Essays on the Economics of Entrepreneurship

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I dedicate this thesis to my family. Thank you for your encouragement and support.

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Introduction

Business startups account for a significant portion of aggregate job creation and industry dynamics. Haltiwanger, Jarmin and Miranda (2013) show that each new cohort of entrants makes a long-lasting contribution to aggregate employment. This pattern masks substantial heterogeneity among entrants. While the majority of new businesses either fails quickly or has no ambitions to grow (Hurst and Pugsley, 2011), a small subgroup of entrants expands quickly.[1]

Given the importance of entrepreneurial entry for job creation and industry dynamics, there is an ongoing interest in the causes and consequences of entrepreneurial entry. This dissertation provides three empirical studies of two determinants of entrepreneurial entry. While chapter one provides an analysis of the role of aggregate economic conditions for firm entry, chapters two and three contain analyses of the effect of entry costs resulting from a specific regulatory restriction to firm entry. Each chapter is supposed to be self-containing and can be read independently. In the following, I briefly motivate each chapter and summarize the core results.

The 2007-09 great recession and subsequent slow recovery have reinvigorated the interest in the cyclical dynamics of entrepreneurial entry and the growth of young firms (Fort et al., 2013). Recent evidence points towards highly persistent negative effects of adverse aggregate economic conditions at birth for the initial size and subsequent growth of firm cohorts (Moreira, 2016; Sedlacek and Sterk, 2017). One factor which may shape this pattern are systematic differences in the quality of firms entering during expansions and recessions. Yet, robust empirical evidence on the influence of aggregate conditions on the individual decision to engage in entrepreneurship and how this may affect the composition of entrepreneurs is scarce.

[1] Haltiwanger, Jarmin and Miranda (2013) provide a detailed analysis of up-or-out employment growth dynamics in young firms.

One reason is that such an analysis requires a controlled setting in which *potential* entrepreneurs are quasi-randomly exposed to varying economic conditions.

In **chapter one**[2] I propose such a setup. I estimate the effect of economic conditions on the decision to engage in entrepreneurship among college graduates in the first years after graduation. This setting is well suited for a study of the effect of economic conditions on entrepreneurship, for three reasons. First, at the time of graduation, students typically enter the full-time labor market and make their initial choice between paid employment and entrepreneurship. Second, college graduates constitute a particularly relevant pool of potential entrepreneurs, since they are disproportionately likely to start firms which eventually grow large. Finally, during their college education students typically acquire field-specific skills which prepare them for a specific set of employer industries. This enables the use of variation in field-specific economic conditions over time. I proxy for field-specific business cycle conditions by mapping industry-level growth rates to fields of study, using as weights the observed industry - college major distribution. Changes in these field-specific conditions at graduation are arguably unanticipated, since students are unable to predict changes in these conditions when deciding for a field of study.[3]

The effect of improved aggregate economic conditions on entry into entrepreneurship is a priori ambiguous as they may on the one hand increase the value of business opportunities through product market demand or capital costs. On the other hand, they raise the attractiveness of the outside option paid employment through increased labor demand.

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 of initial growth halves in the second year and is close to zero in the third and fourth year after graduation. Exit from entrepreneurship decreases slightly. Together with the procylical variation of entry into self-employment, this indicates that college cohorts which graduate under favorable economic conditions are more likely to be

[2] This chapter has been published as Beiler, Hendrik. 2017. "Do You Dare? The Effect of Economic Conditions on Entrepreneurship among College Graduates." *Labour Economics*, 47: 64–74. DOI: 10.1016/j.labeco.2017.05.003 Copyright Elsevier 2017.

[3] A similar identification strategy has been used by Kahn (2010); Oreopoulos, von Wachter and Heisz (2012) and Altonji, Kahn and Speer (2016) to study the effect of regional economic conditions on college graduates' labor market outcomes.

self-employed and that this effect persists at least during the first four years thereafter.

The procyclical entry pattern suggests that college graduates do not view entrepreneurship as an outside option in times of adverse labor market conditions, but as an opportunity whose payoffs are strongly affected by macroeconomic factors at start up. The absence of any effect of initial economic conditions on entry in the third and fourth year after graduation 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. As highly educated are generally more likely to start firms which eventually grow large, many promising businesses may not get set up during recessions, with a negative effect on the composition of new firms during downturns and potentially adverse consequences for economic recoveries (Pugsley and Sahin, 2015).

Chapters two and three are part of joint work with Susanne Prantl. They address the influence of a specific firm entry restriction on entry into self-employment and related outcomes. Firm entry restrictions are a widespread type of product market regulation that raise business entry costs (Djankov et al., 2002). The role of entry restrictions in shaping firm entry, industry dynamics and job creation attracts substantial interest from economists, policy makers and the general public alike.[4]

The second and third chapter provide an investigation of the effect of firm entry restrictions based on a reform to a substantial entry restriction. The restriction follows from the German Trade and Crafts Code, which up to the reform imposed a mandatory standard on potential entrants in a specific set of affected product markets. With the reform, the master craftsman certificate lost that role, leading to a substantial decrease in entry costs in some product markets, while others remained unaffected. The reform is particularly well suited for a causal evaluation of the effects of entry costs: On the one hand, the cross-sectional structure of affected product markets was fixed for a very long time. On the other hand, the reform

[4] For example, restrictions to firm entry have been recently considered as a potential contributor to a secular decline in firm entry and employment dynamics in the U.S. (Davis and Haltiwanger, 2014; Decker et al., 2014; Sedlacek, 2016).

was triggered by events which were unrelated to trends in firm entry and related industry outcomes.

In chapter two we make use of this reform to estimate the effect of firm entry deregulation on the decision to enter entrepreneurship and on the composition of entrepreneurs. Based on comprehensive survey data used also in chapter one, we implement a difference-in-differences approach which compares changes in outcome variables over time in product markets with different deregulation intensities.

In line with our expectations, we find a strong positive effect of the reform on entry into self-employment, which is mostly driven by solo-entrepreneurs. This result implies that the master craftsman requirement was indeed a binding constraint to firm entry. Interestingly, we find no change in the entrants' level of general education in consequence of the abolished mandatory standard for entry. This result has potential implications for industry dynamics, because entrepreneurs' schooling has been found to be a predictor of future entrepreneurial success (Hombert et al., 2014).

The unchanged composition of entrants with respect to schooling offers an interesting insight into the theoretical link between entry costs and selection into entrepreneurship. The result supports the view that entrepreneurial ability is not fully privately known to prospective entrepreneurs before startup but is revealed only after starting a firm (Jovanovic, 1982; Ericson and Pakes, 1995; Poschke, 2010). Under this view, a reduction in entry costs does not affect the composition of entrants with respect to entrepreneurial ability and may be efficiency enhancing.

To investigate the effects of the deregulation reform on the longevity and propensity to hire of the new establishments, as well as effects on incumbent establishments, we turn to administrative establishment level panel data in **chapter three**.

We find a substantial increase in the number of new establishments, which confirms the individual-level result on entry into entrepreneurship in chapter two. We further estimate that the new establishments are similarly stable. However, the new establishments are more likely to start with only one employee (rather than two or more). Consistent with these findings, the number of jobs created by new establishments does not change in consequence of the reform. Finally, we show that due to the reform, incumbents with less than five employees became significantly more likely to shrink and fail, while larger incumbents remained similarly large and stable. This result points towards increased within industry factor reallocation.

Chapter 1

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

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1.1 Introduction

How do economic conditions affect the decision to start a firm? Despite increasing evidence on the association between aggregate economic fluctuations and firm creation, the causal effect of economic conditions on firm creation is poorly understood. This lack of robust evidence is surprising, given that adverse shocks to the size and composition of firm cohorts are found to be highly persistent and to slow

* Financial support provided by the German Research Foundation (DFG) for the research presented in this chapter is gratefully acknowledged (DFG PR 1238/1-1, DFG SPP 1764).

down recoveries.[1] 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 four years after graduation from college in Germany.[2] This group starts a relevant share of firms that eventually grow large: While about 9% of all entrepreneurs entered self-employment in the first four years after graduation from college, about 17% of all entrepreneurs with 50 or more employed entered self-employment within the first four years after graduation (table 1.1).[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 graduation.[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 economic conditions on college graduates' initial earnings path in paid employment.

[1] See, e.g., Sedlacek and Sterk (2017) and Moreira (2016) on the association between aggregate conditions at firm birth and employment in firm cohorts. Clementi and Palazzo (2016) analyze the link between aggregate shocks, firm dynamics and recoveries from recessions.

[2] 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.

[3] Source: German Micro Census. The statistics refer to a sample of self-employed aged 30 to 65 and are averaged over 2003-2011.

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

[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).

The effect of changing economic 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 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, adverse shocks may also affect the field of study specific labor market, lowering graduates' potential earnings in paid employment (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, graduates from "recessionary" cohorts may delay the investment decision involved in firm entry 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

[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 economic 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).

of study specific growth rates from 2-digit 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 to economic conditions in these industries. To illustrate the approach, figure 1.1 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 mainly 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 field-specific employment growth at graduation (0.77 of one standard deviation) 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 an average yearly entry rate of about 3% among recent graduates. This finding suggests that on average, college graduates decision to enter entrepreneurship is positively affected by favorable field-specific economic conditions.

Second, field-specific 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 may 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, economic conditions in the subsequent years after graduation have no effect

[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.

on contemporaneous entry, while the positive effect of economic conditions in the year of graduation on entry in the first two years after graduation remains strong. This underlines that the graduates' self-employment decision is influenced mainly by economic conditions at graduation, rather than by current 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 path even when controlling for subsequent aggregate economic 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.

The structure of the paper is as follows. In the next section I describe links to the literature. I explain the econometric framework and illustrate the data in section 1.3. Section 1.4 contains the empirical results and shows that they are robust to a number of alternative explanations. I conclude in section 1.5.

1.2 Related literature

My analysis mainly relates to three strands of literature. First, I relate to an emerging macro literature on the link between the aggregate economic fluctuations and firm entry. While it is well established that the number of new firms varies procyclically (Campbell, 1998, Lee and Mukoyama, 2015 and Pugsley and Sahin, 2015), Sedlacek and Sterk (2017) and Moreira (2016) documented only recently that businesses born in downturns also start on a smaller scale and remain smaller over their lifecycle. Both papers link this size persistence primarily to demand side constraints. Sedlacek and Sterk (2017) argue that a positive demand shock helps firms devoted to mass markets to expand, shifting the composition towards firms that have the potential to grow large. Moreira (2016) finds that the sectoral degree of product differentiation and the sectoral share of total inputs spent on advertising are significantly related to the persistence of size differences across cohorts. Interestingly, the slow growth of firms started during recessions cannot be explained by systematic

differences in the quality of businesses. In contrast, firms born during recessions seem to be more productive (Moreira, 2016).[9] Taken together, the slow growth of firms born during recessions helps explain slow recoveries (Clementi and Palazzo, 2016).

Second, several studies investigate the association between aggregate economic fluctuations and the individual decision to take up entrepreneurship. The empirical evidence 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 growth and self-employment. Closest to my paper, Yu, Orazem and Jolly (2014) focus on entrepreneurial entry 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.

I contribute to the previous two strands of literature mainly by proposing a novel identification approach of the effect of 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 potential entrepreneurs, whose composition is arguably exogenous to economic conditions as the graduates selected their field on average 4-5 years ago. This empirical specification allows me to address two empirical challenges. First, the use of field-specific variation in economic conditions allows controlling for cohort and year fixed effects, thereby holding constant unobserved confounding effects such as aggregate shifts in labor supply preferences, technological change or policy shifts. Second, because the year of graduation constitutes a reference year in which most graduates enter the full time labor market for the first time, I can investigate whether changes in economic conditions create systematic patterns of delay or pre-dating of entrepreneurial entry.

Third, my paper is related to the literature that investigates the role of cohort

[9] The same applies to firms started during a credit shortage (Ates and Saffie, 2016).

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 on workers' wages. More recently, a series of studies investigated the effect of adverse regional 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.

1.3 Empirical strategy and data

1.3.1 Empirical model

The growth measure I estimate the effect of initial economic conditions faced by a college graduation cohort on the decision to become self-employed. Economic 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:

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

with

$$employment\,growth_{jc} = \frac{\#employees_{jc}}{\#employees_{j,c-1}} - 1$$

where f indexes one of 42 fields of study, c the year of graduation (cohort) and j one of 37 2-digit industry groups spanning all industry sectors. The variable $employment\,growth_{jc}$ denotes the growth of the number of employees at the industry level from the year before graduation to the year of graduation. The variable w_f^j indicates the time-invariant share of graduates up to five years after graduation from 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 1.3.2.

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 opportunities *and* employment opportunities. Business opportunities are spurred by favorable economic conditions through increased product demand. Rising product demand is reflected in employment changes if firm labor demand leads to increased hiring.[10] I measure employment growth as annual change in the number of paid employees rather than hours worked, since changes in the number of employees better reflects the labor market conditions for college graduates in a field. The use of hours worked as a

[10] I show in appendix table 1.B.9 that the use of annual real GDP growth as proxy for economic conditions yields similar results.

proxy for economic conditions shows similar results (table 1.B.8). Intensive margin labor adjustments featured prominently in the German employers' reaction to the 2008-09 economic recession, in particular in the export-oriented manufacturing sector (Burda and Hunt, 2011). Note that I do not use the number of all employed (including self-employed) as proxy for economic conditions to avoid any potential simultaneity issues, as entry into and exit out of self-employment are the dependent variables.[11]

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.[12] Since recent college graduates account for only a small share of overall employment and their preference for given employer industries is mostly determined by their field-specific skills, the constructed proxy is arguably unaffected by recent graduates' labor supply. I support this reasoning with an alternative analysis using an employment growth proxy which excludes fresh college graduates (appendix table 1.B.2). The effect size is almost identical in the measure that includes fresh college graduates and the measure which excludes fresh college graduates, which suggests that the contribution of fresh college graduates to industry employment growth does not drive the effect on the decision to enter and exit entrepreneurship.

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, panel (a) of figure 1.1 shows employment shares recent graduates in broad industry groups, 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 graduates 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 1.1 shows the differences in employment growth across industry sectors. The sample period covers two economy-wide downturns in 2003-2005 and

[11] Results based on all employed are very similar (table 1.B.11).

[12] Related measures have been widely used as instrumental variables. See, e.g., Moretti (2010), Notowidigdo (2019) or Bertrand, Kamenica and Pan (2015).

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 variation in economic conditions translates into rich variation in the constructed field level proxy, which I illustrate for the eight largest fields of study in figure 1.2. 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:

$$y_{ifct} = \sum_{n=1}^{4} \beta_{cn} growth_{fc} \times \mathbb{1}(e = n) + \theta_f + \mu_n + \chi_c + \phi_t + X'_{ifct}\gamma + \epsilon_{ifct}. \quad (1.1)$$

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 $\mathbb{1}(e = n)$, which is a set of indicator variables for each of the first four years n of potential labor market experience 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 the fixed effects, I follow Oreopoulos, von Wachter and Heisz (2012) in simply dropping one additional cohort effect from the regression.[13,14]

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 concentrate on teaching job-related skills. To keep with the terminology used in the related literature, I refer to universities as "colleges".[15]

[13] 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.

[14] The qualitative results are robust to using more parsimonious sets of fixed effects (table **??**).

[15] The tertiary education systems of the U.S. and Germany differ in many respects. For example, several programs offered at U.S. colleges are offered as apprenticeship programs in Germany. Therefore, the distributions of graduates from U.S. colleges and German universities differ in several aspects. These differences include the distribution of educational attainment (Appendix table 1.B.1, panel A) or the field-composition of graduates with tertiary education (Appendix table 1.B.1, panel C). However, the wage

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 conditions. 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 conditions. To this purpose, I additionally control for the contemporaneous effect of field-specific growth in each year after graduation:

$$y_{ifct} = \sum_{n=1}^{4} \beta_{cn} growth_{fc} \times \mathbb{1}(e=n) + \sum_{n=1}^{4} \beta_{c+n} growth_{f,c+n} \times \mathbb{1}(e=n) + X'_{ifct}\gamma + \theta_f + \mu_n + \chi_c + \phi_t + \epsilon_{ifct}. \tag{1.2}$$

In this specification, the added second summation interacts field-specific economic

wage premium of workers with a college degree (excl. short cycle degrees) compared to non-college workers is broadly similar in Germany and the U.S. (Appendix table 1.B.1, panel B).

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.[16] 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 the economic conditions are unrelated to the field-cohort composition of graduates' unobservable characteristics, conditional on the individual covariates and experience, cohort, time and field fixed effects.

There are two particular channels which may create an association of the field-cohort composition with economic conditions at graduation. 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 economic conditions in employer industries vary considerably over time.

Second, the cohort composition may be endogenous in field level economic 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 1.4.2 I show that there is indeed no empirical association between economic conditions on the one hand and student enrolment and age at graduation on the other hand.

1.3.2 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 labor market related information. Second, the data is of particularly high quality, which is reflected in low non-response rates (response to most questions is legally required) and high comparability of items across survey

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

waves.[17] Finally, the survey is comparably large. Its yearly coverage of between 600,000 and 700,000 individuals (about 1% of the German population) allows to combine individual level outcomes with rich variation in economic conditions at the field of study - cohort level.[18]

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.[19] The main estimation sample includes college graduates who obtain their degree when aged 23 to 32.[20] Further, I drop graduates from PhD programs[21] and fields of study which are closely linked to the primary or public sector.[22] Finally, I drop all individuals who do not respond to all of the survey questions used to construct the variables.[23] This leads to a regression sample of 20,407 graduates in 42 fields of study. Note that the sample includes non-employed and graduates enrolled in post-graduate education because labor force participation and post-graduate education are affected by economic conditions.

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 worked as an employee or non-employed in $t-1$ (12 months

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

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

[19] 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 1.B.3).

[20] 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. 83% of all college graduates obtain their college degree in the used age range.

[21] 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.

[22] I use a classification of fields of study as provided by the German Statistical Office. See appendix A for further documentation. In appendix table 1.A.2 I show all used fields of study.

[23] See appendix A for information on response rates.

ago). Exit is defined as working as an employee or being non-employed in t and having been self-employed in $t-1$.[24] These definitions are applied to graduates in year one to four after graduation. In the case of fresh college graduates (year one after graduation), the employment status refers to the last year of college. In consequence, graduates which are self-employed in the first year after graduation are only counted as entrants if they were not self-employed alongside their studies. Self-employed are individuals that are (partial) owners of a firm to which they dedicate most of their employment activity. The employment status in $t-1$ is asked retrospectively.

Table 1.2 shows sample means of the two main dependent variables entry and exit, as well as the self-employment status in t and t-1, 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%. The share of entrepreneurs among recent graduates increases steadily throughout the first four years to about 9% in the fourth year after graduation.

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.[25] I use employment information of graduates in years one to five after graduation, to focus on graduates' typical first employment industries. 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 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

[24] Note that I code helping family members as employees, but the results are insensitive to this categorization.

[25] In appendix figure 1.B.2 I show field-industry employment weights over time for 6 fields of study.

classification of the service sector, which accounts for a large share of high skilled employment.[26] This leads to a weighting sample of 14,251 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.[27] This leads to a set of 37 industries (shown in table 1.A.3).

1.4 Results

1.4.1 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 favorable economic conditions may increase the value of both business and labor market opportunities. Table 1.3 shows the corresponding empirical results of model 1.1. 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 (0.77 of one standard deviation) in the year of graduation raises the probability of entry by 1.1 percentage points (sign. at 1%) in the first year after graduation and by 0.5 percentage points in the second year (sign. at 10%). These effects correspond to substantial relative increases of 31% and 24% over the respective sample means of 3.6% in the first and 2.1% in the second year after graduation. During the sample period, an increase of field-specific employment growth by one standard deviation

[26] 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 1.B.14).

[27] 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. The results are very similar when using the original industry classification (appendix table 1.B.13).

describes a typical expansion.[28] The coefficients are unchanged when additionally controlling for gender, foreign nationality, children at graduation and the type of university (column 2). This implies that potential changes in the composition of graduates with respect to these characteristics have no effect on the decision to start a firm.

The positive effect on entry in the first and second year after graduation implies that improving economic conditions seem to "pull" college graduates into self-employment.[29] 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 variation of the number of new employer firms (Chatterjee and Cooper, 1993; Campbell, 1998; Lee and Mukoyama, 2015). Possible channels for the procyclical entry behavior are cyclical demand affecting firms' growth prospects (Moreira, 2016; Adelino, Ma and Robinson, 2017) and capital availability (Siemer, 2014). 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 economic conditions. The pattern of coefficients allows for two interpretations. First, the increase in entry in the first and second year does not occur at the cost of a subsequent decrease in entry, 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 negative in the third or 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

[28] An increase of field-specific employment growth in the year of graduation by one standard deviation corresponds to an increase in entry of about 1.5 percentage point (40% relative to the mean).

[29] In an additional analysis, I find that the industry wage growth in the year of graduation mapped to the field of study level shows a negative association with entry into self-employment, which is independent of the effect of employment growth (table 1.B.9, columns 3-4). This suggests that also the outside option paid employment may influence the value of starting a firm.

sector may be due to occupational experience which cannot be fully transferred from paid employment to self-employment.[30]

As discussed in section 1.3, 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 of economic conditions in the years after graduation on the contemporaneous entry and exit decision (model 1.2). The results in column 3 of table 1.3 show that growth in years one to four after graduation has no contemporaneous effect on entry into entrepreneurship. When controlling for current growth, 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 control for lagged growth in the years after graduation or include a full set of interacted field-year fixed effects (appendix table 1.B.10). This result implies that economic conditions at graduation seem to be more important for the decision of recent graduates to become self-employed than current economic conditions in the subsequent years. The result is in line with the effects of initial and later economic conditions on the size of firms (Moreira, 2016) and earnings of college graduates (Oreopoulos, von Wachter and Heisz, 2012; Altonji, Kahn and Speer, 2016).

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. While a thorough analysis of firm growth and survival patterns goes beyond the scope of this paper, I will focus on individual level exit from entrepreneurship in the main sample of recent college graduates.

Exit from entrepreneurship is influenced by current economic conditions through their effect on current product demand, and by previous economic conditions

[30] 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.

through their effect on selection into entrepreneurship and potentially changes in the survival rate of these entrants.

Column 1 of table 1.4 refers to the baseline model (i.e. without controls for current growth in years 1-4 after graduation 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). This negative coefficient on (lagged) growth in the year of graduation seems not to be a result of correlated current growth. Even though current 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 1.2) does not change the negative effect of initial growth (column 4).

Taken together, the results suggest that the economic conditions which induced an increase in entry into entrepreneurship did not increase exit from entrepreneurship among fresh college graduates.

Two mechanisms may be simultaneously at play. The first mechanism is changes in the composition of college graduates which enter entrepreneurship, such as a cyclical shift in entrepreneurial ability and ambitions which may affect subsequent exit rates. The evidence on such cyclical composition changes is mixed. 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, Moreira (2014) offers evidence that the likelihood that someone becomes an entrepreneur out of necessity does not vary substantially with aggregate economic conditions. 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 than firms started during economic expansions (Moreira, 2016).

The second mechanism implies that favorable initial conditions positively influ-

ence 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, 2016; Foster, Haltiwanger and Syverson, 2016) and weaker financial constraints which facilitate capital accumulation (Chodorow-Reich, 2014; Siemer, 2014).

1.4.2 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, Fougere and Maurel, 2012; Wiswall and Zafar, 2015). On the other hand, given the inclusion of field and cohort fixed effects, selection on cyclical changes in earnings expectations requires the successful anticipation of *changes* in field-specific economic conditions at graduation. The large over-time variation of field-specific conditions (figure 1.2, panel b) and the fact that university education in Germany takes about 4-6 years to complete suggest that the anticipation of economic conditions at graduation is unlikely.[31]

To test explicitly for selective enrolment, I regress the number of first year students and their composition with respect to gender and nationality on field growth in the year of enrolment and future growth rates.[32] Since there is no information on enrolment in the Micro census data, I rely on publicly available administrative

[31] 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).
[32] Gender and nationality are the only two available characteristics.

data at the level of fields of study (see appendix A.3 for details). The results in table 1.5 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.[33] There is no correlation, however, between enrolment and *future* growth rates, suggesting that students have difficulties in anticipating economic conditions at graduation. Also, the share of females among first year students is not significantly associated with future field-specific growth. Only the share of foreign students among the newly enrolled exhibits a statistically significant correlation with field-specific current growth and growth in t+5, though the implied effect is economically small.[34] Related evidence on the selection of college majors based on aggregate economic conditions has 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 conditions 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 1.B.4). Furthermore, the qualitative results do not change when controlling for linear field of study trends (appendix table 1.B.5). 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 reacting to economic conditions either, since related fields are subject to similar economic conditions due to a typically similar employer industry structure.

A second mechanism that may lead to endogeneity of the field-cohort compo-

[33] Given the low correlation of industry growth over time, field-specific economic conditions at enrolment and graduation should not be correlated (figure 1.2).

[34] A one percentage point increase in employment growth (0.77 of one standard deviation) five years after enrolment raises the share of foreign students at enrolment by 0.3 percentage points (sign. at 5%). This corresponds to a relative increase of 1.7% over the sample mean of 17%.

sition to economic conditions is strategic timing of graduation. Students close to graduation may systematically move forward or postpone their graduation date 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 1.6). 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 1.B.6). This is in line with Oreopoulos, von Wachter and Heisz (2012) and Liu, Salvanes and Sørensen (2016), 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 arrived at least 2 years before migration and are subject to the here considered economic conditions at graduation. The results remain qualitatively unchanged (table 1.B.7, columns 3-4).

In a final set of regressions, I verify the robustness of my results to the use of

alternative industry growth measures. I show in table 1.B.8, columns 1-2, that the results are quantitatively similar when using deviations from long-term trends in the number of employees. To separate the cyclical component of the time-series, I use the conventional Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997).[35] Similar to the main specification, an increase in the detrended number of employees by its interquartile range leads to a rise in the probability of entry in the year after graduation by about 30% relative to the mean.

Further, I obtain similar results when using the HP-filtered cyclical component of the logarithm of total hours worked (table 1.B.8, 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).

Finally, I also investigate the effect of annual real GDP growth and hourly wage growth on entry into entrepreneurship (table 1.B.9). I find a positive effect of GDP growth in the year of graduation on entry in the first year after graduation (sign. at 5%). The coefficient size is comparable to the main coefficient on employment growth due to a larger variation of GDP growth relative to employment growth. There is no effect in the subsequent years. The effect of GDP growth disappears when controlling for employment growth, suggesting high multicollinearity. Wage growth has a negative effect on entry in the first year after graduation (sign. at 10%). This negative effect of wage growth is stable when controlling for GDP or employment growth, which suggests that field of study specific wage growth has no close contemporaneous correlation with field of study level GDP and employment growth. The results suggest that the main employment based growth proxy seems to capture mainly cyclical conditions in product markets related to a given field of study, which positively affect the decision to start a firm. Wage growth may relate to favorable conditions in labor markets, which in turn reflect improving outside options in paid employment and therefore decrease the value of self-employment.

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

1.5 Conclusions

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 setup allows me to proxy for field of study level economic conditions using weighted employment growth in the respective typical 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, current growth in later years has no effect, which demonstrates that college gradddduates' 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.

1.6 Figures and tables

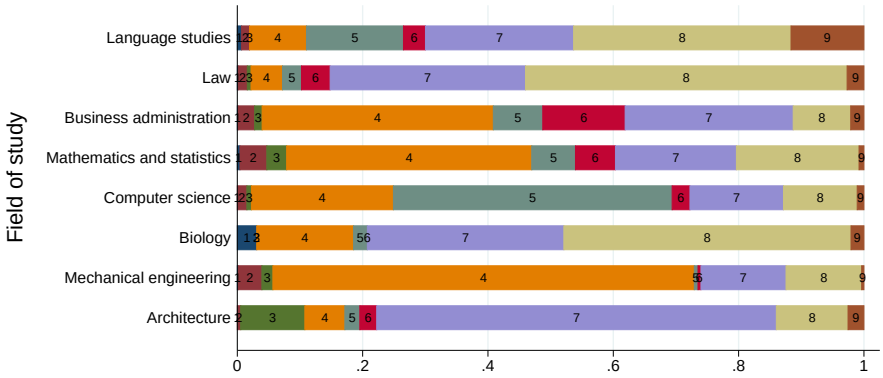
Table 1.1: Share of entrepreneurs by firm size and entrepreneurial characteristics

	Firm size			
Entrepreneur characteristics	50+	6-49	1-5	All
Started self-employment within 4 years after college	17.4	12.6	8.2	9.1
Started self-employment before college or 5 or more years after college	30.7	25.2	19.0	20.2
Entrepreneur with no college degree	51.9	62.2	72.8	70.7
Total	100	100	100	100

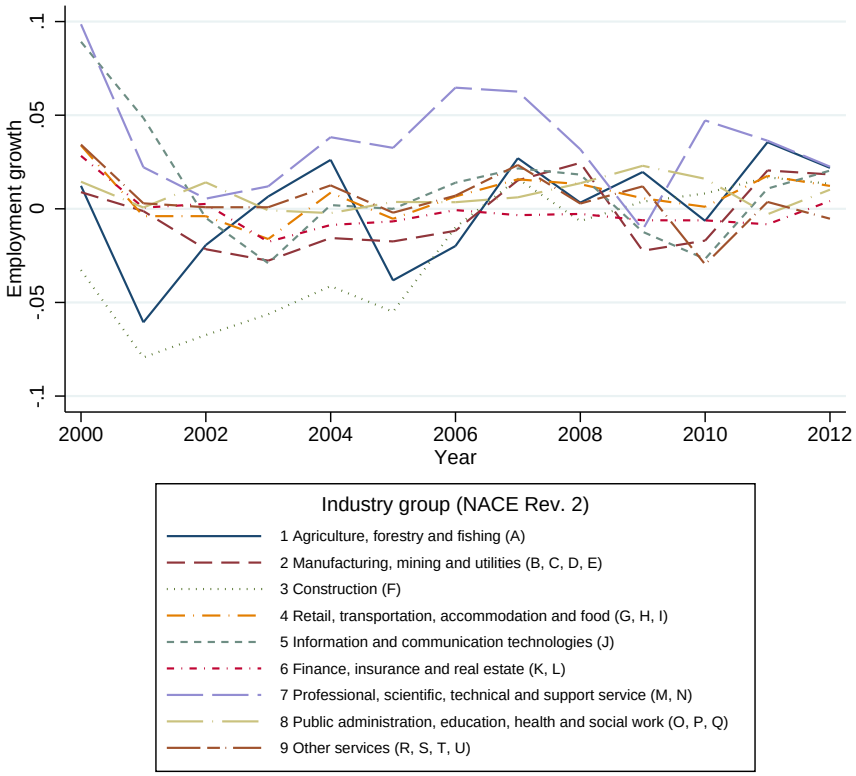
Notes: In this table, I show a tabulation of all entrepreneurs aged 30-65 by firm size (columns) and entrepreneurial characteristics by three groups: entrepreneurs which entered self-employment within four years after graduation (row 1), entrepreneurs which entered self-employment before graduation or more than four years after graduation (row 2) and entrepreneurs without college education (row 3). Firm size is measured in the year the owner is interviewed and includes the owner. It relates to the main self-employment activity. Data: German Micro Census, pooled over 2003-2011. Survey weights used.

Figure 1.1: Sectoral distribution of the 8 largest fields and annual growth by sectors

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



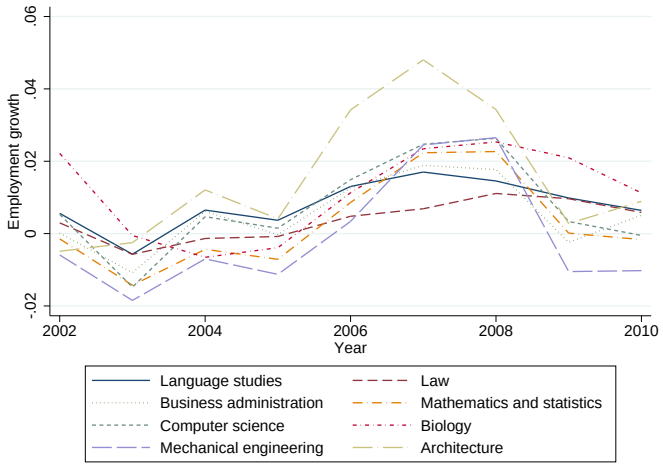
(b) Employment growth by broad industry groups



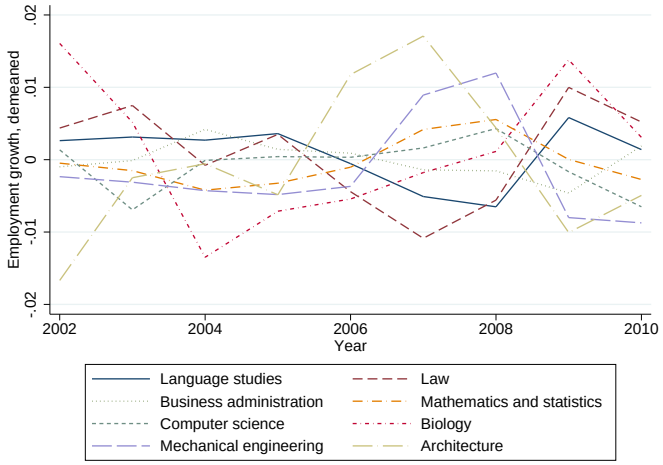
Notes: In panel (a) I illustrate the industry distribution of college graduates from the 8 largest fields of study. The used 2-digit NACE Rev. 2 industries are joined into 9 groups for illustrative purposes. The calculation is based on college graduates in paid employment in years 1-5 after graduation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

Figure 1.2: Annual growth rate for the 8 largest fields of study

(a) Actual growth rate



(b) Growth rate, demeaned



Notes: In the upper panel I show the yearly growth rate of the number of employees for the 8 largest fields of study. In the lower panel I show 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 1.2: Means of dependent variables by years since graduation

Years since graduation	1	2	3	4	Total
Entry	0.036	0.021	0.021	0.026	0.026
Self-employed	0.062	0.075	0.084	0.090	0.075
Self-employed t-1	0.032	0.061	0.070	0.071	0.056
Exit	0.006	0.007	0.007	0.006	0.007
Observations	6456	5720	4604	3627	20407

Notes: In this table I show sample means of the two main dependent variables *Entry* and *Exit* as well as the current and lagged self-employment status used to construct the variables. The sample means are presented separately for each of the first four years after graduation. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. *Exit* is defined as being an employee or non-employed 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. I exclude fields of study directly related to the primary or public sector.

Table 1.3: 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. $growth_{fc}$ denotes annual industry growth in the number of employees in the year of graduation, mapped 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, so that all results are presented separately for each of the first four years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation (accordingly, column 3 reports results on current growth). 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Standard deviation: 1.3. 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 1.4: 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 an employee or non-employed 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, mapped 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, so that all results are presented separately for each of the first four years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation (accordingly, column 3 reports results on current growth). 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Standard deviation: 1.3. 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 1.5: Evidence on the correlation between economic conditions and enrolment into fields of study

Dependent var:	ln(№ 1st year students)		Share female		Share foreign	
	(1)	(2)	(3)	(4)	(5)	(6)
$growth_{ft}$	0.0461**		0.0005		-0.0024*	
	(0.0182)		(0.0016)		(0.0014)	
$growth_{f,t+1}$	0.0020		-0.0011		-0.0005	
	(0.0078)		(0.0010)		(0.0015)	
$growth_{f,t+2}$	-0.0009		0.0001		0.0024	
	(0.0149)		(0.0009)		(0.0024)	
$growth_{f,t+3}$	0.0044		-0.0003		0.0007	
	(0.0163)		(0.0012)		(0.0015)	
$growth_{f,t+4}$	0.0042	0.0150	-0.0008	-0.0006	0.0018	0.0009
	(0.0123)	(0.0125)	(0.0010)	(0.0011)	(0.0017)	(0.0013)
$growth_{f,t+5}$	0.0053	0.0100	-0.0013	-0.0015	0.0034**	0.0025*
	(0.0146)	(0.0105)	(0.0016)	(0.0014)	(0.0016)	(0.0013)
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. Standard deviation: 1.3. 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 1.6: Evidence on strategic timing of graduation from college

Dependent variable:	Age at grad.	Aged 28+ at grad.	Aged 25- at grad.
	(1)	(2)	(3)
$growth_{fc}$	-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, so that all results are presented separately for each of the first four years after graduation. $growth_{f,c-n}$ indicates growth n years before graduation. 1st quartile, 3rd quartile and interquartile range of *growth*: -0.02, 1.77, 1.79. Standard deviation: 1.3. 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.

Appendix 1.A Data appendix

1.A.1 Micro Census data

The Micro Census is a household survey sampling 1% of the German population.[36] I use the Scientific Use File which contains a 70% sub-sample of the households in the Micro Census.[37] 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 1.A.1 contains definitions and summary statistics for the sample described in the data section.

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.

1.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

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

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

Table 1.A.1: Definitions of variables and summary statistics

Variable	Definition	Mean/ share	Standard deviation
Entry	1: self-employed in t, employee or non-employed in t-1, 0: else	0.026	
Exit	1: employee or non-employed 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 graduates 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: In this table I provide 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.

prepare directly for employment in the primary or public sector, since these sectors are strongly regulated. Examples include majors 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 1.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.

1.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.[38] 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.

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

Table 1.A.2: List of used fields of study

Field of study	Obs.	Perc.	Field of study	Obs.	Perc.
Other social sciences	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 and literature	32	0.2	Precision mechanics	171	0.8
German (language and literature) studies	610	3.0	Electrical engineering	549	2.7
English language and literature	310	1.5	Electronics and telecommunication	325	1.6
Roman 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	Tourism	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.

Table 1.A.3: Industry classification

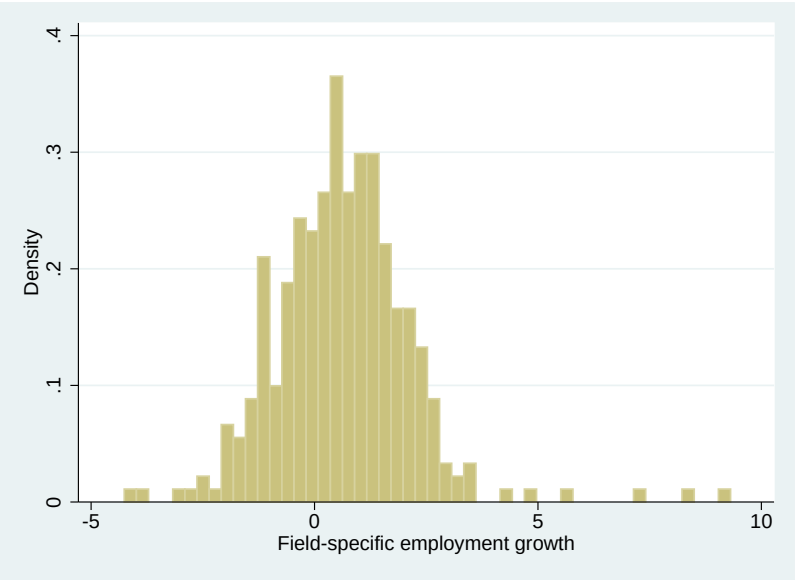
NACE 2.0 code	Industry description
1-3	Agriculture, forestry and fishing
5-9	Mining and quarrying
10-12	Manufacture of food, beverages and tobacco products
13-15	Manufacture of textiles, wearing apparel, leather products and shoes
16-18	Manufacture of wood and paper products; printing
19-20	Manufacture of coke and refined petroleum products; chemicals
21	Manufacture of pharmaceutical products
22-23	Manufacture of rubber, plastic and other non-metallic mineral products
24-25	Manufacture of metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29-30	Manufacture of motor vehicles and other transport equipment
31-33	Manufacture of furniture; Other manufacturing; Repair and installation of machinery
35-39	Energy and water supply, sewerage, waste and remediation activities
41-43	Construction
45-47	Wholesale and retail trade; repair of motor vehicles and motorcycles
49-53	Transportation and storage
55-56	Accommodation and food service activities
58-60	Publishing; motion picture, video, TV and music production; broadcasting
61	Telecommunications
62-63	Computer programming, consultancy and related activities; IT services
64-66	Financial and insurance activities
68	Real estate activities
69-70	Legal and accounting activities; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74-75	Other professional, scientific and technical activities; veterinary activities
77-79	Rental and leasing activities; employment activities; travel services
80	Security and investigation activities; Services to buildings and landscape activities; other business support activities
84	Public administration and defence; compulsory social security
85	Education
86	Human health activities
87-88	Residential care activities; social work activities
90-93	Arts and entertainment; cultural activities; gambling; sports and recreation
94-98	Other service activities; activities of households

Notes: Industry classification used for calculation of industry-field of study weights as described in section 1.3.2.

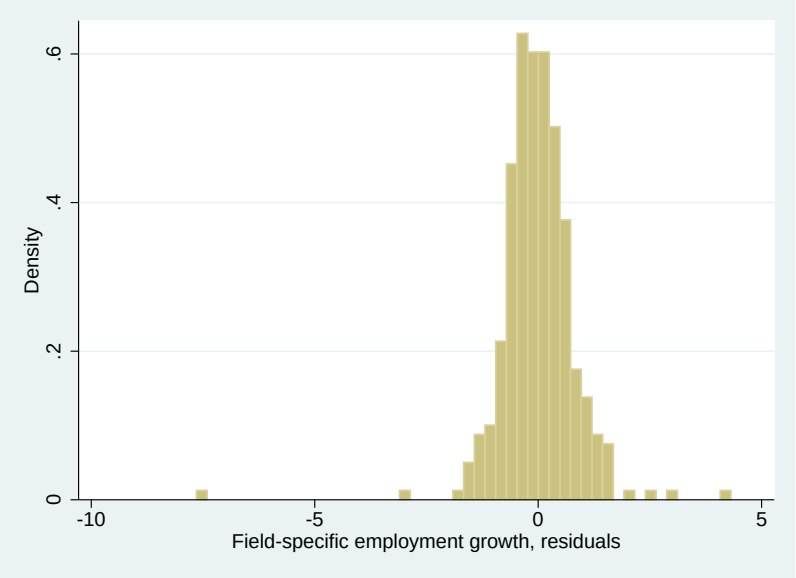
Appendix 1.B Additional figures and tables

Figure 1.B.1: Distribution of field-specific annual employment growth

(a) Distribution of field employment growth



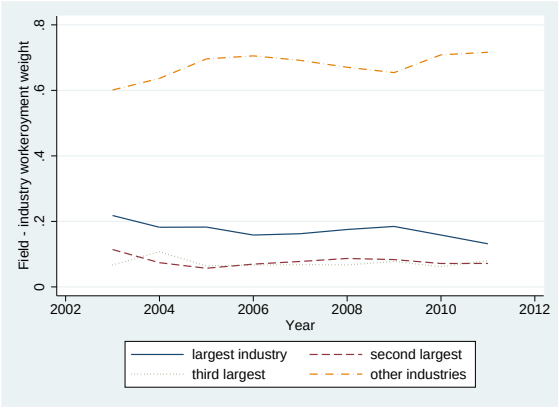
(b) Distribution of field employment growth, net of field and year FE



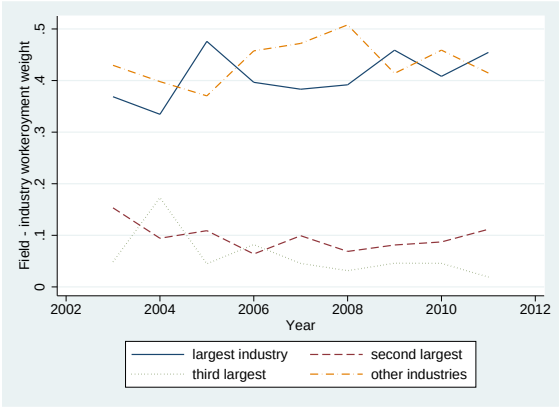
Notes: In panel (a) I show a histogram of field-specific employment growth in the regression sample. In panel (b) I show the residuals of a regression of field-specific employment growth on field and year fixed effects. The figure illustrates the variation of the annual field-specific employment growth used as main proxy for economic conditions.

Figure 1.B.2: Industry weights of the six largest fields of study

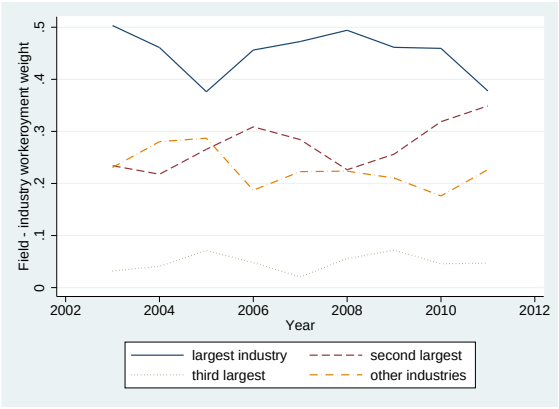
(a) Business administration



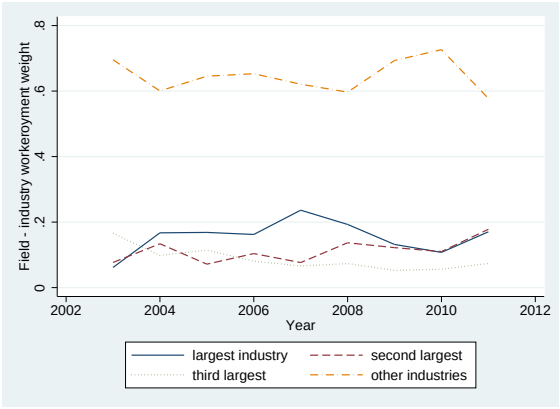
(b) Computer science



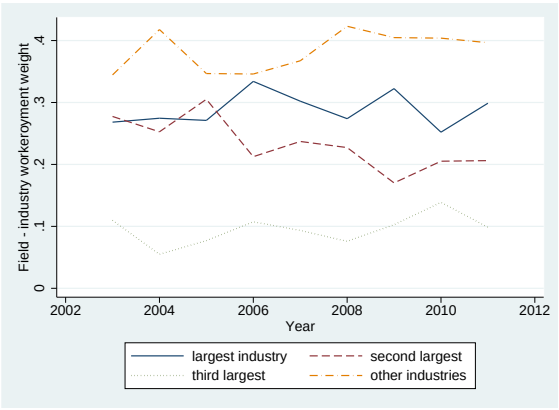
(c) Law



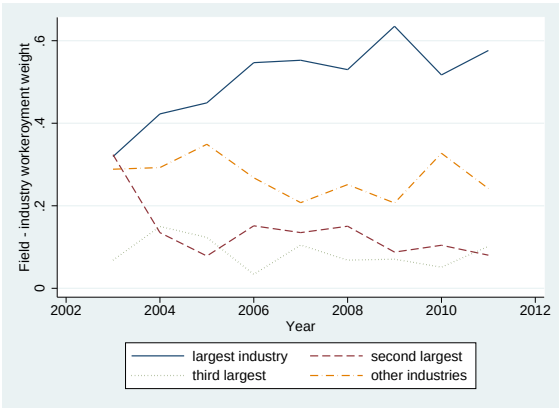
(d) Mathematics and statistics



(e) Mechanical engineering



(f) Architecture



Notes: In this figure I show the evolution of the field of study - industry weights for the largest six fields of study. For each field, I show the employment share of each of the three largest industries and the joined employment share of all remaining industries. The calculation is based on employees surveyed in years 2003 to 2011 who graduated up to five years ago. All other sampling restrictions as in the main weighting sample described in chapter 1.3.2.

Table 1.B.1: OECD statistics on tertiary education for Germany and the United States

Panel A: Educational attainment

ISCED 2011 education level	Below upper secondary education	Upper secondary education	Post-secondary non-tertiary education	Short-cycle tertiary education	Bachelor's or equivalent education	Master's, Doctoral or equivalent education
Germany	13.5	46.0	11.9	0.5	15.2	12.9
U.S.	9.4	44.3		10.9	22.5	13.0
OECD Average	21.1	38.5	5.7	7.4	17.0	13.6

Panel notes: Age 25-64, year 2017.

Source: OECD.Stat, Table "Share of population by educational attainment"

Panel B: Relative earnings - Upper secondary education = 100

ISCED 2011 education level	Below upper secondary education	Upper secondary education	Post-secondary non-tertiary education	Short-cycle tertiary education	Bachelor's or equivalent education	Master's, Doctoral or equivalent education
Germany	86.2	100.0	109.5	133.0	164.4	174.9
U.S.	76.3	100.0		111.2	162.7	220.2
OECD Average	82.2	100.0	..	121.8	143.7	186.6

Panel notes: Full-time full-year earners, year 2016.

Source: OECD.Stat, Table "Relative earnings, by educational attainment"

Panel C: Graduates by field

Field	Education	Arts & humanities	Social sciences & journalism	Business, administration & law	Natural sciences & mathematics	IT	Engineering	Agriculture	Health & welfare	Services
Germany	10.4%	11.9%	7.1%	24.1%	8.4%	4.6%	22.5%	1.8%	6.3%	2.7%
U.S.	8.3%	12.2%	14.9%	22.3%	7.9%	3.9%	7.0%	1.0%	16.3%	6.2%
OECD Average	9.9%	11.6%	11.9%	24.8%	6.9%	2.9%	12.8%	1.4%	13.8%	3.8%

Panel notes: Full-time full-year earners, year 2016. Source: OECD.Stat, Table "Graduates by field"

Table 1.B.2: Alternative employment growth proxy which excludes fresh graduates

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth\,based\,on\,MC_{fc} \times e_1$	0.0050**		-0.0003	
	(0.0023)		(0.0010)	
$growth\,based\,on\,MC_{fc} \times e_2$	-0.0002		0.0003	
	(0.0019)		(0.0008)	
$growth\,based\,on\,MC_{fc} \times e_3$	-0.0001		0.0013	
	(0.0024)		(0.0011)	
$growth\,based\,on\,MC_{fc} \times e_4$	0.0026		-0.0003	
	(0.0024)		(0.0013)	
$growth\,excl\,rec\,grad_{fc} \times e_1$		0.0054**		-0.0002
		(0.0023)		(0.0009)
$growth\,excl\,rec\,grad_{fc} \times e_2$		-0.0008		-0.0001
		(0.0020)		(0.0008)
$growth\,excl\,rec\,grad_{fc} \times e_3$		-0.0007		0.0014
		(0.0023)		(0.0011)
$growth\,excl\,rec\,grad_{fc} \times e_4$		0.0014		-0.0002
		(0.0024)		(0.0013)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	20407	20407	20407	20407

Notes: In this table I first calculate industry employment growth from Micro Census survey data instead of using administrative data ($growth\,based\,on\,MC_{fc}$, col. 1 and 2). I then modify this proxy by excluding recent college graduates (graduates within last 10 years, about 6% of all employees) so that the second proxy $growth\,excl\,rec\,grad_{fc}$ is based on employees with no college and graduates with completed college more than 10 years ago (col. 3 and 4). Both proxies are measured as annual year on year growth at the 2-digit industry level and smoothed using a moving-average filter with equal weight on the current value and the first lag, because of a small number of observations in some industry-year-cells. These series are subsequently mapped to the field of study level in the same way as the main employment based proxy. To obtain consistent industry groups over the years 2002 to 2011, I constructed a correspondence from the NACE rev. 1.1 industry classification (survey waves 2002-09) to the NACE rev. 2 industry classification (survey waves 2009-11) using the algorithm proposed by Pierce and Schott (2012). 1st quartile, 3rd quartile and interquartile range of $growth\,based\,on\,MC_{fc}$: 0.741, 2.726, 1.985. 1st quartile, 3rd quartile and interquartile range of $growth\,excl\,rec\,grad_{fc}$: 0.080, 2.307, 2.227. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.3: Balanced sample: cohorts 2003-2007

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0181***	0.0178***	-0.0020*	-0.0037**
	(0.0065)	(0.0060)	(0.0011)	(0.0015)
$growth_{fc} \times e_2$	0.0066	0.0072*	-0.0009	-0.0010
	(0.0040)	(0.0041)	(0.0014)	(0.0014)
$growth_{fc} \times e_3$	-0.0047	-0.0029	-0.0012	-0.0016
	(0.0034)	(0.0031)	(0.0014)	(0.0017)
$growth_{fc} \times e_4$	-0.0047	-0.0028	-0.0010	-0.0005
	(0.0052)	(0.0043)	(0.0022)	(0.0020)
$growth_{f,c+1} \times e_1$		0.0043		0.0008
		(0.0058)		(0.0017)
$growth_{f,c+2} \times e_2$		0.0067		0.0011
		(0.0049)		(0.0012)
$growth_{f,c+3} \times e_3$		0.0052		-0.0030*
		(0.0038)		(0.0018)
$growth_{f,c+4} \times e_4$		0.0035		-0.0035***
		(0.0039)		(0.0012)
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Observations	14696	14696	14696	14696

Notes: In this table I provide 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.028. *Exit* is defined as being an employee or non-employed 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, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. 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 1.B.4: Additional covariates which aim at controlling for selective enrolment

Depvar:	Entry				Exit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$growth_{fc} \times e_1$	0.0113***	0.0112***	0.0116***	0.0112***	-0.0013	-0.0011	-0.0012	-0.0012
	(0.0036)	(0.0036)	(0.0040)	(0.0036)	(0.0014)	(0.0014)	(0.0013)	(0.0014)
$growth_{fc} \times e_2$	0.0050*	0.0049*	0.0054*	0.0050*	-0.0016	-0.0016*	-0.0017	-0.0016
	(0.0028)	(0.0028)	(0.0032)	(0.0028)	(0.0010)	(0.0009)	(0.0010)	(0.0010)
$growth_{fc} \times e_3$	-0.0018	-0.0016	-0.0014	-0.0018	-0.0028**	-0.0026**	-0.0028**	-0.0028*
	(0.0027)	(0.0027)	(0.0029)	(0.0027)	(0.0013)	(0.0012)	(0.0013)	(0.0013)
$growth_{fc} \times e_4$	-0.0019	-0.0021	-0.0014	-0.0018	-0.0022	-0.0024	-0.0023	-0.0023
	(0.0041)	(0.0042)	(0.0045)	(0.0041)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$ln(\#\,grad.)_{fc}$	-0.0061				0.0032			
	(0.0052)				(0.0028)			
$growth_{age19}$		-0.0002				-0.0002		
		(0.0006)				(0.0003)		
$growth_{f,c-2}$			0.0012				-0.0001	
			(0.0022)				(0.0010)	
$growth_{f,c-4}$				-0.0005				0.0001
				(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: In this table I provide 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, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.5: Controlling for linear field of study trends

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$	0.0107***	0.0118***	-0.0009	-0.0011
	(0.0041)	(0.0039)	(0.0016)	(0.0017)
$growth_{fc} \times e_2$	0.0043	0.0061**	-0.0013	-0.0009
	(0.0029)	(0.0028)	(0.0013)	(0.0013)
$growth_{fc} \times e_3$	-0.0028	-0.0007	-0.0025	-0.0024
	(0.0027)	(0.0028)	(0.0016)	(0.0015)
$growth_{fc} \times e_4$	-0.0031	-0.0014	-0.0020	-0.0012
	(0.0043)	(0.0036)	(0.0019)	(0.0018)
$growth_{f,c+1} \times e_1$		0.0015		-0.0003
		(0.0038)		(0.0012)
$growth_{f,c+2} \times e_2$		0.0057		0.0010
		(0.0040)		(0.0009)
$growth_{f,c+3} \times e_3$		0.0048		-0.0023*
		(0.0038)		(0.0013)
$growth_{f,c+4} \times e_4$		0.0007		-0.0022
		(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: In this table I provide 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. 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 1.B.6: 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 28 + *at grad.*		0.0115***			0.0037**	
		(0.0035)			(0.0018)	
Age 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: In this table I provide 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. 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 1.B.7: The effect of economic conditions on entrepreneurship among natives

Sample:	Baseline		Drop late immigrants	
	(1)	(2)	(3)	(4)
Dependent variable:	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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. 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 1.B.8: HP-filtered number of employees and total hours worked as proxies for economic conditions

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$employed\,(HP)_{fc} \times e_1$	0.7694**		-0.1905	
	(0.3777)		(0.1513)	
$employed\,(HP)_{fc} \times e_2$	0.0444		-0.2284	
	(0.4411)		(0.1424)	
$employed\,(HP)_{fc} \times e_3$	-0.3182		-0.2922*	
	(0.3787)		(0.1566)	
$employed\,(HP)_{fc} \times e_4$	-0.1345		-0.1296	
	(0.5569)		(0.1844)	
$hours\,worked\,(HP)_{fc} \times e_1$		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. The variables $employees\,(HP)_{fc}$ 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.9: GDP and wage growth as proxies for economic conditions

Dependent var.:	Entry					Exit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$GDP\,gr._{fc} \times e_1$	0.0013*	0.0008			0.0018**	0.0003		
	(0.0007)	(0.0009)			(0.0009)	(0.0004)		
$GDP\,gr._{fc} \times e_2$	0.0013	0.0006			0.0009	0.0005		
	(0.0010)	(0.0009)			(0.0010)	(0.0005)		
$GDP\,gr._{fc} \times e_3$	0.0012	0.0011			0.0009	-0.0001		
	(0.0009)	(0.0010)			(0.0012)	(0.0006)		
$GDP\,gr._{fc} \times e_4$	0.0008	-0.0001			0.0017	-0.0001		
	(0.0013)	(0.0012)			(0.0016)	(0.0007)		
$empl\,gr._{fc} \times e_1$		0.0109***		0.0108***				-0.0010
		(0.0039)		(0.0038)				(0.0015)
$empl\,gr._{fc} \times e_2$		0.0052*		0.0048*				-0.0019*
		(0.0028)		(0.0028)				(0.0010)
$empl\,gr._{fc} \times e_3$		-0.0027		-0.0009				-0.0033**
		(0.0031)		(0.0028)				(0.0014)
$empl\,gr._{fc} \times e_4$		-0.0012		-0.0018				-0.0020
		(0.0043)		(0.0040)				(0.0020)
$wage\,gr._{fc} \times e_1$			-0.0061**	-0.0056*	-0.0079**		-0.0019*	-0.0021*
			(0.0030)	(0.0029)	(0.0037)		(0.0011)	(0.0011)
$wage\,gr._{fc} \times e_2$			-0.0008	-0.0030	-0.0016		-0.0015	-0.0020
			(0.0028)	(0.0030)	(0.0031)		(0.0014)	(0.0015)
$wage\,gr._{fc} \times e_3$			0.0029	0.0007	0.0032		-0.0018	-0.0024
			(0.0030)	(0.0031)	(0.0031)		(0.0013)	(0.0017)
$wage\,gr._{fc} \times e_4$			-0.0064	-0.0073*	-0.0066		0.0002	0.0004
			(0.0043)	(0.0041)	(0.0056)		(0.0016)	(0.0018)
FE	yes	yes	yes	yes	yes	yes	yes	yes
Covariates	yes	yes	yes	yes	yes	yes	yes	yes
Observations	20407	20407	20407	20407	20407	20407	20407	20407

Notes: In this table I use annual year on year growth of real GDP ($GDP\,growth_{fc}$) and hourly wage growth ($wage\,growth_{fc}$) in the year of graduation as alternative proxies for economic conditions. Both proxies are measured at the 2-digit industry level and subsequently mapped to the field of study level in the same way as the main employment based proxy. 1st quartile, 3rd quartile and interquartile range of $GDP\,growth_{fc}$: -1.635, 4.044, 5.679. 1st quartile, 3rd quartile and interquartile range of $wage\,growth_{fc}$: 0.831, 2.285, 1.454. Dependent variables and sample as in tables 3 and 4. 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 1.B.10: Controlling for lagged effects of growth in years 1-4 after graduation and interacted field - calendar year fixed effects

	Additional Controls		Interacted Field-Year FE	
	(1)	(2)	(3)	(4)
Dependent variable:	Entry	Exit	Entry	Exit
$growth_{fc} \times e_1$	0.0129***	-0.0012	0.0110***	-0.0015
	(0.0035)	(0.0014)	(0.0038)	(0.0013)
$growth_{fc} \times e_2$	0.0056**	-0.0023	0.0050	-0.0022*
	(0.0027)	(0.0015)	(0.0032)	(0.0012)
$growth_{fc} \times e_3$	0.0002	-0.0030*	-0.0014	-0.0015
	(0.0039)	(0.0016)	(0.0029)	(0.0015)
$growth_{fc} \times e_4$	0.0015	-0.0002	-0.0000	-0.0004
	(0.0040)	(0.0017)	(0.0043)	(0.0017)
$growth_{f,c+1} \times e_1$	0.0022	-0.0006		
	(0.0036)	(0.0012)		
$growth_{f,c+1} \times e_2$	0.0031	0.0017		
	(0.0022)	(0.0013)		
$growth_{f,c+1} \times e_3$	-0.0008	0.0000		
	(0.0043)	(0.0022)		
$growth_{f,c+1} \times e_4$	-0.0050	-0.0015		
	(0.0045)	(0.0022)		
$growth_{f,c+2} \times e_2$	0.0058	-0.0001		
	(0.0042)	(0.0009)		
$growth_{f,c+2} \times e_3$	0.0046	0.0010		
	(0.0035)	(0.0016)		
$growth_{f,c+2} \times e_4$	0.0030	-0.0024		
	(0.0049)	(0.0025)		
$growth_{f,c+3} \times e_3$	0.0041	-0.0030**		
	(0.0043)	(0.0015)		
$growth_{f,c+3} \times e_4$	-0.0024	0.0017		
	(0.0038)	(0.0020)		
$growth_{f,c+4} \times e_4$	0.0017	-0.0045**		
	(0.0045)	(0.0023)		
FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Field-year FE	no	no	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 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. $growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation, so that all results are presented separately for each of the first four years after graduation. $growth_{f,c+n}$ indicates growth n years after graduation. 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 1.B.11: Employment growth based on all employed

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$alt.growth_{fc} \times e_1$	0.0117***	0.0127***	-0.0007	-0.0009
	(0.0040)	(0.0038)	(0.0014)	(0.0015)
$alt.growth_{fc} \times e_2$	0.0059**	0.0070**	-0.0014	-0.0010
	(0.0028)	(0.0028)	(0.0010)	(0.0010)
$alt.growth_{fc} \times e_3$	-0.0017	-0.0005	-0.0025*	-0.0024*
	(0.0031)	(0.0033)	(0.0014)	(0.0014)
$alt.growth_{fc} \times e_4$	-0.0013	-0.0008	-0.0019	-0.0012
	(0.0042)	(0.0041)	(0.0022)	(0.0021)
$alt.growth_{f,c+1} \times e_1$		0.0012		-0.0005
		(0.0035)		(0.0012)
$alt.growth_{f,c+2} \times e_2$		0.0053		0.0009
		(0.0038)		(0.0009)
$alt.growth_{f,c+3} \times e_3$		0.0063		-0.0025**
		(0.0040)		(0.0012)
$alt.growth_{f,c+4} \times e_4$		0.0018		-0.0025*
		(0.0039)		(0.0014)
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. Different from the main specification, I construct $alt.growth_{fc}$ from annual growth in the number of all employed rather than only paid employees in an industry. Industry employment growth is weighted to the field level using the average industry-field distribution of graduates 1 to 5 years after graduation. $alt.growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation, so that all results are presented separately for each of the first four years after graduation. $alt.growth_{f,c+n}$ indicates growth n years after graduation. 1st quartile, 3rd quartile and interquartile range of *alt.growth*: 0.17, 1.74, 1,57. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.12: The effect of future economic conditions on entry into entrepreneurship

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$growth_{fc} \times e_1$		0.0111***		-0.0016
		(0.0039)		(0.0016)
$growth_{fc} \times e_2$		0.0052**		-0.0015
		(0.0026)		(0.0010)
$growth_{fc} \times e_3$		-0.0017		-0.0027**
		(0.0031)		(0.0014)
$growth_{fc} \times e_4$		-0.0017		-0.0021
		(0.0042)		(0.0018)
$growth_{f,c+2} \times e_1$	-0.0035	-0.0003	-0.0003	-0.0009
	(0.0023)	(0.0027)	(0.0009)	(0.0011)
$growth_{f,c+3} \times e_2$	-0.0000	0.0006	0.0006	0.0004
	(0.0028)	(0.0025)	(0.0011)	(0.0011)
$growth_{f,c+4} \times e_3$	-0.0021	-0.0001	-0.0012	-0.0008
	(0.0028)	(0.0028)	(0.0009)	(0.0009)
$growth_{f,c+5} \times e_4$	-0.0024	-0.0003	-0.0013	-0.0013
	(0.0026)	(0.0020)	(0.0012)	(0.0011)
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 on entry into entrepreneurship in each of the first four years after graduation. Column 1 shows the effect of employment growth in the subsequent year on entry in each of the first four years after graduation. Column 2 adds the effect of employment growth in the year of graduation. Columns 3 and 4 show the equivalent results for exit from entrepreneurship. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.13: 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***	0.0114***	-0.0025***	-0.0029**
	(0.0032)	(0.0033)	(0.0010)	(0.0012)
$growth_{fc} \times e_2$	0.0039	0.0050**	-0.0025**	-0.0022**
	(0.0027)	(0.0025)	(0.0011)	(0.0011)
$growth_{fc} \times e_3$	-0.0025	-0.0005	-0.0033**	-0.0034**
	(0.0030)	(0.0031)	(0.0015)	(0.0014)
$growth_{fc} \times e_4$	-0.0031	-0.0025	-0.0027	-0.0020
	(0.0044)	(0.0036)	(0.0020)	(0.0020)
$growth_{f,c+1} \times e_1$		-0.0005		-0.0007
		(0.0036)		(0.0013)
$growth_{f,c+2} \times e_2$		0.0057		0.0006
		(0.0043)		(0.0009)
$growth_{f,c+3} \times e_3$		0.0062		-0.0031**
		(0.0044)		(0.0015)
$growth_{f,c+4} \times e_4$		-0.0007		-0.0030*
		(0.0040)		(0.0016)
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. 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, so that all results are presented separately for each of the first four 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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 1.B.14: 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)
$growth_{cf} \times e_1$	0.0118***	0.0136***	-0.0021*	-0.0023*
	(0.0037)	(0.0040)	(0.0012)	(0.0013)
$growth_{cf} \times e_2$	0.0040	0.0046*	-0.0017	-0.0013
	(0.0027)	(0.0026)	(0.0011)	(0.0012)
$growth_{cf} \times e_3$	-0.0023	-0.0014	-0.0031**	-0.0030*
	(0.0037)	(0.0036)	(0.0015)	(0.0016)
$growth_{cf} \times e_4$	-0.0011	-0.0014	-0.0026	-0.0018
	(0.0048)	(0.0044)	(0.0024)	(0.0023)
$growth_{f,c+1} \times e_1$		-0.0022		-0.0009
		(0.0031)		(0.0014)
$growth_{f,c+2} \times e_2$		0.0043		0.0011
		(0.0046)		(0.0009)
$growth_{f,c+3} \times e_3$		0.0058		-0.0031**
		(0.0045)		(0.0016)
$growth_{f,c+4} \times e_4$		0.0004		-0.0023
		(0.0036)		(0.0015)
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. 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. To obtain consistent industry groups over the years 2002 to 2011, I to construct a correspondence from the NACE rev. 1.1 industry classification (survey waves 2002-09) to the NACE rev. 2 industry classification (survey waves 2009-11). 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, so that all results are presented separately for each of the first four 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 an employee or non-employed in $t-1$. Mean of *entry*: 0.027. *Exit* is defined as being an employee or non-employed 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.

Table 1.B.15: More parsimonious sets of fixed effects, entry

Dependent variable:	Entry					
	(1) (Baseline)	(2)	(3)	(4)	(5)	(6)
$growth_{fc} \times e_1$	0.0112***	0.0083**	0.0133***	0.0138***	0.0094***	0.0101***
	(0.0036)	(0.0032)	(0.0035)	(0.0040)	(0.0028)	(0.0034)
$growth_{fc} \times e_2$	0.0050*	0.0037*	0.0041*	0.0084***	0.0013	0.0056***
	(0.0028)	(0.0021)	(0.0022)	(0.0019)	(0.0015)	(0.0018)
$growth_{fc} \times e_3$	-0.0017	-0.0015	-0.0002	0.0026	-0.0018	0.0007
	(0.0027)	(0.0023)	(0.0023)	(0.0029)	(0.0017)	(0.0026)
$growth_{fc} \times e_4$	-0.0018	0.0002	0.0002	0.0045	0.0008	0.0035
	(0.0041)	(0.0024)	(0.0036)	(0.0033)	(0.0024)	(0.0023)
FE	yes	yes	yes	yes	yes	yes
Covariates	yes	yes	yes	yes	yes	yes
Year FE (t)	yes	yes	yes	yes	yes	yes
Field FE (f)	yes	yes	yes	no	yes	no
Cohort FE (c)	yes	no	yes	yes	no	no
Years since highest degree FE (n)	yes	yes	no	yes	no	yes
Observations	20407	20407	20407	20407	20407	20407

Notes: In this table I modify the set of fixed effects for the model with entry as dependent variable. Column 1 is the baseline specification (table 1.3, column 2).
$growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. *Entry* is defined as being self-employed in year t and an employee or non-employed in $t-1$. Mean of *entry*: 0.027. 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 1.B.16: More parsimonious sets of fixed effects, exit

Dependent variable:	Exit					
	(1) (Baseline)	(2)	(3)	(4)	(5)	(6)
$growth_{fc} \times e_1$	-0.0012	0.0002	-0.0021	0.0007	-0.0008	0.0011
	(0.0014)	(0.0010)	(0.0014)	(0.0012)	(0.0008)	(0.0009)
$growth_{fc} \times e_2$	-0.0016	-0.0007	-0.0019**	0.0004	-0.0005	0.0002
	(0.0010)	(0.0008)	(0.0009)	(0.0011)	(0.0007)	(0.0008)
$growth_{fc} \times e_3$	-0.0028**	-0.0025***	-0.0035***	-0.0004	-0.0020**	-0.0016
	(0.0013)	(0.0009)	(0.0012)	(0.0014)	(0.0008)	(0.0010)
$growth_{fc} \times e_4$	-0.0023	-0.0025*	-0.0036**	0.0005	-0.0024*	-0.0014
	(0.0018)	(0.0013)	(0.0018)	(0.0016)	(0.0012)	(0.0012)
FE	yes	yes	yes	yes	yes	yes
Covariates	yes	yes	yes	yes	yes	yes
Year FE (t)	yes	yes	yes	yes	yes	yes
Field FE (f)	yes	yes	yes	no	yes	no
Cohort FE (c)	yes	no	yes	yes	no	no
Years since highest degree FE (n)	yes	yes	no	yes	no	yes
Observations	20407	20407	20407	20407	20407	20407

Notes: In this table I modify the set of fixed effects for the model with exit as dependent variable. Column 1 is the baseline specification (table 1.4, column 2).
$growth_{fc} \times e_n$ denotes the interaction with a dummy for graduates n years after graduation, so that all results are presented separately for each of the first four 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. Standard deviation: 1.3. *Exit* is defined as being an employee or non-employed 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.

Chapter 2

Entrepreneurial Entry and Deregulation

This chapter is part of joint work with Susanne Prantl.

2.1 Introduction

There is a long-standing interest in the entry of entrepreneurs and new firms as entry is widely recognized as a major driver of job creation and economic growth.[1] One important factor that can inhibit and shape entry is regulatory restrictions. Their role attracts substantial attention from policy makers, as well as the public, but is not yet fully understood.

In this paper, we study the role of entry regulation and its consequences for entrepreneurial entry and exit, making use of a reform to a specific and strict entry restriction. The reform consists of a major change to the German Trade and Crafts Code (Gesetz zur Ordnung des Handwerks) in 2004. Up to the reform, the Code imposed a substantial mandatory standard, the master craftsman certificate (Meistertitel), on entrepreneurs who wanted to start a legally independent firm in one of

[1] See, for example, Glaeser, Kerr and Kerr (2015) on the spatial link between entrepreneurship and employment and Aghion et al. (2004, 2009) on the effect of foreign firm entry on domestic innovation and productivity.

a large number of regulated product markets. Similar standards are known in other European countries as well, but the regulation in Germany was particularly strict. A master craftsman certificate is a professional degree that an individual can earn after several stages of training, collecting work experience, and taking examinations. Earning the certificate involves not only monetary costs, such as fees for preparation courses, but also a substantial investment of time. As of 2004, the German master craftsman certificate lost its role as a mandatory standard for prospective entrepreneurs (up to some minor exceptions). Given the substantial costs involved in acquiring the certificate, the deregulation led to a significant reduction in entry restrictions. Due to two core features, the reform qualifies as a suitable quasi-natural experiment for identifying effects of an important and substantial entry regulation. First, the set of product markets affected by the regulation relates to a diverse set of manufacturing industries, as well as service industries, and its composition goes back long in time, at least to times before World War II. Second, the timing of the reform was exogenously determined by the strengthening of regulatory activities at the supra-national level of the European Community and a related court case filed at the Federal Constitutional Court in Germany (Bundesverfassungsgericht) in 2002. Still before the Federal Constitutional Court reached its decision, the Federal Government of Germany (Bundesregierung) and the German Bundestag moved ahead by opting for the major change to the German Trade and Crafts Code as implemented in 2004.

For our empirical analysis, we combine data from several sources, using, in particular, a comprehensive and large German population survey where participation is mandatory (Micro Census). Our main sample with about 600,000 observations covers the years 1996 to 2009, and 51 industries in manufacturing and services. In our empirical analysis we implement a difference-in-differences approach, estimating effects of the deregulation reform by comparing changes in outcome variables over time in industries with different deregulation intensities.

Our main empirical findings are fourfold. First, we find a statistically and economically significant positive effect of the deregulation reform on entry into self-employment. Second, most new ventures start without employees. This is in line with expectations since the entry regulation effectively constituted a fixed cost to prospective entrepreneurs, which is most restrictive for entrepreneurs which intended

to start on a small scale. Third, in consequence of the reform the entrants are less likely to have no schooling or low schooling. Finally, we see no changes in overall exit from self-employment in the first six years after the reform. The absence of any decrease in the level of general education among entrants and the unchanged exit from entrepreneurship suggest that the entrants which entered in consequence of the reform may be of similar quality.

We contribute to the literature on the effects of entry regulation. An earlier set of studies based on cross country comparison documents a negative relationship between country-level measures of the time it takes to register a new business and firm entry.[2] A second, more closely related strength of literature directly assesses the consequences of policies that reduce specific firm entry restrictions using cross region or industry variation. Among the recent contributions to that literature are Branstetter et al. (2014) who study the effects of a reduction of administrative procedures in Portugal, as well as Bruhn (2011) and Kaplan, Piedra and Seira (2011) who consider a similar administrative reform in Mexico. All three studies document positive effects on firm entry, but only Branstetter et al. (2014) studies the characteristics and performance of entrants. Finally, there are two studies by Prantl and Spitz-Oener (2009) and Prantl (2012) which analyze the economic effects of the entry restriction following from the German Trade and Crafts Code on entry into self-employment. Prantl and Spitz-Oener (2018) use variation in entry restriction generated by the German Trade and Crafts Code in an analysis of the effect of immigration on natives' wages. Differently from this chapter they use quasi-experimental variation from the German reunification.[3]

The rest of the paper is organized as follows. We present the considered entry regulation and its reform in section 2.2. We explain the empirical strategy in section 2.3 and the data in section 2.4. The empirical results are discussed in section 2.5. Section 2.6 summarizes our findings and provides conclusions.

[2] For example, Ciccone and Papaioannou (2007) show that in countries where it takes less time to register a new business, expansionary industry demand and technology shifts lead to higher entry and employment growth.

[3] Furthermore, Damelang, Haupt and Abraham (2018) study wage changes in occupations related to the GTCC around the time of the 2004 reform. Rostam-Afschar (2014) and Zwiener (2017) study the effect of the GTCC reform on self-employment and related labor market outcomes. I will relate to their findings in section 2.5.

2.2 The regulation of firm entry and its reform

2.2.1 The considered entry regulation

The studied firm entry regulation is based on the German Trade and Crafts Code (GTCC; Gesetz zur Ordnung des Handwerks, HwO, December 24, 2003), which - up to its reform in 2004 - imposed a substantial restriction on firm entry into certain product markets, but not in others. The roots of the law go back to the historical guild system of the Middle Ages, when skilled craftsmen who wanted to start a firm needed to join the respective guild (Ogilvie, 2014). In its current form, the entry regulation was formally introduced in 1935. From then on, individuals who wanted to start a business in a regulated product market needed to obtain a master craftsman certificate.[4] After World War II the entry regulation was confirmed in both parts of the then divided West and East Germany. It became part of a federal law in 1953, including a precise list of affected product markets (Gesetz zur Ordnung des Handwerks, September 17, 1953).[5] In 1994, about 18% of all Germans were employed in businesses which were active in product markets regulated under the GTCC.[6] The covered product markets are in fields as diverse as printing and bookbinding, baker and butcher trades or hairdressing. Often, very related product markets are not regulated, such as copying and paper production, manufacture and sale of ice-cream or the beautician trade. The entry regulation and its product market coverage remained essentially unchanged until before the here considered reform.[7] We will make use of the long-standing character of the regulation in our identification strategy.

Until 2004, entrepreneurs wanting to start a firm in a product market regulated

[4] The entry restriction was part of a forced integration of the crafts associations into the totalitarian Nazi system (Wagner, 2006). See Appendix 2.A.1 for historical background on the entry regulation.

[5] Former West Germany's regulation was adopted without changes by the reunified Germany in 1990.

[6] The share is based on 6.3 million employed in firms which are registered with a crafts association (Statistisches Bundesamt, 1996) and 35.7 million employed in Germany (DESTATIS database "Genesis-Online", https://www-genesis.destatis.de/genesis/online , Table 12211-0001).

[7] Appendix 2.A.1 provides details.

under the German Trade and Crafts Code needed to be registered with the local craftsman association.[8,9] Generally, this requires a master craftsman certificate in the respective regulated product market, which can be attained by taking the master craftsman examination.[10] Applicants are generally required a two to three year apprenticeship and three years of work as a journeyman.[11] The master exam tests knowledge on running a business such as book-keeping and legal aspects, skills necessary for training apprentices and occupation-specific skills. The examination is carried out in closed sessions by a regional committee, in which three out of five examiners are from the same regulated product market.[12] In the 1990s, between 10% and 25% of the candidates failed the master craftsman exam.[13] Candidates typically prepare for the examination by taking specialized preparatory courses, which take between one (full-time) and three years (part-time) and typically have to be paid by the candidate. Taken together, the necessary time investment and the financial costs involved in attaining the mandatory entry standard constitute a substantial restriction to starting a firm in the regulated product markets. Similar regulation exists in other countries, as for example in Austria or the Netherlands, but the rules in Germany were particularly strict (Monopolkommission, 1998).

At its legal re-introduction in post-war Germany in 1953, proponents of the GTCC regulation stressed the business-related knowledge and skills which form part of the master craftsman examination, claiming positive effects on firm stability (Deutscher Bundestag, 1953, 12546). However, several institutions such as the German Mo-

[8] Note that the firm entry regulation here is different from occupational licensing. It imposes restrictions on individuals who want to start a business, whereas occupational licensing laws restrict the access to occupations for both employees and self-employed unless they fulfill specific occupational standards (see Kleiner, 2000, among others).

[9] More precisely, the regulation applies to businesses in regulated product markets which are to be distinguished from industrial manufacturing. See Appendix 2.A.2 for details on the scope of the regulation.

[10] Note that there is the possibility of applying for an exemption to the master certificate requirement, if the applicant proves to be equally qualified. Exemptions accounted for about 8% of all registrations in the years 1998-2003. See Appendix 2.A.2 for further information.

[11] An apprenticeship involves professional education at a vocational school and on-the-job training in a regulated product markets. It is completed by a journeyman examination, which certifies the required skills for undertaking all occupation-specific tasks

[12] The committee consists of an independent chair, three employed in the respective regulated product market, of which two are incumbent firm owners, and one expert in law and business administration.

[13] Source: Data provided directly by the German Confederation of Skilled Crafts, ZDH.

nopolies Commission have long criticized the entry regulation in the GTCC (Deregulierungskommission, 1991, Monopolkommission, 1998, Monopolkommission, 2002). The regulation is argued to restrict firm entry, industry dynamics and job creation.

2.2.2 Reform of the entry regulation

In 2003 the German government coalition proposed a major reform of the Trade and Crafts Code, coming into effect on 1 January 2004.[14] The government explicitly motivated the reform as a response to an inconsistency of the former regulation with EU and national constitutional law (Bundestagsdrucksache 15/1206, June 24, 2003). In 2000, the European Court of Justice declared the administrative procedures, which EU citizens had to undertake when offering products or services in product markets regulated under the GTCC, incompatible with the EU Freedom of Services Principle (ECJ, C-58/98 "Corsten", October 3, 2000).[15]

In order to comply with the ECJ ruling, the German government permitted EU citizens to offer their products and services without any prerequisites. They were allowed to start a firm in a regulated product market if they documented sufficient professional experience, irrespective of professional certificates (§ 1 EU/EWR-HwV, December 20, 2007). This situation was claimed to "discriminate" Germans vis-à-vis EU citizens, which served as a basis for an influential case filed at the German Constitutional Court in 2002 (Bundesverfassungsgericht, 1 BvR 1730/02, December 5, 2005). Still before the Court reached its decision, the governing coalition moved ahead by proposing the abolition of the master craftsman certificate's role as a mandatory entry standard.[16]

We will rely on this exogenous triggering of the reform in our identification strategy.

The degree of entry deregulation differs across two groups of regulated product markets. In 35 out of the 94 product markets, entrepreneurs can now start a firm if they possess a journeymen degree and six years of professional experience, of which four years must have been in a leading position, rather than taking the master

[14] Drittes Gesetz zur Änderung der Handwerksordnung und anderer handwerksrechtlicher Vorschriften, December 24, 2003
[15] See section 2.A.3 for further information.
[16] See Appendix 2.A.3 for more detailed information.

craftsman examination ("Altgesellen-Regel"). In this group of product markets, prospective entrepreneurs need to attain a journeyman certificate and can then decide whether to acquire the master craftsman examination or work another six years so that they fulfill the required work experience.

In another 53 previously regulated product markets, the need to attain the master craftsman certificate in order to register a firm was fully abandoned. For this subgroup, the reform effectively led to a reduction in required professional experience by about six years[17] as well as the elimination of the journeyman examination and the master craftsman examination as a requirement for prospective entrepreneurs. As the intensity of deregulation between these two groups of product markets is potentially endogenous, we will not distinguish them in our empirical analysis.[18]

Note that in six previously regulated product markets the master craftsman certificate remained in force as a mandatory standard for entrants.[19] In these fields, the entry regulation was not challenged by the court rulings, because entry into these fields is restricted in most EU member states.[20]

In addition, there were minor changes to the entry regulation. See Appendix 2.A.4 for details and sources.

In short, the reform - leading to the loss of the master craftsman certificate's role as a mandatory entry standard - considerably decreased the entry costs in some product markets, but not in others. We exploit this variation to investigate how regulatory entry restrictions affect the propensity to start a firm. In the described context, we expect an increase in the individual propensity to start a firm in the affected product markets. We will empirically investigate this research question using the empirical model presented in the following section.

[17] The six years result from two to three years apprenticeship plus three years of required professional experience before taking the master craftsman examination.

[18] There was a strong debate about the assignment of product markets to either of these two categories ("Altgesellen-Regel" vs. full deregulation). Initially, the government planned to fully deregulate 65 occupations. In a last-minute agreement with the opposition, 12 trades remained regulated under the "Altgesellen-Regel", leading to the full deregulation of only 53 trades.

[19] These are chimney sweeps, opticians, hearing aid acousticians, orthopedic technicians, orthopedic shoemakers and dental technicians.

[20] These product markets are excluded from the main sample. Including them in the comparison group leaves the main results unchanged (Appendix table 2.C.5, lines 9-10).

2.3 Empirical model

2.3.1 Model specification

We make use of the GTCC reform to identify the effect of entry regulation on entry into and exit out of entrepreneurship. We set up a difference-in-differences model effectively comparing changes in entrepreneurial entry and exit over time in product markets with a differing intensity of firm entry deregulation.

We estimate several versions of the following model:

$$y_{ijt} = \alpha + \beta\ share_j \times reform_t + X_{ijt}\prime\gamma + \theta_t + \mu_j + \epsilon_{ijt} \tag{2.1}$$

where subscript i denotes individuals working in 3-digit industry j, and t denotes calendar years.[21]

We implement our main analysis at the level of industries rather than occupations for two reasons. First, we focus on outcomes related to industry dynamics. Second, the firm entry regulation resulting from the GTCC restricts potential entrepreneurs in the *product* markets covered by the GTCC.[22]

The main explanatory variable is a measure of firm entry deregulation $share_j \times reform_t$. $Share_j$ takes values between zero and one, corresponding to the industries' pre-reform share of employed in deregulated product markets.[23]

In order to increase the comparability of the included industries in terms of unobserved time-varying confounders, we restrict our main sample to 51 out of 134 private-sector industries with a $share_j > 0$. This ensures that also the comparison industries were at least partially affected by the GTCC entry restriction in 1994. We carefully test for the sensitivity of the results to this sample restriction.[24]

The indicator variable $reform_t$ takes the value one in all years beginning in 2004 when the reform of the German Trade and Crafts Code took effect, and zero

[21] We use the national classification of industries, edition 2003, issued by the German Statistical Office (Statistisches Bundesamt). It is closely related to the European classification NACE Rev. 1.1.

[22] An analysis at the occupation level gives similar results, see row 23 of Appendix Table 2.C.5.

[23] See section 2.4.1 for the calculation of the treatment intensity.

[24] Results of estimations for entrepreneurial entry and exit on the sample of all 134 private-sector industries are very similar to those estimated on the restricted sample (columns (3) and (4) of Table 2.C.4).

before. The interaction term is a treatment intensity which proxies for the deregulatory change in the ease of starting a business in an industry. The main dependent variables y_{ijt} are entry into and exit out of self-employment. Individual background variables X_{ijt} include age, age squared and binary variables for gender, non-German citizenship and both general and professional education. Further, X_{ijt} includes as well fixed effects for the current occupation, since human capital is partly occupation specific. State fixed effects and fourth order state trends proxy for region-time specific heterogeneity. Industry fixed effects μ_j allow for selection on level differences between industries. Year fixed effects θ_t capture unobserved aggregate macro shocks. The construction of the variables is explained in the data section.

We estimate ordinary least squares estimates of linear probability models, even though the main dependent variables are binary. The main reason is potential inconsistency of non-linear models with a large number of fixed effects due to the incidental parameter problem. However, the main results are confirmed when estimated with probit models with industry and year fixed effects, as we show in rows (13) and (14) of Appendix Table 2.C.5. In all regressions, observations are weighted to readjust to the structure of the population sampled from.

We cluster standard errors at the industry level to allow for arbitrary forms of correlation within industries. In our preferred sample the number of industry clusters is 51.[25]

2.3.2 Identification

We identify the deregulatory effect on the propensity to start a business using reform induced variation in firm entry regulation within product markets over time. β corresponds to an average treatment effect on the treated (ATT) under the assumption that the deregulation was unrelated to changes in the potential non-treatment outcomes over time (Blundell and Dias, 2009; Lechner, 2011). Stated differently, we assume that in the absence of the reform, the industries would have evolved similarly over time. For example, our strategy would be misleading if industries with a large

[25] Using monte-carlo simulations of difference-in-differences models, Bertrand, Duflo and Mullainathan (2004) showed that allowing for arbitrary error correlation through clustering standard errors at the longitudinal dimension achieves rejection rates close to those of a simulation with a known covariance matrix when the number of clusters exceeds 50.

1994 share of employed in deregulated product markets ($share_j$) experienced rapid growth around the year of the reform.

We argue the deregulation to be exogenous to unobserved confounding factors based on two aspects of the reform. First, as explained in section 2.2, the set of eventually deregulated product markets was legally defined in 1953 and remained essentially unchanged up to the reform in 2004. This rules out a selection of regulated industries in response to unobserved trends affecting the outcome variable (Besley and Case, 2000). Second, the timing of the reform was determined exogenously by court decisions at the European and national level (section 2.2). Given this longstanding cross-sectional variation in regulatory status and exogenous timing of the reform, we argue that the policy shift is exogenous to any differential unobserved trends around the time of reform. Even though this common trend assumption cannot be tested directly since it involves unobserved outcomes, we establish the credibility of the assumption by testing for differential trends in outcome variables in any of the eight pre-reform years (Figure 2.1), by additionally including linear industry trends estimated on the pre-reform sample (Table 2.7) and controlling for lagged industry sales (rows 7 and 8 of Appendix Table 2.C.5).

Furthermore, one may claim that potential entrants may adjust their behavior in response to an anticipation of the 2004 reform. Although the regulation was repeatedly criticized in the preceding decades, it was completely unclear when or whether at all the entry regulation would be abandoned due to the backing by the German constitutional court up to 2003. This is confirmed by the absence of any pre-reform dip in entry rates in the years immediately preceding the reform (cf. Figure 2.1). Further, our identification strategy relies on the absence of systematic unobserved composition changes of the industries in order to ensure before-after comparability. Our use of individual level data and inclusion of a rich set of individual control variables enables us to control for compositional changes in relevant observable characteristics such as general and professional education, age, gender, occupation and nationality.

2.4 Data and descriptive statistics

2.4.1 Data

The main data set is a comprehensive and large German population survey, called the Micro Census.[26] It is a repeated annual survey of a one percent random sample of the German population, carried out by the Statistical Offices of the German Federal States (see Appendix 2.B.1 for details on the data set). The survey provides us with several advantages. Firstly, 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.[27] Secondly, it contains detailed work-related information on self-employed, employees, unemployed and individuals outside the labor force, allowing us to control for a rich set of individual-level characteristics.

We use repeated cross-sectional data from scientific use files of the Micro Census for all waves from 1996 to 2009.[28] Since our analysis is at the industry level, we restrict our main sample to all currently employed (self-employed or wage earner), as their industry affiliation can be determined directly.[29] Further, we limit our sample to those aged 20 to 59[30] and exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector.[31]

The main dependent variables are defined as follows. We define entry as being self-employed in period t and having worked as employee, been unemployed or outside

[26] Scientific Use File des Mikrozensus, FDZ der Statistischen Ämter des Bundes und der Länder

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

[28] The survey was conducted in April of each year up to 2004 and throughout the year in all subsequent waves.

[29] The results are very similar when we include unemployed and individuals currently outside the labor force that worked at least once in their life. They are assigned to industries according to the industry they last worked in. The results remain virtually unchanged (columns 1 and 2 of Appendix Table 2.C.4).

[30] Estimations on a sub-sample restricted to individuals aged 25 to 54 show very similar results (rows 11 and 12 of Appendix Table 2.C.5)

[31] We exclude the following industries (2-digit SIC rev. 3 / NACE rev. 1 in brackets): agriculture (01-05), mining (10-14), water provision (41), public administration (75), education (80), health (85), public utilities (90), non-profit organizations (91), private households (95) and extra-territorial entities (99). This leads to a sample of industry families with the following industries ("private" sector): 15-40, 45-74 and 92-93.

the labour force in $t-1$. The employment status in $t-1$ (12 months ago) is asked retrospectively in t.[32] Note that in the entry regressions, the entrants' industry affiliation (and treatment status) is measured in t, i.e. the first period of self-employment. Exit is defined as being self-employed in t and working as employee, being unemployed or outside the labour force in $t+1$. Analogous to entry, we use the variable "employment status 12 months ago" of the survey of year $t+1$ to construct this variable. Exitors are assigned to industries based on their industry affiliation in t, which corresponds to their last period of self-employment. It is asked retrospectively as "industry 12 months ago". The main sample for the exit regressions consists of all employed in t.

Our main explanatory variable is the industry-level measure of firm entry deregulation, $share_j$. To calculate the treatment intensity, we first assign all product markets to which the German Trade and Crafts Code applies to occupations, because the structure of product markets listed in the GTCC is very similar to the German occupation classification.[33] We then calculate the occupation-level 1995 share of employed in deregulated product markets, using data from a survey of all firms regulated under the GTCC (*Handwerkszählung 1995*, Statistisches Bundesamt, 1996). In a third step, we map the occupation-level share of employed in deregulated product markets to the industry level. We describe in detail how we construct the used measure for deregulation in Appendix 2.B.2.

When defining the regulated product markets, we use the list of regulated product markets in the 1953 version of the GTCC, in order to exclude any potentially endogenous subsequent changes to the set of regulated product markets. In particular, in 1998 scaffolder activities were added to the activities regulated by the GTCC.[34] As this expansion of the GTCC coverage may have been endogenous, we exclude

[32] Note that the retrospective questions are asked to a 45% sub-sample until 2004 and are non-mandatory to respond. Non-response for the employment status 12 months ago amounts to about 4%.

[33] For the (manual) assignment of deregulated product markets to occupations, we compare in detail the descriptions of regulated product markets in the legal guidelines on master craftsman examinations in each regulated product market *("Meisterprüfungsverordnungen")* with the 3-digit and 4-digit occupation code description of the 1992 occupation classification by the German Statistical Office *("Klassifikation der Berufe, 1992")*.

[34] Further, several listed product markets were joined in 1998, without modifying the overall set of regulated activities. Appendix 2.A.1 contains further information on the minor 1998 reform of the GTCC.

this product market when calculating the treatment intensity.[35]

As explained in section 2.2.2, in six regulated activities the master craftsman certificate kept its role as a mandatory entry standard, while minor deregulations applied (see Appendix 2.A.4). We exclude the related product markets from the main regression sample, as well as when calculating the industry-level treatment intensity. The results are very similar when including the six activities as non-deregulated activities in the sample (rows 9 and 10 of Appendix Table 2.C.5).

Some covariates require a short explanation. We control for professional education by including a dummy variable for academic education, i.e. degrees from applied universities and universities, and one dummy variable for any kind of vocational degree, i.e. journeyman, master craftsman and technician.[36] Individuals with both a vocational and a university degree are coded as university degree holders. General education is controlled for by using indicator variables for low or no schooling ("Hauptschule", typically 9 years), a medium level of schooling ("Realschule", typically 10 years) and a high-school diploma ("Gymnasium", typically 12-13 years).

Further, we control for 70 fixed effects for "current occupation" at the 2-digit level of the 1992 national classification of occupations by the German Statistical Office. In the regressions on exit from self-employment all covariates are recoded to the previous year since individuals are assigned to industries based on the previous year, which corresponds to exitors' last period of self-employment. As the occupation is not asked retrospectively for the previous year and may change due to exit from self-employment, we do not include occupation FE in our main exit regressions.[37] Similarly, the highest vocational degree is only known for the current period and may differ from the one in the previous period. We control for vocational degree in our main exit specification because there is no reason to expect any systematic relationship between vocational degree changes and exit from self-employment.[38] Appendix Table 2.C.1 contains descriptive statistics of the main variables.

[35] The results are not affected by this sample modification.

[36] We join individuals with an apprenticeship degree and master craftsman certificate in one group because attaining a master craftsman certificate in addition to a journeyman degree is potentially endogenous in the considered reform.

[37] The results are robust to including current occupation fixed effects for the sub-sample of individuals who indicate not to have changed their occupation in within the past 12 months (see rows 17 and 18 of Appendix Table 2.C.5)

[38] Our results are robust to excluding all who acquired their vocational degree in the current or previous period (rows 19 and 20 of Table 2.C.5).

2.4.2 Descriptive statistics

In Table 2.1 we show descriptive statistics at the industry level for our regression sample, which includes only industries with a non-zero share of employed in deregulated product markets ($share_j$). We assign these industries into two groups. Industries with a pre-reform share of employed in deregulated product markets ($share_j$) below the median (column 1) and industries with an above median $share_j$ (column 2). The outcome variables entry into and exit from self-employment as well as most individual covariates show similar sample means (t-test in col. 3). Employed in industries with an above median share of employed in deregulated product markets tend to be younger and are more likely to be male than employed in industries below the median. The under-representation of women is largely driven by deregulated product markets in the construction sector. The age difference is mostly due to a higher share of apprentices in the deregulated product markets.

To verify the absence of any systematic differences in pre-reform trends, in column 4 we compare growth rates of each variable across the two groups of industries. Growth rates are calculated as 1996 to 2003 growth in industry averages for each variable.[39] The growth rates are not statistically or economically different between the two groups of industries. Column 5 shows that industry growth rates are not significantly correlated with the treatment intensity $share_j$. This absence of differential pre-reform trends supports our identification strategy.

In the following section we present regression results to systematically investigate the effects of the deregulation on entrepreneurial entry and exit.

2.5 Results

2.5.1 Main results

Entry As discussed in section 2.2.2, we expect an increase in the propensity to enter into self-employment resulting from the deregulation of the German Trade and

[39] In order to reduce sampling error, we calculate the growth as average annual growth rate from the bi-annual average of the years 1996 and 1997 to the bi-annual average of the years 2002 and 2003.

Crafts Code in 2004, given the substantial previous restriction to firm entry.[40] We expect this increase to be larger in industries with a higher share of employed in deregulated product markets, $share_j$.

We start by estimating a parsimonious version of our model in which the main explanatory variable is an interaction term between $\mathbb{1}(share_j > median)$, a variable which takes the value one in all industries with an above median 1994 share of employed in deregulated product markets, and $reform_t$, which equals one starting with the year when the reform took effect (2004). Further, we add industry and year fixed effects, so that the model effectively compares changes in entry rates over time between two groups of industries: industries with a below median $share_j$ and industries with an above median $share_j$. In this specification, the estimated coefficient β on the interaction term is 0.004 (significant at 5%) (column 1, Table 2.2). Given that the sample mean of entry is 0.019, this estimate suggests that in the years after the reform the propensity to enter increased by about 21% in the group of industries with an above median $share_j$ compared to the pre-reform level, relative to the group of industries with a below median $share_j$.

In the model in column 2 we replace the previous interaction term with $share_j \times reform_t$, which interacts the industry share of employed in deregulated product markets with the indicator variable for the years 2004-2009. The specification compares changes in entry rates over time between industries with varying shares of employed in deregulated product markets. Since $share_j$ does not fully range from 0 to 1, we calculate interquartile effects. The interquartile range amounts to 0.416, so the coefficient of 0.013 (significant at 1%) implies an absolute interquartile effect of 0.006. Given the sample mean of 0.019, this is equivalent to a sizable 31% relative increase in the propensity to start a firm in an industry at the 3$^{\text{rd}}$ quartile compared to an industry at the 1$^{\text{st}}$ quartile.

In column 3 we additionally control for a rich set of individual characteristics, occupation fixed effects as well as fixed effects and quartic trends for the 16 German states (equation 2.1).[41] The coefficient remains virtually unchanged, which suggests

[40] Sunk entry costs have to be compensated by higher profits ex post. See the theoretical models by Hopenhayn (1992), Poschke (2010) and Barseghyan and DiCecio (2011) on the link between sunk entry costs and firm entry.

[41] The coefficients of individual covariates are not reported but turn out as expected. Results are available upon request.

that changes in industry composition related to the covariates seem to be of no concern.

To investigate the timing of the reform impact, we estimate the main difference-in-differences coefficient separately for each year. The coefficient is estimated from yearly interactions between the industry-level share of employed in deregulated product markets ($share_j$) and an indicator variable $year_t$ for each year from 1996 to 2009, with $share_j * year_{2004}$ being the excluded category (model 2.2).

$$y_{ijt} = \alpha + \sum_{t=1996}^{2009} \beta_t \; share_j * year_t + X_{ijt}\prime\gamma + \theta_t + \mu_j + \epsilon_{ijt} \tag{2.2}$$

This specification allows to flexibly test for differential pre-reform trends correlated with the treatment intensity measure. The corresponding Figure 2.1 shows that the yearly coefficients are not statistically significantly different from zero in the years up to the reform, indicating that the increase in entry rates cannot be explained by differential industry trends prior to the reform. This finding supports the common trend assumption. The yearly coefficients are strongly significant in all years following 2005, reaching full size immediately in 2005.[42]

The positive effect on entry into self-employment suggests that the entry cost resulting from the mandatory entry standard was previously binding compared to the benefits from self-employment. The result is in line with the literature on entry restrictions following from administrative burden at startup (Bruhn, 2011; Kaplan, Piedra and Seira, 2011; Branstetter et al., 2014). Furthermore, the results are in line with Prantl and Spitz-Oener (2009) and Prantl (2012) who document a decrease in entry in consequence of the GTCC regulation, using quasi-experimental variation from the German reunification.

Finally, the documented increase in entry into self-employment is in line with related findings on the 2004 reform of the German Trade and Crafts Code by Rostam-Afschar (2014) and Zwiener (2017). The studies differ substantially in their empirical model specifications and focus. Most importantly, as a comparison group they use product markets in which the restriction to firm entry remained in place. Specifi-

[42] Note that until 2004, the Micro Census survey was conducted in the first week of April. Given the that setting up a business requires some time, this may explain the divergence in entry rates only in 2005, not already in 2004 when the reform took effect.

cally, Rostam-Afschar (2014) uses 6 product markets in which the master craftsman certificate continued to be the mandatory entry standard as a comparison group and all other deregulated product markets as treated groups. The comparison group in Zwiener (2017) are the 6 product markets in which the master craftsman certificate continued to be the mandatory entry standard, and 29 product markets in which entrepreneurs became allowed to start a firm if they possess a journeymen degree and six years of professional experience. In contrast, we exclude the 6 product markets in which the master craftsman requirement continued to be the mandatory entry standard from our main estimation sample and classify the 29 product markets in which in which entrepreneurs became allowed to start a firm if they possess a journeymen degree and six years of professional experience as deregulated. Furthermore, the above mentioned authors assign the deregulated product markets to a classification of occupations due to their focus on labor market outcomes. We assign the deregulated product markets to an industry classification due to our focus on industry dynamics.

Furthermore, we add to the literature an analysis of changes in the composition of entrants in the next section of this chapter and an analysis of the entrants' post-entry performance as well as the effect on incumbents in chapter three.

Entrant composition In this subsection, we investigate changes in the composition of entrants with respect to their initial firm size, income, professional training and general education (schooling). To this end, we restrict the sample to entrants and exclude all self-employed which did not enter in the current year as well as all employees.[43]

We expect a mechanical shift in the composition of the entrants' level of professional training, since the reform explicitly facilitated entry for individuals with no master craftsman certificate, such as journeymen or individuals with no professional training. We also expect a decrease in initial firm size, as the fixed entry cost following from the entry restriction should have been be more binding for firms which intended to start on a small scale. In contrast, there is no reason to expect a mechanical change in the entrants' composition with respect to general education, as

[43] Recall that the entry definition includes entrants started out of employment as well as out of non-employment (section 2.4.1).

journeymen or individuals with no professional education are composed of all levels of general education (Appendix Table 2.C.2).[44] Since general education tends to predict firm size,[45] changes in the general education of entrants may indicate an effect of the reform on the entrants' long-run quality.

First, we consider the entrants' firm size and income in their first year of activity. As expected, the additional entrants tend to be initially smaller. Entrants are significantly more likely to start without employees (Table 2.3, column 1). While there is no statistically significant change in the propensity to start with 1-3 employees (column 2), the propensity to start with at least four employees (column 3) decreases significantly. Note that this compositional shift among entrants notwithstanding, the deregulation raised the overall probability to start a firm with 1-3 employees (Appendix Table 2.C.3). Also, the average net income of the newly self-employed decreases significantly (column 4). Interestingly, this effect disappears after controlling for initial firm size, suggesting that additional entrants with similar firm size do not earn significantly less (column 5).

We then explore composition changes among entrants with respect to their professional training. As the reform explicitly facilitated entry for individuals with no master craftsman certificate, the additional entrants should be (mechanically) less likely to possess a master craftsman certificate and more likely to have a journeyman degree or no professional education. As expected, an analysis of the composition of entrants in their first year with respect to professional training shows an increase in the entrants' probability of possessing a journeyman degree and a decrease in the probability of having attained a master craftsman certificate or an equivalent degree such as technician (columns 2-3, Table 2.4). Interestingly, the probability of possessing no professional education remains unchanged, indicating that the reform did not attract disproportionately many individuals with no professional education.

We then investigate whether the reform led to a shift in the general education (schooling) of the entrepreneurs. First, we show in Panel A of Table 2.5 that general education correlates positively with firm size. We distinguish three levels of schooling: *low or no schooling* (9 or less years of schooling), *middle school* (10 years) and *high school* (12-13 years). Firms run by entrepreneurs with a middle

[44] In Germany, both the journeyman degree and the (consecutive) master craftsman certificate can be attained without a preceding school degree.

[45] See, among others, Hombert et al. (2014).

school degree are on average 12% larger than firms run by entrepreneurs with less schooling. Firms run by high school graduates are on average 19% larger than firms run by individuals with low or no schooling. Hence, general education appears to be correlated with entrepreneurial ability and ambition. A similar correlation between education and firm size has been found by many authors, including Hombert et al. (2014).

Changes in the entrants' general education in consequence of the decrease in entry cost may shed light on two opposing views on selection into entrepreneurship. On the one hand, under the assumption that prospective entrepreneurs have private ex-ante information about their own entrepreneurial ability (Lucas, 1978), entry costs should screen out entrepreneurs with low entrepreneurial ability. In this case, a decrease in entry costs should disproportionately attract individuals with low entrepreneurial ability and education ("selection view"). On the other hand, if entrepreneurial success is not privately known ex-ante (Jovanovic, 1982; Ericson and Pakes, 1995; Asplund and Nocke, 2006), there is no reason to expect a negative effect on the composition of entrants in consequence of the reform ("experimentation view").

Interestingly, our results in panel B of Table 2.5 show no indication of a decrease in average general education. In contrast, the reform led to a significant increase in the entrants' probability of having a middle school degree and a significant decrease in the probability of having no or low schooling. There is no statistically significant change in the probability of having a high school degree. We interpret this result as support for the experimentation view.

Exit An increase in entrepreneurial entry raises the number of self-employed only if exit from entrepreneurship does not increase to a similar extent. We investigate this issue by considering changes in individual entrepreneurial exit around the time of reform. As in the entry regressions, we run the analysis on a sample of employed.[46]

Table 2.6 presents the related results, structured analogously to the main results on entry. The dependent variable *exit from entrepreneurship* takes the value 1 for individuals that are self-employed in the current year and wage earner, unemployed

[46] The repeated cross-sectional data structure of the Micro Census and lack of reliable retrospective information on the year of entry into self-employment prevent us from analyzing entrant survival in this chapter. We investigate entrant survival using longitudinal establishment data in chapter three.

or outside the labour force in the subsequent year. We rescaled the treatment variable $share_j$ by 100 to improve the readability of the tables.

In column 1 we show estimates of a version of the model where we regress exit on the interaction term $\mathbb{1}(share_j > median) * reform_t$, which takes the value one for industries with an above median 1994 share of employed in deregulated product markets in all years beginning in 2004. Conditional on full sets of industry and year fixed effects, the specification compares changes in exit over time between industries with an above and below median share of employed in deregulated product markets. The coefficient is very small and statistically insignificant.

In column 2 we replace the binary treatment variable with the industry share of employed in deregulated product markets, interacted with the reform indicator. The estimate remains statistically insignificant, indicating that relative to the years before the reform, industries with a higher share of employed in deregulated product markets did not experience an economically or statistically significant change in exit. The result is confirmed when adding individual-level control variables (column 3).

Together with the documented increase in entrepreneurial entry, the absence of any effect on exit from entrepreneurship suggests a net increase in entrepreneurship in consequence of the reform.

Changes in entrepreneurial exit may be driven by both entrepreneurs which entered in consequence of the reform as well as entrepreneurs which entered before the reform took effect (incumbents). Since there is no reason to expect a *decrease* in exit among incumbents in consequence of the reform, counteracting changes in exit among entrants and incumbents are unlikely. This suggests that the additional entrants may be similarly stable. In chapter three we will provide specific evidence separately for entrants and incumbents using establishment panel data.

The documented absence of any increase in exit from self-employment in consequence of the GTCC reform is in line with similar findings by Rostam-Afschar (2014) and Zwiener (2017).

Our result is relevant for economic policy since long-lived entrants are much more likely to enhance welfare, growth and technological progress by lowering prices, attracting demand and innovating, as well as causing advancing reactions in incumbents through competitive pressure. In contrast, entrants that exit already after a few periods may even cause welfare losses in the form of sunk set-up costs related

to entering (Mankiw and Whinston, 1986).

2.5.2 Robustness

In the following we present a number of checks to verify the robustness of our results. One potential problem are pre-existing outcome dynamics that are systematically related to the used treatment intensity $share_j$. If industries that were more affected by deregulation experienced an increase in entry rates after the reform due to differences in time trends that preceded the reform, the common trend assumption would be violated and estimates inconsistent. To check for the potential impact of differential industry trends prior to the reform, we include linear industry trends estimated on pre-reform years 1996 to 2003 in our main entry and exit regressions. The corresponding coefficients in columns 2 and 4 of Table 2.7 remain similar to the baseline coefficients (columns 1 and 3), indicating that the positive effect on entrepreneurial entry and the near-zero effect on entrepreneurial exit are not driven by differential pre-reform trends.

Additional concerns may relate to two policy changes which were implemented around the time of the considered deregulation. First, a series of active labor market policies was implemented between 2003 and 2005, including an expansion of start-up subsidies to previously unemployed which affected the incentives for starting a firm among unemployed (Caliendo and Künn, 2011). Our results would be invalidated if the policies' effect on entrepreneurial entry interacted with the considered deregulation. We test for the relevance of this concern by adding an interaction of the 2003 industry-level share of unemployed and $reform_t$ to the main model. Here, we include all currently unemployed and those outside the labor force, who have been employee or self-employed once in their life. They are assigned to industries based on their last employer's industry affiliation or industry of last self-employed.[47] This specification controls for differential changes over time in entrepreneurial entry rates that are related to the pre-reform industry share of unemployed. Note that the specification also partially controls for potential differences between wage earners and unemployed in the propensity to enter into self-employment over the business cycle (Parker, 2009). Individuals which recently became unemployed may be dispropor-

[47] Unemployed and those outside the labor force that never worked are not included.

tionately more likely to enter self-employment during recessions compared to wage earners, as they want to earn a subsistence income. On the other hand, individuals which are drawn into self-employment by product market expansions should be less likely to have been unemployed before entry into self-employment. It turns out that the corresponding results are very similar to the baseline results (column 1 of Table 2.8), indicating that active labor market policies and differences in the industry share of unemployed cannot explain our results.

Further, the 2004 enlargement of the European Union by 10 countries and the 2007 enlargement by Bulgaria and Romania led to a considerable influx of migrants which were permitted to start a firm. In column 2 of Table 2.8 we show the result of the main model estimated on a sample in which we exclude immigrants who immigrated to Germany within the last 8 years. As our last sample year is 2009, we ensure with this alternative sample specification that immigrants migrated to Germany in 2000 or earlier, i.e. long before the 2004 enlargement of the European Union and before the GTCC reform was announced. The corresponding coefficient is very similar to the coefficient of the baseline specification, indicating that the deregulation's positive effect on entry cannot be explained by the differential immigration. Further robustness checks are provided in Appendix 2.C.

2.6 Conclusions

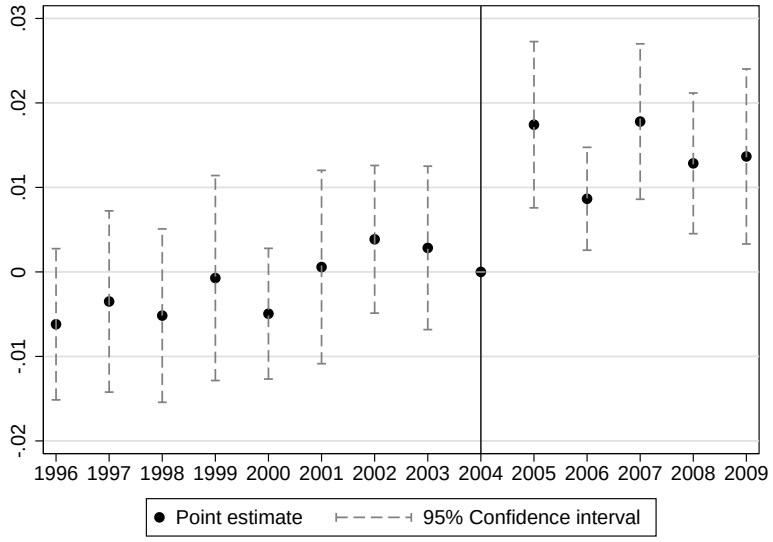
This paper has investigated the impact of regulatory entry restrictions on entrepreneurial entry and exit, focusing on a reform to a specific and substantial entry restriction, the German Trade and Crafts Code. The reform essentially led to the repeal of the master craftsman certificate's role as a mandatory standard for prospective entrepreneurs.

We find a significant positive effect of the deregulation reform on entry into self-employment, but no effect on exit from self-employment. As expected, the reform raised the propensity to enter among both individuals with a vocational degree and no professional training. Interestingly, the entrants' propensity to have low or no schooling did not increase. Finally, entrants are found to be disproportionately small - the newly created firms are mostly solo-entrepreneurs. This specific type of firm creation raises interesting questions about resulting effects on industry dynamics

and employment.

2.7 Figures and tables

Figure 2.1: Effect of the deregulation on entry into self-employment (annual effects)



Coefficients β_t and 95% confidence interval of the model

$$y_{ijt} = \alpha + \sum_{t=1996}^{2009} \beta_t \; share_j \times year_t + X_{ijt}\prime\gamma + \theta_t + \mu_j + \epsilon_{ijt}$$

in which $share_j \times year_{2004}$ is the excluded category. The dependent variable *entry* is defined as being self-employed in year t and an employee, unemployed or outside the labor force $t-1$. Sample mean of *entry*: 1.9%. $Share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. Covariates: age, age squared, indicator variables for female, immigrant, three general education groups, three professional education groups, 2-digit current occupation FE, and fixed effects and quartic trends for the 16 German states. Estimation performed using linear probability models. The sample consists of 617,549 employed aged 20 to 59, observed in the years 1996-2009 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors are clustered at the level of industries.

Table 2.1: Pre reform averages and growth rates of main variables

	(1) Industries with Share$_j$ < Median Average (Levels)	(2) Industries with Share$_j$ ≥ Median Average (Levels)	(3) Difference in Average (Levels)	(4) Difference in Average (Growth)	(5) Coefficient on Share$_j$ (Growth)
Entry	0.017	0.019	0.002	0.011	0.039
	(0.013)	(0.011)	(0.005)	(0.024)	(0.055)
Exit	0.011	0.010	0.000	0.000	0.007
	(0.003)	(0.002)	(0.001)	(0.001)	(0.036)
Foreign	0.081	0.099	0.018	-0.016	-0.039
	(0.026)	(0.041)	(0.011)	(0.011)	(0.028)
Vocational	0.722	0.765	0.043	0.001	0.001
degree	(0.088)	(0.083)	(0.031)	(0.001)	(0.003)
University	0.111	0.068	-0.043	-0.002	-0.015
	(0.109)	(0.043)	(0.029)	(0.010)	(0.024)
Age	39.550	38.864	-0.685***	0.001	0.003
	(0.621)	(0.863)	(0.235)	(0.001)	(0.002)
Female	0.459	0.292	-0.167*	0.003	0.005
	(0.211)	(0.217)	(0.092)	(0.003)	(0.007)
N (industries)	23	28	51	51	51

Sample: 51 industries with positive non-zero share of employed in deregulated product markets in year 1994 in industry j ($share_j$). Columns 1 and 2 show industry averages over the years 1996-2003 for employed in industries with above and below median $share_j$, respectively. Column 3 provides a t-test on the difference of averages between the two groups of industries. Column 4 provides a t-test of the difference in growth rates, calculated as average yearly growth of industry averages from 1996/97 to 2002/03. Column 5 presents the coefficients of a separate regression for the growth in each variable on the share of employed in deregulated product markets, $share_j$. The calculations are based on all employed aged 20 to 59 reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.2: Effect of the deregulation on entry into self-employment

Dependent variable:	Entry		
	(1)	(2)	(3)
$\mathbb{1}(Share_j > Median) \times Reform_t$	0.004***		
	(0.002)		
$Share_j \times Reform_t$		0.013***	0.014***
		(0.004)	(0.004)
Industry FE	*yes*	*yes*	*yes*
Year FE	*yes*	*yes*	*yes*
Covariates	*no*	*no*	*yes*
Observations	617549	617549	617549

In this table we show the effect of the deregulation on entry into self-employment. The dependent variable *entry* is defined as being self-employed in year t and an employee, unemployed or outside the labor force $t-1$. The variable $\mathbb{1}(share_j > median)$ takes the value 1 for industries with an above median share of employed in deregulated product markets in the year 1994. $Reform_t$ is an indicator variable for the years 2004-2009. The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. Sample mean of the dependent variable: 1.9%. Covariates: age, age squared, indicator variables for female, immigrant, three general education groups, three professional education groups, 2-digit current occupation FE, and fixed effects and quartic trends for the 16 German states. All estimations are performed using linear probability models. The sample consists of all employed aged 20 to 59, observed in the years 1996-2009 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.3: Entrant composition: initial firm size and income

Dependent variable:	No employee	1-3 employees	$\geq$ 4 employees	Income	
	(1)	(2)	(3)	(4)	(5)
$Share_j \times Reform_t$	0.191***	-0.062	-0.129**	-0.185*	-0.095
	(0.043)	(0.046)	(0.053)	(0.104)	(0.098)
$Firm\,size$					0.060***
					(0.006)
$Firm\,size^2$					-0.001***
					(0.000)
Mean depvar	0.567	0.245	0.187		
Industry FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
Occupation FE	yes	yes	yes	yes	yes
State FE and trends	yes	yes	yes	yes	yes
Observations	11482	11482	11482	10346	10346

This table illustrates changes in the composition of entrants with respect to initial hiring activity and net self-employment income. The sample consists of entrants in their first year of activity (t_0), observed in the years 1996-2009 and reporting all relevant information. The dependent variable *No employee in* t_0 indicates entrants with no employee (solo-entrepreneur) in the first year of activity. *1-3 employees in* t_0 indicates having 1-3 employees in the first year $\geq$ *4 employees in* t_0 indicates that the entrant employs at least four workers. The dependent variable $ln(income)$ *in* t_0 denotes the log of the net income of self-employed (corrected for national inflation). The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. $Reform_t$ is an indicator variable for the years 2004-2009. Estimations in columns 1-2 are performed using linear probability models, those in columns 3-4 with OLS. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.4: Entrant composition: professional training

Dependent variable:	No professional education	Journeyman degree	Master craftsman or technician	University degree
	(1)	(2)	(3)	(4)
$Share_j \times Reform_t$	-0.005	0.142***	-0.105***	-0.032
	(0.028)	(0.051)	(0.036)	(0.023)
Mean depvar	0.131	0.490	0.203	0.176
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Occupation FE	yes	yes	yes	yes
State FE and trends	yes	yes	yes	yes
Observations	12217	12217	12217	12217

In this table we illustrate changes in the composition of entrants with respect to their professional training. The sample consists of entrants in their first year of activity, observed in the years 1996-2009 and reporting all relevant information. The dependent variable $Noprof\,educ$ is defined as having 1 year or less of professional training, zero else. The dependent variable $Journeyman$ indicates a journeyman degree, which is earned after the successful completion of an apprenticeship. The dependent variable $Technician\,/\,Master\,craftsman$ is defined as being a technician, master craftsman or possessing an equivalent advanced professional degree. $University$ denotes individuals with a degree from a (scientific) college or university (incl. universities of applied sciences). The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. $Reform_t$ is an indicator variable for the years 2004-2009. All estimations are performed using linear probability models. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.5: Entrant composition: general education (schooling)

Panel A: In a sample of self-employed, education is positively correlated with firm size

Dependent variable:	ln(firm size)	$\geq$ 1 employee	$\geq$ 2 employees	$\geq$ 10 employees
	(1)	(2)	(3)	(4)
Middle school	0.123***	0.025	0.038**	0.036***
	(0.031)	(0.015)	(0.016)	(0.006)
High school	0.192***	0.008	0.045**	0.070***
	(0.044)	(0.020)	(0.019)	(0.009)
Mean depvar		0.534	0.392	0.098
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Occupation FE	yes	yes	yes	yes
State FE and trends	yes	yes	yes	yes
Observations	74450	74450	74450	74450

Panel B: Effect of the deregulation on the entrant composition

Dependent variable:	Low or no schooling	Middle School	High School
	(1)	(2)	(3)
$Share_j \times Reform_t$	-0.075**	0.068**	0.007
	(0.032)	(0.032)	(0.038)
Mean depvar	0.336	0.342	0.322
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Occupation FE	yes	yes	yes
State FE and trends	yes	yes	yes
Observations	12217	12217	12217

In **Panel A** we provide descriptive statistics on the correlation between general education (schooling) and firm size. The sample comprises all self-employed aged between 20 and 59, observed in the years 1996-2009. The dependent variable *ln(firm size)* denotes the log of the number of employed as reported by the entrepreneur. $\geq$ *2 employees* indicates that the entrepreneur employs at least two workers, and $\geq$ *10 employees* indicates the employment of at least 10 workers. The variable *Low or no schooling* is defined as having a school degree equivalent to 9 years of schooling or less *(Hauptschule). Middle school* is defined as having a middle school degree (typically 10 years of schooling) *(Realschulabschluss). High school* is defined as having a high school degree (typically 12-13 years of schooling) *(Abitur).*
In **Panel B** we provide evidence on the effect of the deregulation on the composition of entrants with respect to their general education. The sample consists of entrants in their first year of activity, observed in the years 1996-2009 and reporting all relevant information. The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. $Reform_t$ is an indicator variable for the years 2004-2009. All estimations are performed using linear probability models. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.6: Effect of the deregulation on firm exit

Dependent variable:	Exit		
	(1)	(2)	(3)
$\mathbb{1}(Share_j > Median) \times Reform_t$	0.001×10^{-2}		
	(0.001×10^{-2})		
$Share_j \times Reform_t$		0.128×10^{-2}	0.075×10^{-2}
		(0.135×10^{-2})	(0.130×10^{-2})
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Covariates	no	no	yes
Observations	551399	551399	551399

In this table we provide evidence on the effect of the deregulatory reform on the propensity to exit from self-employment. The dependent variable *exit* is defined as being self-employed in t and being and an employee, unemployed or outside the labor force in $t+1$. Sample mean of the dependent variable: 1.0%. The variable $\mathbb{1}(share_j > median)$ takes the value 1 for all industries with above median share of employed in deregulated product markets in the year 1994. $Reform_t$ is an indicator variable for the years 2004-2009. The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. It is scaled by 100 to improve readability. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. Covariates: age, age squared, gender, immigrant, for three general education groups, three professional education groups, and fixed effects and quartic trends for the 16 German states. The estimations are performed using linear probability models. The sample consists of all employed aged 20 to 59, observed in the years 1996-2008 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.7: Robustness: controlling for linear pre-trends

Dependent variable:	Entry		Exit	
	(1)	(2)	(3)	(4)
$Share_j \times reform_t$	0.014***	0.010***	0.075 $\times 10^{-2}$	-0.047 $\times 10^{-2}$
	(0.004)	(0.003)	(0.130 $\times 10^{-2}$)	(0.167 $\times 10^{-2}$)
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Covariates	yes	yes	yes	yes
Linear Ind. Pre-Trends	no	yes	no	yes
Observations	617549	617549	551399	551399

Columns 1 and 3 reproduce the baseline specification for entry and exit, respectively. The models in columns 2 and 4 additionally include linear industry pre-trends, estimated on the pre-reform sample only. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. In columns 3 and 4 (exit), $share_j$ is scaled by 100 to improve readability. Covariates: age, age squared, gender, immigrant, for three general education groups, three professional education groups, and fixed effects and quartic trends for the 16 German states. In the entry regressions, we add 2-digit occupation FE. The estimations are performed using linear probability models. The sample consists of all employed aged 20 to 59 reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.8: Robustness: alternative explanations

Dependent variable:	Entry	
	(1)	(2)
$Share_j \times Reform_t$	0.011***	0.012***
	(0.003)	(0.004)
$Share\ unemployed_{2003,j} \times Reform_t$	0.023	
	(0.018)	
Industry FE	*yes*	*yes*
Year FE	*yes*	*yes*
Covariates	*yes*	*yes*
Observations	617549	608538

Column 1: The model is extended by $Share\ unemployed_{2003,j} \times Reform_t$, where $Share\ unemployed_{2003,j}$ is defined as the 2003 share of unemployed (ILO definition) at the industry level. Column 2: We exclude immigrants which entered Germany within the last 8 years.
The sample consists of all employed aged 20 to 59, observed in the years 1996-2009 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Covariates: age, age squared, indicator variables for female, immigrant, three general education groups, three professional education groups, 2-digit current occupation FE, and fixed effects and quartic trends for the 16 German states. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Appendix 2.A Institutional background

2.A.1 Historical background

The institutional framework of the considered firm entry regulation dates back to the historical guild system of the Middle Ages. Guilds were social communities of craftsmen, which generally possessed legal privileges endowing its members with exclusive rights to practice particular economic activities, such as selling certain goods in a particular city (Ogilvie, 2014, who also provides a recent overview of the topic). Guilds covered most of the urban production and services sector of the Middle Ages. Most guilds effectively limited firm entry, aimed at increasing rents for incumbents (Ogilvie, 2004). Guilds gradually declined in the 18th century, when the growing industrialization contributed to a strong increase in competition for the traditional crafts workshops (Ogilvie, 2014). In 1810 Prussia officially introduced free firm entry (freedom of trade), partly inspired by the growing liberalism of the time, partly as part of a legal package introducing taxes on crafts businesses.[48] A similar entry regulation was restored only in 1935, when the master certificate requirement became the mandatory standard to be obtained by individuals who wanted to start a firm in one of the product markets covered by the entry restriction.[49]The entry restriction was part the forced integration of the crafts associations into the totalitarian Nazi system.

After WWII, the Federal Republic of Germany reintroduced the entry regulation essentially in the form of 1935 (Gesetz zur Ordnung des Handwerks, September 17, 1953). When proposing the GTCC in 1950, the government stated two main motivations for restricting entry into the defined set of product markets. Firstly, it claimed that it is "in the interest of the general public" to protect the "competitiveness" ("Leistungsfähigkeit") of the regulated product markets (Bundestagsdrucksache 1/1428, October 6, 1950). The government thereby referred to the "craft sector's" small businesses, which should be protected against harmful competition from larger firms. Further, the administration underlined the "crafts sector's surplus professional education" (Bundestagsdrucksache 1/1428, October 6, 1950). In

[48] Edikt über die Einführung einer allgemeinen Gewerbesteuer (November 2, 1810), cited in Wagner, 2006.The regulation later applied to the Second German Reich.

[49] Dritte Verordnung über den vorläufigen Aufbau des deutschen Handwerks (January 10, 1935)

this context, one of the master certificate's stated purposes is to guarantee a certain degree of management skills by prospective entrants in order to raise the economic stability of crafts businesses (BT Plenarprotokoll, March 3, 1953).

The law was challenged in 1961 at the German Constitutional Court on the grounds of Art. 12(1) of the German Constitution (Grundgesetz), granting free occupational choice. The court confirmed the law and the motivations stated by the administration (Bundesverfassungsgericht, E13, 97, July 17, 1961). According to the court, the entry restriction resulting from the master craftsman requirement may be reconciled with the constitutionally guaranteed free choice of occupation because the master craftsman requirement "is an adequate measure" to guarantee the craft sector's "competitiveness" by fostering "trust" in the "quality of the crafts sector's products" (Bundesverfassungsgericht, E13, 97, July 17, 1961).

After 1945, the 1935 regulation was also formally reestablished in the former GDR. As part of the 1990 reunification, the West German regulation was applied without changes to East Germany.[50]

From its re-introduction in 1953 to the considered reform in 2004 the GTCC was subject to three minor changes. A 1965 reform extended eligibility to establish a firm to those with vocational degrees which are equivalent to the master examination.Further, master craftsmen became permitted to be active in a defined set of *related* product markets.[51] There were two minor changes to the GTCC in 1994 and 1998 which concerned the incumbents but did not reduce the entry restrictions. As a result of the 1994 reform, master craftsmen are permitted to perform tasks of other regulated product markets if they complement the product market pertaining to the own master craftsman certificate.Further, business owners in affected product markets became permitted to hire managing master craftsmen trained for other product markets, so that they can offer services in these other regulated markets as well.[52] In a minor reform in the year 1998, similar regulated product markets were joined in order to facilitate the provision of services in related markets. In addition,

[50] Gesetz über die Inkraftsetzung des Gesetzes zur Ordnung des Handwerks (Handwerksordnung) der Bundesrepublik Deutschland in der Deutschen Demokratischen Republik (July 12, 1990).

[51] Bekanntmachung der Neufassung der Handwerksordnung (December 28, 1965)

[52] Gesetz zur Änderung der Handwerksordnung, anderer handwerksrechtlicher Vorschriften und des Berufsbildungsgesetzes (December 20, 1993)

six small and antiquated regulated product markets were removed from the list of regulated product markets, reducing the number of regulated product markets from 127 to 94.[53] The by then unregulated scaffolders market was added to the list of regulated product markets.[54]

2.A.2 Scope of the firm entry regulation

In this section, we explain in more detail under which circumstances a firm is subject to the considered entry regulation. A firm is regulated under the GTCC if four kinds of requirements are fulfilled (Detterbeck, 2013, § 1 par. 1-55). First, essential tasks need to be part of one of the regulated product markets listed in Appendix A of the GTCC (§ 1 HwO). Essential tasks are activities which can not be learned in less than three months and which are a relevant element of a regulated product market (§ 1 (2) HwO). The tasks constituting a regulated product market are not defined in the law, in order to leave room for changes in the definition of a craft due to technological innovation.[55] Second, regulated product markets are distinguished from non-regulated industrial manufacturing by characteristics such as no technically automated production, low division of labor and high complexity of the performed tasks (Detterbeck, 2013, § 1 par. 25-31). Third, the business must be independent or an independent and relevant part of another business (§ 3 HwO). Finally, the regulation applies only to businesses with a fixed location but not to traveling craftsmen (§ 55 HwO). The decision whether a business qualifies as a regulated craft is taken by the local craftsmen association, representing the local incumbent business owners in the regulated product markets. If the GTCC applies to the activities of a firm, it needs to be registered in a local skilled crafts register ("Handwerksrolle") (§ 6 (1) HwO).

[53] Among these were glove makers knitters, tanners and lithographic printers. Together, the six removed product markets accounted for less than 0.05% of the total employment in the regulated product markets (Statistisches Bundesamt, 1996).

[54] Zweites Gesetz zur Änderung der Handwerksordnung und anderer handwerksrechtlicher Vorschriften (March 25, 1998) As described in section 2.4, we code the scaffolder trade as non-deregulated.

[55] The two main sources describing the regulated product markets are legal guidelines regulating the master certificate examination in each craft and descriptions by the National Craftsmen Association (ZDH).

2.A.3 Legal aspects of the reform

As described in the main text, a court ruling by the European Court of Justice related to the Freedom of Service Principle,[56] and a related case pending at the German Constitutional Court were central to triggering the 2004 reform of the German Trade and Crafts Code. In this Appendix section, we explain the related legal background in more detail.

Until 2002, firms from EU countries which served one of the product markets regulated under the GTCC in Germany had to register with the local crafts association, which involved either applying for an exemption (§ 8 HwO ed. September 24, 1998, see Appendix 2.A.2 on exemptions) or documenting relevant occupational experience (generally three to six years, depending on previous occupational training).[57] In any case, the registration required a burdensome authorization process with the local German administration. In 2000, the European Court of Justice ruled that this administrative burden was incompatible with the Freedom of Services Principle, in particular with the Council Directive 1999/42 EEC, Art. 4, July 31, 1999. The Directive requires a direct and efficient procedure of recognition of professional qualifications (ECJ, C-58/98 "Corsten", October 3, 2000). In 2002 the German administration responded by abolishing the need to register with the crafts association for entrepreneurs from the EU, as long as they do not establish themselves.[58] The resulting improved access of EU firms to the product markets regulated under the GTCC raised competitive pressure on German firms.[59] In addition, it was claimed to lead to a "discrimination" of German entrepreneurs, who still needed to attain the costly master craftsman certificate, against EU firms.[60] This difference in treatment formed the basis for an influential case filed in 2002 at the German Constitutional Court by a German entrepreneur, referring to the constitutionally

[56] The Freedom of Service principle states that each EU citizen is free to provide services on the territory of another EU Member State (Art. 49 EC).

[57] § 9 HwO ed. September 24, 1998 in connection with § 1 EU/EWR-HwV ed. March 25, 1998

[58] Fünfte Verordnung zur Änderung der EWG/EWR-Handwerk-Verordnung, Art. 1, § 1, October 9, 2002

[59] EU citizens that want to establish a firm in a product market regulated by the GTCC are still required to document related vocational experience (§ 1 EU/EWR-HwV, March 25, 1998).

[60] See Früh, 2001 and Monopolkommission, 2002 for a discussion.

guaranteed freedom before the law (Art. 3 GG) (Bundesverfassungsgericht, 1 BvR 1730/02, December 5, 2005).[61] The suspected unconstitutionality was expected to become more acute in face of the 2004 enlargement of the EU and the potential wave of migrants establishing firms based on the EU/EWR-HwV exemptions.

Against the backdrop of these developments, in the draft of the 2004 GTCC reform the German government motivated the reform by the diminishing efficacy of the master craftsman certificate in fostering the "crafts sectors competitiveness" vis-à-vis the growing number of foreign competitors whose access to the regulated product markets was facilitated as a consequence of the ECJ ruling of 2000 (Bundestagsdrucksache 15/1206, June 24, 2003).

2.A.4 Minor parts of the reform

In chapter 2.2.2 of the main text, we mentioned four minor elements of the 2004 reform of the GTCC. In the following, we will give a brief explanation of each of the changes.[62]

The first concerned university graduates and technicians. Before the 2004 reform, in addition to documenting a journeyman degree and three years of professional experience, they needed to apply with the local crafts association for recognition of their degree as equivalent to a master craftsman examination (§ 7 (2) HwO, September 24, 1998). The local associations then proceeded on a case by case basis. As a result of the reform, university graduates and technicians have a *legal right* to start a firm in a product market related to their degree, without being required a journeymen degree or professional experience (§ 7 (2) HwO, December 24, 2003).

Second, until 2003 each owner of a civil-law association active in a regulated product market was required to sign up to the crafts register (i.e. acquire a master craftsman certificate or get an exemption). In the case of partnership, the partner responsible for technical processes was required to get registered.[63]In contrast, corporations were only required to have one registered craftsman as a manager for

[61] The court initially planned to decide on the complaints in 2003 but deferred its decision because of the German Government's plans to reform the master craftsman requirement in 2003 (Wagner, 2006)

[62] A detailed discussion of the reform can be found in Müller (2004).

[63] Civil-law associations and partnerships are the most common legal forms in the regulated product markets (Müller, 2014).

each establishment (§ 7 (4) HwO, September 24, 1998). Hence, the old regulation favored limited liability corporations vis-à-vis individually owned full liability civil-law associations and partnerships. From 2004 on also these two legal forms may be registered by an eligible employee, so that the legal owner may not be a master craftsman or equivalent (§ 7 (1) HwO, December 24, 2003).

Third, before the reform journeymen had to document about two to three years of work experience before being permitted to take the master craftsman examination (§ 49 (1) HwO, September 24, 1998). This requirement was repealed, allowing journeymen to predate their master examination (§ 49 (1) HwO, December 24, 2003).

Finally, the government used the reform to clarify legal exemptions for entrepreneurs which are active in fields which are "not essential" to a regulated task. Tasks are denoted "not essential" if they can either be learned within three months or if they are not an essential part of a regulated product market (Gesetz zur Änderung der Handwerksordnung und zur Förderung von Kleinunternehmen, December 24, 2003). Previously, "non-essential tasks" were specified only by legal practice (e.g. Bundesverwaltungsgericht - 1 C 27.89, February 25, 1992). According to the government the legal clarification was necessary, because - so it claimed[64] - local crafts associations were previously reluctant in permitting entrepreneurs without a master craftsman certificate to engage in small-scale activities and activities only loosely linked to a regulated product market (Bundestagsdrucksache 15/1089, June 3, 2003).

[64] Bundestagsdrucksache 15/1089, June 3, 2003

Appendix 2.B Data appendix

2.B.1 The Micro Census data set

The main data set used is the Micro Census, a household survey sampling 1% of the German population.[65] The Scientific Use File we use is a 70% sub-sample of the households in the Micro Census. 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 sample for four years so that in each year a quarter of the sampling districts are replaced. As mentioned in the main text, sampled individuals are obliged by law to provide information on most of the survey questions. The data are collected mostly via personal interviews. Only if not possible otherwise, respondents can answer a self-administered questionnaire. We use weighting factors provided in the data set, which adjust the sample to the population based on distributions of age groups, nationality groups and gender.

2.B.2 Construction of the measure of deregulation

The treatment variables we use are based on a survey of all firms regulated under the German Trade and Crafts Code, conducted in 1994 (*"Handwerkszählung 1995*, Statistisches Bundesamt, 1996). For the construction of the main treatment intensity at the 3-digit industry level ($share_j$), we proceed in three steps.

First, we carefully assign all deregulated activities listed in the GTCC to the 3-digit level of the official German occupation classification *("Klassifikation der Berufe, Ausgabe 1992, Statistisches Bundesamt").* We base the assignment on a manual comparison of detailed descriptions of regulated activities in the legal guidelines on master craftsman examinations in each regulated craft *("Meisterprüfungsverordnungen")* with the official descriptions of the 4-digit occupations.

We match deregulated product markets to occupations (instead of industries) because the structure of product markets defined in the GTCC is very similar to the

[65] See Schimpl-Neimanns and Herwig (2011) and references therein. English documentation is available at http://www.gesis.org/missy/en/study/

German occupation classification. This similarity is due to the fact that the GTCC mostly affects product markets which are closely linked to occupations (Prantl and Spitz-Oener, 2009). However, as argued in the main text, the firm entry regulation resulting from the GTCC ultimately affects the ease of starting a business in the *product* markets covered by the GTCC, so we perform the main empirical analysis at the industry level.

In a second step, we calculate a 3-digit occupation-level treatment intensity by dividing the 1994 number of employed in a deregulated product market (source: Handwerkszählung) by the 1995 projected number of employed in the corresponding 3-digit occupation in the Micro Census.[66]

In a third step we map the occupation-level treatment intensity to the industry level by multiplying the occupation-level treatment intensity with each occupation's share in a 3-digit industry and subsequently add up the weighted shares at the industry level.

$$Share_j = \sum\nolimits_o w_{oj,1995} \times \frac{\#\text{Employed in deregulated product markets}_{o,1994}}{\#\text{All employed (Micro Census)}_{o,1995}}$$

where $w_{oj,1995}$ indicates the share of employed of occupation o in industry j.

We illustrate the approach with the following example. One of the regulated product markets is the activity "vehicle mechanics" *("Kraftfahrzeugtechniker")*. Here, the regulation mainly covers the product market of cars maintenance, since the GTCC does not apply to industrial manufacturing (see Appendix 2.A.2). In the first step, we assign the product market to the 3-digit occupation "vehicle/car mechanics" in our data set. In step two, we construct the corresponding occupation-level treatment intensity. We divide the number of employed in the regulated product market "vehicle mechanics" (listed in the *"Handwerkszählung" 1995*) by the

[66] Note that in the nominator, we use employed in both legally independent firms and subsidiaries in regulated product markets of which the parent firm is not active in a regulated product market *("Nebenbetriebe")*. Firms are allocated to crafts based on their main economic activity. In the denominator, we can not use the projected 1994 number of employed because up to 1995 the Micro Census was conducted biannually only. For 14 out of 303 3-digit occupations, the number of employed according to the Handwerkszählung exceeds the projected number of employed according to the Micro Census, so that the treatment intensity would exceed the value 1. In these cases, we set the treatment intensity to 1.

number of employed in the occupation "vehicle/car mechanics" (calculated from the Micro Census). We then calculate the industry level treatment intensity $share_j$ by mapping the occupation level treatment intensity to the industry level. The calculation shows that individuals with the occupation "vehicle/car mechanics" work in several industries, including mainly "maintenance and repair of motor vehicles" and to a much lesser extend "sale of motor vehicles" and "manufacture of motor vehicles". This is then reflected in the treatment intensity $share_j$, which takes the value 0.64 for the industry "maintenance and repair of motor vehicles" (502), but much smaller values for the industries "sale of motor vehicles" and "manufacture of motor vehicles". Consequently, the treatment intensity $share_j$ correctly reflects the extent to which the mentioned industries are affected by the GTCC.

Note that our results are similar when using an alternative industry-level treatment intensity definition, which is based on a direct allocation of deregulated product markets to 3-digit industries. This alternative treatment intensity is constructed by dividing the number of employed in regulated product markets in 3-digit industries (reported directly in "Handwerkszählung" 1995) by the overall number of employed in the 3-digit industry according to the 1995 Micro Census. The results are very similar (rows 21 and 22 of table 2.C.5). Furthermore, the main results hold when we use the treatment intensity at the occupation-level (calculated in step two). The treatment intensity is then the occupation-level share of employed in deregulated product markets.[67]

[67] See row 23 of table 2.C.5.

Appendix 2.C Additional tables

In this section we will present summary statistics and a series of robustness checks, of which many were already mentioned in the text. Table 2.C.1 provides short explanations and summary statistics of the main variables.

In the main text we showed that the deregulation led to a large increase in entry into entrepreneurship, and at the same time a decrease in initial firm size. In table 2.C.3 we investigate whether the reform led to an increase in the propensity of entry into self-employment with employees. To this end we create three dependent variables. *Entry with 0 employees* is one if an individual takes up self-employment without hiring in the first year of self-employment, zero else. *Entry with 1-3 employees* is one for all newly self-employed who hire one to three employees in the year of entry, and *Entry with 4+ employees* is the equivalent with at least four employees. Interestingly, the reform increased not only the propensity to enter as a solo-entrepreneur (coefficient of 0.012, sign. at 1%, col. 1), but also the propensity to enter and hire one to three employees in the first year (coefficient 0.002, sign. at 10%, col. 2). The propensity to start a firm with 4 or more employees did not change due to the reform.

Table 2.C.4 shows the results which are obtained under two sample variations. In column 1 we add unemployed and those outside the labor force to the sample. We include unemployed and those outside the labor force which worked at least once and assign them to industries based on their last employer or industry of last self-employment. Individuals that never worked are not included in the extended sample. This sample variation addresses potential endogeneity concerns in the main specification, which may arise from the fact that the main regression sample consists of employed only. Differential changes over time of the number of employed, unemployed and inactive in the industries may be a function of the deregulation or correlated factors. Unfortunately, we are only able to make this sample extension for entry but not for exit regressions, because the required industry affiliation in $t-1$ is not available for those who were unemployed in $t-1$ and employed in t.

The corresponding effect on entry into self-employment is slightly smaller compared in the main sample but similar in size when compared to the sample means of the dependent variable. The coefficient of 0.010 (sign. at 1%) corresponds to an in-

Table 2.C.1: Definitions of variables and summary statistics

Variable	Definition	Mean/ share	Standard deviation
Entry	1: self-employed in t and employee, unemployed or outside labor force in t-1	0.020	0.139
Exit	1: self-employed in t and employee, unemployed or outside labor force in t+1	0.009	0.094
Share_j	share of employed in deregulated product markets in year 1994 in industry j	0.267	0.206
Age	age of individual i in years at the survey date	39.982	10.483
Gender	1: female, 0: male	0.386	0.487
Immigrant	1: only non-German citizenship, 0: otherwise	0.069	0.254
Low or no schooling	1: individual has a degree from a "Hauptschule" (typically 9 years of schooling) or no schooling, 0: else	0.440	0.496
Medium education	1: individual has a degree from a "Realschule" (typically 10 years of schooling), 0: else	0.365	0.482
High education	1: individual has a degree from a high school ("Gymnasium", typically 12-13 years of schooling), 0: else	0.195	0.396
No professional education	1: individual has 1 year or less of professional training, 0: else	0.163	0.369
Vocational degree	1: individual has a completed apprenticeship (journeyman degree), master craftsman certificate, technician or equivalent, 0: else	0.741	0.438
University	1: individual has a degree from an (applied) university, 0: else	0.096	0.294

The table provides non-weighted summary statistics, based on all employed aged 20 to 59 and observed in the years 1996-2009. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Sample for exit: 551,399 observations. Sample for all other variables: 617,549 observations. Samples described in the data section. Data: repeated cross-section data, Micro Census.

Table 2.C.2: Categories of general education and professional training

General education	Professional training				
	No prof educ	Journeyman	Technician / Master craftsman	University	Total
Low or no schooling	12%	24%	2%	0%	38%
Middle school	3%	25%	4%	0%	34%
High school	5%	6%	2%	14%	28%
Total	21%	56%	9%	15%	100%

The table shows the a tabulation of all individuals by general and professional education. Sample: Individuals aged 20-59, observed in 1996-2009. 3,606,250 observations. Micro census survey weights used.

Table 2.C.3: Effect on entry into self-employment by three initial firm size categories

Dependent variable: Entry with...	0 employees	1-3 employees	4+ employees
	(1)	(2)	(3)
$Share_j \times Reform_t$	0.012***	0.002*	−0.000
	(0.003)	(0.001)	(0.001)
Mean depvar	0.010	0.005	0.003
Industry FE	*yes*	*yes*	*yes*
Year FE	*yes*	*yes*	*yes*
Occupation FE	*yes*	*yes*	*yes*
State FE and trends	*yes*	*yes*	*yes*
Observations	606812	606812	606812

Dependent variable: Binary variables for entry into self-employment without employees (col 1), 1-3 employees (col 2), and 4 or more employees (col 3). The variable $share_j$ corresponds to the share of employed in deregulated product markets in year 1994 in industry j. 1st quartile, 3rd quartile and interquartile range of $share_j$: 0.074, 0.491, 0.417. $Reform_t$ is an indicator variable for the years 2004-2009. The estimations are performed using linear probability models. The sample consists of all employed aged 20 to 59, observed in the years 1996-2009 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

terquartile effect of 0.004 which is equivalent to a relative increase in the propensity to start a firm of 27% (mean entry: 0.015). The similar effect size implies similar changes over time of the number of unemployed in the different industries.

Another sample variation concerns the set of included industries. Recall that in our main specification we use a sample of 51 3-digit industries which contained at least some activity in deregulated product markets according to the 1994 survey of firms regulated under the GTCC. Columns 2 and 3 of table 2.C.4 show the corresponding coefficients on entry into self-employment and exit in a sample of employed in all 134 private-sector industries. The model includes linear industry pre-trends in order to account for differential trends in the highly diverse set of industries. Again, the results are remarkably similar to those of the main specification.

Table 2.C.4: Robustness: alternative samples

Sample:	Incl. unemployed	All industries	
	(1)	(2)	(3)
Dependent variable:	Entry	Entry	Exit
$Share_j \times Reform_t$	0.010***	0.011***	0.194×10^{-2}
	(0.002)	(0.003)	(0.148×10^{-2})
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Covariates	yes	yes	yes
Linear Ind. Pre-Trends	no	yes	yes
Observations	724583	1126613	1014393

Column 1: The main sample is extended to also include all currently unemployed and those outside the labor force which were previously employed in the respective industry. It covers the years 1996-2008 only, since the industry classification for unemployed changed in 2009. Columns 2 and 3: The main entry and exit samples of employed are extended to contain all industries, including the industries which contain no firms active in deregulated product markets (treatment intensity zero). The models in columns 2 and 3 additionally include linear industry pre-trends, estimated on the pre-reform sample only. Coefficients in exit regressions scaled by 100 to improve readability. All samples contain individuals aged 20-59 reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. The estimations are performed using linear probability models. Robust standard errors in parentheses, clustered at industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.C.5 shows an additional set of robustness checks. Rows correspond to separate regressions of the indicated dependent variable entry or exit on the listed treatment intensity and covariates explained in the table notes. We reproduce the baseline results of equation 2.1 in rows (1) and (2). The first robustness check addresses potential mean reversion. If industries with a high or low pre-reform share of

entrants adjusted back to some equilibrium level and the cross-sectional distribution of pre-reform entry shares was correlated with our $share_j \times reform_t$ interaction, this adjustment may be picked up by our main coefficient. We investigate this issue by including the year 2003 industry average of the dependent variable interacted with a full set of year fixed effects. Note that the specification also controls for potential differential trends that depend on baseline industry characteristics (e.g. capital intensity) which are reflected in pre-reform differences in industry shares of entrants or exits. The estimates in rows (3) and (4) are very similar to the baseline, showing no evidence of mean-reverting dynamics affecting our results.

The second robustness check concerns potentially confounding effects of industry-differences in the number of incumbent self-employed. The number of incumbents may negatively affect expected profits and in consequence entry and exit dynamics. Including the industry share of self-employed interacted with the reform dummy in our main regressions leaves the main coefficients virtually unchanged (rows 5 and 6).

Another concern is that industry dynamics such as industry specific growth or industries' heterogeneous exposure to the business cycle may be correlated with the reform and at the same time affect entry into and exit out of self-employment. To alleviate this group of concerns, we control for lagged log industry sales at the 3-digit level.[68] Our main coefficients remain largely unchanged (rows 7 and 8).

Next, we verify the robustness of our results to an alternative way of dealing with 6 product markets in which the entry regulation was not changed in 2003.[69] As explained in section 2.2.2, entry into these product markets remained regulated because entry into these product markets is restricted in most EU member states. In our main specifications, we excluded the six product markets from the sample. In rows 9 and 10 we show results where we include the product markets in the sample and assign them a treatment intensity of zero. The results are not sensitive to this sample modification.

Another sample variation concerns the included age groups. In our main regressions we include employed aged 20 to 59. However, labor supply decisions and the

[68] Data on industry sales are based on administrative revenue tax data for the years 1996 to 2008, available online at the German Statistical Office.

[69] These product markets are optician, hearing aid acoustician, orthopedic technician, orthopedic shoemaker and dental technician

occupational choice of young and old employed may be distorted by education or early retirement, respectively. As shown in rows 11 and 12, our main results hold if we restrict to the sample to employed aged 25-54.

Our empirical models are estimated as linear probability models using OLS regressions. We test the sensitivity of our results to the implicit functional form assumption in rows 13 and 14, which contain estimation results from probit models. We estimated the model comparing industries with above and below median share of employed in deregulated product markets. The treatment effect is calculated as marginal effect of the coefficient of the interaction term $\mathbb{1}(share_j > median) \times reform_t$ in a probit model with industry and year fixed effects. Standard errors are obtained using the delta method and clustered at the industry level. The estimated effects are similar to those from equivalent linear models in column 1 of tables 2.2 and 2.6.

Two robustness checks concern the fact that in the exit regressions covariates are recoded to the previous period since individuals are assigned to industries based on the previous year, which corresponds to exitors last year of self-employment. Since the survey does not ask for the occupation in the previous year, we do not include occupation FE in our main exit regressions. However, we can verify the robustness of our results to including occupation FE in a sub-sample of individuals which indicate to have stayed in their occupation in the past 12 months. By definition, this restriction excludes unemployed and those outside the labor foce in $t + 1$ from this sub-sample. Regression results on this sub-sample, without and with occupation FE are displayed in rows 15 and 16. The coefficients are virtually unchanged. Another variable which can not be recoded to the previous year is the highest vocational degree. Again, the results of a sub-sample where we exclude all individuals who acquired their highest vocational degree in the current or previous year (row 18) are similar to the corresponding results from a sub-sample of those with data on the year of the highest vocational degree (row 17). Note that the variable is part of the survey only since 1999, reducing the number of observations substantially.

Furthermore, we present results using the more aggregated 2-digit industry classification. This specification allows us to account for potential spillovers between 3-digit industries in one 2-digit industry group. For example, entrants in highly reform-affected 3-digit industry may attract product demand from a less affected

3-digit industries in the same 2-digit group. The results in rows 19 and 20 remain remarkably unchanged, suggesting that spillovers between product markets of one 2-digit industry group is not a relevant concern in our application.

A final set of results concerns the robustness of our main results to alternative specifications of the main treatment intensity $share_j \times reform_t$. As explained in Appendix 2.B.2, an alternative treatment intensity can be formed by constructing the 1994 share of employed in firms in deregulated product markets at the 3-digit industry-level over the 1995 number of all employed in the corresponding industry. As explained in Appendix 2.B.2, we decided not to use this specification as our baseline in this chapter because the allocation of product markets to *3-digit* industries is less precise compared to an allocation of product markets to 3-digit occupations, which we do when constructing the main treatment intensity specification. In line with this imprecision, the corresponding estimates in rows 21 and 22 are attenuated towards zero ($Share_{j,alternative}$). However, the coefficient on entry into self-employment remains economically and statistically significant. Finally, our results hold when using a treatment intensity at the 3-digit occupation level ($share_o$, calculated in step two of Appendix 2.B.2, row 23).

Note that our results remain unchanged in a set of regressions in which we sequentially exclude single industries from the sample, suggesting that our reported effects are not driven by a single industry.

Table 2.C.5: Additional robustness checks

		Dependent var.	Coefficient	SE	Observations
			$Share_j \times Reform_t$		
(1)	Baseline	Entry	0.014***	(0.004)	617,549
(2)		Exit	0.075×10^{-2}	(0.130×10^{-2})	551,399
(3)	Mean reversion	Entry	0.014***	(0.003)	617,549
(4)		Exit	0.033×10^{-2}	(0.136×10^{-2})	551,399
(5)	Share incumbents	Entry	0.012***	(0.003)	617,549
(6)		Exit	0.092×10^{-2}	(0.141×10^{-2})	551,399
(7)	Controlling for	Entry	0.012***	(0.003)	584,691
(8)	industry sales	Exit	-0.165×10^{-2}	(0.254×10^{-2})	515,712
(9)	Sample: include non-	Entry	0.013***	(0.004)	620,966
(10)	deregulated product markets	Exit	0.063×10^{-2}	(0.130×10^{-2})	560399
(11)	Sample: age 25-54	Entry	0.014***	(0.004)	502,147
(12)		Exit	0.072×10^{-2}	$(0.163) \times 10^{-2}$	454,007
(13)	Probit model	Entry	0.002***	(0.001)	617,549
(14)		Exit	0.030×10^{-2}	(0.061×10^{-2})	551,399
(15)	Sample: no occupation change	Exit	-0.016×10^{-2}	(0.118×10^{-2})	499,251
(16)	Include occ FE	Exit	-0.022×10^{-2}	(0.119×10^{-2})	499,251
(17)	Sample: year of highest vocational degree non-missing	Exit	0.152×10^{-2}	(0.201×10^{-2})	345,890
(18)	Drop if vocational degree in current or previous year	Exit	0.153×10^{-2}	(0.187×10^{-2})	330,751
			$Share_{2-digit\ ind} \times Reform_t$		
(19)	2-digit industry level	Entry	0.018***	(0.002)	617,549
(20)		Exit	0.111×10^{-2}	(0.194×10^{-2})	551,399
			$Share_{j,alternative} \times Reform_t$		
(21)	Alternative $share_j$	Entry	0.005***	(0.001)	617,549
(22)		Exit	0.002×10^{-2}	(0.070×10^{-2})	551,399
			$Share_o \times Reform_t$		
(23)	Occupation level	Entry	0.006***	(0.002)	617,549

This table contains additional robustness checks described in Appendix 2.C. Rows show results of separate regressions of the dependent variable in column 2 on the indicated treatment intensity and covariates. Exit regressions control for 3-digit industry FE and year FE. Entry regressions additionally include 2-digit occupation FE. The occupation-level regression in row 23 controls for 3-digit occupation FE. Additional covariates included in all regressions are age, age squared, gender, immigrant, three professional training groups, three general education groups, and fixed effects and quartic trends for the 16 German states. $Share_{2-digit\ ind}$ corresponds to the share of employed in deregulated product markets in year 1994 in a 2-digit industry. 1st quartile, 3rd quartile and interquartile range: 0.062, 0.399, 0.337. $Share_{j,alternative}$ is an alternative specification of $share_j$, explained in Appendix 2.B.2. 1st quartile, 3rd quartile and interquartile range: 0.039, 0.631, 0.592. $Share_o$ corresponds to the share of employed in deregulated product markets in a 3-digit occupation (Appendix 2.B.2) with 1st quartile, 3rd quartile and interquartile range 0, 0.656 and 0.656.

Lines 13 and 14 are estimated as probit models, all others as linear probability models. If not stated differently in the text, the entry (exit) sample consists of all employed aged 20 to 59, observed in the years 1996-2009 (1996-2008) and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. In rows 19 and 20, standard errors in parentheses are clustered at the level of 51 3-digit industries. In row 23, SE are clustered at the level of 238 3-digit occupations. In all other rows, SE are clustered at the level of 51 3-digit industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 2.C.6: Effect of the deregulation on entry into self-employment and exit from self-employment - extended table

Dependent variable:	Entry	Exit
	(1)	(2)
$Share_j \times Reform_t$	0.014***	0.075×10^{-2}
	(0.004)	(0.130×10^{-2})
Age	0.002***	-0.000
	(0.000)	(0.000)
Age^2	-0.000***	0.000
	(0.000)	(0.000)
Female	-0.008***	-0.002**
	(0.001)	(0.001)
Foreign	0.004**	0.004***
	(0.002)	(0.001)
Medium general education	0.004**	0.001**
	(0.001)	(0.000)
High general education	0.009***	0.003***
	(0.002)	(0.001)
Vocational degree	-0.000	-0.000
	(0.001)	(0.001)
University education	-0.005**	0.000
	(0.002)	(0.001)
Industry FE	yes	yes
Year FE	yes	yes
Occupation FE	yes	yes
State FE and trends	yes	yes
Observations	617549	551399

In this table we report covariates for column 3 of table 2.2 and column 3 of table 2.6. *Medium general education* denotes individuals with a medium school degree, typically gained after 10 years of schooling ("Realschulabschluss"). *High general education* denotes a high-school diploma ("Abitur/Gymnasium", typically 12-13 years). *Vocational degrees* denotes the journeyman degree, the master craftsman certificate, technicians and related. *University education* joins degrees from applied universities and universities. In column 2 (exit), $share_j$ is scaled by 100 to improve readability. All estimations are performed using linear probability models. The sample consists of all employed aged 20 to 59, observed in the years 1996-2009 and reporting all relevant information. We exclude individuals working in the public sector, non-profit organizations, agriculture and the mining and quarrying sector. Robust standard errors in parentheses, clustered at the industry level. *** denotes significance at 1%, ** at 5% and * at 10% level.

Chapter 3

Entry Deregulation, Industry Dynamics and Employment*

This chapter is part of joint work with Susanne Prantl.

3.1 Introduction

It is well established that new firms contribute substantially to job creation. This phenomenon is driven by a subset of entrants which survives and grows, while the majority of new firms fails relatively quickly (Haltiwanger, Jarmin and Miranda, 2013). At the same time, firm entry is subject to a multitude of regulatory restrictions (Djankov et al., 2002). Reducing such restrictions with the aim of spurring industry dynamics and employment is of interest to policy makers and academics alike (Djankov, 2009). Yet, solid evidence on whether firm entry deregulation can spur employment remains scarce.

We contribute by providing new empirical evidence on the effect of a substantial reduction in firm entry restrictions on entry, industry dynamics and employment. Since additional entrants can contribute to job creation only if they sustain competition, we investigate effects not only on the number of entrants, but also their

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composition with respect to their post-entry longevity and probability to hire. We also analyze effects on the probability of survival and size of incumbent firms, as changes in incumbents' outcomes may counteract job creation by entrants.

We investigate the effects of firm entry restrictions in the context of a recent product market deregulation - the 2004 reform of the German Trade and Crafts Code (GTCC, *Handwerksordnung*). Up to its reform in 2004, the GTCC required prospective entrepreneurs to fulfill a substantial mandatory standard, the master craftsman certificate (Meistertitel), if they wanted to start a firm in one of the specific product markets covered by the regulation. Given the substantial professional training and monetary costs to acquire the certificate, the deregulation led to a significant reduction in entry restrictions.

The reform is well suited for a causal investigation of the effects of firm entry costs, due to two institutional characteristics. First, the pre-reform industry coverage of the GTCC dates back to the historical guilds structure of the Middle Ages, when many professions organized themselves with the aim of restricting firm entry and competition (Ogilvie, 2014). Similar restrictions persisted in other European countries, but the German regulation remained particularly strict. Second, the 2004 reform of the GTCC was spurred by a preceding EU court decision which declared the regulation's incompatibility with the EU Freedom of Services Principle.

In our empirical strategy we adopt a difference-in-differences approach which compares changes in entrant and incumbent outcomes between previously unregulated and regulated product markets around the time of the reform. Due to pre-reform differences in the age and skill composition of the employees in the affected product markets, they may evolve differently over time because of an interaction of the business cycle with these product market characteristics. For example, individuals with different levels of human capital differ in their propensity to enter into entrepreneurship over the business cycle (Svaleryd, 2015). We apply two alternative modifications of the difference-in-differences model to address this concern. First, we control for interactions of year fixed effects and the pre-reform share of employees that are high skilled, medium skilled, aged 15-24 and those aged 25-49. In an alternative modification of the model, we select a matched comparison group of industries with similar pre-reform characteristics using statistical matching. We then estimate the reform effect via difference-in-differences in the resulting matched prod-

uct market sample. We carefully assess the identifying common trend assumption by investigating pre-reform outcome patterns.

We use rich administrative establishment-level panel data which covers a 50% sample of all German establishments with at least one employee. We are able to use four years before and five years after the regulatory reform. The data are well suited for this study since they allow us to disentangle the employment dynamics of entrants and incumbents.

We find that the reduction in entry restrictions leads to an economically and statistically significant increase of about 12% in the number of new establishments with at least one employee. This result suggests that before its reform, the GTCC imposed a binding constraint to establishment entry. This result is in line with chapter two, where we documented an increase in entry into self-employment in consequence of the reform using individual level data. We then study entrant size and follow the new establishments over time to investigate potential changes in post-entry survival and hiring. We find that even though the additional entrants are less likely to start with two or more employees, they are similarly stable and similarly likely to hire in the first years after entry.

Furthermore, we show that in consequence of the reform, incumbents with less than five employees did decrease their number of employees and became significantly more likely to fail, while larger incumbents remained similarly large and stable. Taken together, the overall number of employees did not change significantly in consequence of the reform.

Our results are most closely related to the empirical literature on entry restrictions in the form of administrative burden at start up. Several studies investigate the effects of municipality-level simplifications of the firm registration process (e.g. Bruhn, 2011; Kaplan, Piedra and Seira, 2011; Branstetter et al., 2014). The use of within-country changes in entry restrictions excludes the influence of confounding factors at the national level.[1] While these studies document sizable positive effects

[1] Related cross country studies include Klapper, Laeven and Rajan (2006), who show that national entry restrictions decrease firm entry and slow incumbent growth more in industries which should naturally have high entry rates. For a broader type of product market liberalization, Griffith, Harrison and Macartney (2007) and Fiori et al. (2012) show that the increased competition leads to increased output and employment, and that this effect is more pronounced if labor market regulation is high. Boeri, Cahuc and Zylberberg (2015) and Schiantarelli (2010) review the literature on product market

on the number of entrants and direct job creation by entrants, we contribute a detailed analysis of the impact of a reduction in entry restrictions on the crowding out of incumbents. Furthermore, our study is related to previous work on the entry restriction following from the GTCC. Prantl and Spitz-Oener (2009) and Prantl (2012) investigate the effect of the GTCC on entry into entrepreneurship in the context of the German reunification. They find a negative effect of the entry restriction on entry into entrepreneurship. Prantl and Spitz-Oener (2018) study the effect of immigration on wages of competing native workers in sectors with differing levels of labor market regulation and product market regulation following from the GTCC. Two papers study the 2004 GTCC reform but examine different outcomes and use differing empirical specifications. Rostam-Afschar (2014) finds an increase in entry into self-employment in occupations affected by the GTCC regulation in the context of the 2004 GTCC reform. Damelang, Haupt and Abraham (2018) documents a decrease in wages in occupations affected by the GTCC. Closest to this paper, Zwiener (2017) investigates changes in dependent employment in occupations affected by the GTCC reform. Similar to this paper, she finds no evidence for an increase in dependent employment. In section 3.5.3 we will relate our findings and document substantial differences in the empirical model specification.

Another group of papers has a similar focus on both firm entry and ensuing effects on industry dynamics and employment but investigate different entry-related policies and regulatory restrictions. Hombert et al. (2014) study an unemployment insurance reform which allowed previously unemployed entrepreneurs to retain their rights to unemployment benefits in case of business failure. Similar to our results, the reform increased both the number of entrants and the number of jobs created by young firms, but the increased job creation by start-ups was offset by lower employment growth among incumbent firms. Further comparable evidence on entrepreneurship and ensuing industry dynamics has been found in the context of financial market reforms which improve the allocation of capital to prospective entrants (Bertrand, Schoar and Thesmar, 2007; Kerr and Nanda, 2009) and in the context of restrictions to the maximum size of new retail establishments (Bertrand and Kramarz, 2002; Sadun, 2015).

The following section 3.2 provides an overview of the entry restriction following

reforms and productivity.

from the GTCC and its reform. Section 3.3 outlines our identification strategy and empirical model. We present the data and descriptive statistics in section 3.4 and our results in section 3.5. Section 3.6 provides conclusions.

3.2 Institutional setting

3.2.1 Entry regulation

For our analysis of the effect of firm entry restrictions we make use of a reform to a substantial industry-specific entry restriction in Germany. The restriction follows from the German Trade and Crafts Code (GTCC, *Handwerksordnung*), which imposed a mandatory standard, the master craftsman certificate, on prospective entrants in the product markets covered by the GTCC.[2] This section briefly summarizes the entry regulation and its reform in 2004. A more detailed discussion can be found in section 2.2 of chapter 2.

To obtain the master craftsman certificate, prospective entrepreneurs need to undertake several years of training, pass multiple examinations and collect several years of work experience. Typically, individuals first enroll into a three-year industry-specific apprenticeship training, which is completed with a journeyman examination. After having collected at least three additional years of industry-specific work experience, journeymen may undertake the master craftsman exam.[3] To prepare the exam, most candidates take specific courses, which last one and a half to three years and typically have to be paid by the candidate. Several institutions such as the German Monopolies Commission have long argued that the time and monetary expenses required to obtain the mandatory entry standard result in a substantial entry restriction for prospective entrepreneurs, with adverse consequences for firm entry and industry dynamics (Deregulierungskommission, 1991, Monopolkommission, 1998, Monopolkommission, 2002).

Crucially for our analysis, the GTCC affects a diverse set of specific product markets, but no broad industry sectors, so that often regulated and unregulated

[2] See Appendix section 2.A.2 for details on the exact criteria under which a prospective entrepreneur is affected by the entry regulation.

[3] The exam covers general topics such as business administration as well as occupation-specific contents.

product markets are closely related. For example, metalwork (boring, milling, etc.) in manufacturing, carpentry in construction or hair dressing in the service sector are covered by the GTCC, while the industrial production of engines, renting of construction equipment or beauticians are not covered. This sectoral coverage of the GTCC goes back to the Middle Ages, when many occupations were organized as guilds. Already then, in many European cities craftsmen who wanted to start a business were required to join the respective guild (Ogilvie, 2004). The current form of the entry restriction dates back to 1935 and was confirmed in the first post-war version of the GTCC in 1953. From then on, the regulation and set of regulated product markets remained almost unchanged until the considered reform in 2004.[4]

3.2.2 Reform of the German Trade and Crafts Code

In January 2004, the GTCC was reformed such that the master craftsman certificate lost its role as a mandatory standard for prospective entrepreneurs. The reform was enacted in response to substantial criticism of the entry regulation by European and national courts. In 2000, the European Court of Justice declared the administrative procedures, which EU citizens had to undertake when offering products or services in product markets regulated under the GTCC, as incompatible with the EU Freedom of Services Principle (ECJ, C-58/98 "Corsten", October 3, 2000). In consequence of the ECJ ruling, individuals from EU countries without a degree equivalent to the master craftsman certificate were permitted to offer their products without prior registration. The fact that the mandatory entry standard effectively differed for German and foreign entrepreneurs formed the basis for an influential case filed at the German Constitutional Court in 2002 (Bundesverfassungsgericht, 1 BvR 1730/02, December 5, 2005). Still before the Court reached its decision, in 2003 the German Government moved ahead by proposing the abolition of the master craftsman certificate's role as a mandatory entry standard.[5] In the general public, the abolition of the master craftsman certificate was seen as surprising.[6]

As part of the reform, in 53 out of the 94 previously regulated product mar-

[4] See Appendix 2.A.1 for historical background on the entry regulation.
[5] See section 2.A.3 for further information.
[6] See, e.g., Frankfurter Allgemeine Zeitung, 10.10.2002, Frankfurter Allgemeine Zeitung, 10.02.2003*a* and Frankfurter Allgemeine Zeitung, 28.06.2003*b*.

kets, prospective entrepreneurs were no longer required to obtain any mandatory entry standard. As in product markets which were never regulated by the GTCC, entrepreneurs now merely need to register their business with the local administration. In another 35 product markets, prospective entrepreneurs can now obtain the mandatory standard by completing six years of relevant professional experience. Because the sorting of product markets in these two deregulated groups is potentially endogenous, we will not distinguish these two groups of product markets in our empirical analysis.

In six regulated product markets, the master craftsman certificate kept its role as a mandatory entry standard. These are chimney sweeps and five crafts in the health sector.[7] In these fields, the entry regulation was not challenged by the court rulings, because firm entry is restricted in most EU member states.

Further, the reform entailed a number of technical changes to the GTCC which facilitated firm entry for specific groups of potential entrepreneurs. We explain these minor simplifications to firm entry in Appendix 2.A.4. These simplifications concerned all product markets covered by the GTCC, including the six product markets in which the master craftsman requirement remained in force. Since we are mainly interested in the effect of the entry restriction following from the master craftsman certificate, we will focus our empirical analysis on the product markets where the master craftsman certificate lost its role as a mandatory standard for entrants and exclude the six product markets that were only affected by the minor simplifications from the sample.

In short, the reform - leading to the loss of the master craftsman certificate's role as a mandatory entry standard - considerably decreased the entry costs in some product markets, but not in others. This isolated change in entry costs is arguably unrelated to other developments in the two groups of product markets around the time of the reform, as the cross-sectional structure of product markets covered by the entry regulation was fixed since at least 1953 and the reform event was triggered by legal issues that were unrelated to economic outcomes. In the following section, we propose an empirical identification strategy which makes use of this institutional setting.

[7] These crafts are optician, hearing aid acoustician, orthopedic technician, orthopedic shoemaker and dental technician.

3.3 Empirical strategy

3.3.1 Identification approach

Our objective is to uncover the average effect of the firm entry regulation on industry dynamics and employment in the deregulated product markets (average treatment effect on the treated, ATT). Since the counterfactual outcome is not observed, we make use of industry-time variation generated by the reform of the German Trade and Crafts Code (GTCC). The reform substantially lowered the mandatory standard for firm creation in the covered product markets. It had, however, no direct effect on product markets which were not covered by the GTCC.

Difference-in-differences specification Building on this institutional setting, we set up a difference-in-differences (DiD) model, which compares changes in establishment turnover and employment in deregulated and never regulated product markets in the years 1999 to 2008. Specifically, we examine whether establishment turnover and employment in deregulated relative to never regulated product markets (first difference) are higher after the reform relative to the period before the policy shift (second difference). The main identifying assumption is that, conditional on covariates, the outcomes of interest would have evolved similarly in the deregulated (treated) and never regulated (comparison) product markets in absence of the reform (common trend assumption).

A simple estimate of the ATT is calculated by an unconditional difference-in-differences model, which does not account for potential differences in the product markets' characteristics. Differences between product markets in characteristics which may affect outcome variables are accounted for by the DiD model as long as their influence on the outcomes of interest can be assumed to be constant over time. However, differences in product market characteristics bias the estimator if they cause differences in outcomes dynamics, such as growth of the number of entering establishments. As we will show in the following, the deregulated and never regulated product markets differ in terms of their employee skill and age structure.

Relevant differences in product market characteristics First, differences in the *skill structure* may cause differential firm entry dynamics, if entry

into self-employment over the aggregate business cycle varies across skill groups. Svaleryd (2015) provided recent related evidence for Swedish local labor markets. She finds that low-skilled are more likely to enter self-employment during downturns, while high-skilled are more likely to enter self-employment during booms. This finding is related to recent evidence on entrepreneurial motivations, which have been classified into subsistence entrepreneurship and transformational entrepreneurship (Schoar, 2010; Hurst and Pugsley, 2011; Levine and Rubinstein, 2017). While subsistence entrepreneurs aim at subsistence income for themselves, transformational entrepreneurs engage in ambitious projects. With respect to the effect of business cycle conditions on entry into entrepreneurship, subsistence entrepreneurs are expected to see self-employment as an outside option to escape unemployment during downturns ("recession-push" hypothesis, choice based on necessity). In contrast, transformational entrepreneurs should be more likely to start a firm when the economy is growing ("prosperity-pull" hypothesis, choice based on business opportunities, Parker, 2009).

In addition, product market level differences in the firms' employee skill composition may also correlate with a potentially different evolution of product markets due to technological change. High-skilled may be more likely to exploit business opportunities which emerge due to technological innovations, affecting product market level establishment entry and growth dynamics (See, e.g., Giarratana, 2004). Furthermore, the level of general education of entrepreneurs has been found to be strongly associated with firm growth and longevity (Bates, 1990; Gennaioli et al., 2013; Levine and Rubinstein, 2017).

Second, the propensity to start a firm changes over the individual *life cycle*, as individuals need to build up relevant experience and wealth, but also weigh the remaining years of potential income from self-employment against fixed costs of entry (Evans and Leighton, 1989; Evans and Jovanovic, 1989; Bates, 1995). In consequence, entry into self-employment may respond differently to cyclical fluctuations. For instance, product markets with a higher share of employees that are more likely to start a firm due to their age may experience a stronger increase in firm entry during booms.[8]

[8] This argument rests on the idea that employees build up human capital that is partly industry-specific (Parent, 2000; Poletaev and Robinson, 2008; Gathmann and

To reduce the bias potentially introduced by observable differences between deregulated and never regulated product markets, we employ two identification strategies which condition on observable covariates.

Conditional difference-in-differences First, we address the issue of differences in product market characteristics by inclusion of a suitable parametrization of the relevant product market characteristics directly in the linear regression model (specification "Conditional DiD"). To ensure that the product market characteristics we control for are exogenous to the treatment status, we measure the characteristics in the pre-reform period. We use the years 1999 to 2002 to avoid potential anticipation effects in the last pre-reform year 2003.

We will control for interactions of year fixed effects and relevant pre-reform product market characteristics. Based on the previous discussion, the characteristics we control for are the product markets' employee education distribution in three skill groups (share of low, medium and high-skilled) and the employee age distribution in three age groups (age groups 15-24, 25-49, $\geq$50).[9]

However, conditioning on relevant covariates in a simple regression model relies on extrapolation if the covariates' overlap across the treatment and comparison group is limited. The estimate may be biased if the functional form assumptions regarding the covariates are incorrect (see e.g. Imbens, 2004). Therefore, we also combine statistical matching with a regression estimator.

Matched sampling to select a comparison group Our preferred specification is to choose a comparison group of product markets with similar pre-reform characteristics from the pool of never regulated product markets via statistical matching in a first step and then apply a regression estimator to the balanced sample (specification "Matching DiD").[10] We will use the annual effects in the pre-reform period

Schönberg, 2010) and that is valuable for starting a firm in the same industry (Cooper, Gimeno-Gascon and Woo, 1994; Bosma et al., 2004).

[9] We exclude one skill group and one age group to avoid multicollinearity. The medium skill group comprises both individuals with a journeyman degree and a master craftsman certificate (see Table 3.1).

[10] Note that we are not able to chose a comparison group via statistical matching in the second chapter, because a more aggregated industry classification prevents us from assigning the deregulation status to individual industries (treatment intensity rather than binary treatment).

to assess the credibility of the common trend assumption.

We aim at balancing the product markets in the treatment and comparison group in terms of the product market level employee skill and age structure. Specifically, we match at the product market level on the pre-reform product market share of employees in the three skill groups and three age groups which we also use as covariates in the "Conditional DiD" specification. Note that we explicitly do not match on outcome variables. Combining a difference-in-differences estimator with statistical matching on pre-treatment outcomes leads to an inconsistent estimator when DiD is consistent, because it essentially reintroduces the pre-treatment outcome which is differenced out in the DiD specification (Lechner, 2011; Chabé-Ferret, 2014 and Chabé-Ferret, 2015).

We chose the matched sample via propensity score matching at the product market level, estimating each product markets' probability of being deregulated given the matching variables (Rosenbaum and Rubin, 1983). We match on the variables in each of the years 1999 to 2002 rather than the average pre-reform values to account for potential trends in the employee structure. We exclude the last pre-reform year 2003 and the post-reform years to ensure that the matching variables are exogenous from the treatment.

For each affected product market, we match two nearest neighbors based on the estimated propensity score from the pool of unregulated product markets in the private sector.[11] We match with replacement and drop duplicate comparison industries.

In Table 3.C.2 we show that our main results are similar for a sample created by propensity score matching in which we impose common support over the estimated propensity score.[12]

3.3.2 Econometric model

We estimate the effect of the firm entry restriction using variants of the following difference-in-differences model:

[11] See Appendix section 3.A.3 for a list of industries included in the private sector sample.
[12] Specifically, we exclude treated industries whose propensity score is higher than the maximum or less than the minimum propensity score of the comparison industries.

$$y_{jt} = \alpha + \beta\ dereg_j \times reform_t + X_{jt}\prime\gamma + \mu_j + \phi_t + \epsilon_{jt}, \tag{3.1}$$

where the subscript j denotes product markets and t denotes calendar years. We measure product markets as 5-digit industries. Choosing the level of industry aggregation involves a trade-off. On the one hand, a disaggregated industry classification allows to control in detail for industry characteristics that are either permanent and unobserved (fixed effects) or observed and time-varying. On the other hand, the causal identification requires implicitly, that comparison industries are not affected by the firm entry deregulation. We will discuss this issue in the following section.

In this industry-year-level specification, the outcome variables y_{jt} are mainly the log of the number of new establishments and the log of the overall number of employed in an industry-year cell. The main explanatory variable $dereg_j \times \text{reform}_t$ is our measure of the entry deregulation, where $dereg_j$ takes the value one if an industry was deregulated in 2004 and zero if it was never regulated under the GTCC. The second term of the interaction, reform_t, is one for the five calendar years following the reform in January 2004 and zero for the pre-reform years 2000 to 2003. The model controls for time-invariant differences across industries through industry fixed effects μ_j and aggregate shocks through year fixed effects ϕ_t. Industry fixed effects control for fixed differences in outcomes across industries, such as those caused by an industry's product mix. Year fixed effects account for aggregate shocks due to the national business cycle or country-level policy shifts. In the Conditional DiD model, covariates X_{jt} include interactions of the pre-reform share of employees in the age categories 15-24 and 25-49, the share of medium skilled and high skilled employees with year fixed effects.

We also report results from the following more flexible version of the previous model:

$$y_{jt} = \alpha + \sum_{t=1999}^{2008} \beta_t\ dereg_j \times year_t + X_{jt}\prime\gamma + \mu_j + \phi_t + \epsilon_{jt}, \tag{3.2}$$

where the term in the summation interacts the industry-level deregulation dummy $dereg_j$ with a full set of year dummies and $dereg_j * year_{2003}$ is the excluded category. The pre-reform effects allow for a flexible investigation of differential trends in the

outcome variables of interest prior to the reform. Differing trends prior to the reform would question the common trend assumption. The post-reform effects describe the dynamic pattern of the treatment effect, such as its persistence in the examined first five years following the reform.

We then turn to an analysis at the establishment level to investigate the longevity of the newly started establishments and the response of the establishments which were already on the market prior to the reform (incumbents). The main establishment level specification is as follows:

$$y_{ijt} = \alpha + \sum_{t=1999}^{2008} \beta_t \, dereg_j \times year_t + \mu_j + \phi_t + \epsilon_{ijt}, \tag{3.3}$$

where i denotes individual establishments. In this specification, our main establishment outcomes are the size and longevity of entrants and incumbents. Finally, we investigate within-establishment effects on employment in surviving incumbents, by replacing industry fixed effects with establishment fixed effects.

We cluster standard errors at the industry level to allow for arbitrary forms of correlation within industries, such as serial correlation. The number of industry clusters in the matched industry sample is 181.[13]

3.3.3 Discussion of identifying assumptions

The interpretation of the β coefficients from both the Conditional DiD specification and the Matching DiD specification as causal effect of the firm entry deregulation requires that in absence of the reform, the means of the outcome variables of interest would have evolved similarly in the deregulated and included comparison industries, conditional on covariates *(common trend assumption)*. More formally, we assume that the conditional difference between the outcomes in the treatment and comparison group in the pre-treatment period proxies correctly for the conditional difference in potential outcomes in the post-reform period.

[13] Using monte-carlo simulations of difference-in-differences models, Bertrand, Duflo and Mullainathan (2004) showed that allowing for arbitrary error correlation through clustering standard errors at the longitudinal dimension achieves rejection rates close to those of a simulation with a known covariance matrix when the number of clusters exceeds 50.

Given that the common trend assumption cannot be tested directly since it involves a comparison to the unobserved counterfactual outcome, we investigate the pre-reform evolution of all main outcomes. Similar pre-reform outcome changes in deregulated and comparison industries support the common trend assumption.

Conditioning on observable covariates, either by adding them to the regression model or by conditioning on the propensity of being treated, makes the common trend assumption more likely to hold if there are differences in characteristics which may potentially affect the dynamics of the outcome variables, as in our setting. However, we have to assume that conditional on the observed covariates, the potential outcomes are independent of the treatment *(conditional independence assumption, CIA)*. This assumption rules out any remaining differences in unobservable characteristics which may affect the outcome dynamics, after conditioning on the included observable characteristics. We will evaluate this assumption by conditioning on other observable factors that could conceivably be correlated with outcome dynamics, such as industry sales growth.

We also have to require that both the included covariates in the Conditional DiD model and the variables which we use for the statistical matching are exogenous from the treatment (Froelich, 2008). We argue that the product market level employee age and skill structure in the years 1999 to 2002 was determined before the treatment. Similarly, we assume that the outcome variables are not affected by the reform in the pre-reform period. This requires the absence of any anticipation of the reform until 2002. We argue in section 3.2.2 that such anticipation is unlikely since the reform was planned only in 2003 and was then seen as surprising.

The common trend and CIA assumptions are closely related to the *stable composition assumption*, which requires the comparability of the product markets over time in characteristics which are related to outcome dynamics. For example, a disproportionate increase in the share of high-skilled in treated vs. comparison product markets would bias the estimated reform effect if the skill-level affected the outcomes of interest. Note that this concern differs from our motivation for the use of the product markets' cross-sectional *pre-reform* skill and age distribution as covariates in the Conditional DiD model and as matching variables in the Matching DiD model. There, we were concerned with cross-sectional differences between treated and comparison product markets which may cause differential outcome dynamics, e.g. if

they interact with the business cycle. In contrast, the stable composition assumption rules out differential changes over time of characteristics which may affect the outcomes of interest.

Also, the stable composition assumption is not directly testable in principle. We will investigate its plausibility by controlling for the time-varying product market level employee composition with respect to age, education, gender and nationality in robustness specifications. If these characteristics exhibited differential changes over time and were closely related to the outcomes of interest, we would expect the estimator of the deregulation effect to change considerably. It turns out that their inclusion has almost no impact on the results (Table 3.3 column 1).

As discussed above, the Conditional DiD estimator requires that the parametrization of the covariates allows to correctly impute covariate values in the case of limited overlap of the covariate distributions of the treatment and comparison group. In contrast, the Matching DiD estimator assumes common support of the covariate distributions. We will test the common support assumption directly by inspecting the covariate distributions.

Furthermore, we assume that the treated product markets were not selected based on shifts in potential outcomes (Besley and Case, 2000). An endogenous reform implementation (e.g. in response to declining employment) is unlikely given the institutional setting. In section 3.2.2 we argued that the GTCC reform was enacted in response to a preceding EU court decision which challenged the regulation's compatibility with EU law. The necessity to reform the GTCC regulation was therefore arguably unrelated to economic trends in the regulated product markets. Further, at the time of the reform the set of regulated product markets was fixed since at least 1953, as explained in section 3.2.1.

Finally, the potential outcomes of either the treatment group or comparison group must not vary with the treatments assigned to respective other group, and, for each group, there are no different forms or versions of each treatment level, which lead to different potential outcomes *(stable unit treatment value assumption, SUTVA, Rubin, 1977; Imbens and Rubin, 2015)*. This assumption would be violated in the case of spillover effects between the treatment and comparison group. For example, if the deregulation spurred establishment entry in deregulated product markets and the new establishments competed with establishments in the comparison group,

firm entry in the comparison group could be negatively affected by the deregulation. This may exaggerate our estimates of the deregulation effect on entry into entrepreneurship.

Violations of the SUTVA assumption are empirically intractable unless we have a specific hypothesis about the source of the violation. Relating to the example concerning potential spill-overs due to competition between establishments in related product markets, we examine the sensitivity of our results to dropping product markets from the comparison group which are closely related to product markets in the treatment group. As we assign product markets to 5-digit industries and industries are typically grouped in higher order industry groups based on similarities in the production process, "neighboring" industries within industry groups are particularly susceptible to spill-overs. If such spill-overs occurred, we would expect to find smaller treatment effects if we exclude all 3-digit industry groups which contain a deregulated 5-digit industry from the pool of potential comparison industries and match a new set of comparison industries from this restricted pool. The results remain essentially unchanged (columns 3-4, Table 3.C.3).

3.4 Data and descriptive statistics

3.4.1 Data sources

Our main data source is administrative establishment data for Germany from the Establishment History Panel (Betriebshistorikpanel 1975-2014, BHP).[14] The data is a weakly anonymous 50% sample of all establishments with at least one employee in Germany (see Schmucker et al., 2016 for a detailed description). It is based on the mandatory registration of employees liable to social security. This individual level information is aggregated to the establishment level on 30 of June of each year, resulting in a yearly panel data set. The organizational unit 'establishment' refers to a facility in a given geographic location, such as a plant or retail outlet (Schmucker et al., 2016).

The BHP is well suited for this study since it provides detailed and reliable infor-

[14] Data access was provided via on-site use at the Research Data Center (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and remote data access.

mation on establishment turnover and establishment level employment dynamics. Its complete industry coverage and a detailed 5-digit industry classification allow for a precise determination of the product markets which are affected by the studied entry regulation. As the 5-digit industry information is available only from 1999 on and is subject to a major classification change in 2009, we use the waves 1999 to 2008. This sample covers four years before and five years after the reform.

As self-employed are not liable to social security, the data do not cover solo-entrepreneurs. Focusing our analysis on establishments with at least one employee is adequate for this study, since they are more likely to matter for our focus on job creation and industry dynamics.

3.4.2 Definition of main variables

Establishment entry For the definition of our measure of original independent establishment entry, we start from the conceptual definition of entry as an event in which production factors are newly combined, but no other firms are involved in the establishment creation (Eurostat, 2007). Specifically, two types of events are excluded by this definition. The first group contains events where an already existing physical production unit undergoes an organizational change, such as ownership changes, legal form changes, or corporate mergers. Second, a new physical establishment may be created by a multi-establishment firm or result from a corporate spin-off or a corporate split-up / break-up.

Since the data which we use do not contain annually updated information on the ownership and legal form of establishments, we cannot identify ownership and legal form changes directly.[15] Instead, we use information on flows of workers between establishment identifiers (EID) to exclude establishments which are likely to represent merely an organizational change. New physical establishments are generally assigned a new EID by the German social security agency.[16] We do not consider the reappearance of an EID after a period of absence in the data as a new EID,

[15] See e.g. Dunne, Roberts and Samuelson (1988) and Baldwin and Gorecki (1991) for early classifications of firm entrants when ownership information is available.

[16] Establishments may be assigned to a common EID if they are active in the same 5-digit industry and located in the same municipality (NUTS-5) (Schmucker et al., 2016). Physical relocations and industry changes of establishments do generally not lead to the assignment of a new EID.

since the establishment may have continued its activity without employees during the interruption.[17]

We denote a new EID as a new establishment if its workforce consists largely of workers that have newly come together to the production process. To this end, we rely on worker flows between establishments to improve the definition of establishment entry and exit (Benedetto et al., 2007). The required worker flow data at the establishment level was made available for the BHP data by Hethey-Maier and Schmieder (2013). The worker flow data contain information on the proportion of employees who had worked together in another establishment in the previous year (maximum clustered inflow, MCI). Based on a combination of the BHP data with the IAB Betriebspanel, a survey on a subset of the establishments in the BHP, Hethey-Maier and Schmieder (2013) show that new EIDs with a large initial employee cluster (MCI) are less likely to indicate an original establishment entry.

Building on Hethey-Maier and Schmieder (2013), we denote new EIDs as entrants if there are at least four non-marginal employees in their main employment, of which no more than 30% had previously worked together in another establishment. Marginal employees and employees in secondary employment are not included in the worker flow data.[18] About 4% of all new EIDs have four or more non-marginal employees in their main employment, of which no more than 30% had previously worked together in another establishment (Table 3.A.1, column 5).[19] We do not classify new EIDs as entrants if more than 30% of the non-marginal employees previously worked together in another establishment. This applies to about 8% of all new EIDs.[20] Among the new establishments that have a large cluster of workers who were previously employed at another establishment and are, therefore, not counted as entrants, are non-independent entrants from multi-establishment firms where workers from other establishments of the parent firm constitute the initial workforce of the entrant (e.g. opening of an additional plant or store). Further-

[17] Compared to defining all or parts of reappearing EIDs as potential entrants, the definition which we use provides a lower bound of actual establishment entry.

[18] In the years 1999-2002, employees were defined as non-marginal employees if they earned at least 325 Euros or worked more than 15h/week. In 2003 the monthly earnings cutoff was raised to 400 Euros and the work-hours constraint was abandoned.

[19] In Hethey-Maier and Schmieder (2013) this group corresponds to the establishment entry category "New Establishment (med & big)".

[20] In Hethey-Maier and Schmieder (2013), this group corresponds to the categories "New Estab (fuzzy)", "Spin-off", "ID change" and "Unclear".

more, new EIDs with large clustered worker inflows include organizational changes of already existing production units, such as ownership changes, legal form changes, or corporate mergers, but also corporate spin-offs and split-ups.

We follow Hethey-Maier and Schmieder (2013) in classifying new EIDs with three or less non-marginal employees as entrants irrespective of the share of workers which previously worked for another establishment, because this share is difficult to interpret for very small new establishments. For example, the fact that both employees of a new EID with two employees have previously worked at the same establishment may also represent individual worker mobility between establishments. In this case, a classification as spurious entrants would be wrong. On the other hand, a high cutoff below which to ignore worker flow clusters would raise the share of spurious entrants, because more restructuring events remain undetected ('false positives'). New EIDs with three or less non-marginal employees make up about 25% of all new EIDs.[21] In Appendix section 3.A.1, we show that our main results are robust to lowering the size cutoff above which we take clustered worker inflows to new EIDs into account. The results are very similar (Appendix Table 3.A.3, column 3).

Different from Hethey-Maier and Schmieder (2013), we also include new EIDs with only marginal employees or employees in secondary employment in our analysis. About 63% of all new EIDs (with at least one marginal employee) have only marginal employees or employees in secondary employment in the first three years after hiring the first marginal or secondary job employee. We denote new EIDs with only marginal or secondary job employees during the first 3 years as entrants if they have up to three workers (61% of all new EIDs). About 2% of all new EIDs employ more than three marginal and no non-marginal employees in the first three years and are therefore classified as continuing establishments (Appendix Table 3.A.3, column 4). The main results remain valid when we include new EIDs only in the year they hire the first non-marginal employee (Appendix Table 3.A.3, column 2).

Establishment exit Establishment exit is defined analogously to entry. We consider an EID as potential exit in the last year it lists an employee. EIDs with at least four non-marginal employees in the last year are classified as exit if no more

[21] In Hethey-Maier and Schmieder (2013), this group corresponds to the category "New Establishment (small)"

than 30% of the employees work together in another establishment in the following year (Table 3.A.2 column 4). Further, we denote all EIDs with at most three non-marginal employees as exit. Disappearing EIDs with up to three marginal and no non-marginal employees are also classified as exit. Consequently, we consider EIDs with more than four non-marginal employees as continuing establishments if more than 30% work together in another establishment in the following year, as well as EIDs with no non-marginal employee in the last 3 years and more than three marginal or secondary job employees.

Industry classification We use the 5-digit level of the national industry classification by the Federal German Statistical Office, denoted "WZ" *(Wirtschaftszweige)*.[22] Establishments are allocated to industries based on their primary activity. Waves 1999 to 2003 are coded in WZ, 1993 edition, which corresponds to the NACE rev. 1 classification to the fourth digit and is nested in ISIC rev. 3. Waves 2003 to 2008 are coded in WZ, 2003 edition, which is based on NACE rev. 1.1 and ISIC rev. 3.1.[23] We join selected 5-digit industries to merge them to data on yearly industry-level sales.

We subsequently create time-consistent industry definitions by joining 5-digit industries which are subject to classification changes. Following Pierce and Schott (2012), we denote the resulting time-consistent industry groups as industry "families". We limit the inclusion of minor classification changes into industry families to prevent single industry families from growing large, which would inhibit the precise linkage of industry families to product markets regulated under the GTCC. To this end, we apply a threshold method which was proposed by Pierce and Schott (2012) for SIC and NAICS codes. Details are provided in Appendix section 3.A.2. If not otherwise noted, the term "industry" refers to these industry families. We then focus on private sector industries by excluding industry families with a WZ 1993 industry in the public or non-profit sector (details on the excluded industries in Appendix section 3.A.3). This leads to a set of 679 industry families in the private sector.

[22] Klassifikation der Wirtschaftszweige, Ausgaben 1993 und 2003, Statistisches Bundesamt.
[23] The 2003 WZ classification contains only minor changes compared to the 1993 WZ classification. 92% of the 1.041 5-digit 2003 WZ industries have a 1:1 equivalence in the 1993 WZ classification.

Product market regulation We carefully assign the regulated activities listed in the German Trade and Crafts Code to the 5-digit 1993 industry classification.

For the assignment of regulated activities to industries, we manually compare detailed descriptions of regulated activities in the legal guidelines on master craftsman examinations in each regulated craft *("Meisterprüfungsverordnungen")* with the 5-digit industry code description of the industry classification.

We use the 1953 edition of the GTCC to exclude any potentially endogenous subsequent changes to the set of regulated activities. Specifically, in 1998 scaffolder activities became subject to the GTCC regulation. We exclude the corresponding industry from our main estimation sample.[24]

Furthermore, as explained in section 3.2.1, the 2004 reform of the GTCC lifted the entry restriction in all but six regulated activities. In these six regulated activities, the master craftsman certificate kept its status as mandatory standard for prospective entrants because their practice is restricted in some form in most EU countries. In our main specification we exclude the 7 corresponding 5-digit industries from the sample (about 1% of private sector employment). Therefore, we effectively compare product markets in which the master craftsman certificate lost its role as a mandatory standard, relative to product markets which were never regulated by the GTCC. The results are very similar when including the product markets which continued to be affected by the firm entry restriction in the pool of comparison industries (columns 1-2, Appendix Table 3.C.3).

We identify 81 5-digit industries which are subject to the firm entry deregulation, which we compare to 590 never regulated private sector industries. The affected industries account for about 20% of the private sector employment in our data.

3.4.3 Descriptive statistics

Table 3.1 compares pre-reform industry characteristics for three groups of industries. These three groups are the 81 industries which were affected by the deregulation (column 1), the 590 comparison industries which were never regulated ("all control", column 2), as well as the subset of 100 matched comparison industries (column 3).

The first six rows show the average pre-reform industry share of employees by the

[24] The scaffolder industry accounts for about 22,300 employees in 2005 (0.08% of all private sector employees).

three age and three skill groups which we used as matching variables. Column 4 shows significant differences in the age and skill structure between industries affected by the deregulatory reform and non-affected industries. The affected industries have a larger share of employees aged 15-24 (18% vs. 13%, difference sign. at 1%) than the never regulated industries, but a lower share of employees aged 25-49 (61% vs. 65%, difference sign. at 1%). Furthermore, employees in the affected industries are less likely to have a college education (3% vs. 12%, difference sign. at 1%). These differences are reasonable due to the fact that establishments in the affected industries are more likely to train apprentices and less likely to hire college educated workers. Most apprentices start their training directly after completed schooling.

Interactions of these cross-sectional differences with the business cycle may lead to systematically different dynamics of establishment entry and related outcomes between deregulated and never regulated industries. To illustrate this concern, we provide descriptive evidence for systematic differences in industry level entry rates over the business cycle between industries with different initial shares of (1) high skilled employees and (2) employees aged 15-24 in Appendix 3.B.[25]

Against this background, we create a matched industry sample with a similar pre-reform age and skill composition. Column 5 shows that the statistical matching successfully eliminates observable differences in the matched characteristics.

A comparison of pre-reform growth in the number of entrants and the number of employees across the three groups of industries reveals slightly diverging pre-trends between the affected industries and the non-affected industries (rows 7-8, column 4).[26] This divergence confirms our motivation for using a Conditional difference-

[25] In particular, we regress the yearly log industry number of entrants on an interaction term of national employment growth and the initial industry share of high-skilled employees and employees aged 15-24. We show a strong association for four national business cycle measures (HP-filtered employment growth, annual employment growth, HP-filtered sales growth and annual sales growth). Furthermore, we can show a significant association of the initial industry share of high-skilled with establishment entry over the business cycle for a second data set which covers the years 1976 to 2014. As the main data set used, it is based on the IAB Establishment History Panel. As above, we exclude the public sector. Due to the sample coverage from 1974 to 2014, the sample is limited to West Germany (excl. Berlin) and industries are aggregated to the 3-digit level (229 3-digit industries).

[26] For the dependent variables, we examine pre-reform growth rather than levels because we account for time-invariant differences between industries by controlling for industry fixed effects in the DiD specification.

in-differences model and a Matching difference-in-difference model. The matched sample shows very similar pre-reform trends for the main outcome variables (column 5). This supports the identifying common trend assumption.

3.5 Results

3.5.1 Number of new establishments

Main findings We first investigate the reform effects on establishment entry. We expect a positive effect of the entry deregulation on establishment entry, given the substantial monetary and time costs required to comply with the previous mandatory entry standard.[27]

To estimate the effect of the entry deregulation on the number of entrants, we use two types of difference-in-differences model specifications. In the first model we compare changes over time in the number of new establishments among industries which were affected by the entry deregulation with the corresponding changes over time among all non-affected industries in the private sector.[28] To reduce the bias potentially introduced by observable differences between deregulated and never regulated product markets, we control for interactions of year fixed effects and the industries' employee skill distribution (share of medium-skilled and high-skilled) as well as interactions of year FE with the employee age distribution (age groups 15-24 and 25-49). This specification is equivalent to equation 3.1 where X_{jt} denotes the interactions between year FE and the pre-reform industry characteristics and j denotes all private sector industries ("Conditional DiD" or "CDiD"). The dependent variable is the log of the number of new establishments with at least one marginal employee in an industry-year cell.[29]

Column 1 of Table 3.2 shows the result for the CDiD model. The coefficient esti-

[27] See, among others, Hopenhayn (1992), Fonseca, Lopez-Garcia and Pissarides (2001), Poschke (2010) and Barseghyan and DiCecio (2011)

[28] The model compares changes over time between treated and non-treated industries because time invariant (level) differences between industries of the dependent variable are absorbed by the included industry fixed effects and differences over time which are constant across all included industries are absorbed by the year fixed effects.

[29] Recall that we exclude new establishments of which a large proportion of the employees have worked together in another establishment in the previous year. See Appendix Table 3.A.3, row 3 ("main definition").

mate of 0.118 (significant at the 1% level) on the reform indicator *dereg x reform* implies an increase of the number of new establishments with at least one employee by 11.8% from the pre-reform period to the post-reform period in the affected industries, compared to the non-affected industries. The coefficient shows a percentage increase because the dependent variable is specified in log terms. In column 2 we show the results of a more flexible model specification, in which we interact the variable indicating whether an industry was affected by the entry deregulation with the full set of year fixed effects, 2003 being the omitted category. There are no statistically significant differential trends in establishment entry in the four years prior to the reform, raising no worries regarding the common trend assumption. Establishment entry increases strongly in 2005, the year after which the deregulation took effect, and remains large until 2008, the last year of our sample. The coefficient estimate is statistically significantly different from zero in the years 2005 to 2007.

We confirm this finding with an alternative model specification, where we chose a comparison group with similar pre-reform characteristics from the pool of non-affected industries via statistical matching (specification "Matching DiD" or "MDiD"). We match on the pre-reform industry characteristics which we included as covariates in the previous Conditional DiD specification and then estimate the reform effect via DiD in the resulting matched industry sample without additional covariates. The coefficient estimate of the MDiD specification (column 3) shows a 12.2% increase in the number of new establishments in consequence of the reform, which is very similar to the one of the previous CDiD specification.

The corresponding annual coefficient estimates in column 4 show no indication of diverging pre-trends (see Figure 3.1 for a graphical illustration). The coefficient estimates are close to zero in the years before the reform, turn positive in 2005 and remain statistically significantly different from zero in each year until 2008, the last year of our sample.

Population-level implication Given that before the reform on average 410[30] establishments entered in each affected industry and 81 industries were affected by the deregulation, the increase based on the average effect estimate of 12% corre-

[30] See Appendix Table 3.C.1 panel A. The descriptive statistics in the table refer to the 50% random sample which we use in this analysis, so they have to be multiplied by two to reflect the population level.

sponds to 3,985 additional establishments with at least one employee per year.

Comparison to chapter two The documented effect of the GTCC reform on the number of new employer establishments can be seen as complimentary to chapter two, where we identify a positive reform effect on entry into (individual-level) self-employment.

While establishment entry corresponds to the event where production factors are newly combined, individual entry into self-employment denotes the transition from paid employment, unemployment or outside the labor force into self-employment. An establishment entry may not correspond to entry into self-employment if a self-employed starts an additional establishment or shuts down one establishment and directly starts another production process in a different establishment. Analogously, entry into self-employment may not correspond to establishment entry if a previous wage earner or unemployed becomes a managing owner of an already existing establishment.

Given the conceptual difference between establishment entry and individual level entry into self-employment, the positive reform effect on both empirical measures supports our overall finding of increased entrepreneurial activity in consequence of the reform.

Moreover, the here documented increase in entry of establishments with at least one employee supports our finding regarding a small but statistically significant increase of entry with one to three employees in chapter two (Table 2.C.3). Relative to solo-entrepreneurship, the entry of establishments with at least one employee is a more mature measure of new business activity, because the hiring of a first employee suggests that the entrepreneur is more likely to pursue a business opportunity and grow rather than earning only a subsistence income for herself.[31]

Robustness We assure the robustness of the previous result to several alternative specifications of the Matching DiD model. First, we explore the influence of potential systematic industry-specific changes over time in the employee industry composition, by additionally controlling for the current industry share of employees by gender,

[31] See Schoar (2010) for a discussion of opportunity and subsistence entrepreneurship.

age, skill and nationality.[32] Industry-specific changes over time in the industries' composition would invalidate the stable composition assumption if the changes are systematically related to both the reform and the dependent variable.[33] We show the result in column 1 of Table 3.3. The estimate of the reform effect is very similar in size and more precisely estimated. Most coefficients on the industry characteristics are economically small and statistically insignificant.[34]

Second, we additionally control for interactions of average pre-reform industry sales growth with a post reform dummy and a linear trend variable, to flexibly capture the influence of potentially systematic differences in pre-reform industry growth.[35] The coefficient estimate increases to 14.3% (column 2), but the difference to the baseline estimate is not statistically significant. The coefficient on the interaction of sales growth and the post reform dummy is positive and statistically significant. This points to lower pre-reform sales growth in industries affected by the reform compared to non-affected industries and to a positive association between pre-reform sales growth and growth of the number of entrants at the industry level.

Third, we show that our results remain similar when we control for linear industry trends which are identified from the pre-reform sample years (column 3). This result shows that the measured effect is not a mere continuation of diverging pre-reform trends in establishment entry.

Fourth, we rule out that our results are driven by systematic differences in the product markets' covariation with the business cycle. To this end, we compute industry betas with respect to sales growth. For each industry, we calculate the beta as coefficient from a time-series regression of the industry's annual sales growth

[32] Specifically, we control for the current industry share of employees along seven characteristics: female, aged 15-24, aged 25-49, medium skilled, high skilled, foreign EU citizen and foreign non-EU citizen.

[33] Note that this concern differs from our motivation for the use of the product markets' pre-reform *(time-invariant)* skill and age distribution as covariates in the Conditional DiD model and as matching variables in the Matching DiD model. There, we were concerned with cross-sectional differences between treated and comparison product markets which may cause differential outcome dynamics, e.g. if they interact with the business cycle.

[34] For example, the coefficient on the share of women in an industry-year cell of -0.696 would indicate that industry-year cells with a 1 percentage point higher share of women have on average 0.696 percent fewer entrants.

[35] The sales growth is calculated as average annual growth over the period 1996-2001 at the industry level. Data on industry sales are based on administrative revenue tax data (Statistisches Bundesamt, 2010 and previous editions).

on aggregate annual sales growth in the pre-reform time series 1994 to 2003. The retrieved coefficient estimate proxies for the degree of covariance of each industry with the business cycle in the pre-reform period. We then include interactions of the industry beta with a post reform dummy and a linear trend variable (column 4) in the main model. The results are similar to the baseline estimates.

Fifth, we verify that our results are not driven by systematic differences in the industries orientation towards international trade. Following Mian and Sufi (2014), we create a geographical Herfindahl index for each industry, which is based on the share of an industry's employment that falls in each municipality. Specifically, we define the geographical Herfindahl index as the sum of the squared shares of an industry's employment in each municipality *("Kreis")*, using the Establishment History Panel of the years 1999-2002. This index of tradability relies on the idea that industries which are oriented towards international trade tend to be geographically concentrated, while industries relying on local demand will be more uniformly distributed. We then add interactions of this share with a post reform dummy and a linear trend variable to capture potential differences in the evolution of industries with different geographic industry concentration. The results are similar to the baseline estimates (column 5).

Finally, we present results for an alternative model specification at level of industry-region-year cells (38 NUTS-2 regions). While the identifying variation remains at the industry-year level, this specification allows to control for the potential influence of systematic local trends via interacted region-year fixed effects. The dependent variables are the log number of entrants in an industry-region-year cell. Both the conditioning and matching remains at the industry level, as in the main industry-level specification. Also this model shows a significant increase in the number of new establishments (columns 1 and 3 of Appendix Table 3.C.4). Including interacted region $\times$ year fixed effects does not change the results (columns 2 and 4).

3.5.2 Size, longevity and hiring of the new establishments

After having established the positive effect of the GTCC reform on the number of entrants in the previous section, we now turn to an investigation of the ex-post

quality of the new establishments. The here investigated ex-post quality measures are complementary to the ex-ante measure education (skill level), which we analyzed in chapter two.

We create an establishment level sample of entrants in their first year and use three main empirical measures of ex-post quality: the probability of having $\geq$2 employees at entry, the probability of 2-year survival and the probability of hiring within the first 2 years. To demonstrate the robustness of our results, we also present estimates for 1-year and 3-year survival and 3-year hiring and hiring 2 employees within 2 years.

Since the analysis of survival of an entry cohort depends on outcomes up to three years later, we restrict the estimation sample to the entry cohorts 2000 to 2006 to rule out any confounding influence of the 2008 financial crisis. We estimate the effect on each dependent variable with the Conditional DiD model (full sample) and the Matching DiD model (matched sample).

Propensity to have 2 employees at entry We start with an analysis of the initial size of the new establishments. As the deregulation decreased the initial fixed entry cost, we expect that it facilitated entry disproportionately for those entrepreneurs who intend to start at a small scale.

We define the dependent variable *$\geq$2 employees at entry*, which takes the value one if a new establishment has at least two employees (marginal or non-marginal) in the year of entry *(t)* and zero if the establishment has only one employee. We expect a decrease in the propensity of having two or more employees in the year of entry. This is also what we find. With the Matching DiD model we estimate a decrease of the probability of having two or more employees at in the first year by 1.5 percentage points after the reform, compared to the matched comparison industries (Table 3.4, column 2). Given the sample mean of 0.43 (i.e. 43% of all new establishments have two or more employees), the coefficient estimate indicates a relative decrease of about 3.5%. The Conditional DiD model yields a similar qualitative result (column 1).[36] This result is in line with a similar analysis in chapter two, where we found a decrease in the entrants' probability of having at least one employee in the year of entry in consequence of the GTCC reform (Table 2.3).

[36] See Appendix Table 3.C.6 for the corresponding industry level results.

Propensity to survive for at least 2 years For our analysis of entrant longevity, we create the dependent variable *survive ≥2 years*, which turns one if the entrant survives and has at least one (marginal or non-marginal) employee in *t+1* and *t+2* (first and second year after entry).[37] The variable is zero if the new establishment drops out of the data set within two years. This may be due to exit or indicate that the establishment continues without employees. For example, for entrants in 2004 the variable indicates the continued operation of an establishment until at least June 2006.

Columns 3 and 4 of Table 3.4 shows the result for the entrants' propensity to survive for at least two years. With both the CDiD and the MDiD model, the effect is not statistically significantly different from zero. The results are very similar for entrants' 1-year and 3-year survival (see Appendix Table 3.C.5). Also estimates at the industry-year level show an increase of both the number of entrants which fail within 2 years and the number of entrants which survive for 2 years (Appendix Table 3.C.7). We conclude that the GTCC reform had no statistically significant effect on entrant longevity.

The documented unchanged longevity of the new establishments is in line with chapter two, where we found no significant change in exit from self-employment in consequence of the reform.

Propensity to hire within the first 2 years Next, we investigate potential changes in the new establishments' propensity to hire. We create a dependent variable which indicates the propensity to survive for two years *and* hire at least one additional (marginal or non-marginal) employee within two years (*hire within 2 years*). The variable is zero if the new establishment has equally many or less employees after two years *(t+2)*, compared to the year of entry, or drops out of the data set.

Using the Conditional DiD model, we estimate a decrease in the propensity to hire by 0.9 percentage points (sign. at 1%). Relative to the mean of 22%, the estimate corresponds to a relative decrease of 4% (column 5). The estimate is smaller and not statistically significantly different from zero with the Matching DiD model (column

[37] Recall that conditioning on an employee count of at least one is necessary because the data is restricted to employer establishments.

6).[38] At the industry level, the CDiD model delivers an increase in the number of new establishments which hire within 2 years by 8% (sign. at 10%, Appendix Table 3.C.8, column 1). The according coefficient of the MDiD model on the number of new establishments which hire is positive but imprecisely estimated (column 2). The number of new establishments which survive but do *not* hire within 2 years increases by 15% (sign. at 1%, column 3) according to the CDiD model and by 10% according to the MDiD model (sign. at 1%).

Taken together, the results suggest that there is an economically small average decrease in the new establishments propensity to hire.

The related empirical evidence has been mixed. Branstetter et al. (2014) finds that a decrease in administrative entry costs leads to an increase in the number of entrants but a decrease in the two-year survival probability.[39] In contrast, Hombert et al. (2014) consider a reform which reduced the downside risk from entrepreneurial entry out of unemployment through an extension of unemployment benefit claims in case of business failure, but did not affect entry costs. Similar to our results, they find an average decrease in the initial size of the entrants but find no significant change in the average propensity to survive or hire.

The unchanged composition of entrants with respect to longevity on the one hand, and the fact that we find only an economically small decrease in the propensity to hire on the other hand may also contribute to the understanding of individual selection into entrepreneurship. Our results do not support the theoretical view that individuals select into entrepreneurship based on private ex-ante information about their entrepreneurial ability ("selection view") (Lucas, 1978). In this case, entry costs would screen out entrepreneurs with low expectations about success and a decrease in entry costs should negatively affect the entrant composition. In contrast, our results speak in favor of the view that individuals can learn about their entrepreneurial ability only by starting a firm because they have no private information about their entrepreneurial ability ("experimentation view") (Jovanovic, 1982; Ericson and Pakes, 1995; Asplund and Nocke, 2006). Under this assumption,

[38] Also the propensity to hire at least one employee within 3 years is not statistically and economically significantly affected (see Appendix Table 3.C.5, columns 5-6).

[39] In a different institutional context, Jensen, Leth-Petersen and Nanda (2015) show that a reform that relaxed financing constraints for potential entrepreneurs attracted mostly entrepreneurs which failed within 3 years.

there is no reason to expect a change in the composition of entrants with respect to post-entry outcomes in response to a change in entry costs.

In the following, we investigate whether the increase in the number of entrants translated into an increase in the overall number of employees.

3.5.3 Number of employees in new establishments and overall employment

Number of employees in new establishments First, we investigate whether the reform of the GTCC increased the number of employees in entering establishments. As a dependent variable we use the log of the industry-level number of all employees after two years in entering establishments with at least one employee of a given year. The measure thus counts the number of jobs that will be created by entrants in two years and excludes new establishments which will exit within two years. Employment is measured in full-time equivalents.[40]

With both the Conditional DiD model and the Matching DiD model, the estimated effect of the GTCC reform on the number of jobs created by entrants is not statistically significantly different from zero, but positive (Table 3.5, columns 2 and 4). The result is robust to adding time-varying covariates for the current industry employee composition, controlling for average pre-reform sales growth, as well as including linear industry pre-trends (Appendix table 3.C.9).

Number of employees in all establishments In Table 3.6 we show the effect of the reform on the number of full-time equivalent employees in *all* establishments with at least one employee in the years 1999 to 2008.[41]

[40] We calculate FTE employment as follows: Full-time employees are assigned a weight of 1, (non-marginal) part-time employees *("Teilzeit")* a weight of 0.5 and marginal (part-time) employees *("Geringfügige Beschäftigtung")* a weight of 0.25. The values correspond to the self-reported median number of work hours in the respective employment status in Germany (own calculation based on the Micro Census 2008).

[41] Theoretical predictions on the link between entry restrictions and employment depend strongly on the underlying assumptions on product market conditions (such as the extent and quality of entry, product market differentiation and competition) and labor market conditions (such as the labor supply elasticity or rent sharing) (Fonseca, Lopez-Garcia and Pissarides, 2001; Blanchard and Giavazzi, 2003; Koeniger and Prat, 2007; Ebell and Haefke, 2009; Felbermayr and Prat, 2011).

With the Conditional DiD model we estimate a negative coefficient of the GTCC reform on the number of employees (sign. at 5%, column 1). However, the estimate is driven by a steady decrease in the number of employees in the affected industries relative to the non-affected industries, which started already before the reform (column 2). Hence, the decrease cannot be attributed to the reform.

The Matching DiD model performs better in isolating the reform effect. The number of employees developed similarly in the affected industries and matched non-affected industries in the pre-reform years (column 4). The estimated coefficient of the MDiD model on the interaction term $Dereg_j \times \text{reform}_t$ is not statistically significantly different from zero (column 3).

The MDiD result is robust to adding time-varying covariates for the current industry employee composition (Appendix table 3.C.10, column 1), controlling for average pre-reform sales growth (column 2) and including linear industry pre-trends (column 3).

We therefore conclude that we find no change in dependent employment in consequence of the GTCC reform. Our finding is in line with Zwiener (2017) who finds no change in dependent employment in consequence of the GTCC reform. Differently from this paper, Zwiener (2017) uses individual level data (SIAB), chooses a different specification of the treatment and comparison group and performs her analysis at the occupation level.[42] In the context of administrative burden to start-ups in Mexico, Bruhn (2011) finds a positive effect of a reduction in entry restrictions on the number of wage earners in industry sectors affected by the change in entry restrictions, at the cost of reduced wage employment in non-affected sectors. Bertrand and Kramarz (2002) show that a restriction to the maximum size of new retail establishments slowed down employment growth.

Note that our result does not include employment changes accounted for by solo-entrepreneurs. The increase in the entry by solo-entrepreneurs measured in the second chapter suggests that the here measured effect on the number of employees in establishments with at least one employee may underestimate the effect on overall

[42] As comparison group, Zwiener (2017) chooses the 6 product markets in which the master craftsman certificate continued to be the mandatory entry standard and 29 product markets in which entrepreneurs became allowed to start a firm if they possess a journeymen degree and six years of professional experience. We exclude the first group from the sample and specify the second group as deregulated.

employment.

3.5.4 Incumbent survival and establishment size

We now examine incumbent employment and exit, to explore whether the reform increased reallocation between entrants and incumbents. Exit by inefficient incumbents is expected to increase if the additional entrants raise industry productivity and compete directly with the incumbents (market selection) (Hopenhayn, 1992; Poschke, 2010). However, if the incumbents had market power before the deregulation reform, they may have found it optimal to restrict output and employment (Blanchard and Giavazzi, 2003). Then, firm entry may increase incumbent employment if the new firms increase industry competition. Finally, the strategic reaction of incumbents to firm entry may depend on their competitiveness. Aghion et al. (2009) show that foreign firm entry has adverse effects on incumbent productivity growth and patenting in industries far below the technology frontier, but positive effects in industries close to the frontier.

To this end, we create an establishment level sample which contains only establishments aged five years or older. The definition ensures that establishments observed in the last sample year 2008 have been created before the reform in June 2003.[43] Note that the conditioning/matching is not adapted when going from the industry level to the establishment level in order to consistently use one covariate set and one industry-level comparison group throughout the chapter.

We first investigate establishment exit as the extensive margin of adjustment. Using the CDiD model, we find no overall increase in incumbent exit in consequence of the reform (Table 3.7, column 1). Using the MDiD model, the increase in exit amounts to 0.4 percentage points (col. 3, sign. at 10%), which is equivalent to a relative increase of 8% compared to the pre-reform sample mean of 0.05 (Appendix Table 3.C.1).

[43] This age restriction is implemented by imposing that establishments needed to have at least one full-time employee five years ago. It therefore excludes incumbents which had only marginal employees five years ago, since marginal employment is included in the data only from 1999. Note that the sample is unbalanced. The number of observations is smaller in the employment regressions since the inclusion of establishment fixed effects omits all variation from establishments that are observed only for one period, i.e. establishments which exit at age six.

To further explore which subgroup of incumbents drives this result, we estimate heterogeneous effects by initial establishment size. Specifically, we create an indicator variable $small_{i,t-5}$, which is one if an incumbent had one to four full-time employees five years ago.[44] The corresponding result for both the CDiD and MDiD show a statistically significant increase in overall exit among incumbents which were small before the reform. According to the MDiD model, small incumbents became 0.4 percentage points more likely to fail in consequence of the reform (column 4, row 2, sign. at 10%), while there is no significant change for non-small incumbents ($large_{i,t-5}$). The results are very similar with the CDiD model (column 2) and when controlling an interaction of pre-reform industry sales growth with a post-reform dummy and a linear trend (column 6).

We then investigate effects on employment changes within surviving incumbents, which is the intensive margin of adjustment (Table 3.8). We use the same incumbent sample, but now include establishment fixed effects rather than industry fixed effects to control for differences in unobserved permanent establishment characteristics such as entrepreneurial ability. In this model, the reform effect is identified from employment changes within surviving establishments in affected product markets around the reform year, relative to within establishment employment changes in non-affected product markets.

With the MDiD model, the estimated coefficient on employment of the average incumbent is not significantly different from zero (column 3). However, the analysis of heterogeneous effects by pre-reform size as above reveals that incumbents in the affected industries which had 4 or less employees before the reform did shrink more or grow less around the time of the reform than small incumbents in the non-affected industries (sign. at 10%, column 4, row 2). Also, this result is similar for the CDiD model (column 2), when controlling for linear industry trends (column 5).

Note that the results are very similar when restricting the sample to incumbents which are in the sample in each year from 1999 to 2008 (balanced sample, Appendix Table 3.C.11). This implies that the within-establishment employment changes are not driven by later exiting establishments.[45]

[44] Note that we cannot include marginal employees in this definition, since they are observed only from 1999 on.

[45] Since the sample is restricted to establishments which have been active for 5 years, the establishments of the restricted sample survive for at least 15 years.

The results on incumbent exit and employment growth are consistent with a reform-induced increase in industry dynamics. Small incumbents are partially crowded out in consequence of the reform. This finding is in line with Hombert et al. (2014), who document a decrease in employment among small incumbents as a result of reform which facilitated entry into entrepreneurship in France.

3.6 Conclusions

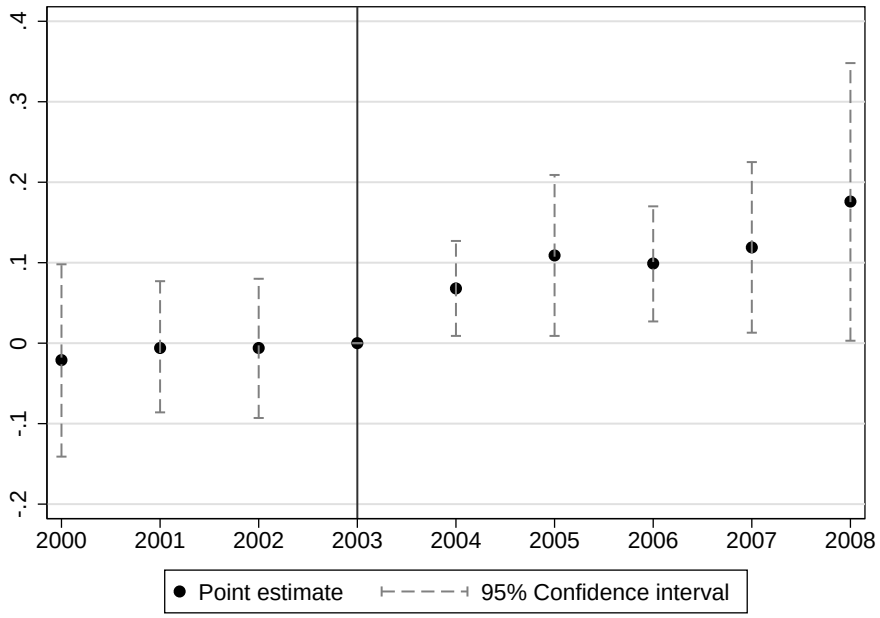
In this chapter we estimate the effect of a deregulation that led to a substantial reduction in firm entry restrictions in a large and diverse set of product markets, while other markets remained entirely unaffected. Up to its reform, the regulation imposed a mandatory standard, the master craftsman certificate, on prospective entrepreneurs. Given its arguably exogenous implementation, the deregulation qualifies as a suitable quasi-natural experiment for identifying effects of a reduction in entry restrictions.

We find that the deregulation led to a substantial increase in the number of new establishments with at least one employee. The new establishments are initially smaller, which was expected given that the fixed entry cost resulting from the entry restriction was more binding for prospective entrepreneurs who intended to start on a small scale. Interestingly, the new establishments are similarly likely to survive. This suggests that the deregulation did not negatively affect the composition of the new entrepreneurs.

In a second set of findings, we show that at least in the first five years after the reform, the increased activity by new establishments did not result in a statistically significant increase in dependent employment. This may be partly due to crowding-out of small incumbents, which experienced an increased probability of exit and lower employment in consequence of the deregulation.

3.7 Figures and tables

Figure 3.1: Effect of the deregulation on the number of entrants (annual effects)



Notes: In this figure we show coefficients β_t and 95% confidence intervals of the model

$$y_{jt} = \alpha + \sum_{t=2000}^{2008} \beta_t \, dereg_j \times year_t + \mu_j + \phi_t + \epsilon_{jt}$$

in which $dereg_j \times year_{2003}$ is the excluded category. The dependent variable is the log of the number of new employer establishments per industry-year (details in section 3.4.2). The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Sample: matched sample of 181 5-digit industries (details in section 3.3.1), years 2000-2008. Number of observations: 1629. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. Coefficients reported in table 3.2 column 4.

Table 3.1: Characteristics of treatment and comparison group industries

	(1) Treat	(2) All Control	(3) Matched Control	(4) (1)-(2) t-test		(5) (1)-(3) t-test	
	Mean	Mean	Mean	Coeff.	SE	Coeff.	SE
Pre-reform matched product market characteristics							
Employee age:							
Share age 15-24	0.182	0.127	0.161	0.054***	(0.013)	0.020	(0.020)
Share age 35-49	0.613	0.654	0.621	-0.040***	(0.008)	-0.008	(0.013)
Share age 50+	0.205	0.219	0.217	-0.014	(0.010)	-0.012	(0.013)
Employee education:							
Share low skilled	0.198	0.158	0.176	0.040	(0.026)	0.022	(0.030)
Share medium skilled	0.768	0.727	0.781	0.041	(0.025)	-0.013	(0.026)
Share high skilled	0.034	0.115	0.043	-0.081***	(0.010)	-0.009	(0.009)
Pre-reform product market characteristics not matched							
Growth Nº entrants	-0.140	-0.183	-0.151	0.043	(0.026)	0.011	(0.033)
Gr. Nº entrants with 1 employee	-0.125	-0.154	-0.106	0.028	(0.032)	-0.019	(0.045)
Gr. Nº entrants with 2+ empl.	-0.159	-0.197	-0.198	0.038	(0.027)	0.039	(0.040)
Gr. Nº entrants which survive 2y	-0.116	-0.140	-0.083	0.024	(0.027)	-0.034	(0.031)
Gr. Nº entrants don't survive 2y	-0.172	-0.251	-0.239	0.079	(0.043)	0.068	(0.052)
Gr. Nº entrants hire within 2y	-0.031	-0.104	-0.024	0.072*	(0.033)	-0.007	(0.033)
Gr. Nº entrants don't hire in 2y	-0.199	-0.174	-0.143	-0.025	(0.036)	-0.057	(0.040)
Gr. Nº employees$_{t+2}$ in entrants	-0.162	-0.244	-0.201	0.083	(0.060)	0.039	(0.048)
Gr. Nº employees	-0.073	-0.041	-0.075	-0.032*	(0.014)	0.002	(0.035)
N (industries)	81	590	100	671		181	

Notes: In this table we show industry level characteristics for industries affected by the deregulatory reform (column 1), all non-affected industries (column 2) and matched comparison industries (column 3). Column 4 compares deregulated to all never regulated industries and column 5 compares deregulated to matched comparison industries. The pre-reform matched product market characteristics (share aged 15-24 etc.) are calculated as industry average in the years 2000-2003. For the non-matched outcome variables (growth of the number of entrants etc.) we report the industry-level growth from 2000/2001 to 2002/2003. *Low skilled* denotes employees with no apprenticeship training (no vocational qualification). *Medium skilled* denotes employees with an apprenticeship training or master craftsman certificate. *High skilled* are those with a degree from a university or college of higher education. Industry-observations are weighted by employment. Robust standard errors in brackets. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.2: Effect of the deregulation on the number of entrants

Specification	(1)	(2)	(3)	(4)
	Conditional DiD		Matching DiD	
Dependent variable	ln(Nº entrants)			
$Dereg_j \times \text{reform}_t$	0.118***		0.122*	
	(0.041)		(0.066)	
$Dereg_j \times$ 2000		-0.033		-0.021
		(0.036)		(0.061)
$Dereg_j \times$ 2001		0.014		-0.006
		(0.043)		(0.042)
$Dereg_j \times$ 2002		-0.003		-0.006
		(0.031)		(0.044)
$Dereg_j \times$ 2004		0.042		0.068**
		(0.050)		(0.030)
$Dereg_j \times$ 2005		0.141***		0.109**
		(0.034)		(0.051)
$Dereg_j \times$ 2006		0.124***		0.099***
		(0.040)		(0.036)
$Dereg_j \times$ 2007		0.123**		0.119**
		(0.054)		(0.054)
$Dereg_j \times$ 2008		0.132		0.176**
		(0.105)		(0.087)
Pre-reform industry char. × Year FE	yes	yes	no	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6039	6039	1629	1629

Notes: In this table we show results on the effect of the deregulation on establishment entry. In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008). We include interactions of year fixed effects with pre-reform industry characteristics. These are the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). To create the matched regression sample, we match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
In columns 1-4, the dependent variable is the log of the number of entering employer establishments per industry-year (details in section 3.4.2). The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Table 3.3: Effect of the deregulation on the number of entrants - Robustness

Specification	(1)	(2)	(3)	(4)	(5)
	Matching DiD				
Dependent variable	ln(Nº entrants)				
Robustness	Employee composition	Sales growth	Lin. pre-reform industry trends	Industry beta	Geographical concentration
$Dereg_j \times \text{reform}_t$	0.119**	0.143***	0.106***	0.136**	0.123**
	(0.055)	(0.042)	(0.040)	(0.053)	(0.054)
Share female$_{jt}$	-0.696	1.131	-0.177	0.024	-0.724
	(2.082)	(1.623)	(1.388)	(1.652)	(2.083)
Share age 15-24$_{jt}$	3.502	4.181*	2.479	4.225**	3.252
	(2.389)	(2.193)	(1.940)	(2.076)	(2.388)
Share age 25-49$_{jt}$	2.072	2.911*	1.488	2.312*	2.319
	(1.420)	(1.543)	(1.117)	(1.330)	(1.466)
Share medium skilled$_{jt}$	1.607	2.639*	1.752	2.049	1.340
	(1.636)	(1.422)	(1.331)	(1.447)	(1.661)
Share high skilled$_{jt}$	-1.131	0.614	-0.157	-0.754	-1.578
	(4.460)	(3.727)	(3.013)	(4.340)	(4.455)
Share foreign non-EU$_{jt}$	2.936	4.488**	2.996	3.154	2.938
	(2.131)	(1.962)	(1.941)	(2.063)	(2.129)
Share foreign EU$_{jt}$	5.779	3.980	5.223*	6.289*	5.654
	(3.864)	(3.390)	(3.099)	(3.781)	(3.821)
1996-2001 sales growth$_j$		0.821**			
$\times$ reform$_t$		(0.403)			
1996-2001 sales growth$_j$		0.112			
$\times$ trend$_t$		(0.118)			
Industry beta$_j$				-0.020***	
$\times$ reform$_t$				(0.006)	
Industry beta$_j$				0.002	
$\times$ trend$_t$				(0.001)	
Geogr. HHI$_j$					0.245
$\times$ reform$_t$					(0.516)
Geogr. HHI$_j$					0.157
$\times$ trend$_t$					(0.136)
Linear pre-reform industry trends	no	no	yes	no	no
Industry FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
N (industry-year)	1629	1629	1629	1629	1629

Notes: In this table we show results for alternative specifications. In col. 1, we control for the current industry share of employees along seven characteristics. In col. 2, *1996-2001 sales growth$_j$* is average industry sales growth in 1996-2001. In col. 3, we control for linear industry trends which are identified from the pre-reform sample. The industry betas in col. 4 are calculated as coefficient from a regression of the industry's annual sales growth on aggregate sales growth in 1994-2003. In col. 5, we control for a geographical Herfindahl concentration index, defined as the sum of squared shares of industry employment in each municipality, using pre-reform data. All other components as in col. 4 of the previous table.

Table 3.4: Initial entrant size, entrant longevity and hiring

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	CDiD	MDiD	CDiD	MDiD	CDiD	MDiD
Dependent variable	$\geq$ 2 employees in t_0		Survive $\geq$2 years		Hire within 2y	
$Dereg_j \times \text{reform}_t$	-0.025***	-0.015*	0.002	-0.003	-0.009*	-0.006
	(0.007)	(0.009)	(0.006)	(0.011)	(0.005)	(0.006)
Mean depvar	0.376	0.426	0.577	0.559	0.220	0.245
Pre-reform industry char. $\times$ Year FE	yes	no	yes	no	yes	no
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Observations	638473	221752	638473	221752	638473	221752

Notes: In this table we show results on the effect of the deregulation on initial entrant size, entrant longevity and hiring of entrants in their first year. The dependent variable *$\geq$2 employees in t_0* takes the value one if the entering establishment has at least two (marginal or non-marginal) employees in the first year and zero if the new establishment has only one employee. *Survive $\geq$2 years* is one if the entrant survives at least two years. This implies that the establishment has at least one (marginal or non-marginal) employee in the first and second year after entry. The variable is zero if the new establishment drops out of the data set within two years. This may be due to exit or indicate that the establishment continues without employees. *Hire within 2 years* takes the value one if the entrant survives and hires at least one additional (marginal or non-marginal) employee within two years. The variable is zero if the new establishment has equally many or less employees after two years, compared to the year of entry, or if the establishment drops out of the data set.
In columns 1, 3 and 5 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008). We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2, 4 and 6 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries, years 2000-2008). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using a linear probability model, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Table 3.5: Effect of the deregulation on the number of employees in entrants

Specification	(1)	(2)	(3)	(4)
	Conditional DiD		Matching DiD	
Dependent variable	ln(Nº employees$_{t+2}$ in entrants)			
$Dereg_j \times$reform$_t$	0.116*		0.063	
	(0.063)		(0.080)	
$Dereg_j \times$ 2000		-0.204**		-0.038
		(0.083)		(0.108)
$Dereg_j \times$ 2001		0.026		-0.042
		(0.090)		(0.105)
$Dereg_j \times$ 2002		-0.011		-0.027
		(0.088)		(0.115)
$Dereg_j \times$ 2004		-0.036		0.047
		(0.093)		(0.084)
$Dereg_j \times$ 2005		0.145		0.023
		(0.090)		(0.102)
$Dereg_j \times$ 2006		0.081		0.107
		(0.091)		(0.082)
$Dereg_j \times$ 2007		0.057		-0.070
		(0.084)		(0.081)
$Dereg_j \times$ 2008		0.098		0.073
		(0.141)		(0.140)
Pre-reform industry characteristics × Year FE	yes	yes	no	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6039	6039	1629	1629

Notes: In this table we show results on the effect of the deregulation on the number of employees in entering establishments. In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The dependent variable is the annual industry-level log of the entrants' number of employees two years after entry. Employment is measured in full-time equivalents. The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Table 3.6: Effect of the deregulation on the number of employees

Specification	(1)	(2)	(3)	(4)
	Conditional DiD		Matching DiD	
Dependent variable	ln(Nº employees)			
$Dereg_j \times \text{reform}_t$	-0.086**		-0.003	
	(0.040)		(0.078)	
$Dereg_j \times$ 1999		0.060**		-0.020
		(0.030)		(0.078)
$Dereg_j \times$ 2000		0.042*		-0.015
		(0.022)		(0.055)
$Dereg_j \times$ 2001		0.022		-0.006
		(0.014)		(0.032)
$Dereg_j \times$ 2002		0.015		0.001
		(0.009)		(0.011)
$Dereg_j \times$ 2004		-0.029***		-0.010
		(0.010)		(0.018)
$Dereg_j \times$ 2005		-0.050***		-0.012
		(0.018)		(0.036)
$Dereg_j \times$ 2006		-0.064**		-0.014
		(0.032)		(0.046)
$Dereg_j \times$ 2007		-0.074*		-0.010
		(0.042)		(0.057)
$Dereg_j \times$ 2008		-0.075		-0.008
		(0.046)		(0.065)
Pre-reform industry characteristics × Year FE	yes	yes	no	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6710	6710	1810	1810

Notes: In this table we show results on the effect of the deregulation on the number of employees. In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 1999-2008). We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
In both specifications, the dependent variable is the annual industry-level log of the number of employees in establishments with at least one employee. Employment is measured in full-time equivalents. The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Table 3.7: Effect on incumbent establishment exit

Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Conditional DiD		Matching DiD			
Dependent variable	Establishment exit					
$Dereg_j \times \text{reform}_t$	0.002		0.004*			
	(0.001)		(0.002)			
$Dereg_j \times reform_t \times small_{i,t-5}$		0.002		0.005**	0.001	0.006**
		(0.001)		(0.002)	(0.002)	(0.002)
$Dereg_j \times reform_t \times large_{i,t-5}$		-0.001		0.002	-0.002	0.002*
		(0.001)		(0.001)	(0.002)	(0.001)
$Dereg_j \times small_{i,t-5}$		-0.008***		-0.009***	-0.009***	-0.009***
		(0.002)		(0.002)	(0.002)	(0.002)
$Reform_t \times small_{i,t-5}$		-0.002***		-0.002	-0.002***	-0.002*
		(0.001)		(0.001)	(0.001)	(0.001)
$Small_{i,t-5}$		0.039***		0.040***	0.041***	0.040***
		(0.001)		(0.002)	(0.002)	(0.002)
1996-2001 sales growth$_j$						0.043***
$\times$ reform$_t$						(0.009)
1996-2001 sales growth$_j$						-0.006**
$\times$ trend$_t$						(0.003)
Pre-reform industry char.	yes	yes	no	no	no	no
$\times$ Year FE						
Linear industry trends	no	no	no	no	yes	no
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
N (establishment-year)	4792675	4792675	2214679	2214679	2214679	2214679

Notes: In this table we show results on the effect of the deregulation on exit of incumbent establishments. The dependent variable is a binary variable which takes the value one if an incumbent exits in the current year and zero for all continuing incumbents. Sample mean of exit: 0.05. Incumbents are defined as establishments with at least one employee 5 years ago. $small_{i,t-5}$ is defined as having had up to 4 employees 5 years ago. $large_{i,t-5}$ is defined as having had 5 or more employees 5 years ago. Since last sample year is 2008, both variables refer to the pre-reform period.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using a linear probability model, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.
In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 1999-2008). We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.

Table 3.8: Effect on incumbent establishment employment

Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Conditional DiD		Matching DiD			
Dependent variable	log(establishment size)					
$Dereg_j \times \text{reform}_t$	-0.044**		-0.018			
	(0.019)		(0.036)			
$Dereg_j \times reform_t \times small_{i,t-5}$		-0.054***		-0.050*	-0.029**	-0.038
		(0.017)		(0.029)	(0.013)	(0.030)
$Dereg_j \times reform_t \times large_{i,t-5}$		-0.026		0.023	0.010	0.030
		(0.023)		(0.046)	(0.011)	(0.041)
$Dereg_j \times small_{i,t-5}$		0.011		0.028	0.013	0.020
		(0.009)		(0.022)	(0.010)	(0.017)
$Reform_t \times small_{i,t-5}$		0.036***		0.081**	0.055***	0.076**
		(0.011)		(0.036)	(0.016)	(0.031)
$Small_{i,t-5}$		-0.074***		-0.091***	-0.073***	-0.083***
		(0.007)		(0.021)	(0.009)	(0.016)
1996-2001 sales growth$_j$						-0.132***
$\times$ reform$_t$						(0.041)
1996-2001 sales growth$_j$						0.109*
$\times$ trend$_t$						(0.058)
Pre-reform industry char.	yes	yes	no	no	no	no
$\times$ Year FE						
Linear industry trends	no	no	no	no	yes	no
Establishment FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
N (establishment-year)	4660729	4660729	2160669	2160669	2160669	2160669

Notes: In this table we show results on the effect of the deregulation on the size of incumbent establishments. The dependent variable $log(establishment\ size)$ is defined as the log of the number of employees (full time equivalents) at the level of establishments. Incumbents are defined as establishments with at least one employee 5 years ago. $small_{i,t-5}$ is defined as having had up to 4 employees 5 years ago. $large_{i,t-5}$ is defined as having had 5 or more employees 5 years ago. Since last sample year is 2008, both variables refer to the pre-reform period.

The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 1999-2008). We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.

Appendix 3.A Data appendix

3.A.1 Alternative definitions of new establishments

In this appendix section we describe three additional entry definitions. Recall that, in the main definition, we follow Hethey-Maier and Schmieder (2013) who classify all new establishments with one to three non-marginal employees as entrants. New EIDs with four or more non-marginal employees are classified as entrants if no more than 30% had previously worked together in another establishment. New EIDs with only marginal or secondary job employees during the first 3 years are denoted as entrants if they have three or less workers.

First, we create an alternative entry definition which excludes new EIDs with only marginal employees, for which there is no worker flow information (alternative definition 1). Then, an establishment is counted as new establishment in the first year if it employs at least one non-marginal employee. As above, new establishments are entrants, if no more than 30% of the employees have previously worked together in another establishment or if there are no more than three employees. Using the log of the industry-level number of entrants based on this definition yields results which are very similar to the main definition (table 3.A.3, column 2).

With our alternative definition 2 we explicitly take worker flows of new EIDs with one to three employees into account. Different from the main definition, now we do not count new EIDs with up to three non-marginal employees as entrants if two or more non-marginal employees were employed in the same establishment in the previous year. This case covers 3.3% of all new EIDs (table 3.A.1, column 4). This implies that under this alterative definition 2, new establishments with up to three non-marginal employees are only classified as entrants if all employees previously worked in different establishments (column 3). As in the main definition, new EIDs with four or more non-marginal employees are classified as entrants if less than 30% of the employees have previously worked for an identical establishment.

Our third alternative firm entry definition concerns new establishments which have only marginal employees in the first year and hire their first non-marginal employee in the following years (first worker flow information). The choice of the time period until when to take a first hiring of non-marginal employees into account

involves a trade-off. On the one hand, late hirings may be less related to the entry event but rather represent the expansion of already existing establishments. On the other hand, a new establishment with only marginal employees may be started to prepare the actual entry, which may then be classified as a spurious entry if the later inflow of non-marginal workers is highly clustered. In our alternative definition 3, we take worker flow information of the first year when non-marginal employees are hired into account, irrespective of the time period between the hiring of the first marginal and non-marginal employee. The results are robust to this modification (table 3.A.3, column 4).

Finally, we show that the effect is of similar size when we specify the dependent variable as industry-level share of new establishments over the lagged number of employees, rather than the log of the number of entrants. This alternative definition is closest to the firm entry definition in chapter two, where we define firm entry as entry into self-employment (individual level). The average number of entrants per 1000 employees is 7.3 (Table 3.A.3, column 5). The measured effect of the reform on the share of entrants over 1000 employees is 0.95, which is an increase of 13% relative to the sample mean. The size of the effect is comparable to the main result in column 4 (12% increase).

3.A.2 Time-consistent industry definitions

In this section we explain the algorithm that we use for concording the industry classification change from the German national classification *Klassifikation der Wirtschaftszweige (WZ), 1993 edition*, to the subsequent classification *WZ, 2003 edition*. We start out from the algorithm for concording revisions of product and industry classifications over time which was proposed by Pierce and Schott (2012) for SIC and NAICS codes. We adapt the procedure to the German national industry classification. If a 1993 code splits into several 2003 codes or vice versa, the threshold method joins the 1993 "parent" code and the 2003 "children" codes into one "industry family", unless a child code accounts for only a minor share of the parent employment. Ignoring minor industry links prevents the families from growing large. Minor industry links are determined as follows. First, tabulate employment according to the 1993 and 2003 industry classifications, using the 2003 wave in which establishments are coded in both industry classifications. This cre-

Table 3.A.1: Definition of establishment entry

	(1)	(2)	(3)	(4)	(5)	(6)
1st criterion: newly appearing administrative establishment identifier (EID)						
2nd criterion: number non-marginal employees	0 non-marginal employees		1-3 non-marg empl.		≥ 4 non-marg empl.	
3rd criterion: Maximum clustered inflow (MCI)	≤ 3 marginal employees	≥ 4 marginal employees	MCI = 1	MCI > 50%	MCI < 30%	MCI ≥ 30%
Examples (MCI / Size)			1/1, 1/2, 1/3	2/2, 2/3, 3/3	1/4, 1/5, 1/6, 1/7, 2/7,...	2/4, 3/4, 4/4, 2/5,...
Main definition	entry	no entry	entry	entry	entry	no entry
Alternative def. 1: ≥ 1 non-marginal employee (column 2, table 3.A.3)	**no entry**	no entry	entry	entry	entry	no entry
Alternative def. 2: Exclude clustered inflows for small entrants (column 3, table 3.A.3)	entry	no entry	entry	**no entry**	entry	no entry
Share new EIDs	61.23	2.07	21.27	3.27	3.78	8.38

Notes: This table compares our main establishment entry definition to two alternative entry definitions. A clustered inflow denotes a group of non-marginal employees who had previously worked together in another establishment. MCI denotes the largest clustered outflow of a new establishment (Schmieder, 2013). Marginal employees *(marg empl.)* do not contribute to social security but have to be reported by the employer. Their maximum monthly earnings were 325 Euros up to 2002 and 400 Euros from 2003 on. Non-marginal employees *(non-marg empl.)* have earnings above the respective thresholds. The shares of new EIDs in the final row refer to all 1,104,599 new EIDs in years 2000-2008 in 671 private sector industries.

Table 3.A.2: Definition of establishment exit

	(1)	(2)	(3)	(4)	(5)
1st criterion: disappearing administrative establishment identifier (EID)					
2nd criterion: number non-marginal employees	0 non-marginal employees		1-3 non-marg empl.	≥ 4 non-marg empl.	
3rd criterion: Maximum clustered outflow (MCO)	≤ 3 marginal employees	≥ 4 marginal employees		MCO < 30%	MCO ≥ 30%
Examples (MCO / Size)				1/4, 1/5, 1/6, 1/7, 2/7,...	2/4, 3/4, 4/4, 2/5,...
Definition	exit	no exit	exit	exit	no exit
Share disappearing EIDs	28.79	1.19	54.61	5.94	9.47

Notes: This table illustrates our establishment exit definition. A clustered outflow denotes all non-marginal employees who will work in the same establishment in the year after exit. MCO denotes the largest of all clustered outflows of a disappearing establishment. Marginal employees *(marg empl.)* do not contribute to social security but have to be reported by the employer. Their maximum monthly earnings were 325 Euros up to 2002 and 400 Euros from 2003 on. Non-marginal employees *(non-marg empl.)* have earnings above the respective thresholds. The shares of all disappearing EIDs in the final row refer to 1,039,615 disappearing EIDs in years 1999-2008 in 671 private sector industries.

Table 3.A.3: Results for alternative definitions of establishment entry

	(1)	(2)	(3)	(4)	(5)
	Baseline	Alternative definition 1	Alternative definition 2	Alternative definition 3	Alternative definition 4
Specification		≥1 non-marginal employee	Exclude clustered inflows for small entrants	Include worker flow info for late non-marginal inflow	
Dependent var.:	ln(№ entrants)				$\frac{N^{o}entrants_t \times 1000}{N^{o}employees_{t-1}}$
$Dereg_j \times \text{reform}_t$	0.122*	0.124**	0.135**	0.131**	0.952**
	(0.066)	(0.062)	(0.065)	(0.061)	(0.395)
Industry FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
Mean dep. var.					7.267
N (industry-year)	1629	1629	1629	1629	1629

Notes: This table shows results for alternative definitions of establishment entry. In columns 2-4, we use the log number of entrants as dependent variable. In column 2, we classify EIDs as entrants only after hiring their first non-marginal employee and exclude all new establishment IDs with only marginal employees in the first year ("Alternative definition 1", table 3.A.1). In column 3, we provide results for an alternative entry definition which also excludes new EIDs with up to three non-marginal employees if the initial employee structure is highly clustered ("Alternative definition 2", table 3.A.1). In column 4, we include worker flow information of new establishments which hire their first non-marginal employees more than three years after hiring of the first (marginal) employee. In column 5, we use the industry level share of entrants (multiplied by 1000) over the lagged number of employees as dependent variable.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Sample: matched sample of 181 5-digit industries (details in section 3.3.1), years 2000-2008. Robust standard errors in brackets, clustered at the level of 181 industry groups. *** denotes significance at 1%, ** at 5% and * at 10% level.

ates a matrix which indicates the employment shares of all 2003 industries in 1993 industries and vice versa. The employment shares proxy for the empirical proximity between two industry codes. Second, sort all corresponding 2003 (base) industries in descending order according to their employment share in a 1993 (target) industry. Third, keep correspondences until the cumulative employment share of all base correspondences to the target industry exceeds the defined threshold of 50%. Note that minor correspondences are only dropped if the minor industry is part of another industry family (many-to-many-match). The larger the threshold, the larger (and more diverse) industry families may become. A threshold of one results in joining all correspondences into families. A threshold of zero would be equivalent to keeping only the modal base correspondence.

3.A.3 Private sector

In our definition of the "private sector", we exclude industry families with the following industries (2-digit SIC rev. 3 / NACE rev. 1 in brackets): agriculture (01-05), mining (10-14), water provision (41), central bank (4-digit NACE rev. 1 65.11), public administration (75), education (80), health (85), public utilities (90), non-profit organizations (91), broadcasting (92.20.1), libraries (4-digit code 92.51) and museums (4-digit code 92.52). These exclusions lead to an estimation sample of industry families in the "private sector", covering the following industries: ("private" sector): 15-40, 45-74 (except 65.11), 92-93 (except 92.20.1, 92.51, 92.52).

Appendix 3.B Industry differences in entry over the business cycle

We use the Matching DiD model and Conditional DiD model due to the presence of systematic cross-sectional differences between industries which may cause differing industry trends in establishment entry over the business cycle. As explained in section 3.3.1, we expect high-skilled to be more likely to enter during expansions than low-skilled as they are more likely to engage in ambitious projects, which may be positively influenced by expansionary business cycle conditions. Furthermore, young individuals may differ in their propensity to start a firm as they had less time to acquire necessary human and financial capital. If these production factors are disproportionately relevant for ambitious self-employment projects, young individuals should be less likely to enter during booms than older individuals.

To illustrate this concern, we provide descriptive evidence for systematic differences in industry level entry rates over the business cycle between industries with different initial shares of (1) high skilled employees and (2) employees aged 15-24 in this appendix section.

We use two alternative data sets. First, we use the data and industry-year sample of the main analysis, i.e. variation from 671 5-digit private sector industries in the years 2000 to 2008. We report descriptive statistics of the initial industry shares of high-skilled (degree from a university or college of higher education) and young employees (age 15-24) as well as the business cycle measures in Table 3.B.1.

We regress the yearly log industry number of entrants on an interaction term of the national detrended number of employees and the 1999 industry share of high-skilled employees (degree from a university or college of higher education) or the 1999 industry share of employees aged 15-24. We also add industry and year fixed effects. To calculate the detrended employment, we apply a Hodrick-Prescott-filter (Hodrick and Prescott, 1997).[46]

We present the regression results in Table 3.B.2 Panel A. We find that industries with a 1 percentage point higher 1999 share of high-skilled have 16 percent more

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

entrants when the aggregate number of employees deviates from its non-linear trend by 1 percent (Panel A, column 1). The coefficient on the interaction term is statistically significant at the 1% level. Adding linear industry specific trends does not alter the coefficient (column 2). We obtain similar results when using detrended aggregate sales as a business cycle measure (columns 3-4).

Alternatively, we use the annual log growth of the aggregate number of employees (column 5) or sales growth (column 6) as a business cycle measure and the industry level annual log growth of the number of entrants as dependent variable. Also these specifications yield a statistically significant positive coefficient. To illustrate the size of the coefficient, we express the coefficient of column 5 for reasonable changes of the two components of the interaction term. When moving from the lowest national employment growth to the highest national employment growth (trough to peak, 5.5 percentage points difference), an industry at the third quartile experiences on average a 5.1 percentage point larger annual entry growth than an industry at the first quartile of the industry distribution of high-skilled (0.036 to 0.117 = 0.081). Relative to the average annual entry growth rate of -3.1%, this corresponds to an economically relevant relative difference of 65%.

The initial industry share of employees aged 15-24 is negatively associated with entry during business cycle expansions (Table 3.B.2 Panel B).

The positive association between the industries' initial share of high-skilled and entry during business cycle expansions holds also for a second data set, which covers the years 1976 to 2014. As the main data set used above, it is based on the IAB Establishment History Panel. We exclude Eastern Germany (incl. Berlin) and the public sector. Due to multiple industry classification changes in this longer time period, industries are aggregated to the 3-digit level (229 3-digit industries).[47] We show results for the business cycle measures detrended employment and annual employment growth in Table 3.B.3.

[47] In the 1975-2014 sample we use the 3-digit industry correspondence created by Eberle et al. (2011).

Table 3.B.1: Summary statistics on industry differences in entry over the business cycle

Panel A: Years 1999-2008 (5-digit industry sample) (N=6710)

	mean	SD	min	max
Nº non-marginal entrants$_{jt}$	100.459	284.761	0	5841
Δln(Nº non-marginal entrants)$_{jt}$	-0.032	0.486	-2.303	4.143
Share high skilled 1999$_j$	0.094	0.091	0.000	0.534
Share aged 15-24 1999$_j$	0.115	0.064	0.000	0.589
ln(Employees detrended)$_t$	0.000	0.013	-0.018	0.023
ln(Sales detrended)$_t$	0.000	0.018	-0.026	0.027
Δln(Employees)$_t$	-0.002	0.020	-0.032	0.023
Δln(Sales)$_t$	0.036	0.026	-0.005	0.076

Panel B: Years 1976-2014 (3-digit industry sample) (N=8,931)

	mean	SD	min	max
Nº non-marginal entrants$_{jt}$	195.197	749.979	0	9848
Δln(Nº non-marginal entrants)$_{jt}$	-0.018	0.471	-3.056	2.303
Share high skilled 1975$_j$	0.031	0.050	0.000	0.568
Share aged 15-24 1975$_j$	0.179	0.082	0.040	0.544
ln(Employees detrended)$_t$	0.000	0.016	-0.024	0.033
Δln(Employees)$_t$	0.001	0.021	-0.046	0.038

Notes: In this table we show summary statistics for two samples. The sample in Panel A consists of 671 5-digit private sector industries in the years 1999-2008 (regression results in table 3.B.2). This is the sample which we also use in the main analysis of establishment entry. The alternative sample in Panel B consists of 229 3-digit private sector industries over the years 1976-2014 (regression results in table 3.B.3).
Nº non-marginal entrants is the number of entrants with at least one non-marginal employee in an industry-year cell. Δln(Nº non-marginal entrants)$_{jt}$ is the log growth of the number of entrants with at least one non-marginal employee. Share high skilled 1999$_j$ is the industry level share of employees with a degree from a university or college of higher education, measured in 1999. Share aged 15-24 1999$_j$ is the industry level share of employees aged 15-24, measured in 1999. ln(Employees detrended)$_t$ is the Hodrick and Prescott (HP) filtered natural logarithm of the annual aggregate number of employees. ln(Sales detrended)$_t$ is the Hodrick and Prescott (HP) filtered natural logarithm of annual aggregate sales. Δln(Employees)$_t$ is the difference in logarithms of the annual aggregate number of employees. Δln(Sales)$_t$ is the difference in logarithms of annual aggregate sales.

Table 3.B.2: Descriptive evidence on industry differences in entry over the business cycle 1999-2008

Panel A: Initial differences in the industry level share of high-skilled employees

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Nº non-marginal entrants)				Δln(Nº entrants) (non-marginal)	
Share high skilled 1999_j	16.327***	16.368***				
× ln(Employees detrended)$_t$	(4.174)	(4.405)				
Share high skilled 1999_j			11.753***	11.819***		
× ln(Sales detrended)$_t$			(3.834)	(4.061)		
Share high skilled 1999_j					10.062***	
×Δln(Employees)$_t$					(2.476)	
Share high skilled 1999_j						7.861***
×Δln(Sales)$_t$						(2.624)
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Linear industry trend	no	yes	no	yes	no	no
N (industry-year)	6710	6710	6710	6710	6039	6039

Panel B: Initial differences in the industry level share of employees aged 15-24

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Nº non-marginal entrants)				Δln(Nº entrants) (non-marginal)	
Share aged 15-24 1999_j	-11.525**	-12.235**				
× ln(Employees detrended)$_t$	(5.164)	(5.216)				
Share aged 15-24 1999_j			-6.604*	-7.018*		
× ln(Sales detrended)$_t$			(3.779)	(3.866)		
Share aged 15-24 1999_j					-7.617**	
×Δln(Employees)$_t$					(3.168)	
Share aged 15-24 1999_j						-5.167*
×Δln(Sales)$_t$						(2.732)
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Linear industry trend	no	yes	no	yes	no	no
N (industry-year)	6710	6710	6710	6710	6039	6039

Notes: In Panel A we show results on the correlation between the initial industry level share of high skilled employees and establishment entry over the business cycle. In Panel B we show the corresponding correlation for the initial industry level share of employees aged 15-24. ln(Employees detrended)$_t$ is the Hodrick and Prescott (HP) filtered natural logarithm of the annual aggregate number of employees. ln(Sales detrended)$_t$ is the HP filtered natural logarithm of annual aggregate sales. Δln(Employees)$_t$ is the difference in logarithms of the annual aggregate number of employees. Δln(Sales)$_t$ is the difference in logarithms of annual aggregate sales. We include year and industry fixed effects. The sample includes all 671 5-digit private sector industries in the years 1999-2008 (col 1-4) or 2000-2008 (col 5-6). The estimations are performed using OLS. Observations weighted by current industry employment (FTE). SE clustered at the industry level.

Table 3.B.3: Descriptive evidence on industry differences in entry over the business cycle 1976-2014

Panel A: Initial differences in the industry level share of high-skilled employees

	(1)	(2)	(3)
	ln(Nº non-marginal entrants)		Δln(Nº entrants) (non-marginal)
Share high skilled 1975_j	16.738***	15.500***	
× ln(Employees detrended)$_t$	(5.054)	(5.449)	
Share high skilled 1975_j			8.590**
×Δln(Employees)$_t$			(3.683)
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Linear industry trend	no	yes	no
N (industry-year)	8931	8931	8702

Panel B: Initial differences in the industry level share of employees aged 15-24

	(1)	(2)	(3)
	ln(Nº non-marginal entrants)		Δln(Nº entrants) (non-marginal)
Share aged 15-24 1975_j	-1.759	-1.570	
× ln(Employees detrended)$_t$	(4.272)	(4.431)	
Share aged 15-24 1975_j			-2.075
×Δln(Employees)$_t$			(2.613)
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
Linear industry trend	no	yes	no
N (industry-year)	8931	8931	8702

Notes: In this table we show additional results on the correlation between the initial industry level share of high skilled employees (Panel A) and employees aged 15-24 (Panel B) and establishment entry over the business cycle for an alternative sample of 229 3-digit private sector industries over the years 1976-2014 (col 1-2) and 1977-2014 (col 3).
In columns 1-2 the dependent variable is the log number of entrants with at least one non-marginal employee. In column 3 the dependent variable is the is the difference in logarithms of the number of entrants with at least one non-marginal employee. Share high skilled 1975_j is the industry level share of employees with a degree from a university or college of higher education, measured in 1975. Share aged 15-24 1975_j is the industry level share of employees aged 15-24, measured in 1975. ln(Employees detrended)$_t$ is the Hodrick and Prescott (HP) filtered natural logarithm of the annual aggregate number of employees. ln(Sales detrended)$_t$ is the HP filtered natural logarithm of annual aggregate sales. Δln(Employees)$_t$ is the difference in logarithms of the annual aggregate number of employees. Δln(Sales)$_t$ is the difference in logarithms of annual aggregate sales.
The estimations are performed using OLS, with industry-year observations weighted by current industry employment (full time equivalents). Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Appendix 3.C Additional tables

Table 3.C.1: Descriptive statistics of outcome variables

Panel A: Number of entrants and employed, industry-level, pre-reform average

	(1) All Ind		(2) Treated	(3) All control	(4) Matched control
	Mean	SD	Mean	Mean	Mean
Nº entrants	135.32	(390.53)	204.95	125.76	147.77
Nº entrants 1 empl t_0	84.32	(251.60)	117.43	79.77	85.02
Nº entrants 2+ empl t_0	51.00	(157.76)	87.52	45.99	62.74
Nº entrants fail within 2y	60.43	(185.10)	88.44	56.58	72.41
Nº entrants survive 2y	74.89	(212.85)	116.51	69.17	75.36
Nº entrants hire within 2y	29.55	(76.37)	53.81	26.22	32.40
Nº entrants not hire within 2y	45.33	(147.52)	62.70	42.95	42.96
$\frac{Nº entrants}{Nº employees} \times 1000$	10.19	(17.40)	9.72	10.25	11.22
Nº employees	14497.68	(27351.37)	23984.51	13195.26	14333.98
N (industries)	671	671	81	590	100

Panel B: entrant characteristics, establishment-level, pre-reform

	(1) All Ind		(2) Treated	(3) All control	(4) Matched control
	Mean	SD	Mean	Mean	Mean
P(2 employees in t_0)	0.35	(0.48)	0.43	0.34	0.42
P(survive ≥1 year)	0.71	(0.46)	0.72	0.70	0.68
P(survive ≥2 years)	0.55	(0.50)	0.57	0.54	0.51
P(survive ≥3 years)	0.45	(0.50)	0.47	0.44	0.41
P(Hire within ≥2 years)	0.21	(0.40)	0.26	0.19	0.22
P(Hire within ≥3 years)	0.19	(0.40)	0.25	0.18	0.20
N (establishment-year)	294329		49804	244525	44330

Panel C: incumbent characteristics, establishment-level, pre-reform

	(1) All industries		(2) Treated	(3) All control	Matched control
	Mean	SD	Mean	Mean	Mean
Nº employees	16.53	(110.94)	10.90	19.11	14.87
Δ_{5y} ln(Nº employees)	-0.03	(0.67)	-0.08	-0.01	-0.07
P(exit)	0.05	(0.21)	0.04	0.05	0.05
N (establishment-year)	1854108		582913	1271195	296061

Notes: This table reports summary statistics for the main outcome variables in 1999-2002. Statistics are computed at the industry level in Panel A and at the establishment level in Panels B and C. *All Ind* refers to the private sector sample defined in appendix section 3.A.3. *Treated* refers to industries which were subject to the deregulation of the GTCC. *All control* refers to all industries which were never covered by the GTCC. *Matched control* is the sample of matched comparison industries. The statistics refer to the 50% BHP sample. Incumbents are establishments which had at least one employee five years ago.

Table 3.C.2: Robustness: common support

Panel A: Descriptive statistics

	(1) Treat	(2) Matched	(3) Control Common Support	(4) t-test (1)-(2)		(5) t-test Common Support	
	Mean	Mean	Mean	Coeff.	SE	Coeff.	SE
Pre-reform product market characteristics not matched							
Growth Nº entrants	-0.140	-0.151	-0.151	0.011	(0.033)	0.008	(0.034)
Growth Nº employees	-0.073	-0.075	-0.075	0.002	(0.035)	-0.000	(0.035)
Pre-reform matched product market characteristics							
Employee age:							
Share age 15-24	0.182	0.161	0.161	0.020	(0.020)	0.014	(0.020)
Share age 25-49	0.613	0.621	0.621	-0.008	(0.013)	-0.004	(0.012)
Share age 50+	0.205	0.217	0.217	-0.012	(0.013)	-0.010	(0.013)
Employee education:							
Share low skilled	0.198	0.176	0.176	0.022	(0.030)	0.022	(0.031)
Share medium skilled	0.768	0.781	0.781	-0.013	(0.026)	-0.014	(0.027)
Share high skilled	0.034	0.043	0.043	-0.009	(0.009)	-0.008	(0.009)
N (industries)	81	100	99	181	181	178	178

Panel B: Regression

Specification:	(1) Baseline	(2) Common Support
Dependent var.:	ln(Nº entrants)	
$Dereg_j \times \text{reform}_t$	0.119**	0.114**
	(0.055)	(0.056)
Industry-year covariates	yes	yes
Industry FE	yes	yes
Year FE	yes	yes
N (industry-year)	1629	1602

Notes: In columns 3 and 5 we report the effect on the industry number of entrants for an alternative sample created by propensity score matching in which we impose common support over the estimated propensity score. Specifically, we exclude treated industries whose propensity score is higher than the maximum or less than the minimum propensity score of the comparison industries. This applies to two treated industries. One comparison industry is dropped because it was the nearest neighbor to the two dropped treated industries. Under this restriction we identify the average effect over the common support region instead of the ATT.
In column 2 of Panel B we report the effect on the number of entering establishments for the common support sample. Industry-year covariates is the current industry share of employees along seven characteristics: female, aged 15-24, aged 25-49, medium skilled, high skilled, foreign EU citizen and foreign non-EU citizen. Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries.

Table 3.C.3: Number of entrants - Robustness: modifying the industry sample

	(1)	(2)	(3)	(4)
Specification	CDiD	MDiD	CDiD	MDiD
Sample	Incl. A1 Product Markets		Excl same 3dig	
Dependent variable:	ln(№ entrants)			
$Dereg_j \times \text{reform}_t$	0.139***	0.180***	0.124***	0.138**
	(0.039)	(0.060)	(0.043)	(0.054)
Share female$_{jt}$	-0.168	2.428	-0.214	-2.286
	(0.945)	(1.888)	(1.006)	(1.837)
Share age 15-24$_{jt}$	4.319***	10.542***	4.485**	8.836***
	(1.644)	(3.487)	(1.881)	(3.280)
Share age 25-49$_{jt}$	2.631*	7.263***	2.909*	7.034***
	(1.369)	(2.688)	(1.507)	(2.547)
Share medium skilled$_{jt}$	-1.837	3.055*	-1.913	-0.856
	(1.260)	(1.765)	(1.280)	(2.090)
Share high skilled$_{jt}$	0.521	4.861	0.654	-3.748
	(1.445)	(3.764)	(1.494)	(3.044)
Share foreign non-EU$_{jt}$	-0.361	1.785	-0.768	-0.998
	(1.336)	(2.414)	(1.238)	(2.335)
Share foreign EU$_{jt}$	-2.965	3.771	-2.721	0.927
	(2.197)	(2.793)	(2.089)	(2.662)
Pre-reform industry char. × Year FE	yes	no	yes	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6111	1674	5148	1548

Notes: This table shows results for two alternative industry samples. We modify the pool of comparison group industries. In the Matching DiD specification (col. 2 and 4) matched comparison groups are selected from this modified industry sample. In columns 1-2, we include seven industries for which firm entry is restricted under the GTCC but which were not subject to the 2004 deregulation. In columns 3-4, we exclude industries which are in the same 3-digit industry group as an affected industry in order to rule out potential spill overs between "neighboring" 5-digit industries in 3-digit industry groups.
In columns 1 and 3 (specification "Conditional DiD") we include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2 and 4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries. We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). reform$_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.4: Number of entrants - Robustness: local product market level

Specification	(1)	(2)	(3)	(4)
	Conditional DiD		Matching DiD	
Dependent variable	ln(Nº entrants)			
$Dereg_j \times \text{reform}_t$	0.065*	0.067**	0.102*	0.102*
	(0.033)	(0.033)	(0.059)	(0.057)
Share female$_{jt}$	-0.032	-0.040	-0.099	-0.112
	(0.091)	(0.091)	(0.212)	(0.212)
Share age 15-24$_{jt}$	0.302*	0.264	1.179***	1.075***
	(0.179)	(0.177)	(0.400)	(0.386)
Share age 25-49$_{jt}$	0.956***	0.930***	1.157***	1.085***
	(0.157)	(0.156)	(0.298)	(0.288)
Share medium skilled$_{jt}$	-0.204	-0.223	-0.145	-0.161
	(0.143)	(0.144)	(0.215)	(0.219)
Share high skilled$_{jt}$	0.063	0.045	-0.582*	-0.600*
	(0.173)	(0.174)	(0.311)	(0.315)
Share foreign non-EU$_{jt}$	0.425	0.435	1.120	1.155
	(0.415)	(0.414)	(0.748)	(0.747)
Share foreign EU$_{jt}$	0.008	-0.012	0.515	0.485
	(0.220)	(0.221)	(0.412)	(0.421)
Pre-reform industry characteristics × Year FE	yes	yes	no	no
Industry FE	yes	yes	yes	yes
Region FE	yes	no	yes	no
Year FE	yes	no	yes	no
Region × year FE	no	yes	no	yes
N (industry-region-year)	189040	189040	54301	54301

Notes: This table shows results for an alternative specification at the local product market level. The unit of observation is an industry-county-year cell (38 NUTS-2 regions). The dependent variable is the log number of entrants in an industry-county-year cell. In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match industries on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
Covariates are measured at the industry-region-year level. $Dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. The estimations are performed using OLS. Robust standard errors in brackets, clustered at the level of industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.5: Initial entrant size, entrant longevity and hiring - Additional dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	CDiD	MDiD	CDiD	MDiD	CDiD	MDiD
Dependent variable	Survive ≥1 year		Survive ≥3 years		Hire within 3y	
$Dereg_j \times \text{reform}_t$	-0.000	-0.000	0.003	-0.004	-0.004	-0.006
	(0.005)	(0.009)	(0.006)	(0.012)	(0.005)	(0.007)
Mean depvar	0.726	0.708	0.481	0.465	0.209	0.230
Pre-reform industry char. × Year FE	yes	no	yes	no	yes	no
Industry FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
N (estab.-year)	638473	221752	638473	221752	638473	221752

Notes: In this table we show results on the effect of the deregulation on alternative measures of entrant longevity and hiring. *Survive ≥1 year* is one if the entrant survives at least one year. In the data set that we use, this implies that the establishment has at least one (marginal or non-marginal) employee in the first year after entry. The variable is zero if the new establishment drops out of the data set in the first year after entry. This may be due to exit or indicate that the establishment continues without employees. *Survive ≥3 years* is equivalently defined and is one if the entrant survives at least three year. *Hire within 3 years* takes the value one if the entrant survives and hires at least one additional (marginal or non-marginal) employee within three years. The variable is zero if the new establishment has equally many or less employees after three years, compared to the year of entry, or if the establishment drops out of the data set.
In columns 1, 3 and 5 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2, 4 and 6 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries, years 2000-2008). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using a linear probability model, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.6: Initial entrant size: industry level

	(1)	(2)	(3)	(4)
Specification	CDiD	MDiD	CDiD	MDiD
Dependent variable	ln(Nº entrants 1 employee in t_0)		ln(Nº entrants ≥2 employees in t_0)	
$Dereg_j \times \text{reform}_t$	0.170***	0.158***	0.060	0.083
	(0.040)	(0.060)	(0.045)	(0.076)
Pre-reform industry char. × year FE	yes	no	yes	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6039	1629	6039	1629

Notes: In this table we show results on the effect of the GTCC reform on the (industry-year) number of entrants with only 1 employee in the year of entry (col 1-2) and the number of entrants with 2 or more employees in the year of entry (col 3-4).
In columns 1 and 3 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2 and 4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.7: Entrant longevity: industry level

	(1)	(2)	(3)	(4)
Specification	CDiD	MDiD	CDiD	MDiD
Dependent variable	ln(№ entrants fail within 2 years)		ln(№ entrants survive $\geq$ 2 years)	
$Dereg_j \times \text{reform}_t$	0.098**	0.149**	0.118***	0.096*
	(0.048)	(0.075)	(0.041)	(0.056)
Pre-reform industry char. $\times$ year FE	yes	no	yes	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6039	1629	6039	1629

Notes: In this table we show results on the effect of the GTCC reform on the (industry-year) number of entrants which fail within the first 2 years (col 1-2) and the number of entrants which survive for at least 2 years (col 3-4).
In columns 1 and 3 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2 and 4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.8: Entrant hiring: industry level

	(1)	(2)	(3)	(4)
Specification	CDiD	MDiD	CDiD	MDiD
Dependent variable	ln(№ entrants hire within 2 years)		ln(№ entrants do not hire in 2 years)	
$Dereg_j \times \text{reform}_t$	0.077*	0.074	0.148***	0.105*
	(0.045)	(0.060)	(0.040)	(0.056)
Pre-reform industry char. × year FE	yes	no	yes	no
Industry FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
N (industry-year)	6039	1629	6039	1629

Notes: In this table we show results on the effect of the GTCC reform on the (industry-year) number of entrants which hire within the first 2 years (col 1-2) and the number of entrants which do not hire for at least 2 years (col 3-4).
In columns 1 and 3 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 2000-2008) We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 2 and 4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.9: Number of employees in entrants - Robustness

	(1)	(2)	(3)
Specification		Matching DiD)	
Dependent variable	ln(Nº employees$_{t+2}$ in entrants)		
$Dereg_j \times$reform$_t$	-0.020	0.078	0.052
	(0.089)	(0.102)	(0.075)
Share female$_{jt}$	0.158		
	(3.535)		
Share age 15-24$_{jt}$	-3.520		
	(4.886)		
Share age 25-49$_{jt}$	4.333		
	(3.506)		
Share medium skilled$_{jt}$	-0.452		
	(4.684)		
Share high skilled$_{jt}$	-11.608		
	(9.201)		
Share foreign non-EU$_{jt}$	4.506		
	(5.484)		
Share foreign EU$_{jt}$	8.023		
	(9.049)		
1996-2001 sales growth$_j$		1.060	
$\times$ reform$_t$		(0.939)	
1996-2001 sales growth$_j$		-0.056	
$\times$ trend$_t$		(0.274)	
Linear pre-reform industry trends	no	no	yes
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
N (industry-year)	1629	1629	1629

Notes: In this table we show results on the effect of the deregulation on the number of employees in entering establishments. In column 1, we control for the current industry share of employees along seven characteristics. In column 2, we control for the interaction of average pre-reform industry sales growth (1996-2001) with year fixed effects. In column 3, we control for linear industry trends which are identified from the pre-reform sample. The sample includes the industries affected by the deregulation and matched comparison industries (specification "Matching DiD", 181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The dependent variable is the annual industry-level log of the entrants' number of employees two years after entry. Employment is measured in full-time equivalents. The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.10: Number of employees - Robustness

	(1)	(2)	(3)
Specification	Matching DiD)		
Dependent variable	ln(Nº employees)		
$Dereg_j \times$reform$_t$	0.028	0.023	-0.022
	(0.058)	(0.059)	(0.014)
Share female$_{jt}$	-3.141***		
	(1.056)		
Share age 15-24$_{jt}$	4.693***		
	(1.464)		
Share age 25-49$_{jt}$	1.767*		
	(0.908)		
Share medium skilled$_{jt}$	-0.589		
	(1.003)		
Share high skilled$_{jt}$	-1.401		
	(2.959)		
Share foreign non-EU$_{jt}$	0.463		
	(1.408)		
Share foreign EU$_{jt}$	3.910		
	(2.711)		
1996-2001 sales growth$_j$		0.024	
$\times$ reform$_t$		(0.072)	
1996-2001 sales growth$_j$		0.207**	
$\times$ trend$_t$		(0.080)	
Linear pre-reform industry trends	no	no	yes
Industry FE	yes	yes	yes
Year FE	yes	yes	yes
N (industry-year)	1810	1810	1810

Notes: In this table we show results on the effect of the deregulation on the number of employees. In column 1, we control for the current industry share of employees along seven characteristics. In column 2, we control for the interaction of average pre-reform industry sales growth (1996-2001) with year fixed effects. In column 3, we control for linear industry trends which are identified from the pre-reform sample. The sample includes the industries affected by the deregulation and matched comparison industries (specification "Matching DiD", 181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The dependent variable is the annual industry-level log number of employees. Employment is measured in full-time equivalents. The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimations performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

Table 3.C.11: Effect on incumbent establishment employment - Robustness: balanced sample

Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Conditional DiD		Matching DiD			
Dependent variable	ln(establishment size)					
$Dereg_j \times \text{reform}_t$	-0.045**	-0.033	-0.026	0.006	0.003	0.011
	(0.019)	(0.022)	(0.036)	(0.043)	(0.009)	(0.032)
$Dereg_j \times reform_t \times small_{i,t-5}$		-0.022		-0.067*	-0.031*	-0.053*
		(0.014)		(0.037)	(0.017)	(0.028)
$Dereg_j \times small_{i,t-5}$		0.017*		0.030	0.013	0.019
		(0.009)		(0.024)	(0.011)	(0.018)
$Reform_t \times small_{i,t-5}$		0.019*		0.062*	0.035**	0.049*
		(0.011)		(0.036)	(0.015)	(0.026)
$Small_{i,t-5}$		-0.077***		-0.089***	-0.068***	-0.076***
		(0.008)		(0.023)	(0.010)	(0.016)
1996-2001 sales growth$_j$						-0.067
$\times$ reform$_t$						(0.050)
1996-2001 sales growth$_j$						0.136***
$\times$ trend$_t$						(0.044)
Linear industry trends	no	no	no	no	yes	no
Pre-reform industry char.	yes	yes	no	no	no	no
$\times$ Year FE						
Establishment FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
N (establishment-year)	2328774	2328774	1129935	1129935	1129935	1129935

Notes: In this table we show additional results on the effect of the deregulation on the size of incumbent establishments. The sample is restricted to incumbents which are in the sample in each year from 1999 to 2008 (balanced sample). The dependent variable *establishment size* is defined as the number of employees (full time equivalents) in incumbents. Incumbents are defined as establishments with at least one employee 5 years ago. $small_{i,t-5}$ is defined as having had up to 4 employees 5 years ago. Since last sample year is 2008, the variable refers to the pre-reform period.
In columns 1-2 (specification "Conditional DiD"), the sample includes all 671 5-digit private sector industries (years 1999-2008). We include interactions of year fixed effects with the industries' pre-reform share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49. In columns 3-4 (specification "Matching DiD") the sample includes the industries affected by the deregulation and matched comparison industries (181 industries). We match on the following four pre-reform industry characteristics: share of medium-skilled, share of high-skilled, share of employees aged 15-24 and share of employees aged 25-49.
The measure of deregulation $dereg_j$ takes the value one for 81 industries which were subject to the 2004 reform of the German Trade and Crafts Code (details in section 3.2). $Reform_t$ takes the value 1 for the years 2004-2008 and 0 before. Estimation performed using OLS, with industry-year observations weighted by average pre-reform industry employment. Standard errors in parentheses are robust and clustered to allow for unrestricted correlation within industries. *** denotes significance at 1%, ** at 5% and * at 10% level.

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