sampled at the level of small sampling districts, comprising on average 15 individuals. Each sampling district remains in the survey for four years so that in each year a quarter of the sampling districts are replaced. The data are collected mostly via personal interviews. Only if not possible otherwise, respondents can answer a self-administered questionnaire (ca. 20% of all respondents). Individuals are interviewed in April in the survey years 2003 and 2004 and on a randomized date throughout the year in subsequent survey years. In all regressions I use weighting factors provided in the data set, which adjust the sample to the population based on distributions of age groups, nationalities and gender. Table A.1 contains definitions and summary statistics for the sample described in section 3.2.

Most survey questions are mandatory to respond to, leading to response rates close to 100%. The following variables are based on non-mandatory survey questions (average item non-response rates and non-mandatory survey years in brackets): employment status 12 months ago (4%, all years), field of study (4%, years 2003 and 2004) and graduation year (17%, 2003 and 2004). Unit-non-response amounts to 2.4 - 3.0% in the used survey years. Since the question eliciting the employment status 12 months ago is asked to a 45% sub-sample in 2003 and 2004, I use this sub-sample in these two survey years.

A.2 Classification of fields of study

The used classification of fields of study builds directly on the classification which is provided in the Micro census data and constitutes the answer categories of the corresponding survey question *(Hauptfachrichtung, HFR03)*. I exclude fields which prepare directly for employment in the primary or public sector, since these sectors are strongly regulated. Examples include majors

[27] English documentation is available at http://www.gesis.org/missy/en/study/

[28] Scientific Use File des Mikrozensus, FDZ der Statistischen Ämter des Bundes und der Länder, 2003-2011

Table A.1: Definitions of variables and summary statistics

Variable	Definition	Mean/ share	Standard deviation
Entry	1: self-employed in t, wage earner or unemployed in t-1, 0: else	0.026	
Exit	1: wage earner or unemployed in t, self-employed in t-1, 0: else	0.007	
Growth_{fc}	2-digit NACE rev. 2 employment growth of college graduation cohort c, weighted to 42 fields of study f using the average industry-field distribution for employees surveyed in 2008-2011 (graduation years 2003-2010)	0.709	1.300
Gender	1: female, 0: male	0.440	
Foreign	1: non-German citizenship, 0: German citizenship	0.096	
Children at graduation	1: children present in the household, which have been born in the year of graduation or earlier, 0: else	0.075	
Full university	1: individual graduated from a research university *(Universität)*, 0: graduated from an applied university *(Fachhochschule)*	0.623	
Age at graduation	age in the year of graduation	26.522	2.322

Notes: The table provides non-weighted summary statistics for all graduates in the regression sample of 20407 college graduates. The sample covers graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector.

in agriculture, education, health, the social sector and public administration. I consistently join fields which are joined in any of the scientific use file waves due to small cell sizes. Furthermore, I join closely related fields with few observations. The results are robust to this modification. Table A.2 shows the used fields of study and the number of observations for each field in the regression sample. As explained in the main text, I use the distribution of employer industries to construct weights that aggregate industry employment growth to the field of study level.

Table A.2: List of used fields of study

Field of study	Obs.	Perc.	Field of study	Obs.	Perc.
Language studies	840	4.1	Chemistry	234	1.2
Philosophy	87	0.4	Biology	637	3.1
History	208	1.0	Geography	275	1.4
Library and information studies	94	0.5	Nutrition and food science	167	0.8
Journalism	220	1.1	Mechanical engineering	954	4.7
Latin and greek language	32	0.2	Precision mechanics	171	0.8
German	610	3.0	Electrical engineering	549	2.7
English	310	1.5	Electronics and telecommunication	325	1.6
Other languages	100	0.5	Chemical engineering	318	1.6
Psychology	395	1.9	Automotive engineering	200	1.0
Sports	220	1.1	Other engineering	104	0.5
Law	1,625	8.0	Architecture	691	3.4
Economics	324	1.6	Civil engineering	493	2.4
Business administration	4,429	21.7	Toursim	77	0.4
Marketing	131	0.6	Environmental sciences	112	0.6
Finance	296	1.5	Art history	102	0.5
Accounting	125	0.6	Fine arts	99	0.5
Business and engineering	587	2.9	Performing arts	120	0.6
Mathematics and statistics	999	4.9	Music	240	1.2
IT science	1,785	8.8	Design	266	1.3
Physics	292	1.4	Audiovisual techniques	564	2.8
			Total	20,407	100

Notes: The table shows the used fields of study and the number of observations for each field in the regression sample. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. 20407 observations.

A.3 Data on first year students

To investigate the association between economic conditions and field of study enrolment, I use publicly available administrative data at the field level. The data are reported by the universities and compiled by the German Statistical Office.[29] I manually match the fields of study to the classification used in the Micro Census data. First year students are defined as those who enroll in the first semester of a field of study, including multiple enrolments. The data refers to enrolments for the winter term, which is the principal enrolment term. Students typically have to apply in July and take up their studies October.

[29] Table 21311-0012 in the online data base at www.destatis.de/genesis

B Additional figures and tables

Table B.1: Employment share of largest field of study in 2-digit industries

Industry (2-digit NACE rev. 2)		Largest field	Share
1-3	Agriculture, forestry and fishing	Biology	0.11
5-9	Mining and quarrying	Environmental sciences	0.19
10-12	Manufacture of food products	Business administration	0.36
13-15	Manufacture of textiles	Other engineering	0.25
16-18	Manufacture of wood, paper and printing	Business administration	0.25
19-20	Manufacture of coke, petroleum products and chemicals	Business administration	0.31
21	Manufacture of basic pharmaceutical products	Business administration	0.34
22-23	Manufacture of plastic, glass ceramics and stone products	Business administration	0.31
24-25	Manufacture of metals and metal goods	Business administration	0.23
26	Manufacture of computer, electronic and optical products	Electrical engineering	0.19
27	Manufacture of electrical equipment	Business administration	0.23
28	Manufacture of machinery	Mechanical engineering	0.31
29-30	Manufacture of motor vehicles	Mechanical engineering	0.22
31-33	Manufacture of furniture and other manufacturing	Business administration	0.21
35-39	Utilities	Business administration	0.24
41-43	Construction	Civil engineering	0.42
45-47	Wholesale and retail trade and repair of motor vehicles	Business administration	0.37
49-53	Transportation and storage	Business administration	0.36
55-56	Accommodation and food service activities	Business administration	0.32
58-60	Publishing and broadcasting activities	Computer science	0.30
61	Telecommunications	Business administration	0.34
62-63	Information technology services	Computer science	0.51
64-66	Financial service activities	Business administration	0.52
68	Real estate activities	Business administration	0.48
69	Legal and accounting activities, management consulting	Business administration	0.42
71	Architectural and engineering activities	Architecture	0.36
72	Scientific research and development	Biology	0.16
73	Advertising and market research	Audiovisual techniques	0.26
74-77	Other professional, scientific and technical activities	Business administration	0.18
78-79	Employment service activities and travel agencies	Business administration	0.41
80-82	Security and investigation activities, business support activities	Business administration	0.34
84	Public administration and defense	Law	0.31
85	Education	Computer science	0.03
86	Human health activities	Psychology	0.09
87-88	Residential care and social work activities	Language studies	0.04
90-93	Arts, entertainment and recreation	Music	0.18
94-98	Other service activities	Business administration	0.11

Notes: For each NACE rev. 2 industry group, the table lists the employment share of the largest field of study, excluding fields that are dropped from the regression sample (see section 3.2). The calculation is based on college graduates in paid employment in years 1-5 after graduation *(weighting sample)*.

Table B.2: Balanced sample: cohorts 2003-2007

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0181***	0.0168***	-0.0024**	-0.0041***
	(0.0064)	(0.0059)	(0.0012)	(0.0016)
$growth_{fc} \times e_2$	0.0061	0.0068*	-0.0008	-0.0010
	(0.0040)	(0.0041)	(0.0013)	(0.0013)
$growth_{fc} \times e_3$	-0.0049	-0.0034	-0.0014	-0.0017
	(0.0032)	(0.0031)	(0.0014)	(0.0017)
$growth_{fc} \times e_4$	-0.0050	-0.0032	-0.0009	-0.0003
	(0.0052)	(0.0042)	(0.0022)	(0.0021)
$growth_{f,c+1} \times e_1$		0.0057		0.0010
		(0.0057)		(0.0017)
$growth_{f,c+2} \times e_2$		0.0066		0.0014
		(0.0052)		(0.0013)
$growth_{f,c+3} \times e_3$		0.0041		-0.0029
		(0.0034)		(0.0019)
$growth_{f,c+4} \times e_4$		0.0031		-0.0037***
		(0.0039)		(0.0013)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	14696	14696	14696	14696

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship for a balanced sample which covers the cohorts 2003 to 2007. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. I exclude fields of study directly related to the primary or public sector. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.028. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.3: Additional covariates which aim at controlling for selective enrolment

Depvar:	Entry				Exit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$growth_{fc} \times e_1$	0.0118***	0.0117***	0.0121***	0.0117***	-0.0014	-0.0012	-0.0014	-0.0013
	(0.0036)	(0.0036)	(0.0040)	(0.0036)	(0.0014)	(0.0014)	(0.0014)	(0.0015)
$growth_{fc} \times e_2$	0.0045	0.0044	0.0048	0.0045	-0.0013	-0.0014	-0.0014	-0.0013
	(0.0029)	(0.0029)	(0.0033)	(0.0029)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
$growth_{fc} \times e_3$	-0.0019	-0.0018	-0.0016	-0.0019	-0.0028**	-0.0026**	-0.0029**	-0.0028**
	(0.0028)	(0.0027)	(0.0029)	(0.0028)	(0.0013)	(0.0012)	(0.0013)	(0.0013)
$growth_{fc} \times e_4$	-0.0022	-0.0023	-0.0018	-0.0021	-0.0020	-0.0023	-0.0022	-0.0021
	(0.0040)	(0.0040)	(0.0043)	(0.0040)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$ln(\#\,grad.)_{fc}$	-0.0061				0.0033			
	(0.0052)				(0.0028)			
$growth_{age19}$		-0.0002				-0.0002		
		(0.0006)				(0.0003)		
$growth_{f,c-2}$			0.0010				-0.0003	
			(0.0022)				(0.0010)	
$growth_{f,c-4}$				-0.0004				0.0000
				(0.0022)				(0.0007)
FE	yes	yes	yes	yes	yes	yes	yes	yes
Covariates	yes	yes	yes	yes	yes	yes	yes	yes
Observations	20407	20264	20407	20407	20407	20264	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship controlling for additional covariates. $ln(\#\,grad.)_{fc}$ denotes the field-cohort size in the year of graduation. $growth_{age19}$ denotes field-specific growth at age 19, the typical enrolment age in Germany. It is constructed from annual industry growth in the number of employees, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{f,c-2}$ is field-specific growth two years before graduation. $growth_{f,c-4}$ is field-specific growth four years before graduation. $growth_{fc}$ denotes field-specific growth in the year of graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.4: Controlling for linear field of study trends

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0111***	0.0118***	-0.0012	-0.0013
	(0.0041)	(0.0039)	(0.0017)	(0.0017)
$growth_{fc} \times e_2$	0.0037	0.0057**	-0.0011	-0.0008
	(0.0030)	(0.0029)	(0.0013)	(0.0013)
$growth_{fc} \times e_3$	-0.0030	-0.0008	-0.0026*	-0.0025
	(0.0028)	(0.0030)	(0.0016)	(0.0015)
$growth_{fc} \times e_4$	-0.0035	-0.0013	-0.0018	-0.0011
	(0.0042)	(0.0035)	(0.0020)	(0.0019)
$growth_{f,c+1} \times e_1$		0.0028		-0.0007
		(0.0038)		(0.0012)
$growth_{f,c+2} \times e_2$		0.0058		0.0009
		(0.0042)		(0.0009)
$growth_{f,c+3} \times e_3$		0.0042		-0.0025*
		(0.0033)		(0.0014)
$growth_{f,c+4} \times e_4$		0.0006		-0.0026*
		(0.0035)		(0.0014)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Linear trends	yes	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship controlling for a full set of linear field of study trends. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.5: Controlling for age at graduation in order to account for strategic graduation

Dependent variable:	Entry			Exit		
	(1)	(2)	(3)	(4)	(5)	(6)
$growth_{fc} \times e_1$	0.0115***	0.0114***	0.0113***	-0.0011	-0.0012	-0.0012
	(0.0036)	(0.0036)	(0.0036)	(0.0014)	(0.0014)	(0.0014)
$growth_{fc} \times e_2$	0.0052*	0.0051*	0.0050*	-0.0016	-0.0016	-0.0016
	(0.0027)	(0.0027)	(0.0027)	(0.0010)	(0.0010)	(0.0010)
$growth_{fc} \times e_3$	-0.0014	-0.0015	-0.0017	-0.0027**	-0.0027**	-0.0028**
	(0.0027)	(0.0027)	(0.0027)	(0.0013)	(0.0013)	(0.0013)
$growth_{fc} \times e_4$	-0.0018	-0.0018	-0.0019	-0.0022	-0.0023	-0.0023
	(0.0041)	(0.0041)	(0.0041)	(0.0018)	(0.0018)	(0.0018)
Age at grad.	-0.0019			0.0019		
	(0.0085)			(0.0049)		
Age at grad. squared	0.0001			-0.0000		
	(0.0002)			(0.0001)		
$Age \geq 28$ *at grad.*		0.0115***			0.0037**	
		(0.0035)			(0.0018)	
$Age \leq 25$ *at grad.*			-0.0096**			-0.0024**
			(0.0039)			(0.0012)
FE	yes	yes	yes	yes	yes	yes
Covariates	yes	yes	yes	yes	yes	yes
Observations	20407	20407	20407	20407	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship controlling for different functions of age at graduation. *Age at grad.* is the age at graduation. $Age \geq 28$ *at grad.* 1 if the individual is aged 28 or above at graduation, 0 else. $Age \leq 25$ *at grad.* is 1 if the individual is aged 25 or less at graduation. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.6: The effect of economic conditions on entrepreneurship among natives

Sample:	Baseline		Drop late immigrants	
	(1)	(2)	(3)	(4)
	Entry	Exit	Entry	Exit
$growth_{fc} \times e_1$	0.0112***	-0.0012	0.0095***	-0.0013
	(0.0036)	(0.0014)	(0.0031)	(0.0015)
$growth_{fc} \times e_2$	0.0050*	-0.0016	0.0035	-0.0016
	(0.0028)	(0.0010)	(0.0023)	(0.0011)
$growth_{fc} \times e_3$	-0.0017	-0.0028**	-0.0025	-0.0018
	(0.0027)	(0.0013)	(0.0027)	(0.0013)
$growth_{fc} \times e_4$	-0.0018	-0.0023	-0.0026	-0.0023
	(0.0041)	(0.0018)	(0.0041)	(0.0020)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	20407	20407	19560	19560

Notes: In columns 3-4, I exclude non-German citizens who immigrated less than 2 years before graduation from college. Estimations are performed as linear probability models. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, weighted to the field level using a fixed industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.7: HP-filtered number of employees and total hours worked as proxies for economic conditions

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$employees\,(HP)_{fc} \times e_1$	0.7098*	-0.1911		
	(0.3834)	(0.1513)		
$employees\,(HP)_{fc} \times e_2$	0.0557	-0.2357*		
	(0.4555)	(0.1428)		
$employees\,(HP)_{fc} \times e_3$	-0.2638	-0.3318**		
	(0.3767)	(0.1482)		
$employees\,(HP)_{fc} \times e_4$	-0.1504	-0.1382		
	(0.5409)	(0.1851)		
$hours\,worked\,(HP)_{fc} \times e_1$			0.4781**	-0.0809
			(0.1967)	(0.1035)
$hours\,worked\,(HP)_{fc} \times e_2$			0.0578	-0.1579
			(0.2489)	(0.1236)
$hours\,worked\,(HP)_{fc} \times e_3$			-0.2280	-0.1850
			(0.3461)	(0.1577)
$hours\,worked\,(HP)_{fc} \times e_4$			0.1535	-0.1889
			(0.4173)	(0.1862)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: In this table I provide linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship using HP-filtered number of employees and total hours worked as proxies for economic conditions. $employees\,(HP)_{fc}$ and $hours\,worked\,(HP)_{fc}$ denote the cyclical components from HP-filtered logarithms of annual industry-level number of employees and hours worked, weighted to the field of study level. 1st quartile, 3rd quartile and interquartile range of $employees\,(HP)_{fc}$: -0.008, 0.003, 0.011. 1st quartile, 3rd quartile and interquartile range of $hours\,worked\,(HP)_{fc}$: -0.011, 0.011, 0.022. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.8: Controlling for lagged effects of subsequent growth and interacted field - calendar year fixed effects

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0128***	-0.0014	0.0109***	-0.0015
	(0.0036)	(0.0015)	(0.0039)	(0.0014)
$growth_{fc} \times e_2$	0.0056*	-0.0022	0.0046	-0.0020*
	(0.0028)	(0.0014)	(0.0032)	(0.0012)
$growth_{fc} \times e_3$	0.0001	-0.0034**	-0.0016	-0.0016
	(0.0040)	(0.0016)	(0.0029)	(0.0014)
$growth_{fc} \times e_4$	0.0021	-0.0004	-0.0005	-0.0004
	(0.0040)	(0.0018)	(0.0042)	(0.0017)
$growth_{f,c+1} \times e_1$	0.0034	-0.0007		
	(0.0037)	(0.0012)		
$growth_{f,c+1} \times e_2$	0.0023	0.0020		
	(0.0023)	(0.0013)		
$growth_{f,c+1} \times e_3$	-0.0007	0.0010		
	(0.0043)	(0.0018)		
$growth_{f,c+1} \times e_4$	-0.0056	-0.0006		
	(0.0047)	(0.0022)		
$growth_{f,c+2} \times e_2$	0.0062	-0.0002		
	(0.0045)	(0.0009)		
$growth_{f,c+2} \times e_3$	0.0036	0.0003		
	(0.0035)	(0.0016)		
$growth_{f,c+2} \times e_4$	0.0032	-0.0032		
	(0.0049)	(0.0024)		
$growth_{f,c+3} \times e_3$	0.0040	-0.0028**		
	(0.0037)	(0.0014)		
$growth_{f,c+3} \times e_4$	-0.0020	0.0018		
	(0.0038)	(0.0020)		
$growth_{f,c+4} \times e_4$	0.0016	-0.0051**		
	(0.0048)	(0.0022)		
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Field-year FE	no	no	yes	yes
Observations	20407	20407	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship controlling for contemporaneous and lagged effects of growth in the years after graduation (columns 1-2) and interacted field - calendar year fixed effects (columns 3-4). Both specifications aim at accounting flexibly for correlated subsequent economic conditions. Variables and sample as in the main results. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.9: Employment growth at the *original* NACE rev. 2 industry level, weighted to fields of study

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0103***	0.0102***	-0.0025***	-0.0029**
	(0.0032)	(0.0031)	(0.0010)	(0.0011)
$growth_{fc} \times e_2$	0.0039	0.0055**	-0.0025**	-0.0022**
	(0.0027)	(0.0024)	(0.0011)	(0.0011)
$growth_{fc} \times e_3$	-0.0025	-0.0007	-0.0033**	-0.0032**
	(0.0030)	(0.0032)	(0.0015)	(0.0014)
$growth_{fc} \times e_4$	-0.0031	-0.0013	-0.0027	-0.0020
	(0.0044)	(0.0038)	(0.0020)	(0.0020)
$growth_{f,c+1} \times e_1$		0.0045		-0.0009
		(0.0040)		(0.0012)
$growth_{f,c+2} \times e_2$		0.0062		0.0005
		(0.0042)		(0.0008)
$growth_{f,c+3} \times e_3$		0.0048		-0.0029**
		(0.0034)		(0.0013)
$growth_{f,c+4} \times e_4$		0.0008		-0.0031**
		(0.0035)		(0.0015)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship. Different from the main specification, I construct $growth_{fc}$ from annual growth in the number of employees in the original NACE rev. 2.0 industries rather than previously joining small industries. Industry employment growth is weighted to the field level using the average industry-field distribution of graduates 1 to 5 years after graduation. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.08, 1.63, 1.71. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table B.10: Weighting matrix based on individuals surveyed in years 2003-2011, using a self-constructed correspondence between NACE rev. 1.1 and NACE rev. 2

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{cf} \times e_1$	0.0095***	0.0111***	-0.0025**	-0.0028**
	(0.0029)	(0.0031)	(0.0010)	(0.0012)
$growth_{cf} \times e_2$	0.0031	0.0038	-0.0024*	-0.0020
	(0.0026)	(0.0023)	(0.0012)	(0.0013)
$growth_{cf} \times e_3$	-0.0024	-0.0012	-0.0034**	-0.0034**
	(0.0033)	(0.0031)	(0.0015)	(0.0015)
$growth_{cf} \times e_4$	-0.0023	-0.0026	-0.0027	-0.0020
	(0.0049)	(0.0042)	(0.0020)	(0.0020)
$growth_{f,c+1} \times e_1$		-0.0019		-0.0007
		(0.0035)		(0.0014)
$growth_{f,c+2} \times e_2$		0.0042		0.0009
		(0.0043)		(0.0008)
$growth_{f,c+3} \times e_3$		0.0052		-0.0030**
		(0.0046)		(0.0015)
$growth_{f,c+4} \times e_4$		0.0003		-0.0022
		(0.0032)		(0.0015)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: The table provides linear probability model estimates for the effect of economic conditions on entry into and exit from entrepreneurship. Different from the main specification, I construct $growth_{fc}$ from annual growth of the number of employees in aggregated industry groups, weighted to the field level using the average industry-field distribution of graduates surveyed in 2003-2011. The industry groups are consistent for the NACE rev. 1.1 and NACE rev. 2 classifications, using a self-constructed correspondence from 3-digit NACE rev. 1.1 to 2-digit NACE rev. 2. I construct the correspondence from the 2009 wave of the Micro Census which contains employer industries coded in both industry classifications. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.08, 1.63, 1.71. *Entry* is defined as being self-employed in year t and a wage earner or unemployed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being wage earner or unemployed in year t and self-employed in $t-1$. Mean of *exit*: 0.007. The sample covers college graduates in the first four years after graduation, aged 23-32 at graduation, excluding PhDs. Cohorts 2003-2010, observed up to 2011. I exclude fields of study directly related to the primary or public sector. Covariates: dummies for gender, foreign, children at graduation and type of university. FE: Fixed effects for field of study, cohort, year surveyed and number of years since graduation. Robust standard errors in brackets, clustered at field of study level. *** denotes significance at 1%, ** at 5% and * at 10% level.