Making Integration Work? Facilitating Access to Occupational Recognition and Immigrants' Labor Market Performance

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April 2022

Abstract

This paper exploits a reform that facilitated the recognition of foreign occupational qualifications for non-EU immigrants in Germany. Using detailed administrative social security and survey data in a difference-in-differences design, we find that the reform increased the share of non-EU immigrants with occupational recognition by 5 percentage points, raising their employment in regulated occupations (e.g., nurses) by 18.6 percent after the reform. Moreover, despite the large inflow of non-EU immigrants in regulated occupations, we find no evidence that these immigrants had lower skills or that they received lower wages.

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1 Introduction

Immigrants experience worse labor market outcomes than natives in most host countries (e.g., Borjas, 2015; Algan et al., 2010). A large part of this gap results from barriers to the transferability of immigrants' skills to the host country (Hendricks and Schoellman, 2018), often because home country certificates do not allow immigrants to enter regulated occupations in the host country (Tani, 2017, 2018). This occupational downgrading that immigrants experience in many host labor markets leads to an under-utilization of immigrants' skills, implying high individual and society welfare losses (e.g., Friedberg, 2001; Mattoo and Ozden, 2008; Dustmann and Preston, 2013).

Recent research has shown that occupational recognition — the formal proof of the equivalence of a foreign certificate to its native counterpart — can enhance the transferability of qualifications and give immigrants access to regulated occupations, with strong positive effects on their labor market outcomes (Brücker et al., 2021; Sweetman et al., 2015). However, access to recognition in most host countries is both non-standardized and costly for immigrants. For example, as no legal framework for recognition exists, U.S. authorities make recognition decisions case by case (Rabben, 2013). Consequently, application rates are generally low, and only those who expect to gain the most on the labor market apply (OECD, 2017). Thus, in the last two decades, major destination countries have been discussing ways of restructuring recognition procedures (ILO, 2016).

This is the first paper to evaluate a unique reform that introduced a standardized framework for the recognition of professional qualifications. Specifically, we examine the Federal Recognition Act, passed by the German government in 2012, which for all immigrants, independently of their country of origin, (a) introduced a legal basis for recognition, (b) standardized and facilitated the proof of equivalence between German and non-German certificates, and (c) established numerous sources of information about recognition procedures for immigrants. Importantly, the quality standards for foreign certificates to receive recognition did not change. Given these characteristics, the Federal Recognition Act presents a potential blueprint for recognition reforms in other countries.

Despite the clear goals of the reform, its effects on the labor market integration of immigrants are a priori ambiguous. First, a facilitated recognition framework does not necessarily translate into higher application rates. For example, the costs of applying may still exceed the expected gains from occupational recognition for many immigrant groups. Moreover, the reform may attract applicants who

do not meet the unchanged recognition standards. Second, even if the number of recognitions increases, the reform may fail to integrate immigrants into the labor market. For example, the facilitated application process may attract immigrants who meet the quality standards to receive recognition but who still have lower observable and unobservable skills than pre-reform. In such cases, even if their foreign certificates fulfill all recognition criteria, the immigrants' actual or perceived skills may still not meet employers' standards post-reform. Therefore, employers may not hire these immigrants or they may offer them lower-quality jobs in terms of earnings, job security, or other employment conditions.

To identify the effects of the reform on immigrants' labor market integration, we exploit the fact that, since 2005, immigrants from inside the EU were subject to a recognition process similar to that of non-EU immigrants after 2012. Thus the reform allows us to apply difference-in-differences (DiD) designs in which EU immigrants represent the control and non-EU immigrants the treatment group. EU immigrants constitute a legitimate control group because they (a) must also have their home country certificates recognized to work in regulated occupations and (b) face language barriers similar to those of non-EU immigrants. Thus the DiD design rules out the possibility that better labor market outcomes for non-EU immigrants post-reform are merely the result of better economic conditions that coincide with the reform. Had economic conditions improved post-reform, both EU and non-EU immigrants' employment, wages, and out-migration should have been similarly affected.

We take advantage of detailed German survey and administrative social security data in our DiD approach. The survey data allows us to analyze the reform effect on applications because it provides detailed retrospective information on the application and recognition of both EU and non-EU immigrants and on each applicant's socio-demographic and economic characteristics. The administrative social security data allows us to analyze the reform effects on both earnings and employment in regulated occupations. The data includes all non-German individuals in the labor force, over 13 million individuals both five years pre- and post-reform. Beyond many socio-economic and employment-related immigrant characteristics, the data also contains information on occupations, allowing us to identify whether an immigrant was employed in a regulated occupation pre- and post-reform.

We obtain four key results. First, we analyze the reform effect on non-EU immigrants' probability of applying for recognition. Results show

that applications increased by 5 percentage points after the introduction of the standardized recognition framework. Second, we investigate whether the positive effects on applications transfer to increased employment in regulated occupations. As we are mainly interested in the integration effect of the reform (not in its influence on migration inflows), our main analysis concentrates on immigrants who lived in Germany before the reform. We find that the employment probability in regulated occupations for EU and non-EU immigrants developed parallel during the five years before the reform and diverged sharply after it, leading to an increase for non-EU immigrants of 1.7 percentage points, an increase of 18.6 percent. In regulated occupations with the largest application numbers (mainly health care), the probability of employment in regulated occupations for non-EU immigrants increased by 1.5 percentage points, an increase of 25.1 percent. In regulated occupations with the least applications we don't find any employment increase.

Third, we use the panel nature of the administrative data to examine whether – due to the reform – immigrants with recognized certificates but with lower observable and unobservable skills selected into regulated occupations. We show that for non-EU immigrants, neither the characteristics of the last employment spell before moving to a regulated occupation nor the average earnings in these occupations changed as a result of the reform. Fourth, we investigate the reform effects for non-regulated occupations. While a recognized certificate is not mandatory for working in these occupations, the reform could have encouraged applications for recognition, because a recognized certificate may increase transparency about quality and thus facilitate employment. We find that the employment of non-EU immigrants in these non-regulated occupations increased post-reform by 3 percentage points, an increase of 6.8 percent.

Our results are robust to a series of potential biases and identification threats. To deal with concerns about selective out-migration, we restrict our analysis to a balanced sample of individuals working in Germany throughout 2007-2017, and use the total number of immigrants in regulated occupations as the main employment outcome. Further concerns may be related to the choice of the EU15 as our control group. Although we clearly show that employment trends are parallel for both EU and non-EU immigrants pre-reform, factors such as discrimination may vary differently between EU and non-EU immigrants over time. Therefore, as alternative control groups, we also use (a) non-EU immigrants with education acquired in Germany and (b) German natives. All these robustness checks confirm the results from our main specification.

Finally, to handle additional threats from time-varying unobservables correlated with the timing of the 2012 reform, we exploit the additional state-time variation induced by the staggered adoption of state recognition laws from 2012 to 2014. This estimation confirms the baseline results and shows that the probability of non-EU immigrants being employed in occupations regulated at the state level increases by 29 percent after the introduction of state recognition laws.

As our paper is the first to analyze the causal effects of a recognition reform, it makes several important contributions to the literature on the economic integration of immigrants. First, we contribute to the literature on policies aimed at improving immigrants' labor market integration. Numerous studies have investigated the relationship between individual characteristics and economic assimilation. These include studies of host-country language proficiency (Ferrer et al., 2006; Dustmann and Van Soest, 2002; Bleakley and Chin, 2004), the age of arrival in the host country (Bleakley and Chin, 2010) and residence in ethnic enclaves (Cutler and Glaeser, 1997; Xie and Gough, 2011; Battisti et al., 2016). Drawing on this literature, other studies have evaluated policies targeted at individual immigrants, such as language courses (Arendt et al., 2020; Lochmann et al., 2019) and job search programs (Joona and Nekby, 2012; Sarvimäki and Hämäläinen, 2016; Battisti et al., 2019). However, whether these policies can be implemented on a large scale in a cost-efficient way remains unclear.

In contrast, fewer studies have focused on nation-wide integration policies, which by definition target all or a large group of immigrants. One exception is Gathmann and Keller (2018), as they study the effect of two nation-wide citizenship reforms in Germany on immigrants' labor market integration. They find that reduced residency requirements for citizenship have positive effects on employment and earnings, particularly for women. Our results add to the literature on national integration policies, showing that changes in recognition policies appear to be a cost-efficient way of improving labor market integration for large groups of immigrants. As standardizing recognition can be implemented in many countries, our results are highly important for policy makers worldwide.

Second, we contribute to the growing literature on occupational recognition in two distinct ways. We complement research on the labor market gains from recognizing foreign certificates. For example, Kugler and Sauer (2005) find that recognizing a medical degree clearly improves earnings. Brücker et al. (2021) and Tani (2017) analyze gains from recognition for a larger group of occupations

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and find that immigrants who acquire a recognized certificate have both higher employment probabilities and higher earnings. Our results confirm that labor market gains from recognition hold across different occupations, but additionally show that this finding also holds in a context where recognition procedures are easier and the inflow of immigrants into regulated occupations is larger. Moreover, in contrast to these other studies, we demonstrate that recognition also affects employment in non-regulated occupations.

We also contribute to research on how changing requirements for working in regulated occupations affects the selection of workers into these jobs. Studies have demonstrated that changing requirements affects the quality of service and workers (Shapiro, 1986; Anderson et al., 2020; Larsen et al., 2020). In our setting, easier access to recognition may have effects comparable to lowering licensing standards, leading to a lower average productivity and lower wages of applicants. Instead, we show that easier access to recognition can improve the integration of immigrants without altering the average productivity of the applicants. These results are highly policy-relevant, as other countries may also face a trade-off between integrating high-skilled immigrants and maintaining high-quality occupational standards.

Third, we contribute to research understanding of how immigrants make decisions about having their home countries' certificates recognized in host countries. Our results indicate that bureaucratic hurdles and uncertainty about the outcome constitute important obstacles that prevent immigrants from applying for recognition. As the returns to recognition appear high, this finding is surprising. However, it is in line with those studies showing for other groups (e.g., students and welfare recipients) that small changes in application procedures can strongly increase take-up (Bettinger et al., 2012; Hoxby and Turner, 2015; Bhargava and Manoli, 2015). We show for the first time that immigrants are very sensitive to application procedures. Policy makers need to take this finding into account when they make decisions on recognition frameworks.

The rest of the paper is organized as follows. Section II describes the institutional setting in which the empirical analysis takes place. Sections III and IV describe the empirical framework and the data, while Section V presents the main results. Sections VI and VII provide additional analyzes. Section VII concludes.

2 Institutional Background and Potential Mechanisms

2.1 Institutional Setting and Recognition of Foreign Certificates

Working in a regulated occupation in Germany requires a domestic professional qualification or, for immigrants, the formal recognition of their foreign qualification. Brücker et al. (2021) calculate that regulated occupations make up around 12 percent of total employment in Germany, of which 29 percent are in the health sector (e.g., physicians, pharmacists, nurses), 28 percent in the public sector (e.g., police officers, teachers, social workers), and 25 percent in the technical sector (e.g., architects, engineers, physicists). Occupations can be regulated at the federal level (Bundesebene) or at the state level (Landesebene).[1] Other than the responsible authority for the recognition process, these two groups of occupations hardly differ in their recognition procedures.

In contrast, entering a non-regulated occupation requires no formal recognition. Nonetheless, for most of these occupations, immigrants can apply for an official assessment of their home country occupational qualifications. If recognition is successful, that assessment becomes a legally binding document validating the equivalence with the German qualifications. Examples of such unregulated occupations are those requiring training (e.g., office management clerks, electricians) and advanced training occupations (e.g., technician qualifications, certified financial advisors).

Despite the large number of eligible immigrants and the potential gains of recognition, applying for recognition in Germany before 2012 was an unstructured lengthy process for immigrants with degrees from non-EU countries. Applicants had to face different authorities responsible for the recognition procedure and the duration of the process was unclear. Additionally, applicants had no financial support to cover the administrative fee, which ranged from 100 to 600 euros (120 to 720 US-Dollars) depending on the occupation and the federal state in which the application was submitted (BMBF, 2017). Thus only 20 percent of eligible non-EU immigrants applied for recognition of their home-country certificates, 10 percent less than eligible EU immigrants (German Microcensus, 2008), for whom the recognition procedure was easier and more structured before 2012 (see guidelines of the European Directive 2005/36/EC).

Data from the SOEP Migration Sample reveal the reasons immigrants gave why they did not apply for recognition before 2012, despite their eligibility

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[1]In the private sector, for example, 84 occupations are regulated at the federal and 111 at the state level (BMBF, 2017).

(Appendix Table A.1). Twenty-four percent of non-EU immigrants but only fourteen percent of EU immigrants said that they did not apply due to administrative constraints. Furthermore, twenty percent of eligible non-EU immigrants without application stated that they saw no chance of obtaining recognition, compared to only fifteen percent of eligible EU-immigrants.[2] Overall, these numbers indicate that reducing administrative hurdles and increasing information may increase application rates.

2.2 The Federal Recognition Act in 2012

To reduce bureaucratic hurdles and facilitate the process of occupational recognition for immigrants with a non-EU certificate, the German parliament passed the Federal Recognition Act (Anerkennungsgesetz) in April 2012 on the recognition of certificates acquired abroad. The law harmonized the process between EU and non-EU certificates trough three major changes for non-EU certificates. First, and most important, the new law created a legal basis for occupational recognition for all immigrants, independent of their country of origin.

Second, the reform restructured, standardized, and facilitated procedures for the assessment of equivalence between foreign and German certificates. Specifically, the new framework (1) allowed immigrants to send a standardized application form to well-defined administrative bodies (also from abroad), (2) allowed that the proof of equivalence considered not only certificates but also work experience in the home-country, (3) gave all administrative bodies a guideline for decision-making within three months of the application date.[3] Third, from 2012 onwards the government established numerous sources of information about the recognition procedure (e.g., multi-language dedicated websites, mobile apps, hotlines), sources that could be accessed both in Germany and from abroad.[4] Fourth, after the reform, the government offered and advertised subsidies covering the costs of the application process.

While all legal changes apply to professional and vocational qualifications and to university degrees with a clear link to regulated occupations (e.g. physicians, dentists, pharmacists), they do not apply to recognizing higher education

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[2] About 90 percent of all applications were successful pre-reform.

[3] After applying, immigrants may receive three types of standardized decisions: fully recognized (the only way for accessing a regulated occupation), partially recognized, and not recognized. For partial or non-recognition, applicants receive compensative measures to help them to reach full recognition.

[4] Appendix Figure A.1 gives some examples from the website *www.anerkennung-in-deutschland.de*, the main web portal for immigrants interested in acquiring information on the recognition procedure.

qualifications that do not lead to a specific occupation (e.g. mathematician, chemist, economist). Nor does the new framework include the academic recognition of high-school diplomas. For occupations regulated at the state level (e.g., teachers, youth social workers, engineers, architects) each federal state passed its own Federal State Recognition Laws, between 2012 and 2014, which all adhere to the Federal Recognition Act.

Whereas before 2012 the German statistical offices barely kept records on the recognition process, since 2012 German authorities began a structured data collection on all applications. These records show that since the implementation of the Recognition Act, the number of applicants has steadily increased from 15,000 submissions, up to more than 60,000 per year (see Appendix Figure A.2).[5] Occupations regulated at the federal level received the largest number of applications, followed by non-regulated occupations and occupations regulated at the state level. Nonetheless, also within these groups the number of applications for specific occupations strongly varies. Table 1 reports the occupations with the largest total number of applications after 2012 for both regulated and non-regulated occupations. For regulated occupations, the top 15 occupations received about 93 percent of all applications, while for non-regulated occupations applications are less concentrated (around 50 percent in the top 15).

Despite no causal evaluation of the 2012 German recognition reform, the German Ministry of Interior Affairs celebrated the reform as a great success (BMBF, 2017) – an assessment based on the increase of applications after 2012, most of which resulted in recognitions. However, the question of whether this application increase arose from the reform itself or from other factors (e.g., an economic boom or other policy changes), or whether the increase continues a process which had started before 2012, has remained unanswered. Moreover, even if the reform was successful in increasing the number of recognized certifications, the effects on immigrants' labor market integration have not been analyzed yet.

2.3 Potential Mechanisms

Each immigrant with a professional home-country certificate makes a choice about applying for recognition or not, depending on the (expected) costs and benefits. In addition to the direct application costs and the document translation fees, various non-monetary costs arise. These include time investments to gather

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[5]The number of total applications rose to 420,000 by 2021, according to recent numbers from the Ministry of Education https://www.bmbf.de/bmbf/de/bildung/integration-durch-bildung-und-qualifizierung/ anerkennung-auslaendischer-berufsqualifikationen/anerkennung-auslaendischer-berufsqualifikationen$_n$ode.html

Table 1: Occupations with the Largest Number of Applications, by Type of Occupation

Regulated occupations			Non-regulated occupations	
Occupation	Level of regulation	in %	Occupation	in %
Nurse	National	23.68	Electronics technician	12.67
Doctor	National	22.97	Office clerk	6.79
Teacher	State	12.07	Caregiver	3.89
Engineer	State	4.58	Trainer in office work	3.73
Social pedagogist	State	4.29	Commercial clerk	3.23
Social worker	State	4.15	Mechatronic technician	2.81
Children pedagogist	National	4.07	Machines mechanic	2.57
Physiotherapist	National	3.02	Office electrician	2.24
Pharmacist	National	3.02	Industrial electrician	1.82
Educator	State	2.57	IT-specialist	1.74
Architect	State	2.35	Sales clerk	1.66
Dentist	National	2.09	Metal technician	1.57
Children nurse	National	1.36	Cook	1.49
Ostetric	National	1.50	Heating technician	1.32
Nurse assistant	State	1.30	Hairdresser	1.24
Total		93.02		48.76

Notes: Table 1 reports the regulated and non-regulated occupations that received the largest number of applications for occupational recognition after 2012. To identify these occupations we collected data from the state statistical offices and selected the 15 occupations with the largest number of applications in 12 out of 16 federal states (data is incomplete for Hamburg, Saarland, Schleswig-Holstein, and Bavaria), distinguishing between regulated and non-regulated occupations. For regulated occupations we report whether the regulation is at the federal or state level. For all occupations we report applications as percentage of total applications. The percentages are computed based on the percentages for the state *Hessen* for which we obtained the number of applications separately by occupations (5-digit Kldb2010 classification). Since not all occupations have applications in all years from 2012 to 2018, we took the largest application number across all years for each occupation from the *Hessen* list and computed the total accordingly. Alternative calculations (e.g., the sum of all applications across all years) do not change the results.
Source: Regional Statistical Offices.

information and to interact with the administrative bodies (i.e. opportunity costs), as well as effort and potential psychological costs involved in organizing the paper work. Monetary and non-monetary costs of applying are determined by the institutional framework and may depend on individual characteristics of immigrants, such as language proficiency, personal skills, and immigrant networks.

The benefits of applying for recognition stem from better labor market prospects. Immigrants with recognized certificates can enter regulated occupations and access unregulated occupations more easily because their recognized certificates may be transparent in quality for employers.The institutional framework determines these benefits by affecting the duration and the success probability of the recognition process, while labor market conditions influence benefits through employment prospects in the respective occupation. Moreover, benefits may vary by individual characteristics, such as the quality of the home-country certificate affecting individual success probability, and the remaining time in the labor market until retirement or re-migration.

Facilitating the recognition procedure is an intervention directly affecting these choices. Immigrants face lower monetary and non-monetary costs of

the recognition process and may therefore be more likely to apply.[6] The low application rate among eligible immigrants pre-reform reveals the huge potential from increasing the number of applications. As a consequence, more immigrants whose home-country certificate meets the professional standards may have recognized degrees and thus better employment opportunities, higher wages, and better working conditions.

However, the potential benefits of applying for recognition may not be realized for two reasons. First, compositional changes in the pool of applicants may worsen the (perceived) quality of recognized occupational certificates.[7] Although the reform did not affect recognition requirements, a facilitated application may have attracted immigrants with lower observable and unobservable skills than pre-reform to apply.[8] A lower average quality of immigrants with recognized certificates may prevent employers from hiring immigrants despite their recognized occupational degrees or from employing them in high-quality jobs at higher wages.

Second, equilibrium effects in the labor market may lower the value of recognized certificates, as a higher number of recognitions increases the labor supply in the respective regulated or unrelated occupations. In case of excess labor supply, more recognitions do not lead to additional employment or higher wages for immigrants. These equilibrium effects on immigrants' labor market outcomes will also depend on the elasticity of substitution between native and immigrant workers, as well as between different immigrant groups.

Thus far, whether the new recognition framework had the intended effect on immigrants' labor market integration is unknown. In light of the potential mechanisms, three scenarios of an overall reform effect are plausible: immigrants' labor market outcomes may improve, not change, or even worsen due to compositional changes and general equilibrium effects. Therefore, empirical evidence is needed to understand whether facilitating access to recognition present an effective tool to improve immigrants' labor market integration.

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[6]While we are the first analyzing the effects of easier access to recognition on immigrants' decision to apply, Gathmann and Keller (2018) show that facilitating the access to citizenship makes immigrants' more likely to naturalize.

[7]These compositional changes may occur both among immigrants already in Germany pre-reform and among immigrants who arrived in Germany post-reform.

[8]The literature on licensing shows that changing licensing requirements may affect the quality of licensed workers (Shapiro, 1986; Anderson et al., 2020; Larsen et al., 2020).

3 Empirical Strategy

3.1 Recognition and Employment

To investigate the effect of the Federal Recognition Act on the integration of non-EU immigrants, we exploit the fact that the 2012 recognition law eliminated differences in the recognition process between EU and non-EU immigrants.[9] Specifically, the reform introduced a formal recognition framework applying equally to all immigrants, regardless of their country of origin. While the new framework clearly improved non-EU immigrants possibility of obtaining recognition, it introduced no change for EU immigrants, who had benefitted from a standardized recognition process since 2005 (European Directive EC/2005/36). This variation forms the basis of our DiD design, in which non-EU immigrants are treated and EU immigrants are the control group.[10]

In our main analyses, we estimate the following empirical model:

$$y_{it} = \alpha + \gamma NonEU_i + \lambda Post_t + \beta(NonEU_i * Post_t) + \epsilon_{it} \tag{1}$$

For the recognition analysis the dependent variable y_{it} is an indicator for whether the immigrant i applied for recognition and received the results of the application process in year t. [11] For the employment analysis the dependent variable y_{it} is an indicator for whether the immigrant worked in a regulated occupation in quarter t. We define our main outcome for the employment analysis as being employed in regulated occupations relative to any other status, including unemployment.[12] $NonEU_i$ is an indicator for whether the immigrant's nationality is from a non-EU country, $Post_t$ is a time indicator that assigns value 1 to observations in quarters t after the new recognition law and 0 to observations in quarters before it. The parameter of interest β measures the effect of the reform on outcome y_{it} for non-EU immigrants.

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[9] Agersnap et al. (2020) use a similar design to study the effect of a welfare reform applying only to non-EU immigrants while leaving untouched the welfare benefits for EU immigrants.

[10] To improve the validity of the control group, we exclude immigrants from countries that entered the EU during the last two enlargements. After the 2004 Eastern Enlargement, EU15 countries were allowed to apply transitional restrictions to the free movement of the new EU workers. Germany lifted these restrictions in 2011 for the 2004 Eastern countries. This event might therefore confound the effects of the reform for the group of EU13.

[11] In the Appendix we also show results when using as dependent variable an indicator for whether the immigrant i applied for recognition in time t, independently from whether he received the results of the application

[12] We choose the relative employment in regulated occupations, not the absolute employment, as we want to account for the increase in the immigrant population during the selected time window (2007-2017). In a series of robustness checks in Section 5.2, we test whether our results are sensitive to using the log number of immigrants employed in regulated occupations. Additionally, in Appendix Table A.5, we exclude unemployed immigrants from the sample, showing that the coefficient of interest remains positive and significant.

In further specifications, we include a large set of controls. Individual controls include age and age at arrival (proxied by age at entry in the social security register for wage and employment models), nationality (as a proxy for country of origin), and sex. To control for time-constant geographical trends and time-varying trends, we include local labor market fixed effects and year fixed effects in our full specifications. To take into account the underlying panel structure of the data, we cluster standard errors at the individual level.

As we do not directly observe which immigrants apply or receive recognition in the social security data, we estimate intention-to-treat effects when we use these data. To address concerns that recognition is not the direct mechanism through which the reform affects non-EU immigrants' labor market outcomes,we follow two approaches. First, we show that the reform effects on recognized certificates and on non-EU immigrants' employment in regulated occupations are quantitatively similar. Second, we show that the effects on employment occur only in the regulated occupations that received most of the applications for recognition (about 90 percent).[13]

Our identification strategy relies on the assumption that the outcomes for EU and non-EU immigrants would have followed the same trends post-reform had the standardized recognition framework not been established. We clearly show that trends in the probability of being employed in regulated occupations were parallel in the pre-reform period, and in addition we address potential violations of this assumption.

First, the composition of incoming immigrants and immigrants who leave the country might have changed as a consequence of changes in Germany's immigration policies. Specifically, in 2012 the German Residence Act granted non-EU immigrants with specific advanced degrees a work permit (the co-called Blue Card) as long as German authorities recognized those degrees. The combination of the Blue Card Act and the Recognition Act might have affected not only the integration but also the selection of immigrants coming to Germany.[14] Moreover, even without changes in immigration policies, non-EU immigrants with specific skills may have found coming to Germany more attractive as recognition became easier. Finally, in 2015 Germany experienced a large inflow of refugees during the refugee crisis, dramatically changing the

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[13]In the pre-reform period around 30 percent of non-EU immigrants in regulated occupations were working in occupations that received few applications, so that the distribution of applications does not correspond to the distribution of non-EU immigrants across regulated occupations.

[14]For example, in a recent paper Abarcar and Theoharides (2020) show that the expansion and contraction of U.S. visas for nurses in the 2000s changed accordingly both the number of foreign-trained nurses in the U.S. and the enrollment rates in nursing programs in the Philippines.

composition of non-EU immigrants.

To disentangle the integration effect of the reform from selective migration, we exclude from our main analysis those EU and non-EU immigrants who arrived six months pre-reform or later. Applying this sample restriction, we include only immigrants who entered the German labor market more than six months before the reform. In Section 5.3, we expand our analysis and explore the employment effects when we include also immigrants who arrived post-reform.

Nonetheless, even if we restrict our sample to immigrants who arrived pre-reform, our estimates might still be affected by selective in- and out-migration or sample attrition (e.g., due to self-employment periods, which our administrative data does not cover) in both the pre- and post-reform periods.[15] We therefore also run our main estimation on a balanced panel of EU and non-EU immigrants observed in Germany throughout the period 2007-2017. Moreover, with Microcensus data we show descriptively that for both immigrant groups the composition of specific occupational degrees obtained abroad, e.g., the share of nurses, remain the same over time.

A second concern is the choice of the control group. If employment probabilities for EU immigrants changed as a result of either the reform or factors coinciding with it, the estimated reform effects would depend on the choice of EU immigrants as the control group. Employment probabilities could have decreased, for example, if the skills of EU immigrants deteriorated over time and employers started to replace EU with non-EU immigrants. To handle this concern, we define two alternative control groups, German citizens and non-EU immigrants with education acquired in Germany. The reform affects none of the groups directly, and both groups are less likely than foreign-trained EU15 immigrants to be replaced by foreign-trained non-EU immigrants.[16] Using non-EU citizens with German education as a control group has the additional advantage that controlling for nationality allows us to compare the outcomes of treated and controls with the same ethnic background. Therefore, we rule out the possibility that our results are driven by changes in hiring behavior that

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[15]On one hand, the reform might have affected immigrants' decision to leave Germany. On the other hand, economic shocks (e.g., the Great Recession) might have differently affected the labor market opportunities of non-EU and EU immigrants, which had changed the selection towards and out of Germany before 2012. Similar concerns would apply if non-EU immigrants knew about the reform before and selected into migration to Germany based on the perceived probability of recognizing their certificates. In Appendix Figure A.5, we provide evidence from Google Trend data that Google searches about recognition sharply increased only around the first month of the introduction of the Recognition Act, while having remained stable in the previous months.

[16]For example, Signorelli (2020) shows that a selective immigration policy in France, aimed at increasing the hiring of non-EU immigrants in specific occupations, did not affect natives' employment. She explains this finding in terms of an imperfect degree of substitution between natives and non-EU immigrants.

are purely based on immigrants' nationality (e.g., stronger or weaker ethnic discrimination).

Third, the reform might have coincided with a skill shortage in regulated occupations, so that the demand for non-EU immigrant workers increased even without changes in the demand for the other two groups. While such a change would not constitute a threat to our identification strategy, it might limit the generalizability of our results to other settings. To rule out this concern, we show that our estimates remain similar across labor markets with different levels of pre-reform labor demand in regulated occupations and with different sizes of the non-EU network (i.e., immigrants with a similar nationality in a region) employed in regulated occupations. Moreover, we identify a group of occupations that includes non-regulated (for which recognition is not mandatory), skill-intensive occupations that faced a skill shortage in the years pre- and post-reform. These are the non-regulated occupations on the list of occupations suffering from skill shortage (*Mangelberufe*). We show that for non-EU immigrants employment effects in these occupations are zero.

Finally, to exclude the possibility that any additional confounder coinciding with the timing of the reform affects our results, we exploit the additional state-quarter variation given by the staggered implementation of state recognition laws for occupations regulated at the state level.[17] We show that pre-reform trends in employment are parallel, while they diverge from the first quarter after the introduction of state laws.

3.2 Selection Into Regulated Occupations

As a second step of the main analysis, we investigate whether the reform affected the sorting of immigrants into regulated occupations. The longitudinal dimension of the social security data allows us to observe immigrants before and after they move to a regulated occupation, unless the move takes place in their first or last observation spell. We take two complementary perspectives. First, we analyze the selection into regulated occupations in terms of the previous employment or unemployment spell. We do so because, if the recognition reform increases

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[17]We estimate the following model:

$$Pr[E_{it}] = \alpha + \gamma NonEU_i + \sum_{t=-P}^{T} \eta Time_t + \sum_{t=-P}^{T} \beta(NonEU_i * Time_t) + \eta_t + \mu_s + \epsilon_{ist} \qquad (2)$$

where Time are period dummies from 15 quarters before the introduction of the state law and up to 15 quarters after (baseline is the quarter right before the law), η_t are year fixed effects and μ_s are federal state fixed effects. In Figure A.9 we display the timing of implementation of state laws.

the pool of immigrants who meet the quality standards and thus can formally enter regulated occupations, the unobserved quality of immigrants may be lower. Therefore, non-EU immigrants who enter a regulated occupation post-reform may be more likely to move from occupations with lower earnings, with less complex tasks, or from unemployment spells. To test whether such selection occurs, we estimate Equation 1 on the characteristics of pre-transition occupational spells for the subsample of immigrants moving to regulated occupations.

Second, we investigate whether non-EU immigrants who move to a regulated occupation post-reform earn lower full-time wages compared with immigrants who made the transition pre-reform. Lower average earnings could occur if, for example, employers are less able to discern between high- and low-quality certificates, and if their actual quality is lower. We again estimate Equation 1 using log hourly wage as the outcome variable and restricting the sample to full-time employees in regulated occupations. To control for changes in the sorting across regulated occupations, we include three-digit occupation fixed effects, together with the full set of controls used in all other specifications.

4   Data and Sample Characteristics

To conduct our analyses, we use two data sets. Our main data source are the German social security records, which we use to analyze the effects of the reform on the probability of being employed in a regulated occupation and to analyze the effects on wages for employees working in regulated occupations. We complement this data with detailed survey data from the IAB-SOEP Migration Sample on immigrants' application processes.

Social Security Records
Our main analysis relies on the social security records, *Integrated Employment Biographies* (IEB), for a random draw of 15 percent of the full population of immigrants in the German labor market.[18] The Institute of Employment Research (IAB) of the German Federal Employment Agency provides the data.[19] The dataset includes detailed daily administrative longitudinal information on nationality, occupation, educational background, industry, employment status,

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[18]Given the smaller sample size when we consider only immigrants who move to regulated occupations, in Section 6 we use a random draw of 70 percent, the maximum allowed given the size of the resulting extraction and data protection requirements.

[19]For the description of a 2 percent random sample from the IEB, the *Sample of Integrated labor Market Biographies* (SIAB), see Antoni et al. (2019).

and earnings records of all individuals subject to social security in Germany.[20] The detailed information on the occupational groups (see Paulus et al. (2013)) allows us to link occupations to the number of applications in each occupation from administrative data on recognition procedures. The large number of individuals in the data allows us to include very fine-grained controls, such as the local labor market, nationality, and the 3-digit occupational group.

Table 2: Socio-Demographic Characteristics of Immigrants who Entered Germany Pre-Reform, 2007-2017

	(1)	(2)	(3)	(4)
	Non-EU		EU15	
	IEB	Microcensus	IEB	Microcensus
Female	0.47	0.46	0.39	0.42
Higher education	0.33	0.43	0.44	0.64
Age	42.33	42.10	42.49	41.89
Age entry	31.76	31.96	31.18	32.33
Years in the register	10.09	10.62	10.85	10.05
Northern and Continental Europe			0.66	0.68
Southern Europe			0.34	0.32
Eastern Europe and Russia	0.25	0.27		
Balkans and Turkey	0.26	0.26		
Africa	0.09	0.08		
Middle East	0.10	0.10		
Asia	0.19	0.18		
North and Central America	0.06	0.06		
South America	0.04	0.04		
Oceania and others	0.01	0.01		
Observations	1298243	14075	605985	6067

Notes: Table 2 reports variable means for the Integrated Employment Biographies (IEB) sample and for a sample analogue in the German Microcensus. We pull all Microcensus waves from 2007 to 2017 together and compute variables as similar as possible to the IEB sample characteristics, while improving on some of the variables that the IEB does not include. In particular, we replace age at entry into the IEB with actual age at entry in Germany, and we replace the proxy for having acquired education abroad with actual information on acquired education abroad. Moreover, the nationality variable is more precise in the Microcensus. We consider only immigrants with reported year of entry earlier than 2011 to simulate the sample selection in the IEB. We exclude resettled immigrant groups with German origin, as they are likely to be registered with a German nationality in the IEB data. Source: Integrated Employment Biographies (IEB) and German Microcensus.

We use the nationality information in the data to identify EU and non-EU immigrants. We want to minimize the possibility of including individuals who acquired a German education or training, and exclude all immigrants

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[20]For our employment analysis, we consider all immigrants in the register, both employed and unemployed. For our wage analysis, we follow the literature, e.g. Card et al. (2013), and consider only full-time employees who report more than ten Euros in daily wages. We compute hourly wages by dividing the daily wage by eight (a standard full-time daily number of working hours).

whose highest acquired education is not eligible for recognition (immigrants without either vocational training or tertiary education). Therefore, we restrict our sample to immigrants with non-German nationality whose first recorded educational level was either vocational training or tertiary education and who entered the register when they were older than 23 years (if the first recorded educational level is vocational training) and older than 25 (if their first recorded educational level was tertiary education). We exclude immigrants older than 55.[21] In Appendix B we further explain the sample selection and the construction of nationality, education, and occupation variables. As we build quarterly cross-sections from 2007 to 2017, we exclude the few observations available for 2018 and all immigrants who exited the register before 2007. Our main sample thus includes 76,889 individuals with over 2 million observations.

Table 2 presents socio-demographic characteristics of our main analysis sample separately for EU and non-EU immigrants. Since in the administrative data we can only approximate the inclusion of individuals who acquired tertiary education and vocational training abroad, in Table 2 we also show the same socio-demographic characteristics using immigrants in the German Microcensus (GMC). The GMC asks immigrant respondents both their year of immigration and the year they acquired their highest educational level. We can therefore more precisely identify immigrants who acquired their education abroad. The characteristics of immigrants in the IEB and the GMC are remarkably similar, with only the educational level being under-estimated in the IEB data. For this reason we test the robustness of our results to alternative definitions of the sample according to different versions of the educational variable.

IAB-SOEP Migration Sample

As a second data set, we exploit the IAB-SOEP Migration Sample (Brücker et al., 2014) to estimate to what extent the reform increased application and recognition rates. The IAB-SOEP Migration Sample is a unique panel dataset constructed on a sample of immigrants interviewed in 2013, 2014, 2015, and 2016. Respondents answered in addition to the standard SOEP survey, also questions about their nationality, immigration biography, year of arrival in Germany, and education obtained abroad. Crucial for our research question, for each respondent the data contain information whether the immigrant applied

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[21]We choose age 55 as the maximum age to exclude the possibility that individuals leave the sample due to early or partial retirement, which in the Social Security Records cannot be distinguished from other reasons for leaving the labor market.

for recognition and, if so, the month and year of application.[22]

To maximize the sample size, we include all individuals aged 18 to 65 who have a professional certificate or a higher education degree acquired abroad and who arrived in Germany for the first time between 1995 and 2014. After these restrictions, the sample consists of 797 immigrants who hold certificates eligible for recognition.[23]

5   Results

5.1   Effects on Applications for Recognition

Using the IAB-SOEP Migration Sample, we examine the relationship between the introduction of a formal recognition framework and the decision to apply for recognition. This analysis is an important starting point for a) understanding whether reducing application costs, by lowering the administrative burden and facilitating access to information, is an effective policy for increasing immigrants' applications and b) justifying the subsequent analysis on the effect of the reform on labor market outcomes.

Figure 1 displays the share of immigrants who have ever applied for recognition out of all eligible immigrants, by year and EU/Non-EU origin. Before the reform, both EU and non-EU immigrants showed similar trends but different levels, as EU immigrants had on average higher shares. After the reform, the application rates for EU immigrants remained constant at around 35 percent. In contrast, the percentage of non-EU immigrants who have applied for recognition increased significantly post-reform. Along with the graphical evidence, we estimate Equation 1, using an indicator for whether an individual has applied for recognition as dependent variable. The point estimates show a significant increase in the application probability of 4.8 percentage points. That is, an increase of 14.2 percent relative to the average application rate in the pre-reform period (see Appendix Table A.3, Panel A).

To investigate whether the increase in applications of non-EU immigrants transferred into more recognized certificates, we observe closed application procedures[24] as well as successful recognitions pre- and post-reform. We show in Appendix Figures A.3 and A.4 that both the share of non-EU immigrants with a

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[22]In Appendix B, we describe the recognition variables in the IAB-SOEP Migration Sample in more detail and test their validity by comparing them with other data sources.

[23]Table A.2 shows socio-demographics characteristics for this sample.

[24]These are applications with a finalized application process, with either approval of the application (full or partial recognition) or rejection (recognition denied).

Figure 1: Effect of the Recognition Act on Applications for Recognition, Shares and Event Study Plot
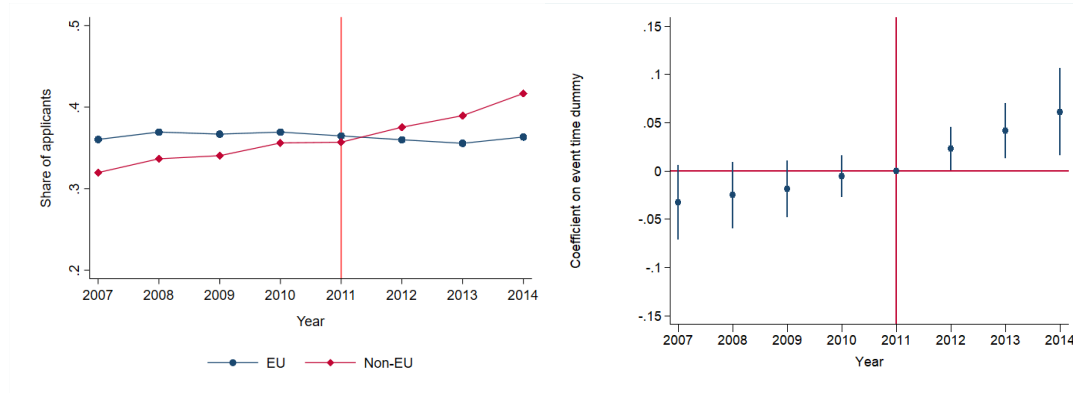
Notes: Figure 1 displays in Panel a) the share of EU-immigrants (circles) and non-EU immigrants (diamonds) who have ever applied for recognition out of all eligible immigrants, in each year from 2007 through 2014; Panel b) the event study plot for the interaction between EU/Non-EU origin and year. The vertical line indicates the year before the Recognition Act in 2012. Shares are computed as percentage of all eligible EU and non-EU immigrants who stayed in Germany in the respective year. The group of EU immigrants includes also ethnic Germans. These are immigrants with German origins that benefit from recognition procedures similar to EU immigrants.
Source: IAB-SOEP Migration Sample, waves 2013, 2014, 2015, 2016

closed application procedure and the share of those with a successful recognition out of all eligible immigrants develop remarkably similar to the application rates. Likewise, Appendix Table A.3 (Panel B and C) shows that the estimated reform effects on closed application probabilities as well as on successful recognitions are virtually identical to those obtained for application probabilities.[25] The almost identical effect sizes on applications and successful recognitions delivers evidence that the success rate, i.e. the share of successful applications in all applications, did not change post-reform. As additional evidence on the direct effect of the reform on immigrants' application behavior, we also show data from Google searches on recognition opportunities in Germany.[26] Appendix Figure A.5 clearly shows that the increase in Google searches for the word "Anerkennung in Deutschland" ("Certificate recognition in Germany") starts in proximity of the reform and keeps increasing thereafter.

The increased rate of applications, closed application procedures, and successful recognitions for non-EU immigrants in response to the reform constitutes an important first result for three reasons. First, it is the basis for our

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[25]Following our empirical strategy for the main outcomes, we also estimate the same regression models, but excluding immigrants who arrived in Germany post-reform. The results, reported in Columns 4,5 and 6 of Table A.3, are qualitatively similar to the baseline estimation.

[26]Google Trend data have been already shown to proxy well for individual behaviors in other contexts, such as job search (Baker and Fradkin, 2017), migration decisions (Böhme et al., 2020), and domestic violence (Anderberg et al., 2022).

further analysis on labor market outcomes. Without an effect on applications and successful recognitions, we would not expect the reform to affect labor market outcomes. Second, it shows that administrative hurdles and difficult access to information represent a barrier to applying for recognition and that a relatively simple and inexpensive legal change had a large impact on immigrants' behavior. Third, we find virtually no post-reform change in recognition rates for EU immigrants, supporting the use of the same empirical design to labor market outcomes. In the following sections, we investigate the effects of the higher recognition rate on labor market outcomes of non-EU immigrants.

## 5.2 Effects on Employment in Regulated Occupations

In this section we estimate Equation 1, using the probability of being employed in a regulated occupation as the dependent variable. As explained in Section 3, the sample for our main analysis includes only immigrants who appeared in the social security data at least six months pre-reform. The three graphs in Figure 2 display event study coefficients from the interaction between time and the nationality indicator. Graph 2a at the top shows the differences between non-EU and EU immigrants for the probability of working in any regulated occupation. Graph 2b, at the bottom left, plots this difference for the probability of working in regulated occupations that received the vast majority (more than 90 percent) of the applications for recognition. Graph 2c, at the bottom right, plots the difference between the two immigrant groups for regulated occupations that received a low number of recognition applications (fewer than 10 percent). In all graphs the difference is relative to one year pre-reform, with the vertical red line indicating the date.

Graph 2a clearly demonstrates a strong increase for non-EU immigrants working in regulated occupations post-reform, compared to EU immigrants. In the pre-reform period (left of the vertical line), the coefficients on the employment probability in regulated occupations did not differ significantly from zero in any quarter, validating the parallel trend assumption. In line with our expectations, Graphs 2c and 2b shows that the post-reform increase concentrates exclusively on regulated occupations with a high number of applications. Graph 2c shows no effect for regulated occupations with very few immigrants requesting recognition.[27]

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[27]In Appendix, Table A.4 reports the estimated coefficients using years instead of quarters around the reform.

Figure 2: Effects of the Recognition Act on Employment in Regulated Occupations, Event Study Plots

(a)

(b)

(c)
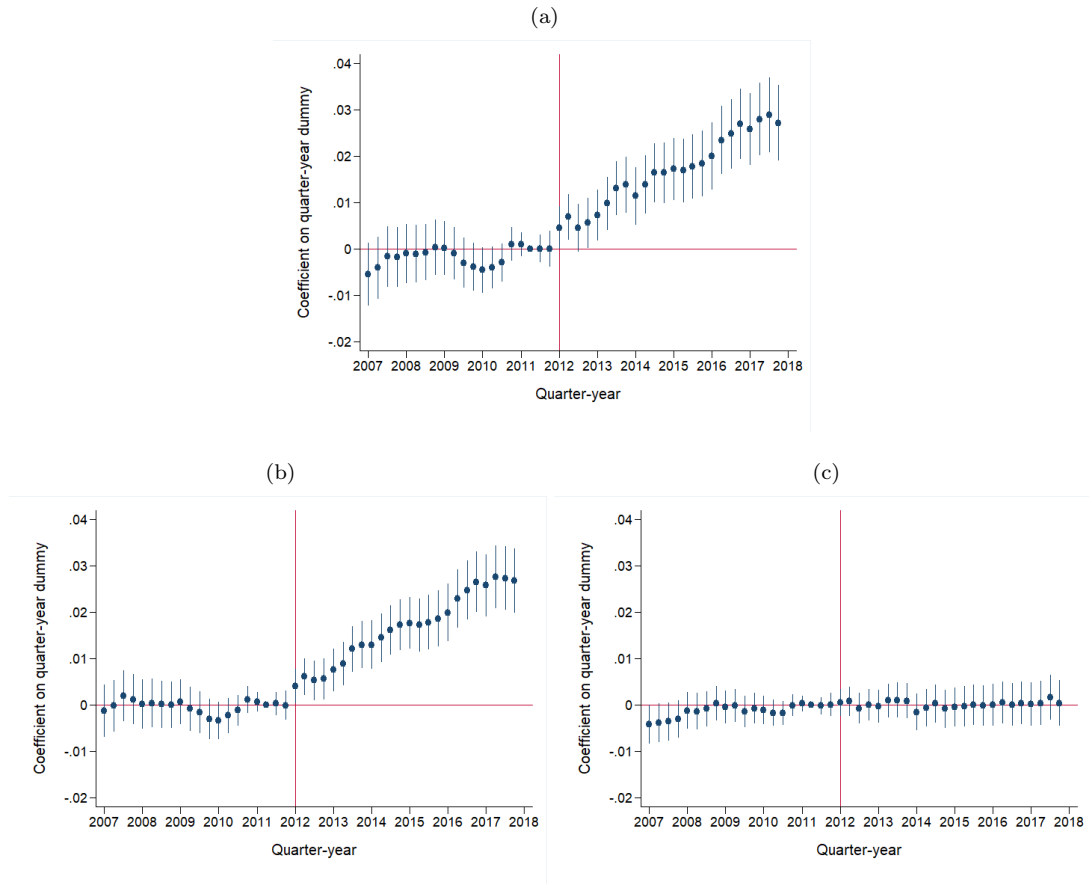
Notes: Figure 2 shows the estimated coefficients and the 95 percent confidence intervals for the following regression model: $y_{it} = \alpha + \gamma NonEU_i + \lambda Quarter_t + \beta(NonEU_i * Quarter_t) + \epsilon_{it}$. y_{it} is the probability of being employed in (a) any regulated occupation, (b) a regulated occupation with a high number of applications or (c) a regulated occupation with a low number of applications, compared to any other employment state. Coefficients are estimated for each quarter pre- and post reform. The baseline is March 2011. Each coefficient represents the difference between EU15 and non-EU immigrants in percentage points from the baseline difference in outcomes.
Source: Integrated Employment Biographies (IEB).

Table 3 reports, for different specifications, the estimated coefficients for the interaction between nationality and the reform dummies. Column 1 shows that the probability of working in any regulated occupation increases for non-EU immigrants by 1.8 percentage points. The point estimate barely changes when the estimation includes a large set of individual control variables and group fixed effects (Column 2). The size of the coefficient appears highly important, as employment in regulated occupations increases by 18.6 percent compared to the baseline share (9.27 percent) of non-EU immigrants employed in these occupations pre-reform.

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Table 3: Reform Effects on Employment in Regulated Occupations

	(1)	(2)	(3)	(4)	(5)	(6)
	All regulated		Regulated (many applicants)		Regulated (few applicants)	
Post*Non-EU	0.018***	0.017***	0.017***	0.015***	0.001	0.002
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
Baseline (Non-EU) in pp.	9.27	9.27	6.76	6.76	2.51	2.51
R-squared	0.006	0.056	0.002	0.052	0.002	0.028
Individuals	76,499	76,499	76,499	76,499	76,499	76499
Observations	1898060	1898060	1898060	1898060	1898060	1898060
Individual Controls	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
LLM FE	No	Yes	No	Yes	No	Yes

Notes: Table 3 reports estimated coefficients and standard errors from regression models that estimate the effect of the reform on employment outcomes. The outcome variable is the probability of being employed in any regulated occupation (Columns 1 and 2), in a regulated occupations with a high number of applications (Columns 3 and 4), or in a regulated occupation with a low number of applications (Columns 5 and 6), compared to any other state. Each individual is assigned the value 1 if employed in one occupation in the respective group, and 0 if in any other labor market condition. Individuals employed, but with invalid or missing information on the occupational code are excluded. The reported baseline is the average value of the dependent variable for the treated group (i.e. Non-EU immigrants) at t = 0 (2007-2010). Only immigrants who arrived in Germany pre-reform are included in the estimation. Controls include sex, age, age squared, age at entry, age at entry squared, time in the register (and its squared transformation), nationality, educational level, year fixed effects, and local labor market fixed effects. Standard errors are clustered at the individual level.
Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies.

Columns 3 to 6 show the effects for the probability of being employed in regulated occupations that received the most (Columns 3 and 4) or the fewest (Columns 5 and 6) applications. In line with the graphs, the estimated coefficients are large and statistically significant for regulated occupations with the most applications. Although the coefficient (1.7 pp) is smaller for occupations with the most applications than for all applications, it corresponds to a relative effect of 25.1 percent, which is larger than the overall effect in Columns 1 and 2. For regulated occupations with the fewest applications the estimated coefficients are close to zero and not statistically significant. Again, the inclusion of control variables barely changes the results.[28]

The size of the coefficients is highly important in absolute terms. Our 15 percent sample of all German immigrants includes 49,724 non-EU immigrants who entered Germany pre-reform, representing 331,493 non-EU immigrants for the entire German population. Of these non-EU immigrants in entire German population, 30,729 worked pre-reform in regulated occupations. The 18.6 percent increase means that, due to the reform 5,716 non-EU immigrants who worked in regulated occupation could not have done so without the reform.

In the previous section we showed, using survey data that the reform has

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[28]To capture the effect of immigrants entering employment in regulated occupations both from unemployment and from a different occupation, the main specification includes both employed and unemployed immigrants. In Appendix Table A.5 we show results when the sample includes only employees and only full-time employees. The results are statistically significant and only slightly smaller in magnitude.

an effect on the recognition rate of non-EU immigrants. As we do not directly observe recognition applications or outcomes in the administrative data, one might argue that the effect on employment could have also occurred without the increase in non-EU recognition rates – for example, if non-EU immigrants had obtained recognition of their certificates pre-reform but only started using them post-reform was implemented.

However, three of our findings provide evidence against this hypothesis. First, the effects on recognition and employment are comparable in magnitude. Second, these effects concentrate fully on occupations that received the majority of recognition applications. Third, by scaling the employment effects by the inverse of the recognition effect (1/0.048), we calculate back-of-the-envelope the average treatment effect of obtaining a recognized certificate on employment in regulated occupations. This effect amounts to 0.31, which is close in magnitude to the individual fixed-effects estimates in Brücker et al. (2021). Overall, these findings provide evidence that employment effects can be reconciled with the increase in recognized certificates.

5.2.1 Robustness Checks

In this section we test the robustness of our main results. As a first step we investigate the sensitivity of our results to various outcomes as an alternative to the binary variable — taking the value 1 if immigrants are employed in regulated occupations and the value 0 if they are either employed in other occupations or unemployed — in our preferred specification, as discussed in Section 3. We now use either the log number of immigrants in regulated occupations or the recognition index as outcome variable. The log number measures the total number of non-EU immigrants in regulated occupations, independently from the overall number of EU and non-EU immigrants in the administrative data. The regulation index is a continuous measure with more regulated occupations having a higher index value.[29] Table 4, Panel A, Columns 1 and 2 shows that we find a positive effect of the reform for non-EU immigrants for both alternative outcomes. In Appendix Table A.6, we additionally show that the results are robust to alternative sample definitions.

We now turn to robustness tests dealing with potential concerns of our identification strategy as outlined in Section 3. First, we test the possibility

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[29]We use the continuous index including zeros for non-regulated occupations. In Appendix Figure A.6 we show the coefficient plots for different definitions of the regulation index, excluding zeros and constructing a binary variable that takes the value 1 if the regulation index is above 0.

that selective in- and out-migration biases our results even after we restrict the sample to only EU15 and non-EU immigrants who arrived in Germany at least six months pre-reform.[30] In Table 4, Panel A, we restrict our baseline sample including only immigrants who had an observation in each quarter between 2007 and 2017 (Column 3) or between 2010 and 2017 (Column 4), so that over the specified period our estimation samples are balanced. The results show that selective in- and out-migration in the years around the reform do not change the effects of the reform on non-EU immigrants employment probabilities in regulated occupations. Additionally, in Appendix Figure A.7, we use the Microcensus to identify more precisely immigrants who entered Germany between 2007 and 2017 with a certificate acquired abroad.[31] For both EU and non-EU immigrants, the distribution of fields of study remains almost constant throughout the time window.

Second, we test the sensitivity of our results to the choice of EU immigrants with foreign education as control group. In Panel B of Table 4 we report the results from regression models where the outcome and the treated group (non-EU immigrants) are the same as in our baseline estimations, while the control groups are either Germans with vocational or university degrees (Column 1) or non-EU immigrants who completed vocational training or higher education in Germany (Column 3).[32] When we use alternative control groups, the effects of the reform for non-EU immigrants who acquired their education abroad are remarkably similar to those estimated with EU15 immigrants who acquired their education abroad as the control group. Furthermore, we show that the effects are virtually zero when we use EU15 immigrants as the treated and Germans as the controls (Column 2), or when using EU15 immigrants educated abroad as the treated and EU15 immigrants with a domestic education as the controls (Column 4). All results are robust to the inclusion of a large set of individual controls and group fixed effects. Overall, these results provide evidence that the choice of our control group does not drive our main results.

Third, we show that skill shortage in regulated occupations is not responsible for the effects in the baseline specification. We distinguish local labor markets by the size of the non-EU ethnic network and the extent of excess labor demand for regulated occupations in the pre-reform period.[33] We then run

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[30]The average length of stay in the register between 2007 and 2017 is 7 years for EU and 8 years for non-EU, allowing for the possibility that our sample might be subject to changes due to selective in- and out-migration

[31]We do not observe this information in the administrative data, as only the educational level is collected, not the field of study.

[32]This group is defined as non-EU immigrants who entered the register before they were 20 years old and with either vocational training or university as their highest educational level.

[33]As explained in detail in Appendix B, to quantify demand for specific occupations we acquire data by

separate regressions for the different groups of local labor markets. In Panel C of Table 4, we show that the estimated effects on the non-EU immigrants' probability of entering regulated occupations are similar across local labor markets with different pre-reform characteristics, ruling out the possibility that these characteristics drive our baseline results. Additionally, in Appendix Figure A.8 and Table A.8, we show that the reform effects are virtually zero for the probability of entering non-regulated, skill-intensive occupations that suffered from skill shortage in the years around the reform (part of the *Mangelberufe*).[34]

Finally, to exclude any potential unobservable confounder to the 2012 reform, we exploit the additional time variation coming from the staggered implementation of state recognition laws that apply to occupations regulated at the state level. The timing of state laws, summarized in Appendix Figure A.9, should be related to administrative and political processes rather than to local socio-economic conditions. Figure 3 displays the difference between EU and non-EU immigrants in the probability of being employed in occupations regulated at the state level in the four years around the implementation of state laws.

While in the pre-reform quarters the difference between EU and non-EU immigrants is close to zero, the employment probability for non-EU immigrants increases after the passage of the state recognition law. Appendix Table A.9 (Columns 5 and 6) reports the regression coefficients. The estimated increase is 0.7 percentage points, which corresponds to an increase of 29.0 percent relative to the pre-reform share of the non-EU working in occupations regulated at the state level (2.4 percent). These results provide additional evidence that (a) changes in the recognition legislation increase employment in regulated occupations and (b) health care occupations – which present the majority of regulated occupations at the federal level and which are subject to skill shortage – do not exclusively generate our baseline effects.

5.2.2 Heterogeneity of the Effects on Employment

After having shown that the effects of the reform on employment in regulated occupations are robust to several robustness checks, we now investigate how the

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occupational code, year, and district (*Kreis*) on job vacancies and the unemployed. We then construct the average unemployment-to-vacancy ratio at the local labor market level, averaging across the pre-reform years (2007-2010) and regulated occupations a high number of applications. We then assign each local labor market to either high or low pre-reform demand based on whether their unemployment-to-vacancy ratio before the reform was below or above the median value across all local labor markets.

[34]The *Mangelberufe* list is a list of occupations suffering from skill shortage, similar to the positive lists introduced in other European countries.

Table 4: Robustness Checks

	(1)	(2)	(3)	(4)
Panel A	Alternative outcomes		Balanced panels	
	Log employed	Regulation index	2007-2017	2010-2017
Post*Non-EU	0.210 ***	0.010 ***	0.019 ***	0.015 ***
	[0.046]	[0.002]	[0.003]	[0.002]
Baseline (Non-EU)		0.13	7.30	7.73
R-squared	0.64	0.13	0.06	0.06
Individuals		69070	20010	24490
Observations	8694	1509333	754053	683656
Panel B	Germans		Migrants with domestic education	
	Non-EU as treated	EU15 as treated	Non-EU	EU15
Post*Treated	0.014 ***	-0,002	0.014 ***	0.003 *
	[0.001]	[0.002]	[0.001]	[0.002]
Baseline (non-EU)	6.76	10.14	6.76	10.14
R-squared	0.032	0.031	0.042	0.039
Individuals	344126	312250	129139	68447
Observations	9933204	9224510	3571721	1832724
Panel C	Pre-reform demand		Pre-reform migrant network	
	<50th	>= 50th	<50th	>= 50th
Post*Non-EU	0.016 ***	0.013 ***	0.017 ***	0.012 ***
	[0.003]	[0.003]	[0.004]	[0.003]
Baseline (Non-EU)	6.72	6.79	6.53	6.96
R-squared	0.053	0.056	0.072	0.043
Individuals	43658	45145	41671	48264
Observations	933882	964178	849964	1048096
Individual Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes

Notes: Table 4 reports estimated coefficients for a series of robustness checks.

In **Panel A**, Column 1 uses the log of the total number of immigrants in regulated occupations with high numbers of applications as the outcome. Column 2 uses the regulation index (Vicari 2014) as an alternative outcome. Column 3 restricts the sample to a balanced panel of immigrants who remained in Germany throughout the period 2007-2017. Column 4 restricts the period to 2010-2017.

In **Panel B**, Columns 1 and 2, we use as an alternative control group Germans with the highest educational level achieved through either vocational training or university. The treated are either non-EU immigrants or EU15 immigrants defined as in the baseline regressions. In Column 3 we use non-EU immigrants with a domestic education. We proxy this group by including non-EU immigrants with the highest value of education (either vocational or university degree) and who entered the register before age 25. In Column 4 we report results from the same regression as in Column 3 but with only EU15 immigrants.

In **Panel C**, Columns 1 and 2, we run separate regressions for labor markets above and below the median value of pre-reform demand for regulated occupations. In Columns 3 and 4 we report the results of separate regressions for labor markets above or below the median value of the pre-reform immigrant network in regulated occupations. Controls include sex, age, age squared, age at entry, age at entry squared, time in the register (and its squared transformation), nationality and educational level, year fixed effects and local labor market fixed effects. In the regressions with alternative control groups, we exclude the control for age at entry, because the alternative control groups are likely to be in Germany before age 25. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies (IEB).

Figure 3: Effect of State Recognition Laws on Employment in State-Regulated Occupations, Event Study Plot
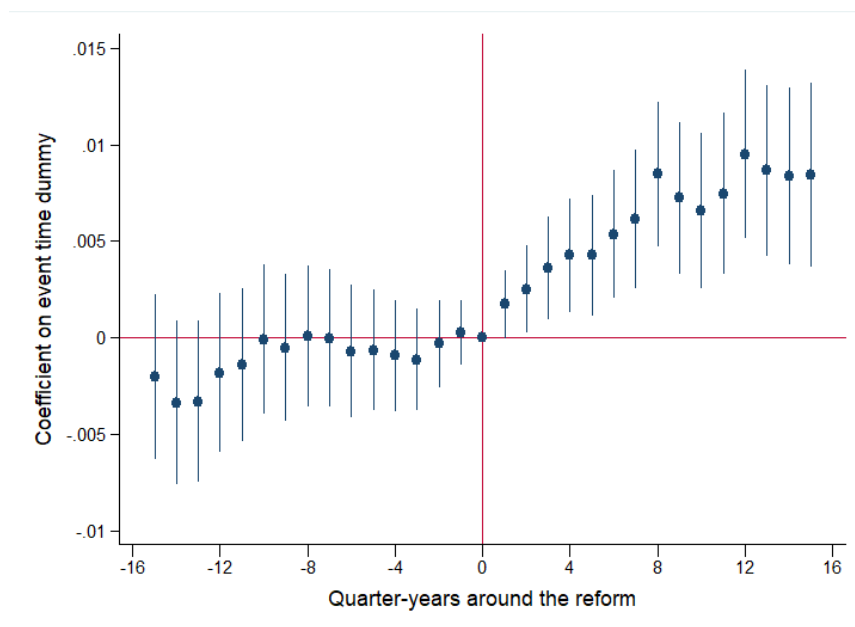
Notes: Figure 3 displays the coefficient from a regression model in which a time variable (-15,+15 quarters from the passing of the law) is interacted with the dummy for EU/Non-EU Origin. State and year fixed effects as well as individual controls are included. The first quarter after the law passed is taken as baseline. Bars identify 95 percent confidence intervals.
Source: Integrated Employment Biographies

effects on employment interact with immigrant socio-demographic characteristics. Figure 4 shows the coefficients estimated from Equation 1 on different subgroups of immigrants.[35] The reform has larger employment effects for female immigrants, immigrants who enter employment at a younger age, and immigrants with a university degree. The characteristics of regulated occupations, in which female workers are overrepresented (e.g. nurses and social workers) and for which a university degree is often required, may explain these heterogeneous effects.

5.3   Effects on Immigrants who Arrived after the Reform

We showed in section 5.1 that the reform increased application probabilities for the full sample of immigrants - including both immigrants who arrived pre- and post-reform. We now investigate whether the reform effect on the probability of being employed in regulated occupations also holds when we include immigrants who arrived post-reform in the employment analysis. This step is important to test whether changes in recognition laws affect not only the integration but also the selection of immigrants.

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[35]Appendix Table A.10 and Figure A.10 show regression coefficients and event study plots for the heterogeneous effects respectively.

Figure 4: Reform Effects on Employment by Socio-Demographic Group
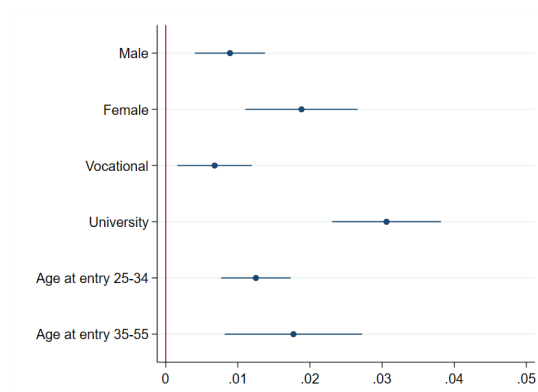
The inclusion of immigrants who arrived post-reform may bias the reform effects for two reasons. First, the reform was enacted in combination with other immigration policies that might have affected the selection of immigrants into Germany. In particular, the EU Blue Card in 2012 intended to facilitate the entrance of non-EU immigrants in specific jobs (e.g., health care and engineering), conditional on having a job contract and a salary above a certain threshold. Second, the 2015 refugee crisis might also have changed the composition of high-skilled non-EU immigrants residing in Germany. We examine the potential impact of both confounding factors in separate regressions, applying two different sample restrictions: (a) excluding immigrants from Syria, Iran, and Iraq, the largest refugee home countries, and (b) excluding Blue Card non-EU immigrants (and their EU15 counterparts).

Table 5, Columns 1-3, displays the coefficient from the same regressions as in Table 3 but including post-reform immigrants. Similarly to our main results, we find a positive effect on the probability of entering regulated occupations with the most applications. However, the effects are smaller than those obtained with the sample of immigrants arrived exclusively pre-reform, indicating that non-EU immigrants arriving in Germany post-reform benefited less than those already in Germany pre-reform. For occupations with the fewest applications, the effect is small and marginally significant even when including immigrants who arrived post-reform.

Table 5: Employment Effects on Immigrants Who Arrived Before and After the Reform

	(1)	(2)	(3)	(4)	(5)
		Full sample		No refugees	No Blue Card
	All regulated	Regulated (many applicants)	Regulated (few applicants)	Regulated (many applicants)	
Post*Non-EU	0.014***	0.011***	0.003*	0.016***	0.012***
	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
Baseline (Non-EU)	9.23	6.76	2.47	6.66	6.76
R-squared	0.061	0.051	0.041	0.053	0.044
Individuals	147065	147065	147065	132553	144964
Observations	2457801	2457801	2457801	2309219	2453714
Ind. Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes	Yes

Notes: Table 5 reports the estimated coefficients from regression models with the full sample of immigrants, including those arrived both pre- and post-reform. The outcome variable is the probability of being employed in regulated occupations (all and by number of applications) and is stated in the third row of each column. Columns 1, 2, and 3 include the full sample, which consists of all EU15 and Non-EU immigrants independently from whether they arrived before or after the Recognition Act. In Column 4, we exclude immigrants from Syria, Iraq and Iran who arrived after 2014. In Column 5, we exclude immigrants who entered the social security data after 2012, with the first employment spell in regulated occupations with a high number of applicants, and whose hourly wage exceeded 14.95 euros (as a proxy for being EU Blue Card holder). To make treated and controls comparable we exclude both EU15 and non-EU immigrants meeting these criteria. For all regressions sample selection, individual controls and group fixed effects are the same as in the baseline regressions. Standard errors are clustered at the individual level.
Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies

Excluding potential refugees (immigrants with Syrian, Iraq, or Iranian nationality) from the sample increases the effect on employment (Column 4), suggesting that this group has lower probabilities of employment in regulated occupations. Without refugees, the size of the reform effect is similar to that of the main results, indicating little post-reform selection except from refugees. Excluding non-EU immigrants who likely entered Germany through the EU Blue Card hardly changes the effect (Column 5). This finding confirms that the only selection mechanism post-reform goes through the large refugee inflow in 2015 and 2016.

6 Selection into Regulated Occupations

The previous section presented strong evidence that the reform increased the employment of non-EU immigrants in regulated occupations, all of which require recognition. Following the theoretical reasoning laid out in Section 2, in this section we first investigate whether the reform affected the actual or perceived quality of non-EU immigrants entering regulated occupations, and second whether equilibrium effects due to a higher number of recognitions may lower the value of recognized certificates. To do so, we first investigate

whether non-EU immigrants who entered regulated occupations post-reform are significantly different in their labor market characteristics from those who entered the same occupations pre-reform. We then investigate whether earnings differ between non-EU immigrants working in regulated occupations pre- and post-reform.

We start by showing graphically in Figure 5 the distribution of only non-EU immigrants along the earnings rank distribution (Figure 5a) and the regulation index (Figure 5b) pre-reform (dashed lines) and post-reform (solid lines).[36] The dark-grey lines in both panels show the density in occupations that non-EU immigrants held before moving to regulated occupations. The light-grey lines show the density in occupations for the same non-EU individuals after they moved to regulated occupations.

Figure 5 shows a very clear shift in the earnings and regulation distribution following transitions from non-regulated to regulated occupations. For example, non-EU immigrants move from cleaning jobs to working as nurses and doctors. This finding corroborates previous results showing positive employment and earnings effects after immigrants acquire recognition (Brücker et al., 2021). However, more important for our question, Figure 5 demonstrates that the earnings and regulation index distributions of non-EU immigrants pre- and post-reform are almost identical. This finding provides initial evidence against selection following the easier access to recognition, because non-EU immigrants move from the same low-paying occupations – which do not required recognition – to higher-paying regulated occupation pre- and post-reform.

6.1 Labor Market Outcomes Before Entering Regulated Occupations

We now use a regression framework to investigate more formally whether the reform created selection. We adopt the same DiD strategy using EU15 immigrants as the control group and estimate Equation 1 with employment status and employment characteristics (e.g., working hours, task, wage, degree of regulation) of the spell before the transition to a regulated occupation as the dependent variable. We include only those EU and non-EU immigrants who switched to a regulated occupation in our observation period.

Table 6, Column 1, shows that more non-EU immigrants switched from

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[36]We construct the earnings rank distribution by computing the average daily wage of Germans per occupation and ranking occupations by this value.

Figure 5: Occupational Distributions of Regulated Occupations and Pre-Transition occupations
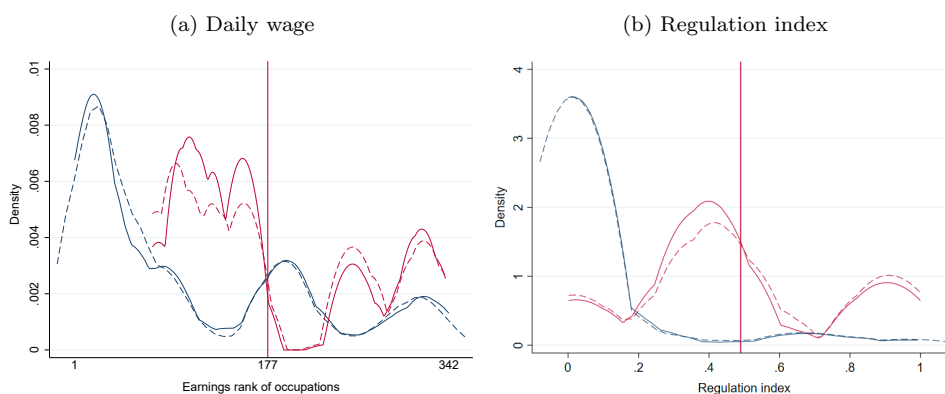
Notes: Figure 5 display the relative frequency of immigrants in different occupations by the earnings rank of an occupation based on natives' average daily wages (Panel a) and by the values of the regulation index (Panel b). We obtain the earnings rank of occupations by computing the deflated average daily wage of all Germans employed in each occupation during 2007-2017 and then rank occupations according to those wages. The ranking is plotted on the x-axis. The density distributions represent the relative frequency of immigrants in the different occupations. Red lines are the density distribution in regulated occupations with the most applications; blue lines are the density distributions in occupations non-EU immigrants held before moving to regulated occupations. Solid lines are constructed from transitions to regulated occupations occurring post-reform; dashed lines, from those pre-reform.
Source: Integrated Employment Biographies

employment to a regulated occupation post-reform than before. This finding indicates that immigrants with strong labor market attachment benefit more from the reform than those with lower attachment. The characteristics of the last employment spell before transition (Columns 2-5) reveal only a small and marginally significant effect on the probability of having a part-time employment in the last spell before moving to a regulated occupation, while we find no effect on the probability of having a manual task, on the degree of regulation, or on the full-time wages (confirming the results in Figure 5). These findings indicate that while the reform led to an increase of non-EU immigrants entering regulated occupations, it did not change the quality of non-EU immigrants, as approximated by the characteristics of the job they held before they moved to regulated occupations.

6.2 Earnings in Regulated Occupations before and after the Reform

Figure 5 suggested that non-EU immigrants switching to regulated occupations increased their wage. However, non-EU immigrants post-reform, relative to EU immigrants, may earn less in regulated occupations than pre-reform. A lower wage could occur if employers believe that post-reform recognized certification is of lower quality, if the quality of recognized certification is de facto lower, or

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Table 6: Characteristics of the Last Employment Spell Before Transition to Regulated Occupations with High Number of Applicants

|	(1)	(2)	(3)	(4)	(5)
	Employed	Part-time	Regulation index	Main task: manual	Full-time wage
Post*Non-EU	0.059 ***	-0.020*	-0.004	0.017	-0.006
	[0.012]	[0.012]	[0.008]	[0.010]	[0.018]
Baseline (Non-EU)	0.65	0.45	0.06	0.70	6.59
R-squared	0.10	0.18	0.24	0.33	0.049
Individuals	24524	24524	24524	24524	16753
Observations	33039	33039	33039	33039	22470
Individual Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes

Notes: Table 6 reports the coefficient for regression models based on Equation 1 in which the outcomes are different characteristics of the last employment spell before moving to a regulated occupation with a high number of applications. Transitions *within* these regulated occupations ware excluded. In column 1 the dependent variable is the probability of being employed in the spell before moving to a regulated occupation with a high number of applications. In columns 2-5, the dependent variables are constructed using the characteristics of the previous employment spell (including if the individual is unemployed at t-1). Column 2 shows the probability that the previous employment spell was part- or full-time. Column 3 presents the regulation index of the occupation before moving to a regulated occupation. In Column 4 the outcome is the probability that the previous main occupational task was manual (routine or non-routine) compared to non-manual. Column 5 shows the previous full-time log hourly wage. The number of observations is lower in this case because only previous spells in full-time employment with valid wage information are included. Baseline is the average pre-reform information for non-EU immigrants. Controls include sex, age, age squared, age at entry, age at entry squared, years in the register (and its squared transformation), nationality, educational level, year fixed effects, local labor market fixed effects, and dummies for all combinations of origin-destination occupations. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies

if he higher supply of immigrants with recognized certificates lead to a lower equilibrium wage.

To deal with this concern, we use the DiD strategy in Equation 1 to examine the wage difference between EU and non-EU immigrants within regulated occupations. If the wage difference between EU and non-EU immigrants does not change in the post-reform period, then it is likely that the wage premium for non-EU immigrants working in a regulated occupation has also remained unchanged.

Figure 6 shows the difference between EU15 and non-EU immigrants in log hourly wage from full-time employment in regulated occupations. Reported coefficients are relative to the difference in 2010. The figure clearly shows no negative effect of the reform in the years after 2012. Indeed, the reform led to a slight increase in wages for non-EU immigrants.

Figure 6: Effects of the Recognition Act on Earnings in Regulated Occupations, Event Study Plot
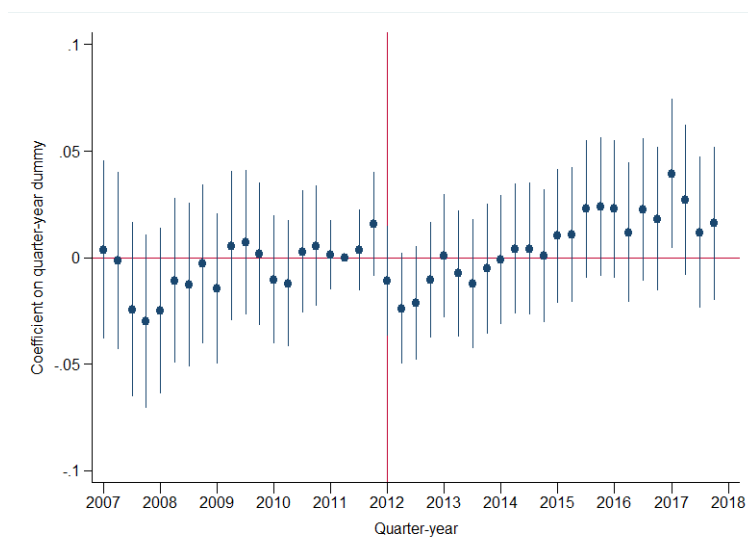
Notes: Figure 6 displays the estimated coefficients and the 95 percent confidence intervals for a regression model of Equation 1, where the outcome is the log hourly wage of full-time employees in regulated occupations. Only full-time employees are included. The regression includes three-digit occupation fixed effects. Coefficients are estimated for each quarter pre- and post-reform. The baseline is March 2011 (one year pre-reform). Each coefficient represents the difference in percentage points from the baseline difference in outcomes between EU15 and Non-EU.
Source: Integrated Employment Biographies (IEB).

Table 7 shows the regression estimation results for the analysis shown in Figure 6, both for the main control group (Column 1) and for the two alternative control groups used in Section 5.2 (Columns 2 and 3). To control for immigrants' possibly sorting into different occupations in the post-reform period, we include three-digit occupation fixed effects. In the post-reform period non-EU immigrants employed full-time in regulated occupations experience a 2 percent increase in hourly wages relative to EU15 immigrants. The estimated coefficients using Germans and non-EU immigrants trained in Germany as alternative control groups are close in magnitude to the baseline coefficient and statistically significant. Column 4 shows the results using EU15 immigrants as the treated and Germans as the control, with the effect of the reform close to zero and not statistically significant.

Taken together, the results in this section show that for earnings in regulated occupations the reform appears to have had no negative effects. Indeed, non-EU immigrant wages in regulated occupations slightly grew. Thus we argue that up to five years post-reform, neither non-EU immigrants with lower quality selected into regulated occupations, nor that the employers valued the certificates less, or that the higher supply of immigrants with recognized certificates lead to a

Table 7: Effects of the Recognition Act on Earnings in Regulated Occupations

	(1)	(2)	(3)	(4)
	EU15	Non-EU with domestic education	Germans	Germans
		Non-EU as treated		EU15 as treated
Post*Non-EU	0.019 *	0.024 **	0.021 **	
	[0.011]	[0.009]	[0.008]	
Post*EU15				0.009
				[0.008]
Baseline (Non-EU)	10.71	10.71	10.71	15.71
R-squared	0.57	0.46	0.42	0.42
Individuals	6902	10980	39828	38261
Observations	111643	160705	702385	678346
Indivdual controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes

Notes: Table 7 reports the estimated coefficients for different regression models based on Equation 1, where the outcome variable is log hourly wage from full-time employment. Only full-time employees are included. The first row indicates the control group used, the second row indicates the treated group. Individual controls include sex, age, age squared, years in the register, years in the register squared, age at entry, age at entry squared, nationality, and educational level. Year fixed effects, local labor market fixed effects, and occupation fixed effects are included. Each occupation dummy corresponds to one regulated occupation with the most applicants, defined by the 3-digit kldb1988 classification. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies

lower equilibrium wage.

7 Effects on Employment in Non-Regulated Occupations

This section extends our main analyzes by investigating the reform effects on non-EU immigrants' employment in non-regulated occupations. Although entering these occupations does not require recognition, certification may contain valuable information on productivity. It may be an important device for employers to dissolve information asymmetries in the presence of foreign professional degrees and thus facilitate access to employment

For non-regulated occupations the identification of reform effects is not as straightforward as for regulated occupations, because recognition is not mandatory to work in these occupations. Therefore, an increase in immigrants' employment in non-regulated occupations is not necessarily linked to more recognized foreign certificates. Nevertheless, we apply the same identification

strategy, since an employment increase of non-EU immigrants in comparison to EU immigrants in non-regulated occupations post-reform would be the result of the reform. This result would provide important insights into the overall effect of the recognition reform although we cannot directly link it to an increase in recognized certificates.

Column 1 and 2 of Table 8, which include results for all eligible non-regulated occupations, show that for non-EU immigrants the employment probability in a non-regulated occupation increases post-reform by 3 percentage points compared to EU immigrants – an increase of 6.8 percent. The next two columns differentiate between non-regulated occupations with a high/low number of applicants for recognition, where occupations with low application numbers serve as placebo. If we observe an employment increase in these occupations, our estimates are likely to pick up a general trend in employment of non-EU immigrants, not a reform effect. For the non-regulated occupations with the most applications (Columns 3 and 4), the effect is also 3 percentage points, which corresponds to a much higher increase (14.8 percent) than for the entire sample. In contrast, the changes are almost zero in the estimations for occupations with the fewest applications confirming that the employment increase results from increased recognition.

The finding that the reform also had an effect on non-regulated occupations indicates that non-EU immigrants indeed used the easier recognition procedure not only for mandatory certification but also for increasing transparency about quality and thus easier access to employment. Likewise, as the recognition reform even affected employment in occupations for which recognition is not legally required, employers appear to value higher transparency. One explanation may be that recognition dissolves information asymmetries for certifications in a foreign language or in case the employer is uncertain on whether to trust its quality. Alternatively, the successful recognition of home-country certification may motivate non-EU immigrants to apply for a non-regulated occupation for which they are qualified. Unfortunately, disentangling these two channels is not possible with our data.

8 Discussion and Conclusion

Immigrants perform worse in the labor market than natives, likely because of the low transferability of home-country professional certificates. The standardized

Table 8: Effects of the Recognition Act on Employment in Non-regulated Occupations Eligible for Recognition

	(1)	(2)	(3)	(4)	(5)	(6)
	All non-regulated		Non-regulated (many applicants)		Non-regulated (few applicants)	
Post*Non-EU	0.030***	0.031***	0.031***	0.033***	-0.001	-0.002
	[0.005]	[0.005]	[0.004]	[0.004]	[0.004]	[0.004]
Baseline (Non-EU)	43.91	43.91	20.85	20.85	23.1	23.1
R-squared	0.008	0.057	0.004	0.049	0.002	0.057
Individuals	51237	51237	51237	51237	51237	51237
Observations	1174472	1174472	1174472	1174472	1174472	1174472
Individual Controls	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
LLM FE	No	Yes	No	Yes	No	Yes

Notes: Table 8 reports the estimated coefficients for regressions of Equation 1, using as outcome variable the probability of being employed in any non-regulated occupation (Columns 1 and 2), in non-regulated with high numbers of applications (Columns 3 and 4), or in non-regulated occupations with low numbers of applications (Columns 5 and 6), as compared to being in any other state. Non-regulated occupations are vocational (*Ausbildungsberufe*). Each individual is assigned the value 1 if employed in an occupation in the respective group, and zero if in any other labor market condition. Employed individuals with invalid or missing values on the occupational code are excluded. The reported baseline is the average value of the dependent variable for the treated group (non-EU immigrants) at t = 0 (2007-2010). Only immigrants who were in Germany pre-reform are included. The sample is further restricted to individuals age 23-55 (to take into account the earlier acquisition of vocational training certificates) and only with an education level equal to vocational certification. Controls include sex, age, age squared, age at entry, age at entry squared, years in the register (and its squared transformation), nationality, educational level, year fixed effects, and local labor market fixed effects. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies.

recognition of professional certificates in the host country represents one policy for increasing their transferability. This paper investigates the effects of a large recognition reform in Germany on the labor market outcomes of non-EU immigrants. We find that the reform was highly effective. It increased both the recognition applications of non-EU immigrants and their employment in regulated occupations, all of which require recognition. The reform also increased employment in the non-regulated occupations with the most recognition applications. These results are stable up to five years post-reform.

As the non-EU immigrants moved from low-wage and non-regulated occupations to higher-paid and regulated occupations, they could also improve their earnings. Furthermore, despite the larger inflow of non-EU immigrants into these occupations, the average wages for non-EU immigrants did not decrease post-reform.

Our results are highly valuable for policy makers worldwide, as many countries are considering facilitating access to recognition as a way to promote the integration of immigrants. Opponents of easing immigrants' access to recognition

often argue that the quality in regulated occupations, for example the quality of health services, may decrease if more and possibly lower skilled immigrants obtain access to recognition. However, our findings show that, as long as the recognition standards remain the same, an increase in the number of recognized certificates does not necessarily lead to lower quality. If the quality of recognized certification had declined post-reform, we would expect employers to have observed this decline and downward adjusted their labor demand for non-EU immigrants. Had this been the case, the reform effects on employment and wages would not have lasted for five years and across regions with different labor demand.

Our empirical strategy does not allow us to investigate in depth how the reform affected the employment and wages of German natives. However, as the percentage of natives who work in regulated occupations and their wages were similar pre- and post-reform, it gives a first indication that the reform did not harm their employment outcomes. The positive reform effects on employment of non-EU immigrants are mainly in health sector occupations (a booming sector in Germany), thereby possibly explaining why natives did not lose employment or earnings. Yet we also find effects of the reform in regions where the demand for health sector jobs is lower and for occupations outside the health care sector. Thus we argue that a recognition reform is effective not only in settings where demand for employment in regulated occupations is high. Moreover, even if the reform is effective only if the demand is high, the reform will raise overall welfare by increasing the supply of scarce human capital.

Taken together, our results point to the importance of removing formal barriers to the transferability of foreign-acquired human capital. Improving recognition procedures in terms of both the administrative burden and access to information may be a cost-efficient policy for integrating immigrants into their host country's labor market.

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A Additional Figures and Tables

A.1 Figures

Figure A.1: Example of the Available Information on the Website "Recognition in Germany"

Notes: Figure A.1 is a screenshot of the webpage www.anerkennung-in-deutschland.de that results from the search of nursing jobs in Berlin. The webpage provides information on the type of certificate required and on the recognition procedure to follow. Source: website www.anerkennung-in-deutschland.de

Figure A.2: Total Number of Applications by Type of Occupation for which Recognition is Requested
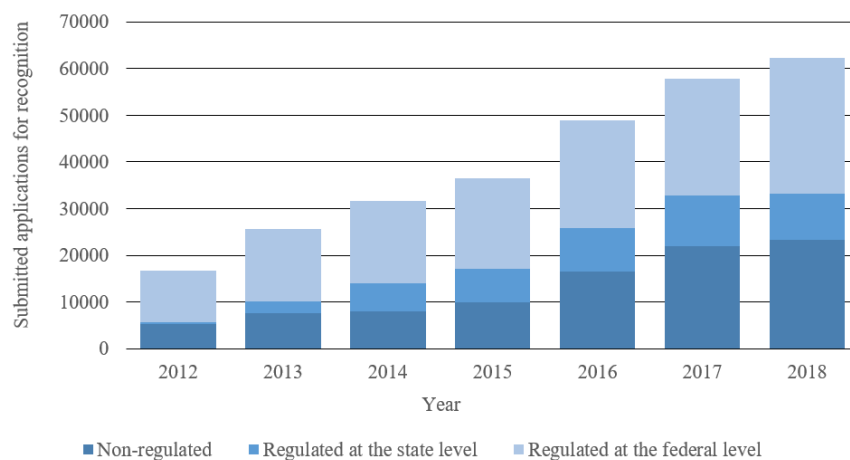
Notes: The figure shows the total number of applications by year and type of occupation for which recognition is requested. Occupations can be regulated at the federal or state level or non-regulated. Non-regulated jobs for which recognition is possible include all vocational occupations (*Ausbildungsberufe*). Data on applications and recognition outcomes is not available before 2012.
Source: BIBB, Official statistics on the Federal Recognition Act.

Figure A.3: Effect of the Recognition Act on Closed Application Procedures, Shares and Event Study Plot

Figure A.3 displays in Panel a) the share of completed applications for EU (circles) and non-EU immigrants (diamonds) out of all eligible immigrants, in each year from 2007 through 2014, Panel b) the event study plot for the interaction between EU/Non-EU origin and year. Completed applic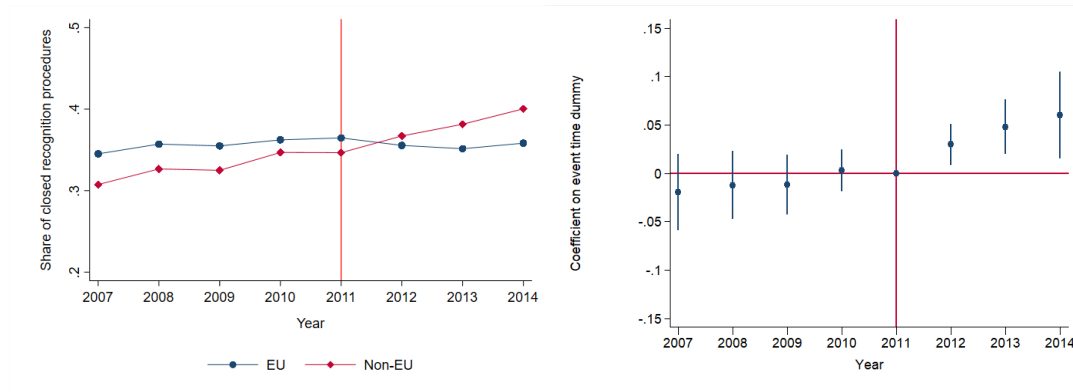ations are applications with a finalized application process, with either approval of the application (full or partial recognition) or rejection (recognition denied). The vertical line indicates the year before the Recognition Act in 2012. Shares are computed as percentage of all eligible EU and non-EU immigrants who stayed in Germany in the respective year. The group of EU immigrants includes also ethnic Germans. These are immigrants with German origins that benefit from recognition procedures similar to EU immigrants.
Source: IAB-SOEP Migration Sample, waves 2013, 2014, 2015, 2016

Figure A.4: Effect of the Recognition Act on Successful Application Procedures, Shares and Event Study Plot
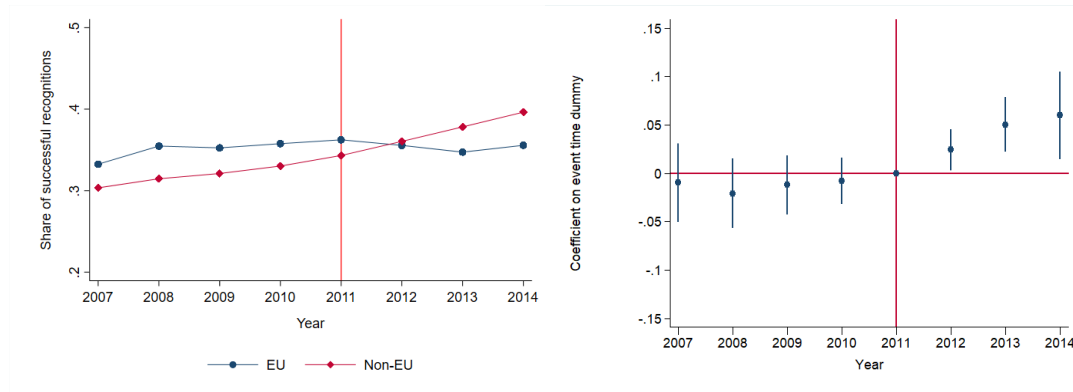
Figure A.4 displays in Panel a) the share of completed applications for EU (circles) and non-EU immigrants (diamonds) out of all eligible immigrants, in each year from 2007 through 2014, Panel b) the event study plot for the interaction between EU/Non-EU immigrant group and year. Successful recognitions are applications that received an approval (full or partial recognition). The vertical line indicates the year before the Recognition Act in 2012. Shares are computed as percentage of all eligible EU and non-EU immigrants who stayed in Germany in the respective year. The group of EU immigrants includes also ethnic Germans. These are immigrants with German origins that benefit from recognition procedures similar to EU immigrants.
Source: IAB-SOEP Migration Sample, waves 2013,2014,2015,2016

Figure A.5: Google Searches About Recognition of Foreign Certificates in Germany
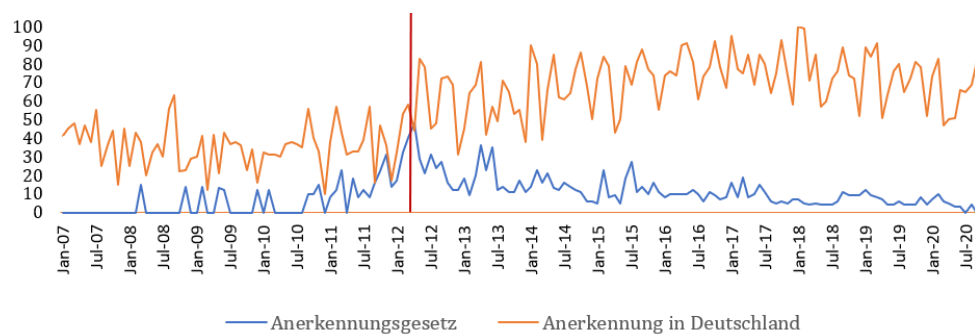
Notes: Figure A.5 displays the amount of google searches for recognition in Germany (*Anerkennung in Deutschland*) and Federal Recognition Act (*Anerkennungsgesetz*) between 2007 and 2020. Data are restricted to searches made in Germany. Searches are normalized to 100 in the peak period. The red vertical line indicates the day in which the Federal Recognition Act came into force (April 1st 2012).
Source: Google Trends (searched on 13.11.2020).

Figure A.6: Event Study Plots for Alternative Definitions of the Regulation Index as Outcome

(a) Regulation index (continuous)

(b) Regulation index (continuous, without 0s)

(c) Regulation index (binary)
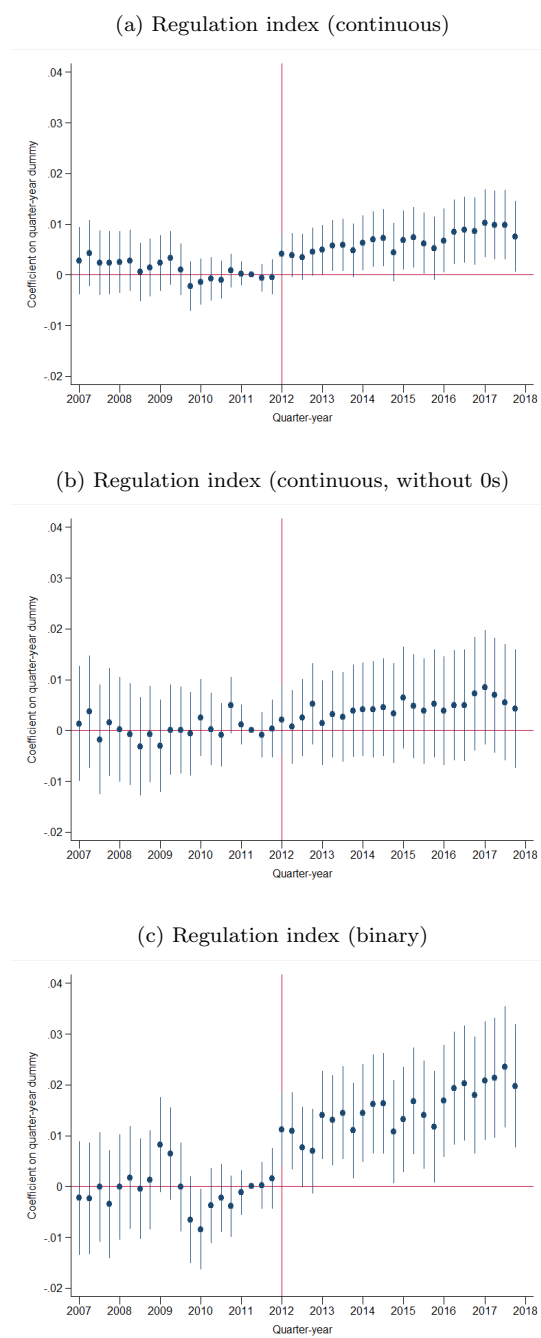
Notes: Figure A.6 shows the estimated coefficients and the 95 percent confidence intervals for regression models where quarters of year are interacted with the nationality dummy. The outcomes are the continuous regulation index measure (Panel a), the continuous regulation index without zeros (Panel b), a dummy variable that takes value 1 if the regulation index is higher than 0, and 0 otherwise (Panel c). Coefficients are estimated for each quarter pre- and post reform. The baseline is March 2011. Each coefficient represents the difference between EU15 and non-EU immigrants in percentage points from the baseline difference in outcomes. Source: Integrated Employment Biographies.

Figure A.7: Evolution of Field of Study for Non-EU and EU Immigrants

(a) Non-EU immigrants

(b) EU15 immigrants
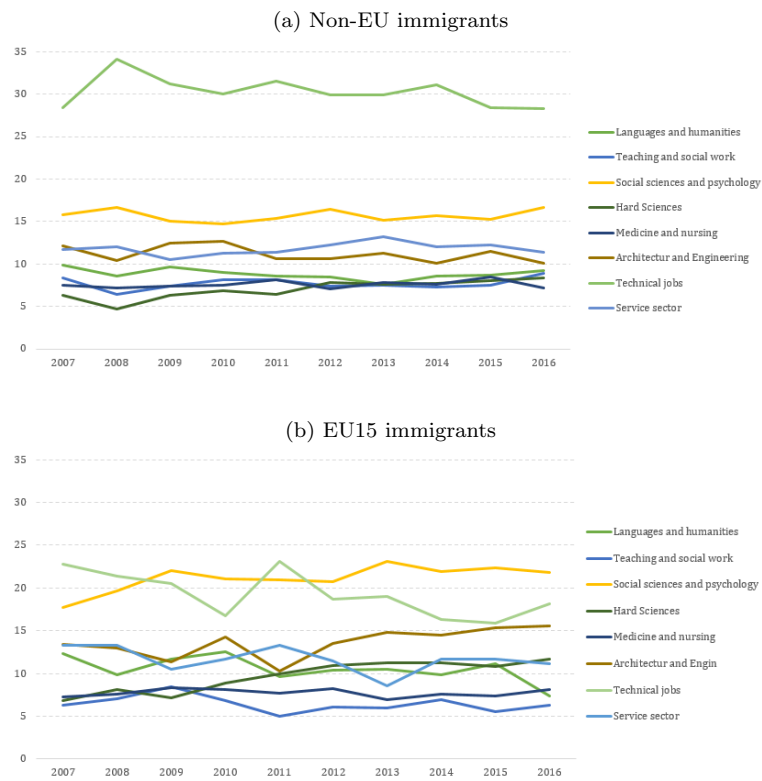
Notes: Figure A.7 displays the distribution of fields of study between 2007 and 2016 for non-EU (Panel a) and EU15 (Panel b). Data come from the German Microcensus and the sample is the same as in Table 2. Technical jobs are jobs in architecture and engineer for immigrants with highest education VET (these are technician certifications for example).
Source: German Microcensus, 2007-2016.

Figure A.8: Effect of the Recognition Act on Employment in Non-Regulated *Mangelberufe*
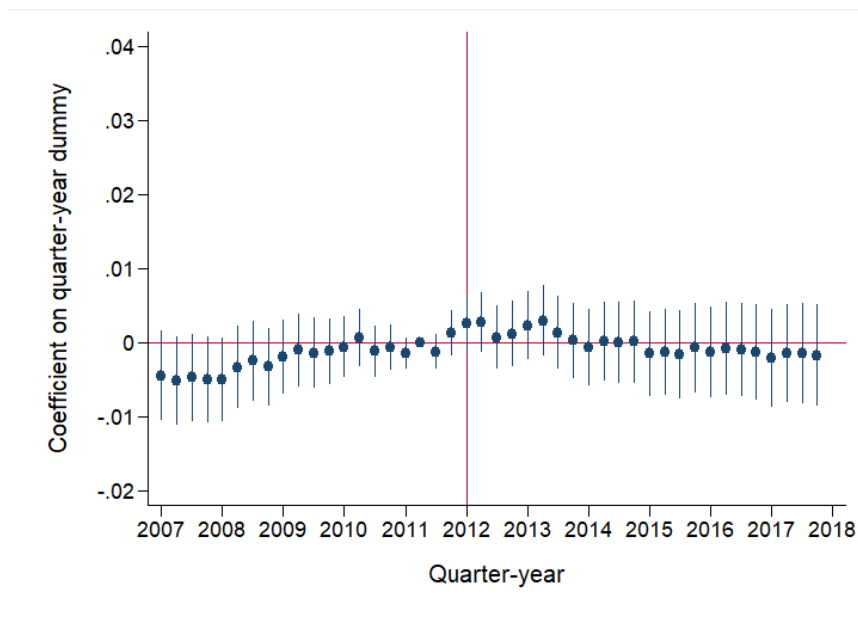
Notes: Figure A.8 shows the estimated coefficients and the 95 percent confidence intervals for regression models where quarters of year are interacted with the nationality dummy. The outcome variable is the probability of being employed in non-regulated occupations with skill shortage and ineligible for recognition (*Mangelberufe*). Coefficients are estimated for each quarter pre- and post reform. The baseline is March 2011. Each coefficient represents the difference between EU15 and non-EU immigrants in percentage points from the baseline difference in outcomes.
Source: Integrated Employment Biographies.

Figure A.9: Timing of the Introduction of Recognition Laws Across Federal States
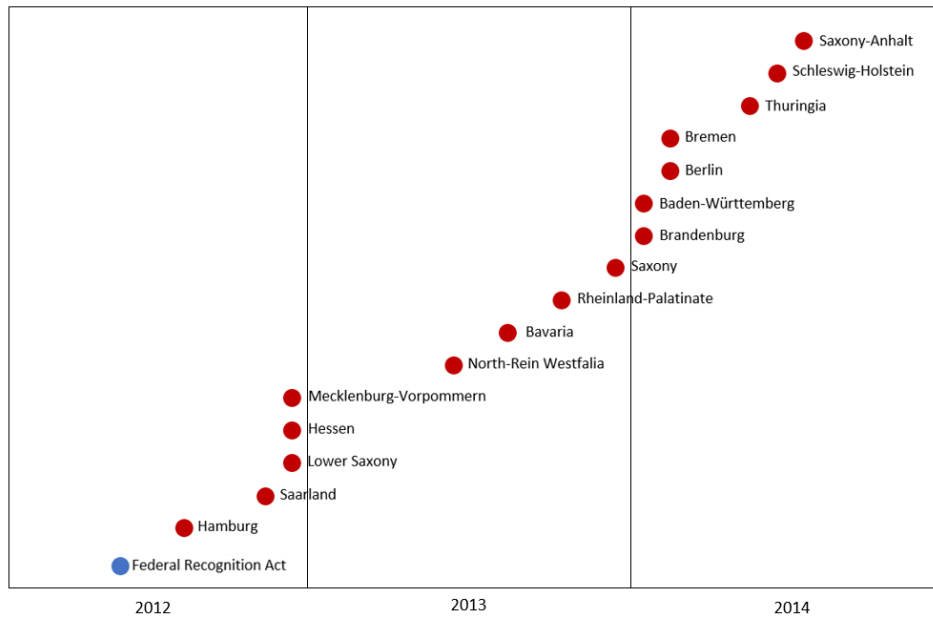
Notes: Figure A.9 displays the timing of state recognition laws fro 2012 to 2014. The blue dot is the Federal Recognition Act (nation-wide recognition law). Source: Own graphical representation from BIBB data (2015)

Figure A.10: Event Study Plots for Heterogeneous Effects Across Individual Characteristics

(a) Female

(b) Male

(c) Vocational education

(d) University education

(e) Age at entry 25-34

(f) Age at entry 35-55
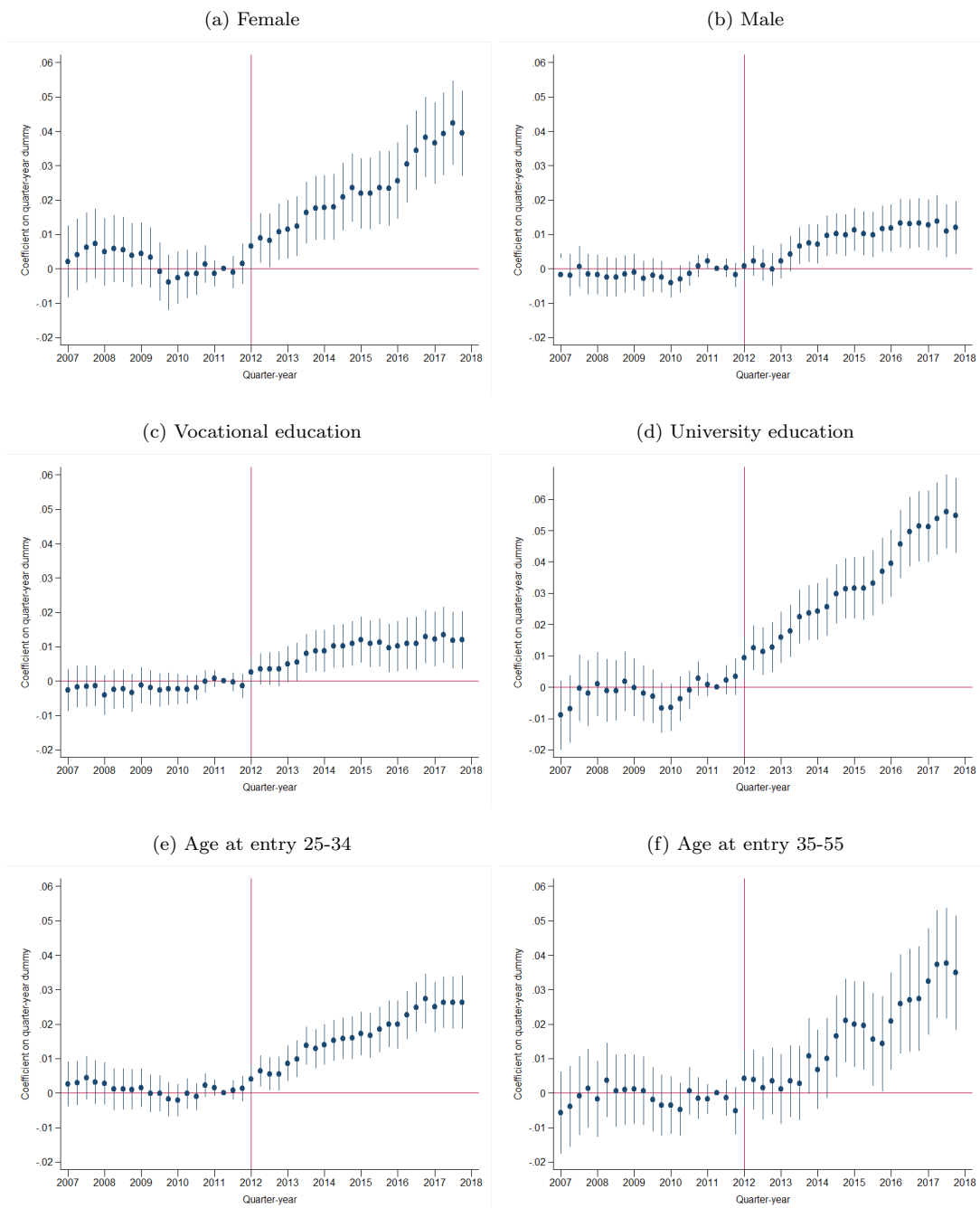
Notes: Figure A.10 shows the estimated coefficients and the 95 percent confidence intervals for regression models where quarters of year are interacted with the nationality dummy, and only subgroups of immigrants are included. The subgroup is stated on top of each plot. In all plots the outcome variable is the probability of being employed in regulated occupations with many applications. are the continuous regulation index measure (Panel a), the continuous regulation index without zeros (Panel b), a dummy variable that takes value 1 if the regulation index is higher than 0, and 0 otherwise (Panel c). Coefficients are estimated for each quarter pre- and post reform. The baseline is March 2011. Each coefficient represents the difference between EU15 and non-EU immigrants in percentage points from the baseline difference in outcomes.
Source: Integrated Employment Biographies.

A.2 Tables

Table A.1: Why do Immigrants not Apply for Recognition?

	(1)	(2)	(3)	(4)
	All immigrants		Arrived pre-reform	
	EU15	Non-EU	EU15	Non-EU
	in %		in %	
Administrative constraints	13.68	23.94	14.57	23.48
No perspective of recognition	14.74	19.69	14.57	20.00
Not important	38.42	32.43	35.76	33.48
Other reasons	33.16	23.94	35.1	23.04
Observations	190	259	151	230

Notes: Table A.1 reports the percentage of immigrants who would have been eligible for recognition but did not apply according to the reasons for no application aggregated in four groups: administrative constraints, no perspective of recognition, not important or other reasons. Responses come from a question included in all waves of the IAB-SOEP Migration Survey on the reasons why immigrants did not apply for recognition of their vocational or university certificate acquired abroad. In the first two columns all EU/ethnic Germans and non-EU immigrants for which the information is available are included. In the last two columns only EU15 and non-EU immigrants who entered Germany pre-reform are included. Source: IAB-SOEP Migration Sample, waves 2013,2014,2015,2016.

Table A.2: Socio-Demographic Characteristics of Immigrants in the IEB-SOEP Migration Sample

	(1) EU15/ethnic Germans	(2) Non-EU
Female	0.53	0.54
Age	46.73	42.18
Age at arrival	33.89	30.63
Higher education	0.33	0.40
Northern and Continental Europe	0.06	
Southern Europe	0.20	
Eastern Europe and Russia	0.43	0.41
Balkans and Turkey	0.01	0.25
Middle East	0.30	0.20
Africa		0.05
Asia		0.05
North America		0.01
South and Central America		0.02
Oceania and others		0.01
Observations	3394	4331

Notes: Table A.2 reports characteristics of the sample used for the analysis of the effect of the reform on recognition. The sample includes only EU and non-EU immigrants that are eligible for recognition (i.e. they acquired the certificate abroad and the certificate may be recognized according to the criteria explained in Section 2. Ethnic Germans are also included in the control group. For this reason EU's regions of origin include Eastern Europe, Balkans and Middle East.

Table A.3: Effects of the Federal Recognition Act on the Probability of Applying for Recognition

	(1)	(2)	(3)	(4)	(5)	(6)
	All immigrants			Arrived pre-reform		

Panel A: Any Application

	(1)	(2)	(3)	(4)	(5)	(6)
Post* Non-EU	0.056***	0.051***	0.048***	0.047***	0.049***	0.047***
	[0.02]	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]
Baseline (Non-EU)	33.87	33.87	33.87	33.87	33.87	33.87
R-squared	0.001	0.21	0.22	0.001	0.21	0.22

Panel B: Closed applications

	(1)	(2)	(3)	(4)	(5)	(6)
Post*Non-EU	0.053***	0.048***	0.046***	0.043***	0.046***	0.044***
	[0.01]	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]
Baseline (Non-EU)	32.70	32.70	32.70	32.70	32.70	32.70
R-squared	0.001	0.20	0.22	0.001	0.20	0.22

Panel C: Successful applications

	(1)	(2)	(3)	(4)	(5)	(6)
Post* Non-EU	0.054***	0.049***	0.046***	0.046***	0.048***	0.047***
	[0.02]	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]
Baseline (Non-EU)	31.77	31.77	31.77	31.77	31.77	31.77
R-squared	0.002	0.21	0.23	0.003	0.21	0.22
Individuals	1156	1156	1156	1040	1040	1040
Observations	7725	7725	7725	7451	7451	7451
Individual controls	No	Yes	Yes	No	Yes	Yes
Year FE	No	No	Yes	No	No	Yes
State FE	No	No	Yes	No	No	Yes

Notes: Table A.3 reports coefficients from our main regression model using as outcome the probability of applying for recognition (Panel A), the probability of completing a recognition procedure (Panel B), and the probability of successfully recognizing a certificate (full or partial recognition). Columns 1,2 and 3 report results for the full sample of immigrants, columns 4,5 and 6 for the subset of immigrants who arrived in Germany in the pre-reform period. Individual controls include sex, age, migration cohort, region of origin and a binary indicator for having acquired higher education (as compared to vocational training) abroad. Year and state (*Land*) fixed effects are included. For each individual only observations within 20 years from migration are included. Ethnic Germans are included in the control group. Robust standard errors. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: IAB-SOEP Migration Sample, waves 2013,2014,2015,2016.

Table A.4: Event Study for the Effect of the Reform on Employment in Regulated Occupations

	(1)	(2)	(3)	(4)	(5)	(6)
	All eligible regulated occupations		Regulated occupations (high number of applicants)		Regulated occupations (low number of applicants)	
t = -5	-0.003	-0.004	0.000	0.002	-0.004	-0.005
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]
t = -4	-0.001	-0.000	0.000	0.002	-0.001	-0.001
	[0.003]	[0.003]	[0.002]	[0.003]	[0.002]	[0.002]
t = -3	-0.002	-0.001	0.001	0.000	0.001	0.001
	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
t = -2	0.003	-0.002	-0.002	-0.001	-0.001	-0.001
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
t = 0	0.005 ***	0.005 ***	0.005 ***	0.005 ***	0.000	0.001
	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]
t = +1	0.011 ***	0.011 ***	0.010 ***	0.010 ***	0.001	0.000
	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
t = +2	0.015 ***	0.015 ***	0.015 ***	0.015 ***	-0.001	0.001
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
t = +3	0.018 ***	0.017 ***	0.018 ***	0.017 ***	-0.000	0.001
	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]
t = +4	0.024 ***	0.023 ***	0.023 ***	0.022 ***	-0.000	0.001
	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]	[0.002]
t = +5	0.028 ***	0.026 ***	0.027 ***	0.025 ***	-0.001	0.002
	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]	[0.002]
Baseline (Non-EU)	9.27	9.27	6.76	6.76	2.51	2.51
R-squared	0,006	0,056	0,002	0,052	0,002	0,028
Individuals	76499	76499	76499	76499	76499	76499
Observations	1898060	1898060	1898060	1898060	1898060	1898060
Individual Controls	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
LLM FE	No	Yes	No	Yes	No	Yes

Notes: Table A.4 reports event study coefficients from the interaction between the non-EU dummy and years. The outcome is the probability of being employed in all regulated occupations (columns 1 and 2), in regulated occupations with many applications (columns 3 and 4) and in regulated occupations with few applications (columns 5 and 6). The baseline year is 2011 (one year pre-reform). Individual controls and group fixed effects are the same as in the main specification. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies

Table A.5: Main Specification with only Employed and only Full-Time Employed

	(1)	(2)	(3)	(4)	(5)	(6)
	Only employed			Only full-time employed		
Post*Non-EU	0.013***	0.012***	0.002	0.011***	0.012***	-0.002
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
Baseline (Non-EU)	12.7	9.3	3.4	12.6	9.2	3.4
R-squared	0.069	0.066	0.031	0.083	0.087	0.026
Individuals	70079	70079	70079	54737	54737	54737
Observations	1554852	1554852	1554852	1038171	1038171	1038171
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Table A.5 reports the coefficients from our main regression model excluding unemployed immigrants. The outcome variable is the probability of working in regulated occupations. Column 1 and 4 are eligible regulated occupations, 2 and 5 are regulated occupations with many applicants, 3 and 6 are regulated occupations with few applications. Columns 1,2,3 refer to all employees (full time and part time), columns 4,5,6 only to full-time employees. Individual controls and group fixed effects are the same as in the main specification. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

Source: Integrated Employment Biographies

Table A.6: Alternative Sample Definitions for the Baseline Estimation on the Effect of the Recognition Act on Non-EU Employment in Regulated Occupations

	(1)	(2)	(3)	(4)	(5)
	Baseline	Education (mode)	Education (highest)	Nationality (first)	Nationality (first, no German)
Post*Non-EU	0.015 ***	0.015 ***	0.016 ***	0.013 ***	0.013 ***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Baseline (Non-EU)	6.76	8.30	7.12	7.69	7.07
R-squared	0,052	0.046	0.050	0.057	0.054
Individuals	76499	80823	94021	67857	77257
Observations	1898060	2055295	2596231	1672058	1931648
Individual controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes	Yes

Notes. Table A.6 reports the estimated coefficients for our main regression using alternative definitions of the sample. The dependent variable is the probability of being employed in regulated occupations with many applications. Column 1 reports the baseline results from Table 3, column 4. In the baseline the sample includes EU15 and non-EU immigrants who entered Germany at age 25 or older, whose education level in the first spell is vocational or higher education and whose nationality mode is non-German. In Columns 2 and 3 we change the definition of education, first with the mode value and second with the highest value obtained. In Columns 4 and 5 we change the nationality variable first taking the first nationality and second taking the first non-German nationality. Individual controls and group fixed effects are the same as in the baseline specification. Age at entry is constant at 25+ in all specifications. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies.

Table A.7: Main Specification with Balanced Panels

	(1)	(2)	(3)	(4)
	2007-2017	2008-2017	2009-2017	2010-2017
Post*Non-EU	0.019***	0.017***	0.015***	0.015***
	[0.003]	[0.003]	[0.003]	[0.002]
Baseline (Non-EU)	7.30	7.41	7.45	7.73
R-squared	0.06	0.06	0.06	0.06
Individuals	20010	21023	22831	24490
Observations	754053	724445	708849	683656
Individual controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes

Notes: Table A.7 reports result from the main regression for employment in regulated occupations with many applications, after applying sample restrictions to obtain a balanced panel of individuals. The balanced panels include only individuals who are present in the data for each quarter-year throughout the time window. For example, in the balanced panel 2007-2017, we include only immigrants who were in the dataset in 2007 and remained through all quarters up to 2017. The other sample restrictions and the controls and FE are the same as in the main regression. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

Source: Integrated Employment Biographies.

Table A.8: Effects of Recognition Act on Employment in Non-Regulated *Mangelberufe*

	(1)	(2)
Post*Non-EU	0.0018	0.0024
	[0.002]	[0.002]
Baseline (Non-EU)	6.53	6.53
R-squared	0.01	0.16
Individuals	76499	76499
Observations	1898060	1898060
Individual controls	No	Yes
Year FE	No	Yes
LLM FE	No	Yes

Notes: Table A.8 reports the estimated coefficiens for regressions where the dependent variable is the probability of being employed in non-regulated *Mangelberufe*. Column 1 includes only the interaction term while Column 2 reports result from the full specification with individual controls and group fixed effects. Only immigrants who entered Germany pre-reform are included, only EU15 and non-EU immigrants, aged 25-55 and with either vocational or university degree. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies.

Table A.9: Estimated Coefficients for the Effect of Federal and State Recognition Laws.

	(1)	(2)	(3)	(4)	(5)	(6)
	All regulated		Nationally regulated		State regulated	
PostNationalLaw*Non-EU	0.017 ***	0.015 ***	0.009 ***	0.008 ***		
	[0.002]	[0.002]	[0.002]	[0.002]		
PostStateLaw*Non-EU					0.008 ***	0.007 ***
					[0.002]	[0.002]
Baseline (Non-EU)	6.76	6.76	4.25	4.25	2.51	2.51
R-squared	0.002	0.052	0.002	0.047	0.002	0.030
Individuals	76499	76499	76499	76499	76499	76499
Observations	1898060	1898060	1898060	1898060	1898060	1898060
Individual Controls	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes
LLM FE	No	Yes	No	Yes	No	Yes
Quarter*Region FE	No	No	No	No	Yes	Yes

Notes: Table A.9 reports result from the main regression for employment in regulated occupations with many applications (column 1 and 2), and distinguishing between occupations regulated at the federal level (column 3 and 4) and at the state (*Land*) level (column 5 and 6). For the estimation of the effects of state laws the post-reform dummy is constructed based on the precise date of introduction of state laws in each region (see Figure A.9). To estimate the effect of state-level laws we include quarter-state fixed effects. Only immigrants who arrived pre-reform are included. The other sample restrictions and the controls and FE are the same as in the main regression. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies.

Table A.10: Heterogeneous Effects: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Male	Female	Vocational	Higher education	25-34	35-55
Post*Non-EU	0.009 ***	0.019 ***	0.007**	0.031 ***	0.013 ***	0.018 ***
	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]	[0.003]
Baseline (Non-EU)	4.70	9.28	5.65	9.26	6.81	6.64
R-squared	0.064	0.043	0.052	0.089	0.058	0.062
Individuals	43193	33306	46170	30329	53053	23446
Observations	1060299	837761	1198203	699857	1392952	505108
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
LLM FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Table A.10 reports the regression results for subgroups of immigrants as specified in the column headers. The dependent variable is the probability of being employed in regulated occupations that received many applications. Subgroups are created according to individual characteristics. Columns 5 and 6 refer to the age of first appearance in the register data. Controls include sex, age, age squared, age at entry, age at entry squared, time in the registered (and its squared transformation), nationality and educational level, year fixed effects and local labor market fixed effect. Standard errors are clustered at the individual level. Significance levels: *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$
Source: Integrated Employment Biographies (IEB).

B   Description of Datasets and Variables

B.1   IEB-SOEP Migration Sample

Sample construction For the analysis of the reform effects on application and recognition rates (Section 5.1) we take advantage of the 2013, 2014, 2015, and 2016 waves of the IEB-SOEP Migration Sample. The data were collected from 2013 to 2016 and contain retrospective information on immigrants' recognition processes. Specifically, the survey asks immigrants with a foreign-acquired education or professional qualification whether and when they applied for recognition and, if they applied, it asks for the result of the application and in which year they received the results (year of recognition). Additionally, the survey asks immigrants in which year they entered Germany for the first time. Combining these pieces of information we construct a panel dataset for each immigrant, where the first observation is the year of arrival to Germany and the last one is the most current survey wave in which the respondent was interviewed. For example, if an immigrant arrived in Germany in 2000 and answered the survey questions in 2014, the panel will have yearly observations from 2000 to 2014.

To construct time-varying application and recognition variables we then proceed as follows. For the application variable, we use the year of application and assign a value of 1 to observations from the year of application onwards, and 0 to the years before application or if the immigrant has never applied. For the successful recognition variable, we use the year of recognition combined with the information on the recognition result and assign a 1 to observations from the year of recognition if the application was successful, and 0 if the application was not successful or if the immigrant has never applied. For example, if an immigrant from the 2014 survey wave arrived in 2000, applied for recognition in 2007 and received recognition results in 2008, then the application variable takes the value 0 from 2000 to 2006, and the value 1 from 2007 to 2014. If the result is positive (either full recognition or partial recognition), the successful recognition variable takes value 1 from 2008 to 2014.

Around 20 percent of the observations for which we have information on the application year and the application decision did not state the year when they received the decision. We deal with missing year information in the following way. We fill in the missing values assigning the year of application + 1. This assumption is reasonable, since before the reform the average distance in year between application and decisions is 1.5 years and the median 1.

Furthermore, for some immigrants who applied for recognition, the application was still pending at the time of the survey. This share increased from 10 percent at the beginning of the observation period to 50 percent in the years 2013 and 2014 due to the right-censoring of the data. We deal with these cases of not yet recognized certificates in the following way. We treat pending applications as successful applications. This is reasonable, since the share of successful applications in all applications is more than 80 percent both pre- and post-reform (as computed based on the IAB-SOEP migration sample), and more than 90 percent according to official statistics on recognition procedures from the BIBB. As a robustness check we nonetheless exclude all observations of immigrants with a pending application. This restriction only slightly reduces the size of coefficients from our main results.

Validation of recognition variables In this section we validate the recognition variables used for the estimation of the effects of the reform on recognition rates. Given that information on recognition procedures is asked retrospectively and might be therefore subject to measurement error, we exploit other data sources on recognition procedures and compare it with the one present in the IAB-SOEP Migration Sample. In detail, we first use the 2008 ad hoc module of the German Microcensus which focused on immigrants' integration and collected information on whether immigrants applied for recognition and on the outcome of the recognition procedures. We compute the percentage of immigrants in Germany before 2012 (i.e. before the Recognition Act) with recognition, with a failed or on-going recognition procedures and with no application for recognition. We also distinguish between different types of certifications (Figure B.1). Reassuringly, we find that the distributions in the two data sets are remarkably similar. Second, we gather information from official recognition statistics on the number of applications by regions of origin and aggregate SOEP immigrants according to the same regions of origin. Since official statistics refer only to recognition procedures after 2012, we consider SOEP immigrants who applied for recognition from 2012 onwards. We then compare the composition of applicants by regions of origin (Figure B.2). Also in this case, the distributions are closely comparable between the two data sources. Overall, these tables show that individual data on recognition from the SOEP are representative of recognition procedures.

Table B.1: Validation of Application Variable: by Education

	(1)	(2)	(3)	(4)	(5)	(6)
	IAB-SOEP Migration			Microcensus		
	Recog	No recog	No app	Recog	No recog	No app
VET	17.5	9.9	72.6	14.1	8.6	77.3
Fachhochschule	34.5	12.3	53.2	36.6	10.0	64.4
University	30.3	9.1	60.6	27.4	8.2	64.4
PhD	47.8	8.7	43.5	40.0	-	60.0

Notes: Table B.1 shows the distribution of immigrants who obtained recognition (*Recog.*), applied but did not obtain recognition (*No Recog.*) and did not apply (*No app.*) within the same type of certification. Columns 1, 2, and 3 report the shares for immigrants in the IAB-SOEP Migration Sample who arrived in Germany in the pre-reform period, while columns 4, 5, and 6 display the percentages for immigrants in the German Microcensus 2008 Ad Hoc Module on immigrants' integration.
Source: IAB-SOEP Migration Sample and German Microcensus 2008 Ad Hoc Module.

Table B.2: Validation of Application Variable: by Nationality

	(1)	(2)
	IAB-SOEP Migration	Register data (BIBB)
European Continent	77.8	81.0
Africa	4.0	5.5
Middle East and Asia	16.0	12.3
North and Central America	0.9	0.8
South America	1.3	1.3
Oceania and others	0.0	0.2
Total	225	17550

Notes: Table B.2 shows the distribution of applicants across regions of origin. In column 1 we report the shares for immigrants interviewed in the IAB-SOEP Migration Sample. In Column 2 we report the shares from the official statistics of the BIBB which were acquired from 2012 onwards to monitor recognition procedures after the implementation of the Federal Recognition Act. The regions of origin were pre-defined in the official statistics. To match the official statistics, in the SOEP computaions we include all applicants who applied from 2012 onwards and recode countries of origin to the same regions in the BIBB data.
Source: IAB-SOEP Migration Sample and Official Statistics (BIBB).

B.2 Integrated Employment Biographies

It is well known that some information collected through administrative sources is less reliable because employers have low incentives to correctly declare it. In particular, in the Integrated Employment Biographies both the nationality variable and the education variable may be problematic due to misreporting or underreporting behaviors of employers. Given the relevance of these two pieces of information for our sample selection and estimation, we explain below how we improved on the raw information and provide validating evidence on the quality of our variables.

Nationality We construct the nationality variable by taking the mode of the nationality value across all spells in the dataset. The value we assign to each individual is therefore the most frequent nationality their employers report. We then exclude all immigrants whose mode value of nationality is German and all who have no valid nationality values. While this might exclude immigrants who received citizenship early on in their employment careers, it allows to better identify the most likely foreign nationality. In alternative specifications we try also alternative definitions of nationality, that is based on the first valid nationality value and by including only immigrants who never had a spell as German natives. Results are not sensitive to this definition. Moreover, we show that the distribution across macro-regions of origin in the IEB data is almost identical to the distribution of origin countries constructed from the German Microcensus where we are able to identify more clearly both the time of immigration and the foreign nationality (in the German Microcensus it is asked explicitily whether they have German citizenship).

Education Two issues with the education variable may be relevant for our analysis. First, which is the true educational level of immigrants, and second whether they acquired education domestically (i.e. in Germany) or abroad. We address both issues by using the first available information on education and by restricting our analysis to immigrants who appear in the data after 25. We choose 25 as the cut-off age of entry as we assume that by 25 immigrants already plausibly acquired both a university degree or a vocational training. Moreover, in Germany many university students and vocational trainees enter the labor market already before the end of their educational career. The restriction based on the age of entry therefore allows us to reduce the concern that education might have been acquired in Germany (and that

recognition wouldn't be necessary). We then compare our education variable with the German Microcensus data where it is possible to precisely identify immigrants who acquired education abroad (from 2012 onwards the question is asked explicitly). Looking at Table 2 we see that the IEB educational variable likely underestimates the true number of university graduates (or above) both for EU15 and nonEU immigrants. To address this issue we show in Table A.6 that results are not sensitive to changes in the definition of the educational variable. In particular, we run the main regression model using the highest level of education achieved instead of the first reported value. This includes immigrants for which employers might have falsely reported the level of education. Moreover, in case the bias from the measurement error is large, this would likely underestimate the positive effects on employment.

Occupational code Throughout the analysis we classify occupations using the 3-digits Kldb1988. For all employees, the employer encodes the employee's job in accordance with the "Classification of Occupations. Systematic and Alphabetical Directory of Job Titles" (published by the Federal Employment Agency, Nuremberg, 1988), which contains approx. 25,000 job titles. The occupational classification Kldb1988 consists of a 3-digit code and comprises about 330 values. In December 2010 the Federal Employment Agency introduced a new classification, Kldb2010, with 5-digits. This change brought a large number of firms to misreport or underreport the occupational variable in 2011. We fix this coding problem with the following approach. We exploit other pieces of information which were not subject to any reporting change from 2010 onwards, that is work and home location at the district (*Kreis*) level [37], industry code (WZ08 classification) and firm identification number. We then considered the last available occupational code before the reporting change and assigned this value to all subsequent employment spells, as long as work or home location, firm ID and industry code did not change. This procedure addresses both mireporting and underreporting errors. As an outcome of this procedure, missing values on the occupational code in 2011 starkly decline. With the fixed occupational code, we then move from the Kldb2010 to the Kldb1988 using a table provided by the Federal Employment Agency. This is particularly relevant to identify occupations with high and low numbers of applications since the statistics from the Regional Statistical Offices on the recognition procedures use the Kldb2010. It should be noticed that the Kldb1988 is a

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[37]The *Kreis* level corresponds to the NUTS3 level of the NUTS geocode standard.

3-digit classification and it is therefore more aggregated than the Kldb1988. As a robustness check, we also run regressions (available upon request) in which we exclude all individuals (any spell) if at some point of their employment history they were employed but the occupational variable had missing or invalid values. Results barely change.

Local demand for regulated occupations We construct pre-reform demand for regulated occupations in local labor markets in the following way. We obtain from the Federal Employment Agency vacancy and unemployment totals by year, occupational code (3-digit Kldb1988) and district (*Kreis*). Unemployment data report the last occupation of employment need to verify. The vacancy data report the numbers of positions open in each occupation as declared by firms. The unemployment to vacancy ratio captures therefore the extent to which firms are able to fill in their vacancies with local supply. We compute the unemployment-to-vacancy ratio in all districts and broad group of occupations (regulated occupations with large number of applicants) averaging the values for the years 2007-2010, the pre-reform period. We exclude 2011 due to its proximity to the reform. We then average the values across districts belonging to the same local labor market and assign to each individual the value according to its local labor market variable.

Ethnic network in regulated occupations We use the IEB data in the pre-reform period (2007-2010) to compute the average share of immigrants in regulated occupations with high number of applicants at the districs level. We then average the values across districts belonging to the same local labor market and assign to each individual the value according to its local labor market variable.