

Runst, Petrik

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## The Effect of Occupational Licensing Deregulation on Migrants in the German Skilled Crafts Sector

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## **ifh Working Papers**

### **No. 6**

# **The Effect of Occupational Licensing Deregulation on Migrants in the German Skilled Crafts Sector**

Petrik Runst

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Institute for Small Business Economics  
Heinrich-Düker-Weg 6  
University of Goettingen, 37073 Göttingen, Germany  
(+49) 551 3917 4889  
[petrik.runst@wiwi.uni-goettingen.de](mailto:petrik.runst@wiwi.uni-goettingen.de)

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Heinrich-Düker-Weg 6  
37073 Göttingen

Tel. +49 (551) 39 174882  
Fax +49 (551) 39 174893  
E-Mail: [info@ifh.wiwi.uni-goettingen.de](mailto:info@ifh.wiwi.uni-goettingen.de)  
Internet: [www.ifh.wiwi.uni-goettingen.de](http://www.ifh.wiwi.uni-goettingen.de)

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## **Abstract**

Occupational Licensing may reduce the entry of minorities, such as migrants, into a profession if the likelihood of fulfilling the licensing requirements is lower in this group. While policy makers typically justify occupational licensing on the grounds of quality control it, thus, also has the potential to adversely affect the labor market integration of foreign-born citizens. Before the backdrop of increased levels of migration into Germany, and the general discussion about the free movement of labor in Europe, this paper empirically examines the effects of the deregulation of occupational licensing in the German crafts sector on the proportion of migrants working in this sector. The results suggest that the reform has increased the proportion of migrants by about 5 percentage points among self-employed professionals and 6 percentage points among employed craftsmen.

JEL codes: D45, K20, L51

Keywords: Occupational Licensing, Migrants, Germany, Crafts



## 1. Introduction

*Occupational licensing* represents a legal market entry barrier where a government mandates certain conditions under which professionals may enter. Individuals are typically required to undergo a specific training, pass a government test, or obtain a university degree. Occupational licensing has been justified by an intention to ensure minimum quality requirements. *Certification*, on the other hand, is an alternative policy that increases market transparency. Instead of requiring individuals to pass tests, or obtain training and educational degrees, the government provides voluntary options. Professionals may then choose to fulfill the necessary steps in order to get certified, and thereby signal higher quality to customers, or they may choose not to pursue this route.

Occupational licensing has been steadily increasing in Europa and North America after WWII. Particularly in the US, this expansionary tendency has not ceased after 1990 (Kleiner, 2006; Kleiner and Krueger, 2013). On the other hand, the common market area of the European Union has led to an attempt to harmonize and reduce national licensing policies in order to enable the free movement of labor between countries (European Commission, 2013). In addition, there have been various national attempts to liberalize labor markets, as for example in Germany after 2004.

Williams (1982) introduced the argument that licensing costs are disproportionately borne by minority groups. If minorities have a harder time to acquire the skills and educational credentials prescribed by licensing requirements, they will be underrepresented in licensed markets. Empirical contributions confirm that labor market regulations in general (Feldmann, 2009; Feldmann, 2003) and licensing regulations in particular (Dorsey, 1983; Federman et al, 2006) affect minorities disproportionately by increasing the costs of entering licensed professions. Pashigian (1979), Kleiner et al (1982) and Kleiner (2015) show that US interstate migration is reduced by licensing requirements; restricting the free flow of labor towards its most productive uses. While the latter set of papers examines within-country mobility, a similar process may unfold on the international level

as strict licensing rules could deter foreigners from entering the country. For example, while citizens of countries within the European Union are permitted to work in any of the member countries *de jure* occupational licensing may still constitute a *de facto* barrier to labor mobility.

While licensing has generally been expanding steadily during the 20<sup>th</sup> century (Kleiner, 2006), the German Government has begun to reverse this development. The so-called “Hartz Reforms” of 2004 selectively abolished licensing requirements for one group of occupations (B-trades) in the German crafts sector, whereas keeping another group of trades in that sector under full licensure (AC). A final group was partially deregulated (A-trades). This natural experiment allows me to study the effects of regulation on labor market participation of minority groups (i.e. migrants).

I use repeated cross-sections (2002-2010) of German microcensus data, which enables me to identify the groups of craftsmen and craftswomen that have been differentially affected by the reform. I use difference-in-differences regressions in order to estimate the effect of the reform on the likelihood of a migrant working in one of the three distinct occupational groups (AC, A, and B). The empirical results are in line with the previous findings of the literature. For self-employed individuals within a deregulated crafts trade, the share of migrants increases by 4 to 8 percentage points as a results of the policy change. For employed craftsmen within a deregulated trade, the share of migrants increases by 5 to 8 percentage points. The increase of migrant workers among employed individuals takes place almost entirely among untrained professionals. The migrant share among trained craftsmen remains virtually constant. The proportion of migrants has increased more strongly for part-time than full-time jobs. Overall, the total number of migrants in the crafts sector has increased by more than 107,000 as a result of the reform.

## 2. Ethnic Diversity & The Deregulation of the German Trade and Crafts Code

### 2.1. The Reform of the Trade and Crafts Code

In Germany, 93 trades belong to what is legally defined as the crafts sector, which comprises about 5 million professionals (Federal Statistical Office, 2016). These trades are governed by a set of laws, the so-called Trade and Crafts Code (TCC, *Handwerksordnung*). Between 1953 and 2004, the crafts laws required the head of a crafts company to hold a Meister-degree. The Meister is the highest degree of vocational training. In order to acquire it a professional must first undergo basic training (typically 3 years) and become a *Geselle*. This first stage of training is comprised of practical learning in a private company as well as taking classes at vocational colleges. After having become a *Geselle* the crafts professional may take additional training and pass associated exams in order to become a *Meister*. This second stage of training involves occupation specific knowledge as well as knowledge about business management and pedagogy (because Meisters are permitted to train craftsmen) (Mueller, 2014).

The regulation has changed after 2004, whereby 53 so-called B-trades such as brewers, interior decorators and musical instrument makers are now fully deregulated and no longer subject to any educational requirements (HwO §7.1). Some trades such as bakers, butchers and car mechanics have been partially deregulated (A-trades hereafter), meaning that experienced employees without a Meister-degree may be permitted to start a business (HwO §7b, *Altgesellenregel*). A business owner without a sufficient degree may also hire a company manager who possesses a Meister degree (*Betriebsleiterregelung*). Finally, six mostly health related trades (AC hereafter) remain fully regulated.

The partial deregulation of some trades constitutes a natural experiment. The fully deregulated trades (B) and the partially deregulated trades (A) represent the treatment groups. The still regulated trades (AC) represent the control group. See table 1 for a summary of the treatment and control groups.



## 2.2. Theoretical Background and Hypotheses

Occupational licensing affects the share of migrants in the German crafts sector in two ways. The first (direct) mechanism pertains to self-employed individuals. The second (indirect) mechanism pertains to employed professionals. This section describes both mechanisms in turn and derives testable hypotheses for the empirical analysis below.

The lower educational attainment of migrants is one of the primary obstacles for entering the labor market (Borjas, 2014; Constant und Zimmermann, 2006, 297). Migrants who desire to work in the crafts sector in Germany face the problem that the specific type of training (dual-training system) which leads to a crafts degree (*Geselle* or *Meister*) is not available in most countries of origin. As a result, almost none of the German migrants were permitted to start a business in the crafts sector before the deregulation in 2004.

If migrants decide to undergo training after they have arrived in Germany, they may be disadvantaged by language deficits and insufficient schooling prerequisites, which may obstruct their way into the dual-training system. We thus expect migrants to have a lower probability of having a Meister degree. In fact, according to the nationally representative data set used in this analysis (described below), only about 5% of all migrants in the crafts sector hold a Meister degree, whereas about 14% of German craftsmen do. Thus, before 2004, migrants have been disproportionately excluded from entrepreneurial activity in the crafts sector. After the removal of these entry barriers the proportion of migrants among self-employed craftsmen can be expected to rise.

### *Hypothesis One*

*The deregulation of occupational licensing in the German crafts sector causes an increase in the proportion of self-employed migrants.*

The secondary mechanism by which the share of migrants may be expected to increase pertains to employed craftsmen. As the deregulated crafts market exhibits lower entry barriers the number of companies will increase. This basic theoretical prediction has been supported by empirical work (Rostam-Afschar, 2014; Runst et al. 2016). The increase in market entry is caused by companies which are owned by craftsmen without a Meister degree as they were the ones previously not

permitted to enter (Mueller, 2014, 2015). The new companies may charge lower prices in an attempt to compete with more established businesses. Thus, new market entrants may hire workers with lower qualification levels in order to pay lower wages. Thus, the likelihood of hiring migrants rises.

*Hypothesis Two*

*The deregulation of occupational licensing causes an increase in the proportion of migrants among untrained employees.*

Finally, as the migrant share among the *self-employed* increases, social networks effects can lead to an increase in the share of migrant *employees* as well. This is because migrant business owners are most likely acquainted with other migrants and sociological studies suggest that social networks play an important role in job search processes (see Granovetter, 1973; Bian, 1997).

While hypothesis two pertains to an increased demand for lower wage migrant labor, the social network mechanism pertains to all forms of migrant labor, including trained craftsmen.

*Hypothesis Three*

*The deregulation of occupational licensing causes an increase in the proportion of migrants among trained employees.*

### **3. Data and Methods**

#### **3.1. German Microcensus Data & Sample Design**

The empirical analysis is based on German microcensus data, provided by the Federal Statistical Office. It is an annual and representative 1% sample of all households in Germany. The questions are designed to gather demographic and labor market information about all individuals possessing a legal residence permit in Germany. The survey does not follow the same individuals each year, thus it is organized as a repeated cross section. The annual scientific use files contain about 490,000 individuals. Since only about 12.5% of the German labor force is comprised of craftsmen, the sample size is nevertheless sufficiently large. The mandatory nature of the census survey guarantees a low rate of item-non-response for most questions.

I use pooled data for the years of 2002 until 2010. As this analysis pertains to labor market participation, individuals younger than 18 or older than 66 are excluded from the sample. Furthermore, all non-craftsmen are dropped. After these preliminary steps have been taken, the sample contains about 25,000 craftsmen of working age per year.

The data set also contains information on the migration background of individuals, including the year of immigration into Germany, their nationality, and whether they possess the German citizenship. For the purpose of the present analysis, migrants are defined as individuals who immigrated to Germany during their life-time, regardless of whether they acquired the German citizenship since then or not. About three quarters of immigrants in the sample arrived after 1980 (see Figure 1).

#### **3.2. Distinguishing Crafts & Non-Crafts Occupations**

If one is to assess the implications of a particular policy change in the crafts sector, it is paramount that the sample only comprises individuals within this sector. It must not contain individuals in the agricultural, industrial or any other sector of the economy, all of which have not been directly affected by the 2004 reform of the Trades and Crafts Code (also see Runst et al., 2016). The data set does not contain direct information on whether a professional works in the crafts sector. However,

craftsmen can be distinguished from non-craftsmen on the basis of the occupational classification code (KldB1992).

Rostam-Afschar (2014) already developed a crafts-classification procedure based on occupation codes in the microcensus (KldB1992). The author kindly provided me with his list of occupation codes. I analyzed this list in detail, because it constitutes an important attempt to make the microcensus data utilizable for studies focusing on the German crafts sector (see Runst et al., 2016). After thorough examination it must be concluded that the demarcation chosen by RA is too broad: while it certainly includes many of the occupations that German craftsmen would practice, it also contains a large proportion of non-crafts individuals who are unaffected by the policy reform.

Therefore, I rely on a new classification system that is still based on the occupation codes of the microcensus (KldB1992) yet also uses additional information, allowing me to exclude a number of non-craft workers. Details on the procedure are provided in appendix A. The selection algorithm which identifies craftsmen and sorts them into one of the three categories (control: AC; treatment: A, B) is described in detail in appendix A.

### **3.3. The Development of Migrant Shares over Time**

This section describes the development of the proportion of migrant professionals in the crafts sector (Figure 2-4). Each figure plots the share of migrants for the fully deregulated trades (B), the partially-deregulated trades (A) and the still regulates trades (AC).

Figure 2 displays the proportion of migrants among *self-employed* craftsmen for the three groups. First, let us turn toward the fully deregulated B-trades. The share of migrants in 2002, 2003 and 2004 is equal to roughly 10%. It moves up to more than 20% in the year 2010. A similar development can be observed in the partially deregulated A-trades, where the share of migrants increases from roughly 6 to 12%. In contrast, the still regulated AC-trades do not display a change in the share of migrants. It remains at or below 5% throughout the time period.

Figure 3 displays the share of migrants among *untrained employed* craftsmen. These professionals do not possess either a *Geselle*-degree, which is typically obtained after a three year apprenticeship, nor do they have an advanced *Meister*-degree. In fully deregulated B-trades, the share of migrants increases by almost 20 percentage points between 2004 and 2010. The partially deregulated A-trades display an increase by 10 percentage points during the same time period. Finally, the still regulated AC trades do not display an increase in the share of migrants.

Figure 4 displays the share of migrants among *trained employed* craftsmen. The increase in the share of migrants is apparent for all three groups (AC, A, and B). However, with an increase of about 10 percentage points, the B-trades display the largest change. The A trades experience an increase by about 7 percentage points. There is also a small increase for AC-trades of about 3 percentage points.

### 3.4. Estimation Procedure

The empirical strategy exploits the deregulation of occupational licensing in 2004 as a natural experiment. I use data from 2002 to 2010 for the two occupational treatment groups (A, B). AC-trades have not been deregulated and serve as the control group. A difference-in-differences (DID) approach is employed. The dependent variable of interest ( $Y_i$ ) is the likelihood of being a migrant. DID regressions contrast the difference in  $Y_i$  across groups, before and after the policy change. This approach does not require panel data. Repeated cross section data works well if the group composition remains identical across time periods (Blundell, Costa Dias, 2013). The present analysis follows Rostam-Afschar (2014) and Runst et al. (2016), who have also employed DID methods in order to estimate the effect of crafts deregulation on new business formation.

The validity of a DID hinges on the common trends assumption. Without the policy change, the proportion of migrants across groups should have developed similarly, which allows us to isolate the effect of the policy reform. Visual inspection of the figure 2, 3 and 4 suggest that prior to the reform, the proportion of migrants moves roughly parallelly. A more detailed discussion can be found in section 4.

A linear probability model is employed. The dummy variables  $A_i$ ;  $B_i$  denote an individuals' affiliation to one of the treatment groups, whereas the dummy  $Post2004_i$  indicates an individual in microcensus wave 2005 up to 2010. The average treatment effect on the treated group is given by the coefficient of the interaction between the treatment and post-policy dummy ( $\beta_5$ ;  $\beta_6$ ). This interaction represents the comparison of the difference across groups before and after the policy change.

$$Y_i = \beta_1 + \beta_2(B_i) + \beta_3(A_i) + \beta_4(Post2004_i) \\ + \beta_5(B_i Post2004_i) + \beta_6(A_i Post2004_i) + \beta_7\bar{X}_i + \varepsilon_i.$$

The vector of covariates  $\bar{X}_i$  represents a number of control variables. It includes age (also  $age^2$  and  $age^3$ ), a number of dummy variables for each type of secondary schooling degree (such as Realschule, Fachabitur, and Abitur), a dummy denoting the completion of basic (*Geselle*) and advanced (*Meister*) crafts training, and a dummy for having obtained a university degree. Furthermore there are dummy controls for all occupations, state of residency, city size, crafts branch and years. The errors are clustered by occupation as suggested by Bertrand, Duflo and Mullainathan (2004).

### 3.5. Descriptive Statistics

Table 2 displays the weighted averages for all variables by treatment group and pre- and post-reform period. The post-reform share of migrants is higher than the pre-reform share in treatment group A (5%) and B (8%). In contrast, the share of migrants in control group AC rises only by 2 percentage points. The share of women is lowest in A-trades, which includes the construction sector, and highest in AC-trades, which are mostly health related (opticians, orthopedic shoe makers, dental technicians, etc.). Secondary schooling and Meister-training is generally higher among AC-trades. Rates of self-employment increase in both treatment groups in the post-policy period (see Rostam-Afschar, 2014; Runst, 2016). The proportion of professionals with basic vocational training (Geselle) appears to increase uniformly across all three categories in the post-policy period.

## 4. Results & Robustness Checks

### 4.1. Regression results

Table 3 displays the regression results for self-employed individuals. Overall, the interaction term between treatment group and the post2004 dummy is statistically significant. Thus, the deregulation of occupational licensing has led to an increase in the proportion of self-employed migrants in the crafts sector. Specification (1) shows an increase of 8 percentage points in fully deregulated B-trades and increase of 3 percentage points in partially deregulated A-trades. The coefficients remain roughly the same if all control variables are included in specification (2). It is important to display results without cleaners because it is doubtful whether this occupational category belongs to the crafts sector (see appendix A). As cleaners are omitted from the sample in specification (3), the treatment effect for B-trades becomes lower (0.05).

It may be objected that the EU membership of East European countries after 2004 has caused the increase in the proportion of migrants in the crafts. While the free movement of employed labor did not initially apply to eastern European countries, eastern Europeans did already have the right to work in Germany if they started a business. Therefore, specification (4) omits all East European migrants who entered Germany after 2004, and all cleaners from the sample. The results remain

identical to the ones in specification (3). It can be concluded that, in accordance with hypothesis one, the deregulation of occupational licensing increased the proportion of migrants among self-employed craftsmen by three to five percentage points.

Table 4 displays regression results for employed craftsmen. Before omitting cleaners, the coefficients of the interaction term are equal to 0.02 for A-trades and 0.08 for B-trades (specification (1) and (2)). After omitting cleaners (specification (3)), the B-trade coefficient is lower (0.04) but still statistically significant. Finally, post 2004 eastern European migrants are again dropped from the sample in specification (4). Although most eastern European citizens were not permitted to work in Germany before 2011, some individuals entered the German labor market if they fulfilled certain conditions. For example, family members of self-employed foreigners, individuals who lived in Germany for more than three years and some individuals willing to undergo vocational training were already permitted to enter. The coefficients of the interaction terms are equal to 0.05 for B-trades and 0.02 for A-trades, and they are statistically significant.

In order to test hypothesis two and three, table 5 displays results for an advanced training sample (Meister), mid-level vocational training (Geselle), and an untrained sample (specifications 1, 2, 3 respectively). It also shows results for a part-time sample (specification 4) and a full-time sample (specification 5).

The results suggest that the deregulation of occupational licensing did not affect the proportion of migrants among *trained* employees. The coefficients of the interaction terms are mostly insignificant (specification 1 and 2), with one exception. The proportion of migrants among mid-level craftsmen (Geselle) has increased by about one percentage point in the partially deregulated A-trades. However, the proportion of migrants among untrained employees has increased by six percentage points, in both A-trades and B-trades (see specification 3). Overall, there is evidence in favor of hypothesis two but not in favor of hypothesis three. While the reform increased the likelihood of migrants to work as *untrained* employees in the crafts, there is little evidence for an increase among *trained* employees.



Among full-time employees, the proportions of migrants remained unaffected by the reform in the B-trades, whereas it increased slightly (0.02) in A trades (specification 4). Finally, among part-time employees, the reform does not appear to have affected the A-trades. However, the proportion of migrants has increased by 6 percentage points in B-trades.

Using the crafts statistics presented in Mueller (2015) and the regression coefficients above, I calculate the total number of migrants, who are working in the crafts sector (self-employed and employed, with training and without training) as a result of the reform. I estimate that about 107,000 additional migrants have entered the crafts sector as a result of the reform.

#### **4.2. Robustness Checks**

In order to further assess the finding of the previous section, the models are re-estimated, varying the specification and the definition of variables.

While the reformed trade and crafts code came into effect in 2004, microcensus questionnaires were filled in early (April) and it can be argued that the impact of the reform only unfolds with a certain delay. In order to assess alternative cut-off points, and following Rostam-Afschar (2014), the year 2004 is dropped, or, alternatively, coded as belonging to the post policy period. Dropping the 2004 observations does not affect the regression results for the self-employed sample nor the employed sample, whereas re-classifying the year 2004 as belonging to the post-policy period lowers all coefficients by about one percentage point. These changes may be seen as evidence for an adjustment period before changes in the proportion of migrant craftsmen become visible.

In analogy to Rostam-Afschar (2014), I test whether other confounding factors that might have affected the treatment, but not the comparison group, exist. Placebo tests are run by restricting the sample period to 2002-2004 and by pretending the policy intervention took place in 2003 (or 2004). Thus, I generate new interaction terms between the treatment groups and a post-2003 (or post-2004) dummy. After re-running all the specifications in table 3 and 5 it can be concluded that the risk of confounding factors appears to be small. However, in two incidences, the coefficient of

the interaction term between the A-trades-dummy and the post-policy period was close to being statistically significant. In both cases, the coefficient itself was about half a percentage point.

The common trends assumption can be investigated by replacing the single interaction term (treatment group times the post policy dummy) with several interaction terms for each year after 2002 (Bx2003; Bx2004; etc.). The results of these regressions can be seen in table 6. While the common trends assumption seems to be mostly satisfied, there is one exception. There appears to be a reduction in the proportion of migrants in A-trades in the year 2004. However, and as noted above, the major results still hold for A-trades if the year 2004 is excluded from the sample. Apart from that, the impact of the reform generally gets stronger as time progresses.

## 5. Conclusion

The reform of the German trades and crafts code in 2004 lowered the occupational licensing requirements that are necessary to enter the crafts sector. It can be seen as an adjustment of an economic policy which attempts to strike a balance between a minimum quality level and lowering entry barriers. This paper has quantified a related, unintended effect of occupational licensing. As migrants are less likely to obtain vocational training or university education, they are disproportionately affected by licensing requirements. The partial removal of occupational licensing in 2004 led to an increase in the proportion of migrants among self-employed and employed craftsmen.

The debate about occupational licensing has yet again become more prominent in recent years as the European Commission seeks to encourage labor mobility and economic growth by reducing national occupation regulations (European Commission, 2013). In addition, Germany and other European countries have experienced increased levels of immigration during the last three decades. The successful integration of these foreign-born citizens becomes an increasingly important topic for political debate. My results suggest that occupational licensing has kept low and untrained migrants from entering into crafts profession before the deregulation of 2004. The removal of occupational licensing can therefore be expected to increase the assimilation of foreign born workers into the German labor market and to reduce the income inequality across ethnic groups.

The present analysis did not address the question of whether the increase in the proportion of foreign-born citizen crowds out employment of German born citizen. However, as Koch and Nielen (2016) have found no positive employment effects of the 2004 reform, crowding out appears to be likely. While the overall welfare effects are, thus, uncertain the deregulation of occupational licensing increases the integration of foreign-born citizen into the labor market.

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Figure 1: Histogram. Year of Immigration. (Craftsmen between age 18 and 66)

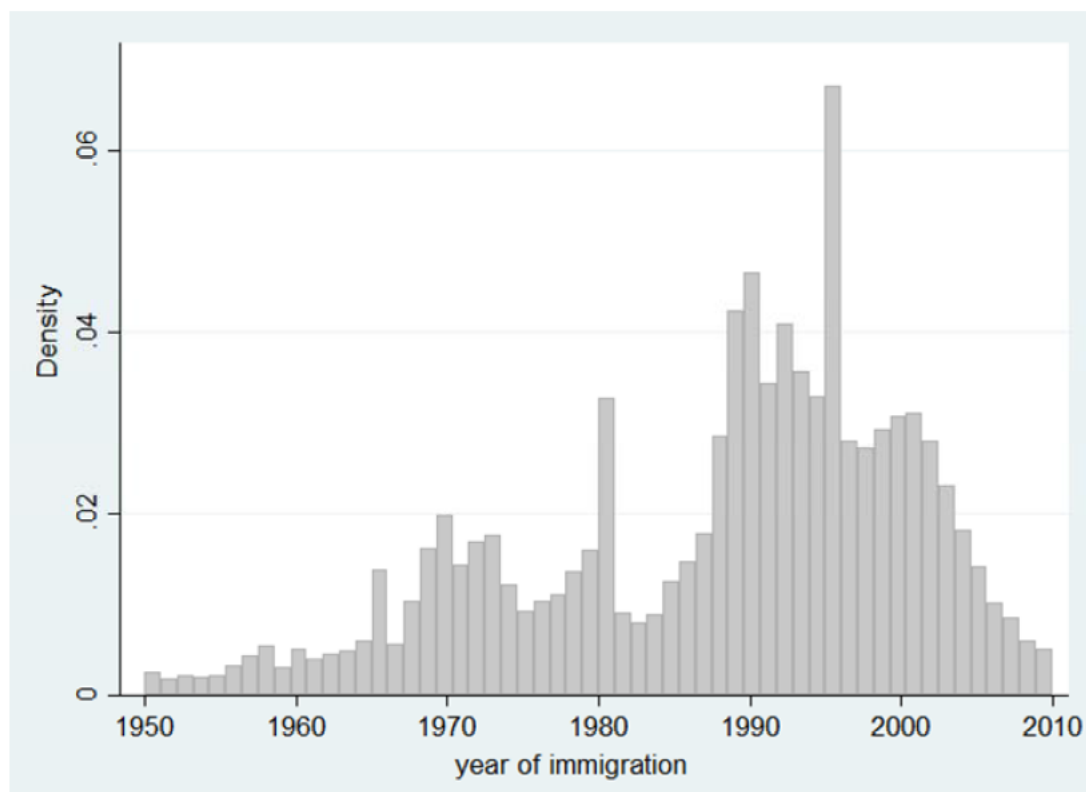
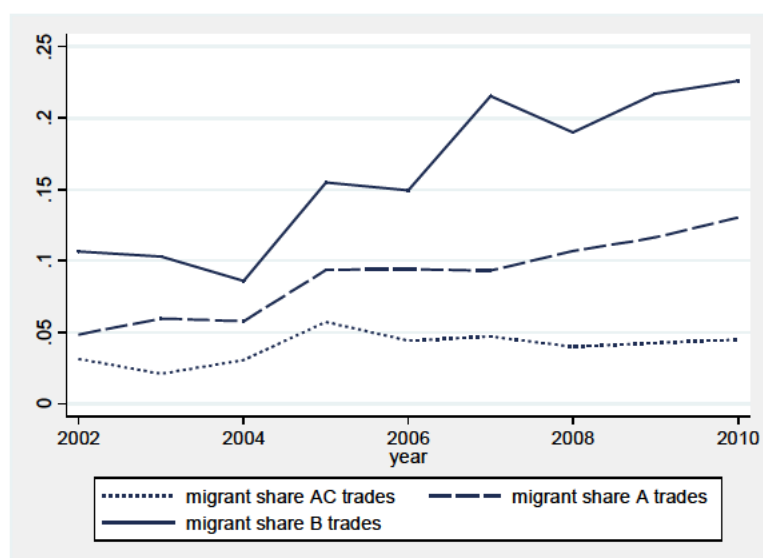
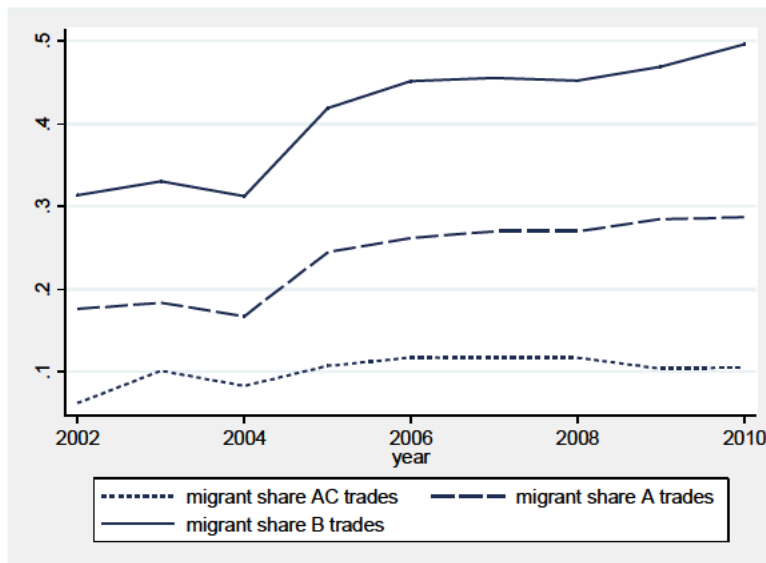


Figure 2: The Share of Self-Employed Migrants over Time



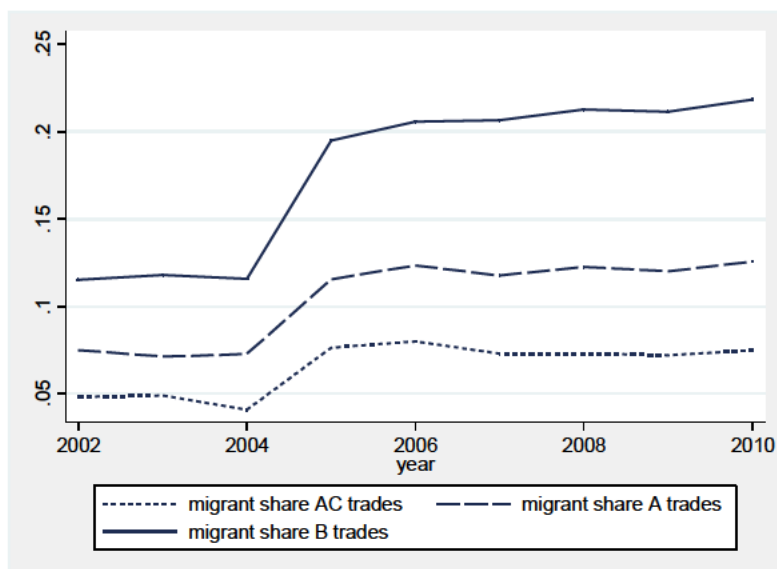
Source: German Microcensus Data, 2002-2010

Figure 3: The Share of Migrant Employees over Time (untrained employees only)



Source: German Microcensus Data, 2002-2010

Figure 4: The Share of Migrant Employees over Time (trained employees only)



Source: German Microcensus Data, 2002-2010

Table 1: The Natural Experiment

Group	Requirments Pre-2004	Requirements Post 2004
AC-trades	Meister	Meister
A-trades	Meister	Meister <i>Exceptions:</i> <i>Altgesellen, Betriebsleiter</i>
B-trades	Meister	No requirements

*Notes:* This table describes the requirements for starting a business in the German crafts sector before and after 2004. A full list of trades for each category can be found at the Federal Association of Skilled Crafts (*ZDH, Zentralverband des Deutschen Handwerks*). B-trades could be further broken down into B1 and B2-trades. However, since B2 have not been subject to a Meister requirement before 2004, this analysis pertains to B1 trades only.



Table 2: Weighted averages by treatment and control groups in pre- and post-reform samples

Weighted averages by treatment and control groups in pre- and post-reform samples						
	A		B		AC	
	Pre	Post	Pre	Post	Pre	Post
Migrant	0.12	0.17	0.15	0.23	0.07	0.09
Self-employed	0.11	0.13	0.17	0.20	0.18	0.18
Female	0.10	0.11	0.36	0.35	0.43	0.45
Age	37.49	38.29	41.44	41.99	37.31	38.67
Secondary schooling						
Realschule	0.23	0.28	0.20	0.24	0.45	0.48
Fachabitur	0.02	0.03	0.03	0.04	0.06	0.08
Abitur	0.03	0.04	0.07	0.09	0.15	0.18
Professional qualification						
Geselle	0.60	0.65	0.57	0.62	0.49	0.56
Meister	0.14	0.14	0.10	0.09	0.24	0.27
University degree	0.01	0.01	0.02	0.03	0.02	0.02
City size						
5k - 20k	0.22	0.22	0.21	0.21	0.21	0.20
20k - 100k	0.23	0.25	0.26	0.26	0.26	0.27
100k - 500k	0.12	0.12	0.13	0.14	0.15	0.14
> 500k	0.08	0.09	0.10	0.11	0.10	0.12
Observations	67,019	125,396	12,330	24,092	3,167	5,869

Notes: All number are weighted by survey weights provided in the microcensus data set. Cleaners are omitted from the sample of B-trades. *Realschule* enables individuals to enter vocational training, whereas *Fachabitur* and *Abitur* permit students to obtain university education. A *Geselle-degree* is acquired after about three years of vocational training. The *Master-degree* represents the highest form of vocational training in the crafts sector.

Table 3: Regression Results. Self-Employed Craftsmen.

	(1) No controls			(2) All controls			(3) No Cleaners			(4) No cleaners and post2004 migrants		
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
dB1xdPost	0.08	**	0.03	0.07	**	0.02	0.05	**	0.02	0.05	***	0.01
dAxdPost	0.03	**	0.01	0.03	*	0.01	0.03	*	0.01	0.03	*	0.01
dPost	0.02	**	0.01	0.07	***	0.01	0.06	***	0.01	0.05	***	0.03
B	0.08	**	0.02	0.14	***	0.03	-0.05	**	0.02	-0.05		0.02
A	0.03	**	0.01	0.01		0.01	0.01		0.01	0.01	**	0.01
Female				-0.02		0.03	-0.05	**	0.02	-0.04	**	0.01
Age				-0.01		0.01	0.00		0.01	-0.01		0.01
Age2				0.00		0.00	0.00		0.00	0.00		0.00
Age3				0.00		0.00	0.00		0.00	0.00		0.00
Realschule				-0.03	***	0.00	-0.03	***	0.00	-0.02	**	0.01
FachAbitur				-0.03	**	0.01	-0.04	***	0.01	-0.03	***	0.01
Abitur				-0.01		0.02	-0.02		0.02	-0.02		0.02
Geselle				-0.12	***	0.03	-0.12	***	0.03	-0.10	**	0.03
Meister				-0.16	***	0.04	-0.16	***	0.04	-0.14	***	0.04
Uni				-0.04		0.03	-0.04		0.03	-0.02		0.03
<i>controls</i>												
occupation	no			yes			yes			yes		
state	no			yes			yes			yes		
city size	no			yes			yes			yes		
branch	no			yes			yes			yes		
cleaners	yes			yes			no			no		
Post 2004 migrants	yes			yes			yes			no		
R2	0.03			0.17			0.16			0.25		
N	29,541			29,541			28,606			25,027		

Table 4: Regression Results. Employed Craftsmen.

	(1) No controls			(2) All controls			(3) No Cleaners			(4) No cleaners and post2004 migrants		
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
dB1xdPost	0.08	***	0.01	0.08	***	0.01	0.04	*	0.02	0.05	*	0.02
dAxdPost	0.02	***	0.00	0.02	***	0.00	0.02	***	0.00	0.02	***	0.00
dPost	0.03	***	0.00	0.06	***	0.00	0.06	***	0.00	0.16	***	0.01
B	0.18	***	0.03	0.22	***	0.01	0.15	***	0.01	0.14	***	0.01
A	0.04	***	0.01	0.11	***	0.01	0.10	***	0.01	0.09	***	0.01
Female	-			-0.05	***	0.01	-0.04	***	0.01	-0.04	***	0.01
Age	-			0.07	***	0.00	0.07	***	0.01	0.06	***	0.01
Age2	-			0.00	***	0.00	0.00	***	0.00	0.00	***	0.00
Age3	-			0.00	***	0.00	0.00	***	0.00	0.00	***	0.00
Realschule	-			0.02		0.02	0.00		0.01	0.00		0.01
FachAbitur	-			0.03		0.02	0.01		0.01	0.02		0.01
Abitur	-			0.10	**	0.04	0.05	***	0.01	0.06	***	0.01
Geselle	-			-0.16	***	0.01	-0.15	***	0.02	-0.14	***	0.02
Meister	-			-0.19	***	0.02	-0.19	***	0.03	-0.19	***	0.03
Uni	-			0.17	***	0.03	0.13	****	0.03	0.14	***	0.03
<i>controls</i>												
occupation	no			yes			yes			yes		
state	no			yes			yes			yes		
city size	no			yes			yes			yes		
branch	no			yes			yes			yes		
<i>sample contains</i>												
cleaners	yes			yes			no			no		
Post 2004 migrants	yes			yes			yes			no		
R2	0.05			0.18			0.12			0.13		
N	208,910			208,910			165,714			144,338		

Table 5: Regression Results. Employed Craftsmen continued.

EMPLOYEES	(1)		(2)		(3)		(4)		(5)	
	<i>Meister</i>		<i>Geselle</i>		<i>No Training</i>		<i>&gt; 25 hours per week</i>		<i>&lt; 25 hours per week</i>	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
dB1xdPost	0.05	0.04	0.02	0.02	0.06	**	0.02	0.02	0.06	**
dAxdPost	0.02	0.01	0.01	*	0.06	***	0.01	0.02	0.00	***
dPost	0.02	*	0.05	***	0.08	***	0.01	0.05	0.10	***
B	-0.08	*	0.01	0.02	-0.09	***	0.01	-0.03	-0.21	***
A	-0.02	0.01	0.09	***	0.14	***	0.01	0.09	-0.01	0.02
Female	-0.01	0.02	-0.04	**	-0.08	***	0.01	-0.04	-0.11	***
Age	-0.02	0.02	0.03	***	0.08	***	0.01	0.07	0.09	***
Age2	0.00	0.00	0.00	***	0.00	***	0.00	0.00	0.00	***
Age3	0.00	0.00	0.00	***	0.00	***	0.00	0.00	0.00	***
Realschule	0.01	0.01	0.01	0.01	-0.03	**	0.01	-0.01	0.01	0.01
FachAbitur	0.05	***	0.02	*	-0.03	0.02	0.01	0.01	-0.03	0.02
Abitur	0.11	***	0.08	***	-0.01	0.02	0.06	***	-0.04	*
Geselle	-	-	-	-	-	-	-0.15	***	-0.16	***
Meister	-	-	-	-	-	-	-0.19	***	-0.20	***
Uni	-	-	-	-	-	-	0.12	**	0.18	**
<i>controls</i>										
occupation	yes		yes		yes		yes		yes	
state	yes		yes		yes		yes		yes	
city size	yes		yes		yes		yes		yes	
branch	yes		yes		yes		yes		yes	
<i>sample contains</i>										
cleaners	no		no		no		no		no	
Post 2004 migrants	yes		yes		yes		yes		yes	
R2	0.07		0.07		0.17		0.12		0.18	
N	13,813		110,262		34,426		153,667		8,944	

Table 6: Regression Results. Common Trends Assumption.

	Self-employed sample		Employed sample	
	A	B	A	B
<i>Interaction year</i>				
2002				
2003	0.02	0.01	-0.02	-0.02
2004	0.00	-0.02	-0.04 **	-0.03
2005	0.02	0.02	0.03 ***	0.07
2006	0.04 **	0.03 *	0.02 **	0.06
2007	0.04 **	0.08 **	0.02	-0.05
2008	0.04 *	0.05	0.04 ***	0.04
2009	0.06 **	0.07 *	0.07 ***	0.08 ***
2010	0.09 ***	0.10 ***	0.09 ***	0.11 ***

Notes: The regressions are based on specification (4) in table 3 (for the self-employed sample) and the specification (3) in table 5 (for the employed sample).

## **Appendix A: Classification of crafts trades**

The following procedure was used to identify individuals who are working in the crafts sector by using the microcensus occupation codes (KldB1992). In a first step, information was gathered on all training occupations and their classification codes (KldB 1992). Training occupations are different from occupations but are nevertheless associated with a particular crafts trade. This was achieved by consulting the official classifications of the ZDH and the Federal Institute for Vocational Education and Training and included present as well as predecessor occupations (Bundesinstitut für Berufsbildung, BiBB, 2012).

In a second step, I used data provided online by BiBB concerning the information about how many apprentices within one occupational field are trained either within crafts companies or non-crafts (mainly industrial) companies. Subsequently, I computed a proportion of crafts apprentices within each occupational code. To exclude occupation codes with a high proportion of non-crafts workers, I used the information on the proportion on crafts trainees and dropped codes if this proportion was less than 60%. Lowering or increasing this cut-off point by up to 20% hardly affects the classification as most occupations contain either a very low or a high proportion of craftsmen. Observations were also removed if occupations could not be clearly marked as either an A or B occupation.

This method is not error-proof as it assumes that the proportion of crafts trainees strongly correlates with the proportion of crafts employees. However, this method removes some of the occupation codes from the analysis that most probably contain very low proportions of crafts workers. For example, while the KldB code 141 ("*Chemiebetriebswerker*", chemical plant employee) may seem a good proxy for the B-trade of "*Wachszieher*" (candle maker), according to my results less than 1% of individuals in the occupation of chemical plant employee are actually craftsmen. The classification scheme implies that most of the individuals in that occupation are industrial workers such as chemical production specialists, chemical technicians or pharmaceutical technicians.

In a last step, I scrutinized the occupation of building cleaners (KldB code: 934). The occupation comprises about 45% of all individuals in the deregulated B-trades in the microcensus dataset. Owing to its large size, it potentially biases any general conclusions about B-trades.

After a thorough inspection, it is doubtful if the occupational group of cleaners in the microcensus data reasonably captures the TCC trade of cleaners. For example, while official company registration data by the Federal Statistics office of Germany points to a sharp increase in market entry in that trade after 2004 (Mueller, 2006), no such trend can be established in the microcensus data. The proportion of self-employed cleaners in the microcensus only increases from 1.6% (2004) to 2.3% (2011). Upon request, employees of the Research Data Centers of the German States confirmed our suspicion and suggested several other classification codes under which cleaners might be found, none of which can be identified as crafts trades based upon our classification scheme.

According to the documentation for an older occupation classification system (KldB1975), there are about seven activity profiles coded as 933 or 934 (cleaners). The classification scheme in the microcensus (KldB1992) merges these codes into one code (934). According to the crafts classification scheme recently developed by the Federal Employment Agency (BAA, 2014 ), only three of these seven occupations belong to the crafts sector.

Table 7: Classification of crafts occupations by Runst et al. (KldB1992 titles)

AC			A		
TCC trade title	KldB code	fraction of crafts trainees	TCC trade title	KldB code	fraction of crafts trainees
Augenoptiker	304	100,00%	Feinwerkmechaniker	221	10,00%
Zahntechniker	303	100,00%	Büchsenmacher (also contains Feinwerkmechaniker)	300	100,00%
Schornsteinfeger	804	100,00%			
Orthopädietechniker	307	100,00%	Dachdecker	488	100,00%
			Elektrotechniker	310	100,00%
Orthopädienschuhmacher (also contains very few individuals from B occupation Schumacher)	372	100,00%	Elektrotechniker	312	100,00%
			Friseure	901	100,00%
			Glaser	485	100,00%
Hörgeräteakustiker (also contains very few individuals from occupation Radio- und Fernsehtechniker)	315	100,00%	Kälteanlagenbauer	266	100,00%
			Klempner	261	100,00%
			Konditoren	392	100,00%
			Maler und Lackierer	510/ 511	100,00%
			Ofen- und Luftheizungsbauer	484/ 441	100,00%
			Seiler	332	100,00%
			Tischler	501	100,00%
			Vulkaniseure und Reifenmechaniker	145	100,00%
			Stukkateure	481	99,53%
			Installateur und Heizungsbauer	264/ 267/ 268	99,36%
			Bäcker	391	99,33%
			Steinmetzen und Steinbildhauer	101	99,09%
			Karosserie- und Fahrzeugbauer	287	98,51%
			Wärme-, Kälte- und Schallschutzisolierer	482	98,45%
			Landmaschinenmechaniker	282	95,34%
			Kraftfahrzeugtechniker, Zweiradmechaniker	281	95,01%
			Boots- und Schiffbauer	506	94,71%
			Metallbauer	254	92,92%
			Gerüstbauer	443	92,24%
			Fleischer	401	91,81%
			Zimmerer	487	88,83%
			Maurer und Betonbauer	441	84,79%
			Elektrotechniker	311	80,36%
			Kraftfahrzeugtechniker	318	77,90%
			Elektromaschinenbauer	313	74,93%
			Maler und Lackierer	512	70,85%
			Chirurgiemechaniker (dropped, cannot be separated from Schneidewerkzeugmacher, 295)	295	70,50%
			Brunnenbauer	466	67,36%
			Straßenbauer	461	54,06%
			Informationstechniker	317	47,20%
			Maurer und Betonbauer	442	38,82%
			Glasbläser und Glasapparatebauer	131	22,07%
			Elektrotechniker	316	8,79%



Table 7 cont'd: Classification of crafts occupations by Runst et al. (KldB1992 titles)

<b>B</b>			<b>B continued</b>		
<b>TCC trade title</b>	<b>KldB code</b>	<b>fraction of crafts trainees</b>	<b>TCC trade title</b>	<b>KldB code</b>	<b>fraction of crafts trainees</b>
Bogenmacher	305	100,00%	Galvaniseure	234	34,93%
Fotografen	837	100,00%	Siebdrucker	175	26,73%
Gebäudereiniger (see appendix A for more details)	934	100%	Brauer und Mälzer	421	20,19%
Geigenbauer	305	100,00%	Behälter- und Apparatebauer	252	17,29%
Graveure	294	100,00%	Betonstein- und Terrazzohersteller	112	16,43%
Rolladen- und Jalousiebauer	259	100,00%	Sticker, Weber	341	9,43%
Schilder- und Lichtreklamehersteller	839	100,00%	Instrumentenmacher	305	74,47%
Wachszieher	141	0,3%	Flexografen	173	12,98%
(This is a small crafts trade. Has been deleted bc of overlap with the industrial occupation of chemical production specialist)			Buchdrucker: Schriftsetzer; Drucker	174	8,51%
Parkettleger, Raumausstatter	491	99,65%	Glasveredler, Feinoptiker	135	7,36%
Estrichleger	486	98,75%	Weinküfer	423	6,10%
Sticker	359	96,55%	Müller	435	5,08%
Fliesen-, Platten- und Mosaikleger	483	93,42%	Metall- und Glockengießer	201	4,46%
Kürschner	378	93,27%	Buchdrucker: Schriftsetzer; Drucker	171	1,18%
Gold- und Silberschmiede, Edelmetallschmied(e/innen)	302	90,47%			
Orgel- und Harmoniumbauer	305	90,71%			
Modisten	354	87,75%			
Sattler und Feintäschner	374	82,47%			
Korbmacher, Drechsler, Holzbildhauer, Holzspielzeugmacher	185	71,61%			
Damen- und Herrenschneider	351	80,56%			
Uhrmacher	308	80,08%			
Schneidwerkzeugmechaniker (dropped, cannot be separated from Chirurgiemechaniker, 295)	295	70,50%			
Keramiker	121	69,61%			
Textilreiniger	931	58,10%			
Modellbauer	502	55,54%			
Glas- und Porzellanmaler	514	54,38%			
Klavier- und Cembalobauer	305	50,00%			
Segelmacher	358	41,47%			
Buchbinder	178	35,38%			