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# Occupational Recognition and Immigrant Labor Market Outcomes*

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**Abstract**

In this paper, we analyze how the formal recognition of immigrants' foreign occupational qualifications affects their subsequent labor market outcomes. The empirical analysis is based on a novel German data set that links respondents' survey information to their administrative records, allowing us to observe immigrants at monthly intervals before, during and after their application for occupational recognition. Our findings show substantial employment and wage gains from occupational recognition. After three years, the full recognition of immigrants' foreign qualifications increases their employment rates by 24.5 percentage points and raises their hourly wages by 19.8 percent relative to immigrants without recognition. We show that the increase in employment is largely driven by a higher propensity to work in regulated occupations. Relating our findings to the economic assimilation of immigrants in Germany, we further document that occupational recognition leads to substantially faster convergence of immigrants' earnings to those of their native counterparts.

**Keywords**: Occupational Recognition, Immigrants, Labor Markets

**JEL Classification**: J15, J24, J44, J61

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# 1 Introduction

It is a well documented fact in most developed economies that immigrants perform significantly worse in the labor market than their native counterparts (see, e.g., Dustmann and Frattini, 2013). In many cases, the main reason appears to be a lack of human capital, which pushes immigrants into low paying and precarious jobs and prohibits them from moving into more desirable segments of the labor market. However, even when immigrants accumulated valuable skills in their countries of origin prior to migration, the transferability of these skills to the host country economy is often problematic, partly because of insufficient language skills (Chiswick and Miller, 2003), partly because of the limited signaling function of foreign qualifications which makes it difficult for native employers to assess immigrants' occupational skills.[1] In addition, legal restrictions often prohibit immigrants from working in certain occupations (Sweetman et al., 2015). Kleiner (2017), for instance, reports that the share of the US workforce holding an occupational license increased from less than 5 percent in the 1950s to about 25 percent in 2015. Koumenta and Pagliero (2016) document a similarly important role of occupational regulation in the EU, where the share of the workforce with a license reached 22 percent in 2015, with Denmark ranking lowest (14 percent) and Germany ranking highest (33 percent).

While occupational regulation is meant to ensure a minimum quality standard within a profession (e.g. Leland, 1979, Bryson and Kleiner, 2010), its prevalence is likely to have a particularly detrimental effect on the labor market outcomes of immigrants. Without formal recognition of their foreign qualifications, immigrants would often not be able to work in licensed occupations nor would they be able to credibly signal their occupational skills to native employers, who are all too often unfamiliar with the skill content of foreign qualifications. This may lead to an underutilization of immigrants' skills as suggested by the widespread occupational downgrading immigrants experience in many labor markets after arrival (see, for example, Friedberg, 2001, for Israel, Mattoo et al., 2008, for the US, and Dustmann et al., 2013, for the UK). Facilitating the recognition of foreign qualifications might be a way to overcome this inefficiency and fundamentally improve the economic integration of immigrants in their host countries.

In this paper, we estimate the impact of occupational recognition on immigrants' labor market outcomes. To obtain recognition for their foreign credentials, immigrants in Germany are required to go through a formal process, at the end of which, if successful, the responsible authorities certify the equivalence between the immigrants' foreign qualification and its German counterpart. From a labor market perspective, occupational recognition affects labor market outcomes through two main mechanisms. First, a

[1] One manifestation of the low transferability of human capital are the remarkably low returns to foreign education and experience observed in many destination countries (see Dustmann and Glitz, 2011, for a comprehensive overview of this literature).

successful recognition gives the immigrants access to segments of the labor market that they could previously not enter. These regulated segments tend to be characterized by high wages, both because of high returns to skills and because of monopoly rents from occupational licensing (see e.g. Stigler, 1971, Kleiner and Krueger, 2010, 2013, or Gittleman et al., 2018).[2] Second, occupational recognition reduces uncertainty about the skills of immigrant workers, which allows employers both in the regulated and unregulated segment of the labor market to better screen in the hiring process, leading to higher quality matches between workers and firms (Arrow, 1973, Spence, 1973). Both mechanisms thus suggest a positive impact of occupational recognition on immigrants' employment outcomes and wages.

Identifying the causal impact of occupational recognition is not straightforward due to self-selection on the part of the immigrants. Presumably, those immigrants who obtain occupational recognition would also perform comparatively well in the labor market if they had not received it, even conditional on other observable characteristics. This is because having obtained recognition reflects a specific set of skills that is likely to be generally valued in the labor market, both in the regulated and unregulated segment. In addition, immigrants who decide to go through the costly application process are likely to differ from those who do not in terms of unobservable characteristics such as ambition and motivation, factors that on their own would be associated with better labor market outcomes. We deal with these issues by exploiting a novel German data set that links detailed survey information on the exact timing of the application process for recognition with comprehensive social security data on the respondents' entire work histories in Germany. Taking advantage of the longitudinal dimension of our data, we estimate both static and dynamic difference-in-differences specifications, comparing the labor market outcomes of immigrants who obtain full recognition to those of immigrants who either never apply or have not yet received full recognition themselves. While the estimates from the static models allow us to assess the average effects of occupational recognition on labor market outcomes in our sample, the estimates from the dynamic specifications provide information on the precise evolution of the employment and wage effects over time.

Our empirical findings show substantial positive effects of occupational recognition on employment and wages. On average, immigrants in our sample who obtained full

[2]For evidence on the positive association between occupational licensing and wages in specific professions in the US, see Pagliero (2011) for lawyers, Timmons and Thornton (2008) for radiologic technologists, Timmons and Thornton (2010) for barbers, Thornton and Timmons (2013) for massage therapists, and Angrist and Guryan (2008) for teachers' certification. The positive wage effects, however, do not necessarily lead to a higher quality of the offered services as shown, for example, by Angrist and Guryan (2008) who find increases of 3-5 percent in the wages of teachers with state-mandated teacher testing in the US but no increase in the quality of teaching. Kleiner and Kudrle (2000) and Kleiner et al. (2014) come to similar conclusions for the dentistry and medical doctor professions, respectively, where more stringent licensing requirements lead to higher prices but no improvement in quality.

recognition in the past are 16.5 percentage points more likely to be employed and earn 15.1 percent higher wages than comparable immigrants who have either not applied or not yet received recognition themselves. We show that these employment effects are primarily driven by successful immigrants moving into occupations that were previously not accessible because of licensing restrictions. These movements into regulated occupations occur both out of non-employment and by workers moving from unregulated to regulated occupations.

Turning to the dynamic processes underlying these average effects, our estimates show that the probability of being employed relative to the control group increases rapidly with the receipt of occupational recognition, reaching 17.1 percentage points within the first twelve months. In subsequent years, the employment gap continues to widen, though at a lower pace, reaching a value of 24.5 percentage points three years after recognition. The wage gains from occupational recognition take a little longer to materialize but increase steadily after obtaining recognition, reaching 19.8 percent after three years. There is no evidence of any significant anticipation effects, neither in the employment nor in the wage regressions. The relative shift into the regulated segment of the labor market starts directly after recognition, primarily through movements out of non-employment. Movements from unregulated to regulated occupations, in contrast, only start intensifying with some delay.

Studying the heterogeneity of these effects across different subgroups of immigrants, our findings suggest that occupational recognition is beneficial for all groups considered. The effects on employment, wages, and access to regulated occupations are positive for all education levels and particularly large for individuals holding a foreign doctoral degree. When looking at the type of occupation for which individuals apply for recognition, our estimates are largest for the group of physicians, dentists, veterinarians and pharmacists for whom recognition is mandatory to practice their profession. However, occupational recognition improves the employment and wage outcomes also for those groups of workers who do not have mandatory recognition requirements, indicating that the certification of the quality of training received in the home country has an independent value in the German labor market.

While our administrative data do not allow us to analyze directly the quality of immigrants' work in regulated occupations vis-a-vis that of their native counterparts, we estimate standard earnings assimilation profiles in which we allow the speed of convergence to change with the recognition of immigrants' foreign qualifications. We show that earnings growth relative to natives accelerates after obtaining recognition, and that the earnings of immigrants who receive full recognition eventually fully converge to those of comparable natives, which could be interpreted as evidence for a similar quality in the services provided by immigrants and natives.

Our paper relates to the literature on the economic assimilation of immigrants (see,

e.g., Borjas, 1995, or Lubotsky, 2007) in that it studies a specific mechanism through which immigrants may be held back in the host country's labor market. In comparison to this extensive literature, the evidence regarding the impact of occupational recognition on immigrant labor market outcomes is scarce.[3] Kugler and Sauer (2005) address this research question by exploiting the fact that Soviet trained physicians who immigrated to Israel in the early 1990s were exogenously assigned to different re-training tracks that differentially affected the probability of eventually obtaining a medical license. Their instrumental variable estimates show substantial monetary returns from obtaining a medical license of the order of 200 percent of monthly earnings within 3 to 4 years after arrival in Israel. Gomez et al. (2015) study the effect of occupational licensing on immigrant labor market outcomes in Canada, using annual data from the Survey of Labour and Income Dynamics (SLID). Controlling for time-invariant unobserved heterogeneity, their estimates show that immigrants receive a 20 log points earnings premium for working in a licensed occupation but are also 20 percent less likely to work in such an occupation than natives with similar observable characteristics. In similar regressions based on the Longitudinal Survey of Immigrants to Australia (LSIA), Tani (2018) finds that immigrants working in licensed occupations earn around 15 log points higher wages than comparable immigrants working in unlicensed occupations. Focussing more specifically on the role of occupational recognition on labor market outcomes, Chapman and Iredale (1993) find that immigrant men who unsuccessfully apply for recognition in Australia earn 15 to 30 percent lower wages than their successful counterparts, while Tani (2015) provides some evidence that the official assessment of immigrants' foreign educational degrees after arrival in Australia is associated with significantly higher wage rates.

While the qualitative results of these studies are similar to some of ours, there are a number of important differences. First, rather than approaching the question of how occupational recognition affects immigrant labor market outcomes indirectly by studying the effects of working in a licensed occupation on wages, we analyze this question directly by focussing on the actual occupational recognition process. Since access to licensed occupations is only one channel through which occupational recognition can improve immigrants' labor market outcomes, our analysis thus provides a more comprehensive assessment of this important labor market institution. Second, apart from wages, we also consider employment and occupational mobility as distinct outcomes in our empirical analysis. Third, we analyze the effects of occupational recognition for a broader set of qualifications, including both post-secondary education and vocational training. Finally, we exploit unique information about the precise timing of the recognition process to estimate dynamic effects at monthly frequency, allowing us to identify both short- and long-run effects and to argue more convincingly for a causal relationship between

[3]For an overview of the literature on occupational regulation and its interplay with the recognition of foreign qualifications, see Sweetman et al. (2015).

occupational recognition and immigrants' labor market outcomes.

The paper is structured as follows. The next section describes the institutional setting in which the occupational recognition process takes place in Germany. Section 3 presents the empirical model and identification strategy. Section 4 describes our data set and provides some key summary statistics. Section 5 presents the main results together with a number of robustness checks and further supportive analysis. Section 6 links our findings to the earnings assimilation process of immigrants in Germany. Section 7 concludes the paper.

# 2 Institutional Setting

For an immigrant about to enter the German labor market, the distinction between regulated and unregulated occupations is of central importance. As many other European countries, Germany has a long tradition of regulated occupations dating back to medieval times. The entry and practice of regulated occupations is thereby governed by legal or administrative provisions that require proof of specific professional qualifications. Only individuals who have the required qualifications or, in the case of immigrants, obtained formal recognition of their foreign qualifications, are entitled to work in regulated occupations and use the corresponding professional job titles.[4] As of 2018, the regulated segment of the German labor market comprises 419 occupations (Bundesagentur für Arbeit, 2018), of which 29 percent are professions in the health sector (e.g. physicians, psychotherapists, pharmacists, nurses, physiotherapists), 27 percent professions in the technical sector (e.g. architects, engineers, physicists), 17 percent professions in the public sector (e.g. civil servants, policemen, firemen), 12 percent professions in the educational sector (e.g. teachers, educators, social workers), 7 percent professions in the transport sector (e.g. pilots), and 2 percent legal professions (e.g. lawyers, judges, attorneys).[5]

The authorities in charge of the recognition process for regulated occupations in Germany are very heterogeneous, depending on the particular occupation pursued. In the important health sector, the recognition of the degrees of physicians, dentists, pharmacists and nurses is regulated by governmental health authorities at the state (*Länder*) level, in case of specialists (*Fachärzte*) additionally by the respective chambers. The entry to most occupations in the education sector, in turn, is regulated by educational

[4]In practice, occupational regulation can take many different forms with the literature mainly distinguishing between *registration*, *certification* and *licensure*. While there are no uniform definitions of these types of regulation, only licensure is generally viewed as being exclusionary in that it restricts access to certain occupations (see e.g. Kleiner and Krueger, 2013 or Sweetman et al., 2015). In distinguishing between regulated and unregulated occupations, we follow the German terminology which uses the terms *regulated occupation* and *licensed occupation* synonymously. For more details about the recognition process and the legal background in Germany, see https://www.anerkennung-in-deutschland.de.

[5]About three-quarters of the regulated occupations in Germany require an academic degree, sometimes in conjunction with further training. The remaining quarter of occupations require vocational training degrees or an occupational training in the public sector.

authorities at the state level, and the entry to most regulated technical occupations by either governmental authorities or chambers, also at the state level. In contrast, in some selected occupations, for instance in the transport sector, the responsible authorities operate at the national level while for some occupations relevant for local authorities, the municipalities themselves are in charge of the recognition process.

In contrast to regulated occupations, formal recognition is not a precondition for the practice of unregulated occupations. Immigrants may work in these occupations without a license and thus without obtaining recognition for their foreign qualifications. For most unregulated occupations, however, immigrants can voluntarily apply for an assessment of their foreign qualifications. In case of a successful evaluation, the notice received at the end of this process serves as an official and legally secure document confirming the equivalence of the foreign qualification with the relevant German reference qualification. Examples of unregulated occupations where this type of certification is possible are so-called training occupations (e.g. office management clerks, mechanics or electricians) and advanced training occupations (e.g. master craftsman qualifications, certified advisors, certified senior clerks, specialist commercial clerks or business economists).[6] The most important authorities for the certification process of unregulated occupations are the chambers of industry and commerce (*Industrie- und Handelskammern*) and the chambers of crafts (*Handwerkskammern*). While the chambers of industry and commerce have set up a central authority at the national level responsible for the recognition of foreign qualifications, the chambers of crafts are organized at the state level.

In order to apply for recognition, immigrants are not required to hold German citizenship or be in the possession of a residence permit for Germany. There is also no need to be living in Germany at the time of application, allowing immigrants to initiate the process while still being located abroad. Applications for occupational recognition need to be accompanied by extensive documentation: proof of identity, tabular summary of the training courses completed including previous occupational activity if relevant, proof of vocational qualification, proof of relevant occupational experience, evidence of other qualifications (e.g. continuing vocational training courses), a declaration of having not previously submitted an application, and evidence of the intention to work in Germany (which does not apply to nationals of the EU/EEA/Switzerland and persons residing in the EU/EEA/Switzerland). All documents must be submitted in German, with the relevant translations made by publicly authorized or certified interpreters or translators. Applications are subject to an administrative fee ranging between 100 and 600 euros depending on the occupation and the federal state in which the application is submitted. The costs of fees and other expenses, for instance for translations and certifications of

[6] All training occupations, i.e. occupations for which training takes place within the dual system, are unregulated in Germany. In contrast, recognition is compulsory in order to work as a self-employed in some craft trades that require a license.

documents, must be borne by the applicants themselves.[7] Since 2005, a proof of language proficiency can be made an additional requirement for the recognition of foreign credentials, as for example in the case of physicians.

These administrative features of the application process suggest that the bureaucratic hurdles to obtain occupational recognition in Germany are not negligible. According to our survey data, among those immigrants who hold a foreign certificate and could therefore, in principle, apply for occupational recognition, only 35.8 percent end up doing so. The main reasons put forward for not applying are that a recognition is not considered important by the respondent (38.1 percent), that an application would have no chance of succeeding (12.9 percent), that the respondent does not know how to apply (6.6 percent), that the procedure is too bureaucratic or time-consuming (6.6 percent) and that important documentation is missing (4.6 percent). Monetary costs, in contrast, seem to constitute only a minor obstacle to applying (2.8 percent).

At the end of the recognition process, there are three possible outcomes: denial, partial recognition and full recognition.[8] In the case of partial recognition, which is a possible outcome only in the context of unregulated occupations, the assessment notification issued by the responsible authorities includes a detailed description of the existing qualifications as well as the knowledge that is still missing relative to the German reference qualification. The notification also provides concrete suggestions for training or apprenticeship measures which, if completed successfully, can then lead to a new application. A decision of full recognition, in turn, certifies the equivalence of the foreign qualification with the relevant German reference qualification and gives the worker full access to the relevant occupation and job title.

During most of our sample period, the recognition of European professional and vocational qualifications was regulated at the European level.[9] In contrast, for immigrants from third countries outside the EU, the EAA and Switzerland, there was no common official procedure regulating the recognition of foreign qualifications. In the absence of a legal basis, decisions on the equivalence between foreign and German qualifications for this group of immigrants were more idiosyncratic, with the applicant's country of origin often playing a decisive role for the outcome of the application. This unsatisfactory situation largely motivated the introduction of the Federal Recognition Act (*Anerkennungsgesetz*) in April 2012 whose aim was to simplify, standardize and accelerate the

[7] In some circumstances, and on an individual case basis, these fees may be paid by other administrative entities. For example, prior to submitting an application, unemployed applicants or applicants registered as job seekers can seek clarification from their local employment offices or job centres whether they will cover the costs of the procedure. The labor administration authorities only provide such support if they consider the recognition of a foreign training qualification necessary for the holder to be integrated into the labor market. In these cases, adaptation measures such as continuing training courses or examination preparations may also be funded.

[8] For more details about the potential outcomes, see https://www.bq-portal.de/de

[9] The relevant legislation was the EU Directive 2005/36/EC on the recognition of professional qualifications, which came into force on 20 October 2005 and was introduced in Germany in 2007.

procedure for the recognition of foreign qualifications governed by federal law, and open up such procedures to groups not covered by previous legislation.[10] However, 80 percent of immigrants in our sample applied for recognition before April 2012, so that our estimates largely reflect observations under the old legislative regime.

# 3 Empirical Framework

In the administrative component of our data set, we are able to continuously track immigrants after their arrival in Germany. We also know from the survey component if and when they receive occupational recognition. We exploit this information to compare the labor market outcomes of individuals after successful recognition with those of individuals who have either not yet received recognition or never applied for it. To facilitate the interpretation of our results, and because of limited sample sizes, we only consider full recognitions as successful and exclude individuals with partial or denied recognition.

Adopting a standard difference-in-differences approach, we start with the following fixed effects regression to obtain an overall estimate of the impact of recognition:

$$\mathrm{y}_{it} = \beta \mathrm{CertRecog}_{it} + X'_{it}\gamma + \lambda_t + \lambda_p + \lambda_i + \varepsilon_{it}. \tag{1}$$

The variable $\mathrm{y}_{it}$ denotes a specific labor market outcome of individual $i$ at time $t$. In particular, we examine the impact of occupational recognition on an immigrant's employment, wages, and an index tracking the degree of regulation of the observed occupation (which we discuss in more detail in the next section). The first two outcomes provide general insights into the effects of occupational recognition on immigrants' labor market performance and are particularly important when viewed in the context of the rather poor employment and wage outcomes of immigrants, documented in much of the migration literature (for Germany, see, for example, Algan et al., 2010). The latter outcome is more specific to our setup and provides insights into the mechanism through which occupational recognition affects labor market outcomes. In particular, it sheds light on the central question whether occupational recognition indeed allows immigrants to move into regulated occupations. By running the regressions first without conditioning on immigrants' employment status, assigning a level of zero regulation to non-employment, and then conditional on employment, we are able to assess whether the movements into

[10] An additional shortcoming before the introduction of the Recognition Act was the absence of a binding time frame for processing the applications which lead to sometimes unnecessarily lengthy procedures. With the introduction of the Recognition Act, the maximum duration for the recognition process was mandated, with the responsible authorities now having to make a decision within 3 months of receipt of the applicant's full documentation (with a single extension possible in difficult cases). This acceleration of the recognition process is already noticeable in our sample, where the average duration between application and final decision was 5.5 months before the introduction of the Recognition Act (with a standard deviation of 13.4 months) and 3.8 months afterwards (with a standard deviation of 3.6 months).

regulated occupations occur primarily out of non-employment or through gradual job changes from unregulated to regulated occupations.

The main regressor of interest, $\text{CertRecog}_{it}$, is a dummy variable taking the value one if individual $i$ has a foreign qualification that was recognized before or in time period $t$. For individuals who never apply, this value is zero for all time periods. We are interested in identifying $\beta$, the causal effect of occupational recognition on labor market outcomes. For this, we require that, in the absence of recognition, the outcomes of individuals who receive full recognition would have evolved in the same way as those of individuals who have either not yet applied or who never apply during our observation window. Below we explain how we assess the validity of this crucial identification assumption based on observable differences in the pre-trends between treatment and control group. To control for general changes in labor market conditions, for example due to seasonal variation or business cycle fluctuations, we include time (month $\times$ year) fixed effects ($\lambda_t$) in our estimation of equation (1). We also add a full set of months since migration fixed effects ($\lambda_p$) which capture the dynamic evolution of immigrants' labor market outcomes as a result of their ongoing integration into the host country's economy. To account for time-invariant observable and unobservable heterogeneity, we further include a full set of individual fixed effects ($\lambda_i$). Their inclusion accounts for much of the personal characteristics associated with better labor market outcomes and the selection into the occupational recognition process, such as country of origin, gender, the level of education before migration, and time-invariant ability and motivation. In addition to the comprehensive set of fixed effects, we also control for a quadratic term in age[11] in the spirit of Mincerian wage equations and a proxy for German language proficiency ($X_{it}$) to capture further heterogeneity in the labor market trajectories of immigrants.[12] We cluster standard errors at the individual level as suggested for difference-in-differences estimations by Bertrand et al. (2004), thus allowing the error terms to be heteroscedastic and arbitrarily correlated over time for a given individual.

To evaluate the sensitivity of our results to changes in behavior after applying for recognition, we also include an indicator variable that switches on during the time period between initial application and final recognition in an alternative specification. It is possible that after submitting their application, individuals wait for the outcome of the recognition process and, if unemployed, search less intensively for a new job or, if employed, stop working altogether or put less effort into their on-going jobs (and thus earn lower wages). On the other hand, being in the process of applying for occupational recognition may already serve as a positive signal in the labor market, improving ap-

[11] Since we include both individual and time fixed effects, the linear age effect is not separately identified.

[12] The survey provides information on self-reported language proficiency at two points in time, before migration and at the time of the interview. Linearly interpolating between the two data points, we construct proxies for language proficiency at monthly intervals.

plicants' labor market outcomes. By including the application dummy, we ensure that our estimate of $\beta$, which measures the change in the outcome variable after recognition relative to the control group, are not confounded by this type of anticipatory behavior.

While specification (1) provides a useful summary measure of the average impact of occupational recognition on employment, wages and the degree of regulation in immigrants' occupations, it conceals valuable information about the dynamic process through which the effects of recognition evolve over time. As an extension, we therefore introduce individual dummy variables for the months around the date of recognition as additional regressors, allowing us to distinguish between short- and long-term labor market effects in an event study type setup. More specifically, we use the regression model:

$$\begin{aligned} \mathrm{y}_{it} = & \sum_{q=-24}^{-1} \delta_{t-q} \mathrm{CertRecogMth}_{i,t-q} + \delta_{t+25} \mathrm{CertRecog}_{i,t+25} \\ & + \sum_{q=1}^{60} \delta_{t-q} \mathrm{CertRecogMth}_{i,t-q} + \delta_{t-61} \mathrm{CertRecog}_{i,t-61} \\ & + X_{it}'\gamma + \lambda_t + \lambda_p + \lambda_i + \varepsilon_{it}, \end{aligned} \tag{2}$$

where the dummy variables $\mathrm{CertRecogMth}_{i,t-q}$, which equal one if individual $i$'s qualification was recognized in period $t-q$, now capture the effect of occupational recognition in specific months around the recognition date. We create these dummy variables starting 24 months before the recognition date and ending 60 months thereafter. All dummy variables are equal to one only in the relevant time period and zero otherwise. For example, $\mathrm{CertRecogMth}_{i,t-10}$ is equal to one when the successful recognition was ten months before period $t$, so that the corresponding estimate $\delta_{t-10}$ measures the effect of recognition ten months after it was obtained. $\mathrm{CertRecog}_{i,t-61}$ is a dummy variable for individuals having a foreign qualification that was recognized before or in period $t-61$. Thus, $\delta_{t-61}$ picks up the long-run average effect of recognition on labor market outcomes during all months more than five years after the recognition date. Similarly, $\mathrm{CertRecog}_{i,t+25}$ is a dummy variable for all periods at least 25 months before an individual's recognition date. By definition, non-applicants get assigned zero for all these dummy variables. Importantly, equation (2) does not include a separate dummy variable for the time period when recognition was actually obtained ($q = 0$), so that the estimated dynamic effects of recognition are measured relative to this baseline period.[13] Just as for the static analysis, it is possible to control for the timing of the application by including a dummy for the application period as an additional regressor.

The main concern regarding our difference-in-differences approach is that unobserved time-varying factors related to both labor market outcomes and the recognition process

[13] Any level differences in outcomes between treatment and control group in the time period when recognition was obtained are absorbed by the individual fixed effects $\lambda_i$, so that the effect of recognition in this baseline period is essentially normalized to zero.

might confound our estimation results. The inclusion of separate dummy variables for the months prior to recognition allows us to directly assess the relevance of this type of endogeneity as it would typically manifest itself through a violation of the parallel trends assumption. For instance, if some positive labor market shock (e.g. landing a new job) incentivizes an immigrant to apply for recognition (maybe because that would allow the worker to further advance in the new job), diverging trends in labor market outcomes relative to the control group should already materialize before the official recognition is received. Conversely, if in anticipation of a positive recognition outcome, applicants hold back in the labor market even before submitting their application, a deterioration in their labor market trajectories relative to non-applicants should show up in the pre-recognition period. The observation of insignificant estimates close to zero in all months prior to the actual recognition date and significant effects moving away from zero soon after would lend support to a causal interpretation of our findings.

While the relatively small sample size of treated individuals with full recognition in our data prevents us from following alternative approaches for the estimation of dynamic treatment effects (see e.g. Fredriksson and Johansson, 2008, Crépon et al., 2009, or Vikström, 2017), we also use a pooled version of the synthetic control method developed by Abadie et al. (2010) to further check the robustness of our findings. In this approach, each immigrant who receives full recognition is matched to an appropriate control group of immigrants who never applied for recognition but whose labor market outcomes in the period prior to application are similar to those of the treated immigrant. Appendix A.2 provides more details on the implementation of this alternative procedure and documents the corresponding findings, which largely corroborate our main regression-based results.

# 4 Data

The basis of our empirical analysis are the first three waves of a novel longitudinal survey of people with migration background in Germany, the IAB-SOEP Migration Sample (Brücker et al., 2014). This survey, jointly conducted by the Institute for Employment Research (IAB) and the German Socio-Economic Panel (SOEP), was initiated in 2013 and designed to oversample recent immigrants who arrived in Germany after 1994.[14] The initial sample comprised around 5,000 first- and second-generation immigrants who were

[14]The sampling of anchor persons proceeded as follows. In a first step, the IEB records were restricted to individuals who first appeared in the data after 1994. Individuals with a migration background were then identified based on their foreign, i.e. non-German, citizenship or their participation in measures of the Federal Employment Agency specifically designed for persons with a migration background (e.g. language classes). A short screening interview was then conducted with each cooperating anchor person after which around 30 percent of all households were screened out because anchor persons turned out not to be part of the target population. In more than half of the cases, screen-out was due to immigration before 1995 and in about one-third of the cases to not having a migration background. Note that other interviewed household members might have arrived in Germany before 1995.

then interviewed on an annual basis, with a refreshment sample added every year to deal with sample attrition. The most innovative feature of this data set is its linkage with the German administrative data of the IEB (the so-called *Integrierte Erwerbsbiografie*), which comprise full employment histories of the universe of workers covered by the social security system in Germany during the period 1975 to 2014.[15] For data protection reasons, respondents to the survey component of the IAB-SOEP Migration Sample were asked to give their prior consent to the record linkage by signing a corresponding statement. The overall approval rate was about 50 percent, giving rise to a linked sample of 2,606 individuals: 1,992 from the first wave, 48 from the second wave, and 566 from the third wave. Out of this sample, we only consider first generation immigrants in our analysis and further exclude those individuals with missing information on the variables of interest.

The linked IAB-SOEP Migration Sample is particularly suited for our analysis for two reasons. First, the survey component contains detailed information on occupational qualifications obtained both before migration and after arrival in Germany. Importantly, this includes a full module devoted to the recognition process of foreign qualifications, with information about the month and year when the application process was initiated and the month and year when a final decision (denial, partial recognition, full recognition) was obtained.[16] Second, the social security component of the data allows us to observe an immigrant's entire work history after arrival in Germany. Linking the information about the precise timing of the recognition process to the spell structure of the administrative data, we can observe each individual's labor market outcomes before, during, and after the application process at monthly intervals.

We construct all our monthly outcome variables from the administrative spell data of the IEB. Employment is measured as the share of days during which an individual is in contractual employment in a given month (thus varying between 0 and 1).[17] Wages in the IEB are measured as log gross daily wages which we average across all full-time spells in a given month and translate into hourly wages by dividing by 8.[18] As indicated before, we also use an index tracking the degree of regulation in an immigrant's current occupation. The use of an index is necessary because even though each 8-digit occupation in the German system can be unambiguously classified as either regulated (licensed) or unregulated, occupations in the IEB data are not recorded at such fine level of disaggregation. We therefore employ the mapping constructed by Vicari (2014) in which, based on information from the full IEB-registry for the year 2012, each 3-digit occupation is

[15] Civil servants, self-employed and military personnel are thus excluded from the IEB.

[16] There are also few cases where the status is pending and the individual still waiting for the result of the application. We exclude those cases from our analysis.

[17] The administrative data refer only to formal employment so that we cannot observe movements from informal to formal employment.

[18] Wages in the administrative data are right-censored at the social security contribution ceiling. This does not constitute a major issue in the context of this study since immigrants in Germany tend to earn wages well below the censoring limit.

assigned an index that represents the share of 8-digit subcategories within that occupation that requires a formal recognition of foreign qualifications in order to be accessible for immigrants. Weighting each 8-digit occupation by its relative size among the working population, the index ranges from zero (no subcategories requiring recognition) to one (all subcategories requiring recognition). We use this continuous index as a proxy for working in a regulated occupation.[19]

To provide some examples, Table 1 reports the ten 3-digit occupations with the highest (Panel A) and lowest (Panel B) share of regulated 8-digit occupations.[20] Apart from the value of the regulation index, we report the fraction of the working population employed in each of these occupation, the average hourly wage in the occupation, the annual rate of wage growth and the rate of wage growth over the first three years in an occupation. The descriptive evidence shows that average wages in the ten occupations with the highest degree of regulation are significantly higher than average wages in the ten occupations with the lowest degree of regulation, 11.70 vs. 8.73 euros per hour. In addition, occupations with a higher degree of regulation are also characterized by faster wage growth. For example, those working in the ten most regulated occupations have an average annual (first 3-year) wage growth of 3.76 (17.05) percent compared to 3.12 (13.45) percent for those working in the ten least regulated occupations. These positive associations between wage levels and wage growth on the one hand and the degree of occupational regulation on the other hand is also more generally detectable in the data. For example, regressing occupation-specific log hourly wages and annual wage growth rates on the regulation index yields positive and highly significant coefficients of 0.425 (0.001) and 0.373 (0.020), respectively.

As mentioned above, we restrict our sample to foreign-born individuals who either eventually receive full recognition or never apply for recognition during our observation window.[21] Out of this group, we select all individuals who migrated to Germany aged 18 or older and who remained in Germany thereafter. We further only consider observations for prime working age individuals aged between 25 and 59 and exclude individuals with a known incapacity for work. Finally, we condition on having requested recognition before 2015 to be able to observe post-recognition outcomes in the administrative data (which end in 2014). Our final estimation sample consists of 1,218 individuals, of which 140 receive full recognition and 1,078 never apply for recognition, either because they do not

[19]Note that if the distribution of immigrants with full recognition across 8-digit subcategories were the same as that of the existing working population, the interpretation of our parameter of interest $\beta$ would be the same whether we use our continuous regulation index on the 3-digit level as the dependent variable or a binary measure on the 8-digit level for whether or not a specific occupation is regulated. In both cases, $\beta$ would reflect the increase in the probability of working in a regulated occupation.

[20]The reported order of occupations is obtained after sorting by the index value and the fraction of the working population.

[21]The samples of immigrants whose application was denied (33) or who obtained only partial recognition (45) are too small to study separately in a meaningful way.

Table 1: Regulated and Unregulated Occupations

| | Index of Regulation (1) | Fraction of Working Pop. % (2) | Mean Wage (3) | Annual Rate of Wage Growth % (4) | First 3 Years Rate of Wage Growth % (5) |
|---|---|---|---|---|---|
| **Panel A. First 10 Occupations with High Degree of Regulation** | | | | | |
| Occupations in human medicine and dentistry | 1.000 | 0.544 | 16.443 | 4.655 | 32.508 |
| Occupations in veterinary medicine and non-medical animal health practitioners | 1.000 | 0.020 | 12.335 | 4.808 | 22.104 |
| Teachers in schools of general education | 0.991 | 0.351 | 13.228 | 3.143 | 13.089 |
| Occupations in police and criminal investigation, jurisdiction and the penal institution | 0.875 | 0.038 | 9.270 | 2.586 | 10.782 |
| Occupations in nursing, emergency medical services and obstetrics | 0.760 | 2.223 | 9.458 | 3.523 | 19.827 |
| Occupations in technical research and development | 0.753 | 1.752 | 14.015 | 2.795 | 11.179 |
| Occupations in construction scheduling and supervision, and architecture | 0.708 | 0.816 | 13.907 | 2.786 | 13.534 |
| Occupations in geriatric care | 0.628 | 0.102 | 7.034 | 7.272 | 18.007 |
| Occupations in education and social work, and pedagogic specialists in social care work | 0.445 | 2.151 | 9.454 | 3.365 | 17.045 |
| Ship's officers and masters | 0.442 | 0.072 | 11.827 | 2.620 | 12.450 |
| First 10 occupations (unweighted average) | 0.760 | 0.807 | 11.697 | 3.755 | 17.052 |
| **Panel B. Last 10 Occupations with Low Degree of Regulation** | | | | | |
| Sales occupations in retail trade (without product specialisation) | 0.000 | 4.262 | 6.844 | 3.689 | 16.922 |
| Driver of vehicles in road traffic | 0.000 | 3.497 | 8.849 | 1.613 | 9.523 |
| Occupations in metalworking | 0.000 | 3.083 | 9.684 | 2.714 | 13.842 |
| Trading occupations | 0.000 | 1.581 | 11.048 | 3.747 | 16.606 |
| Gastronomy occupations | 0.000 | 1.230 | 5.443 | 3.552 | 13.457 |
| Drivers and operators of construction and transportation vehicles and equipment | 0.000 | 0.793 | 9.896 | 1.779 | 6.780 |
| Occupations in housekeeping and consumer counselling | 0.000 | 0.653 | 5.977 | 2.637 | 11.331 |
| Occupations in technical media design | 0.000 | 0.419 | 10.684 | 3.150 | 17.591 |
| Occupations in advertising and marketing | 0.000 | 0.339 | 11.779 | 4.327 | 14.162 |
| Occupations in hotels | 0.000 | 0.272 | 7.074 | 4.007 | 14.243 |
| Last 10 occupations (unweighted average) | 0.000 | 1.613 | 8.728 | 3.121 | 13.446 |

Note: Data source: IEB data. Panel A refers to the first 10 occupations with the highest value of the regulation index. Panel B refers to the last 10 occupations with the lowest value of the regulation index. The index is provided by Vicari (2014) and is weighted according to the working population in each occupation in the full IEB registry in 2012. All descriptive values are computed using a 2 percent sample of the full (including immigrants and natives) IEB registry and refer to the years 1975-2014. Wages refer to the average real gross hourly wage considering all full-time spells. To mitigate the effect of outliers, we exclude the top and bottom 0.1 percentiles of the wage distribution. The rate of annual wage growth (column 4) refers to the within occupation relative difference in wages across two consecutive years. The first 3-year rate of wage growth (column 5) refers to the within occupation wage difference between the first and third year in a given occupation, relative to the first year wage.

have a foreign certificate with which to apply (568) or because they have one but choose not to apply (510).

Table 2 shows a number of descriptive statistics for our estimation sample which comprises individuals who receive full recognition (column 1) and individuals who did not apply for recognition (column 4). For completeness, we also report descriptive statistics for those in the survey who only received partial recognition (column 2) or were denied recognition (column 3). Focusing first on the full recognition sample, we see that 42.9 percent of the immigrants are men, aged 41.8 years on average in their last observable spell in our data. The schooling level of these immigrants is relatively high with 11.0 years of education (not counting tertiary education). The table also provides information about the typical migration and recognition process. On average, immigrants entered Germany when they were 31.3 years old. After that, they take on average about 8 months before making an official recognition request. One of the reasons for this delay could be the demanding recognition process which is one of the most important reasons reported by those deciding not to apply (12.9 percent), together with the lack of knowledge about how to apply (6.6 percent) and the bureaucratic and time-consuming nature of the process (6.6 percent). After on average 5.2 months, successful immigrants get to know the result of their application. However, as indicated by the large standard deviation of 12.1 months, there is significant variation in the waiting times.

Table 2 also provides information about each group's labor market outcomes, both during the first year after arrival in Germany and across all available time periods. In general, there are significant improvements in the employment rate between the first year and subsequent periods, particularly for those who applied for recognition. Average hourly wages for the full recognition and non-applicant group, in contrast, do not increase over time which is most likely due to strong positive selection into employment in the first year after arrival. When comparing across immigrant groups, there is substantial heterogeneity. Immigrants who obtain full recognition perform better in terms of wages relative to all other groups and in terms of initial employment relative to the two other applicant groups. They also tend to be younger when making their request than those immigrants whose application is eventually denied. Across all groups, the largest group in terms of country of origin are immigrants from the former USSR, mostly ethnic Germans, followed by immigrants from South East Europe. Given the heterogeneity in observable characteristics between the different immigrant groups, we analyze the robustness of our main results by replicating the analysis on the restricted sample of immigrants who eventually all received full recognition, thus only exploiting the differential timing of their recognition process for identification.

Unfortunately, until the third wave, the IAB-SOEP Migration Sample did not ask respondents explicitly for which specific occupation or field of study they requested recognition. If that information were available, we could separately study the labor market

Table 2: Descriptive Statistics by Recognition Outcome

| | Full Recognition | Partial Recognition | Denied Recognition | Non-Applicant |
|---|---|---|---|---|
| **Panel A. Immigrants** | | | | |
| Male % | 42.9 | 48.5 | 33.3 | 46.6 |
| | (49.7) | (50.8) | (47.7) | (49.9) |
| Yrs. Schooling | 11.0 | 10.1 | 10.0 | 10.4 |
| | (1.7) | (2.0) | (1.4) | (2.1) |
| Age Last Spell | 41.8 | 43.1 | 44.9 | 41.2 |
| | (9.6) | (8.5) | (8.5) | (9.6) |
| Age at first Migration | 31.3 | 29.5 | 32.8 | 31.3 |
| | (7.4) | (7.2) | (8.5) | (8.9) |
| Age at Request of Recognition | 32.1 | 32.3 | 35.4 | |
| | (7.5) | (9.8) | (9.2) | |
| Time Request to Result (Month) | 5.2 | 12.2 | 4.1 | |
| | (12.1) | (23.2) | (6.8) | |
| West % | 9.3 | 0.0 | 2.2 | 12.2 |
| | (29.1) | (0.0) | (14.9) | (32.7) |
| East Europe % | 12.9 | 12.1 | 4.4 | 16.3 |
| | (33.6) | (33.1) | (20.8) | (37.0) |
| South East Europe % | 25.7 | 15.2 | 8.9 | 22.4 |
| | (43.9) | (36.4) | (28.8) | (41.7) |
| USSR % | 35.7 | 57.6 | 68.9 | 28.6 |
| | (48.1) | (50.2) | (46.8) | (45.2) |
| Others % | 16.4 | 15.2 | 15.6 | 20.6 |
| | (37.2) | (36.4) | (36.7) | (40.5) |
| **Panel B. Observations - First Year In Germany** | | | | |
| Employed % | 29.7 | 13.0 | 7.6 | 31.2 |
| | (45.7) | (33.7) | (26.5) | (46.3) |
| Index Regulation % | 10.6 | 3.7 | 1.1 | 2.4 |
| | (27.6) | (16.0) | (9.7) | (10.3) |
| Real Hourly Wage | 12.7 | 7.5 | 5.2 | 9.0 |
| | (5.2) | (2.4) | (2.7) | (5.4) |
| **Panel C. Observations - Average Over Time** | | | | |
| Employed % | 66.1 | 52.9 | 53.5 | 58.3 |
| | (47.3) | (49.9) | (49.9) | (49.3) |
| Index Regulation % | 13.7 | 11.9 | 7.7 | 3.8 |
| | (27.4) | (25.4) | (22.0) | (12.4) |
| Real Hourly Wage | 10.7 | 8.8 | 7.5 | 8.7 |
| | (5.1) | (4.2) | (3.5) | (4.3) |
| Individuals | 140 | 33 | 45 | 1,078 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. Statistics depicted are means with standard deviations in parentheses. Statistics are based on individuals in upper panel and on monthly observations in the lower two panels. Employed % compares time periods of employment to times of employment and non-employment. Because information on regulated occupations is not available at the level of the single occupation, but only at the aggregate level of the regulation index provided by the IAB, each occupation has a degree of regulation corresponding to the regulation index ranging between 0 and 1. The table reports the average regulation index for the respective groups in the sample. Real hourly wages are constructed from daily wage information using only full-time spells and assuming that full-time employment is 8 hours per day.

effects for regulated and unregulated occupations, which would allow us to distinguish the pure signalling effect of occupational recognition from the effect arising due to better access to certain occupations.[22] What we do observe in all three waves of the data, however, is the general type of certificate for which recognition is being requested, with

[22]Table A.1 in the appendix reports the occupational distribution for the 38 respondents in the refreshment sample of the third wave who received full recognition of their qualifications. In line with official aggregate figures, most of these occupations are indeed regulated (71.1 percent) and require comparatively high skill levels, such as nurses and doctors (23.7 percent of recognitions), engineers (13.2 percent), veterinaries (10.5 percent) and teachers (7.9 percent).

the highest fraction applying for the recognition of a college/university degree (57.0 percent), followed by a vocational training (36.0 percent), a doctoral degree (4.5 percent) and some other education (2.5 percent). In the first two waves, we also observe the type of authority to which immigrants applied for recognition, which can be used as a proxy for seeking recognition of a regulated or unregulated occupation (see Section 5.3).

# 5 Main Results

In this section, we first present estimates of the average impact of recognition on employment, wages and the regulation index and check the robustness of these findings to different sample definitions. We then graphically show the results from our dynamic specification, followed by an analysis of heterogeneous treatment effects in terms of immigrants' characteristics and key features of their recognition process.

## 5.1 Static Effects

In Panel A of Table 3, we report the static results from our baseline specification (1). In Panel B, we add a dummy that turns on during the application period as an additional control variable to deal with any potential anticipatory behavior on the part of the applicants. The estimate in column (1) of Panel A shows that obtaining full occupational recognition increases the share of days in employment per month by 16.0 percentage points, suggesting that occupational recognition helps immigrants find and maintain employment. In the specification including the dummy for the application period (Panel B), the effect of receiving full recognition increases slightly to 16.5 percentage points. The point estimate for having applied, in turn, is close to zero and statistically not significant, indicating that applying in itself neither serves as a positive signal in the labor market nor does it reduce employment outcomes, for example because of a lower job search intensity in anticipation of the final result of the application.[23] In most of the following discussion of our findings, we nonetheless focus on the specification with an included dummy for the application period. Column (2) shows the results of occupational recognition for log wages. Full recognition increases wages by 17.0 percent (15.7 log points) according to Panel A and 15.1 percent (14.1 log points) according to Panel B, suggesting that recognition enables immigrants to more effectively utilize their skills in the host country's labor market. Note, however, that the coefficient in Panel B is not significant at conventional levels.

Column (3) shows that after recognition, immigrants move increasingly into more regulated jobs, with the regulation index of their occupations increasing by around 15

[23] An observationally equivalent explanation would be that both effects exist but that they compensate each other.

Table 3: Occupational Recognition and Average Labor Market Outcomes

| | Employment (1) | Log Wages (Full-time) (2) | Regulation Index (3) | Regulation Index (Employed) (4) |
|---|---|---|---|---|
| **Panel A** | | | | |
| Received full recognition | 0.160*** | 0.157* | 0.150*** | 0.114** |
| | (0.050) | (0.080) | (0.033) | (0.056) |
| **Panel B** | | | | |
| Application period | 0.024 | -0.053 | 0.009 | 0.065 |
| | (0.067) | (0.105) | (0.035) | (0.065) |
| Received full recognition | 0.165*** | 0.141 | 0.152*** | 0.129* |
| | (0.052) | (0.103) | (0.035) | (0.068) |
| Individuals | 1,218 | 830 | 1,218 | 1,081 |
| with recognition | 140 | 114 | 140 | 132 |
| without recognition | 1,078 | 716 | 1,078 | 949 |
| Observations | 136,306 | 50,971 | 129,471 | 74,003 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. Panel A reports the estimates based on specification (1), Panel B adds a dummy variable for the application period as discussed in the text. The dependent variable is the share of days in employment per month in column (1), log real hourly wages for full-time employees averaged over all spells in a given month in column (2), the index of occupational regulation, assigning a value of zero to the non-employed, in column (3), and the index of occupational regulation in column (4). Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency.
Standard errors in parentheses are clustered at the individual level: * p<0.10, ** p<0.05, *** p<0.01.

percentage points on average. Since, for this estimation, we keep non-employed immigrants in the sample and set their regulation indices equal to zero, some of the positive effect is likely driven by the significant movement from non-employment to employment shown in column (1). However, given a mean regulation index of 0.066 for employed immigrants without recognition (0.130 for the 90th percentile), the estimated coefficient is large, suggesting that part of the increase is also driven by movements from unregulated to regulated occupations. To investigate this possibility, we study the effect of occupational recognition on the regulation index conditional on being employed in column (4). For the subset of employed workers, full occupational recognition leads to a move into occupations that are on average 12.9 percentage points more likely to be regulated. The similarity between the results in the last two columns suggests that movements into more regulated occupations happen to a similar extent from non-employment and unregulated jobs.

Table A.2 in the appendix provides robustness checks with respect to our sample selection procedure by introducing additional restrictions one at a time. Column (4) restates the baseline results of Table 3 with our preferred and most restrictive sample. In column (1), we impose only the restriction of having migrated after the age of 18. Compared to our baseline results the effects are smaller, notably for the wage outcome. In

column (2), we then exclude individuals who have an incapacity for work. The estimated effects of full recognition on employment, wages and the regulation index all increase somewhat, with the largest impact being on the employment outcome where the estimate increases from 0.149 to 0.172. In column (3), we impose the additional restriction of only including observations for individuals of prime working age (age 25-59). This leads to a lowering of the employment effect towards our baseline estimate but otherwise only minor changes. Finally, we exclude individuals that migrated to Germany more than once in column (4) which leads to an increase in the estimate for log real wages. We exclude these individuals in our preferred specification since we do not know their labor market outcomes during their time outside of Germany. Overall, the particular sample selection rules do not seem to have a large impact on the magnitude of our main estimates.

Table A.3 in the appendix shows how our estimates of the impact of occupational recognition on the different labor market outcomes vary with the set of control variables included in the specification. After controlling for time since migration and individual fixed effects, the further inclusion of time fixed effects, the quadratic age profile and the German proficiency control has little impact on our point estimates.

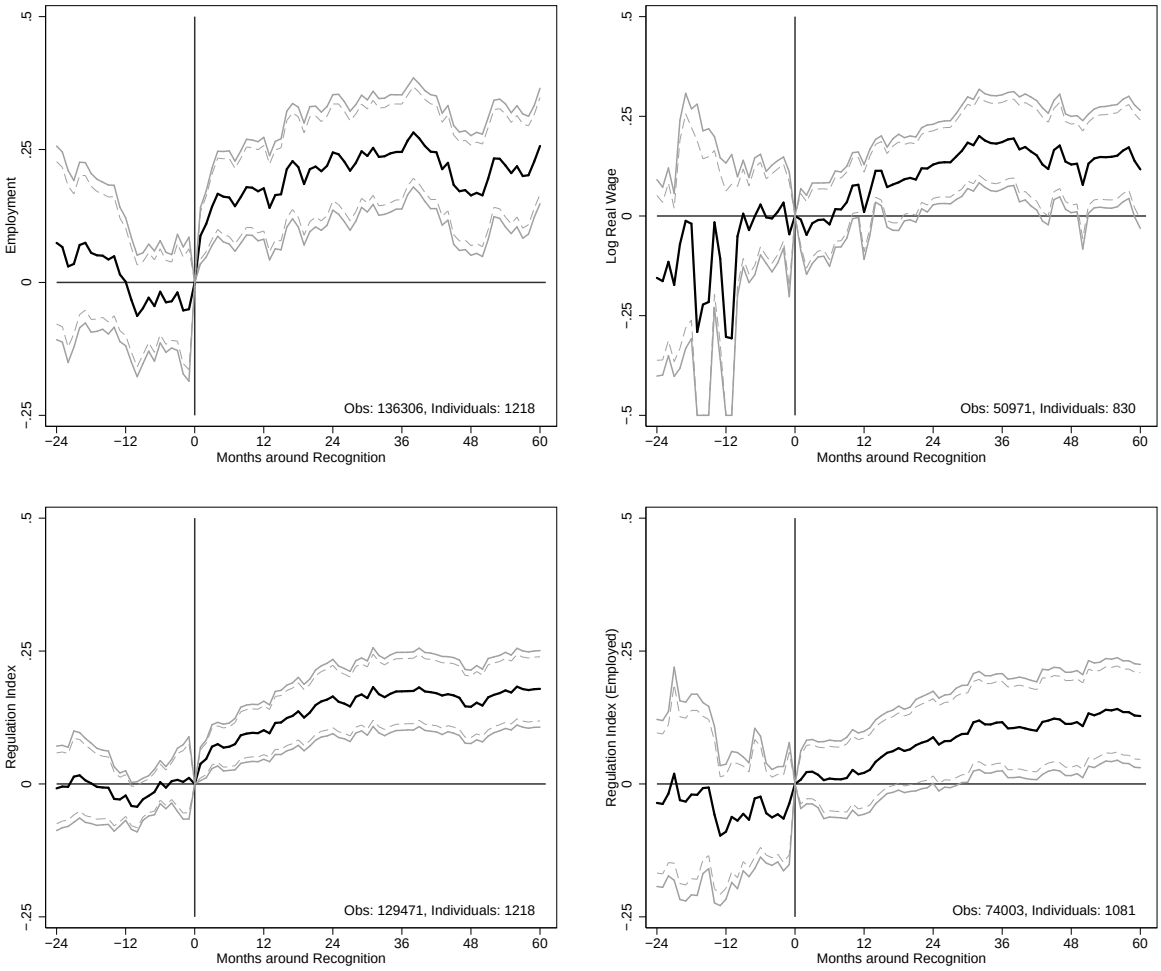
## 5.2 Dynamic Effects

We now turn our attention to the results from the dynamic specification given in equation (2). In all reported estimations, we include a dummy for the application period and use the same sample restrictions as for the static main results in Table 3. For better readability, we plot the estimates of the period-specific effects $\delta_{t-q}$ graphically together with their corresponding 90% and 95% confidence intervals. Figure 1 displays the effects of occupational recognition on employment (upper left panel), log real wages (upper right panel), the regulation index including the non-employed (lower left panel) and the regulation index conditional on employment (lower right panel) in the 24 months before and 60 months after recognition.

In the months after receiving full recognition, the difference in the share of days per month in employment increases rapidly relative to the control group, reaching 17.1 percentage points after 12 months. After that, the employment gap continues to grow albeit at a slower rate, reaching a value of 24.5 percentage points three years after recognition and stabilizing thereafter at slightly lower levels. This pattern suggests that occupational recognition increases the labor market opportunities of immigrants relatively quickly following the positive decision, and that their employability stays higher even in the long run, most likely due to their wider access to jobs. Reassuringly, there is no discernible difference in employment rates between those immigrants who obtain recognition within the following 24 months and those who do not, as indicated by the small and insignificant parameter estimates prior to the recognition date.

The corresponding dynamic pattern for log wages (upper right panel), shows an in-

Figure 1: Dynamic Effects of Occupational Recognition




Note. Data source: IAB-SOEP Migration Sample linked to IEB data. The figures report the coefficients of the period dummies obtained from estimating regressions of specification (2) including a dummy for the application period. The dependent variable is the share of days in employment per month (upper left panel), log real wages for full-time employees (upper right panel), the index of occupational regulation, assigning a value of zero to the non-employed (lower left panel) and the index of occupational regulation (lower right panel). Additional controls are: the long-run average effect after recognition ($\text{CertRecog}_{i,t-61}$), the long-run average effect before recognition ($\text{CertRecog}_{i,t+25}$) an indicator for the application period, individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. 90% and 95% confidence intervals displayed using clustered standard errors at the individual level. Values of the confidence interval in the wage graph are cut at -0.5 for presentation purposes.

crease of the relative wage differential over time without any immediate jump. After receiving recognition, there is an increase in hourly wages that reaches 8.1 percent (7.8 log points) after one year and 19.8 percent (18.1 log points) after three years. From then onwards, the wage differential relative to those without occupational recognition levels off and coefficients fluctuate around a difference of around 16 percent. The reason for the delayed onset of significant wage gains from occupational recognition could be due to the fact that it takes time for immigrants to locate jobs in the higher paying and now accessible regulated segment of the labor market. It could also be that employers' remain initially skeptical regarding the equivalence between foreign and native credentials, and that this skepticism is only overcome with time. While somewhat more noisy due

to the smaller sample size of employed immigrants, there is once again no evidence of a significant wage gap in the months prior to recognition, especially in the immediately preceeding year, lending credibility to the claim that the subsequent positive wage effects are indeed causally related to the occupational recognition.

The dynamic results with respect to the occupational regulation index in the lower panel of the figure provide further insights into the ways immigrants gain employment after recognition by entering increasingly more regulated occupations. When including non-employed individuals in the estimation (lower left panel), there is a rapid increase in the regulation index starting immediately after recognition by 9.6 percentage points after 12 months. Subsequently, the occupations chosen by immigrants with successful occupational recognition continue to have a higher regulation index compared to those of immigrants' without recognition, with the gap increasing to 17.4 percentage points after three years. This delay until all occupational adjustments after recognition materialize is likely due to difficulties of locating a suitable job in the regulated market segment for some migrants.

When considering the effect of recognition on the regulation index conditional on employment (lower right panel), the pattern is slightly different. In this case, we do not observe differentials in the regulation of occupations between immigrants with and without occupational recognition until about 12 months after recognition, mirroring the corresponding pattern for log wages. Only after this initial time period, the relative movements into more regulated occupations become significant, evident by a steady increase in our sequence of estimates. After three years, the relative increase in the probability of working in a regulated occupation amounts to 11.5 percentage points and remains more or less constant over the remaining time period. Taken together, these two dynamic regressions show that a successful recognition is helpful in securing employment in regulated occupations. Initially, these employment gains are mostly due to non-employed workers finding jobs in the regulated segment but after some delay, there is also a shift among employed workers into more regulated occupations. These observations are in line with the suggested mechanism underlying the slow wage growth. Securing a regulated occupation does not directly imply higher wages. But the continuous employment in these occupations, which tend to be the jobs with higher wages and faster wage growth, generate the observed long-term wage effects.

The evidence presented in this section suggests that immigrants who have not yet applied for recognition and those who never apply can serve as a reasonable control group in our difference-in-differences setting. As a robustness check, we redo the analysis but restrict the sample to only those immigrants who eventually all get full recognition. By focussing a priori on this group of immigrants, we reduce observable and unobservable heterogeneity in the sample, and identify the parameters of interest exclusively from the differential timing of the recognition processes across individuals (compare e.g. Arai and

Thoursie, 2009, for a similar approach). As Figure A.1 and Table A.4 in the appendix show, our main results are robust to this alternative identification strategy, with average employment and wage effects slightly higher and movements into regulated occupations slightly lower. Similarly, the results from the pooled synthetic control method reported in Appendix A.2 confirm that occupational recognition has positive effects on immigrants' employment, hourly wages and probability of working in a regulated occupation.

## 5.3 Heterogeneous Effects

Our results so far speak to the overall static and dynamic effects of occupational recognition on immigrants' labor market outcomes. In this section, we study the heterogeneity of these effects across a number of different dimensions. Because of our relatively small sample size, several of the estimates in this section suffer from low precision, making it hard to draw strong conclusions. Table 4 presents results where we allow the treatment effect to vary by the type of foreign certificate for which immigrants applied for recognition. As mentioned before, we do not observe the exact certified occupation or field of study of a successful applicant, but we do observe the broad educational category for which recognition is requested, allowing us to distinguish four groups: vocational training, college/university degree, doctoral degree and any other education.[24]

The empirical results suggest that the recognition process is important for most types of qualifications. Except for the category of *other education*, all coefficients for employment and wage regressions are positive though in several case not statistically significant. The group with a doctoral degree benefits the most with an employment increase of 45.6 percentage points and a wage effect of 35.7 percent (30.5 log points), followed by the group with vocational training with an employment effect of 26.9 percentage points and an insignificant wage effect of 6.3 percent (6.1 log points). The movement into regulated occupations is similar for the groups with vocational training and college/university degrees. For the group with doctoral studies, the movement from non-employment into regulated occupations is particularly important. Conditional on being employed, the coefficient is actually negative, although not significant, suggesting that these immigrants remain unemployed until they get a position in their desired regulated occupation.

A complementary analysis considers heterogeneous effects across the different types of authorities to which immigrants apply for recognition. To which specific institutions immigrants must apply depends on the particular occupation or field of study for which they seek recognition. Different authorities are associated with more or less regulated occupations, allowing us to use the information on the recognizing authority as a proxy

[24]The reported education levels in the survey are, in decreasing order: 1. doctoral degree, 2. university education, 3. college education, 4. vocational school, 5. apprenticeship, 6. practical training, 7. other education, 8. missing. We aggregate groups 2 and 3 into the group "college/university degree" and groups 4-6 into the group "vocational training". Since every immigrant with full recognition provided valid information about his or her education level, there is no "missing" category in Table 4.

Table 4: Static Effects by Type of Recognized Certificate

| | Employment (1) | Log Wages (Full-time) (2) | Regulation Index (3) | Regulation Index (Employed) (4) |
|---|---|---|---|---|
| Application period | 0.026 | -0.041 | 0.005 | 0.062 |
| | (0.065) | (0.104) | (0.035) | (0.066) |
| Full recognition of | | | | |
| vocational training | 0.269*** | 0.061 | 0.164** | 0.189 |
| | (0.055) | (0.174) | (0.065) | (0.122) |
| college/university degree | 0.101 | 0.161 | 0.132*** | 0.135** |
| | (0.070) | (0.122) | (0.039) | (0.065) |
| doctoral degree | 0.456*** | 0.305 | 0.431** | -0.261 |
| | (0.095) | (0.261) | (0.178) | (0.601) |
| other education | -0.148 | 0.261*** | -0.026*** | -0.008 |
| | (0.130) | (0.028) | (0.009) | (0.015) |
| Individuals | 1,218 | 830 | 1,218 | 1,081 |
| with recognition | 140 | 114 | 140 | 132 |
| without recognition | 1,078 | 716 | 1,078 | 949 |
| Observations | 136,306 | 50,971 | 129,471 | 74,003 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. The estimates are based on specification (1) including a dummy for the application period and separate treatment dummies for individuals with vocational training, university/college degree, doctoral degree and other education as their highest level of foreign training for which they requested recognition. The dependent variable is the share of days in employment per month in column (1), log real wages for full-time employees in column (2), the index of occupational regulation, assigning a value of zero to non-employed in column (3), and the index of occupational regulation in column (4). Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. For individuals with several foreign certificates, the highest in terms of educational value is chosen.
Standard errors in parentheses are clustered at the individual level: * p<0.10, ** p<0.05, *** p<0.01.

for recognition of a regulated versus unregulated occupation. We distinguish between five broad groups: the Chamber of Crafts, the Chamber of Industry and Commerce, and the Office for the Recognition of Foreign University Degrees, all of which are dealing primarily with unregulated occupations, and the Chambers of Physicians, Dentists, Veterinarians and Pharmacists, and Other Institutions, which are dealing primarily with regulated occupations.[25]

As shown in Table 5, for trained physicians, dentists, veterinarians, and pharmacists, the benefits from obtaining a recognition are substantial, with an employment effect of 50.6 percentage points and a wage effect of 235.0 percent (120.9 log points). While this wage effect appears large, it is comparable to the findings by Kugler and Sauer (2005) who find a return to a medical license for immigrants in Israel between 180 and 340 percent. There is also a large impact on the probability of working in a regulated occupation, with

[25]To identify the particular authority responsible for the recognition of specific occupations we use information from https://www.anerkennung-in-deutschland.de/. The exact assignment can deviate within occupation, since rules vary by region and the information provided only reflects the current situation.

Table 5: Static Effects by Type of Recognizing Authority

| | Employment (1) | Log Wage (Full-time) (2) | Regulation Index (3) | Regulation Index (Employed) (4) |
|---|---|---|---|---|
| Application period | 0.023 | -0.043 | 0.005 | 0.063 |
| | (0.074) | (0.092) | (0.032) | (0.062) |
| Full recognition from | | | | |
| Chamber of Crafts | 0.096 | 0.327*** | 0.061 | 0.004 |
| | (0.120) | (0.065) | (0.058) | (0.026) |
| Chamber of Industry and Commerce | 0.258*** | -0.005 | 0.067 | 0.193 |
| | (0.065) | (0.251) | (0.065) | (0.181) |
| Office Recognition University Degree | 0.109 | 0.434*** | 0.102 | 0.072 |
| | (0.150) | (0.106) | (0.065) | (0.280) |
| Chambers of Physicians, etc. | 0.506*** | 1.209*** | 0.440*** | 0.284*** |
| | (0.038) | (0.115) | (0.169) | (0.064) |
| Other Institutions | 0.114 | 0.028 | 0.197*** | 0.195** |
| | (0.083) | (0.151) | (0.062) | (0.093) |
| Individuals | 833 | 600 | 833 | 750 |
| with recognition | 99 | 82 | 99 | 93 |
| without recognition | 734 | 518 | 734 | 657 |
| Observations | 122,905 | 46,484 | 116,316 | 66,996 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. The estimates are based on specification (1) including a dummy for the application period and separate treatment dummies for recognition through the Chamber of Crafts, Chamber of Industry and Commerce, Office for the Recognition of Foreign University Degrees, Chambers of Physicians, Dentists, Veterinarians and Pharmacists, and Other Institutions. The dependent variable is the share of days in employment per month in column (1), log real wages for full-time employees in column (2), the index of occupational regulation, assigning a value of zero to the non-employed in column (3), and the index of occupational regulation in column (4). Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency.
Standard errors in parentheses are clustered at the individual level: * p<0.10, ** p<0.05, *** p<0.01.

an increase of the regulation index by 28.4 percentage points, conditional on employment. This reflects the fact that physicians, dentists, veterinarians, and pharmacists are all licensed occupations and hence a formal recognition indispensable for working in these occupations.

Immigrants who obtain recognition from the Office for the Recognition of Foreign University Degrees also experience substantial wage gains of 54.3 percent (43.4 log points) but the employment responses are relatively small, reflecting the fact that most of the relevant occupations are unregulated and thus already accessible prior to obtaining recognition. The same is true for the Chamber of Crafts and the Chamber of Industry and Commerce, where the effect on the probability of working in a regulated occupations, conditional on employment, is once again not as important. Interestingly, for these two cases there are, however, still sizeable employment and wage effects: the wage effect for recognitions from the Chamber of Crafts is 38.6 percent (32.7 log points) and the em-

Table 6: Static Effects by GDP in Country of Origin

| | Employment (1) | Log Wage (Full-time) (2) | Regulation Index (3) | Regulation Index (Employed) (4) |
|---|---|---|---|---|
| Application period | 0.031 | -0.053 | 0.007 | 0.068 |
| | (0.068) | (0.100) | (0.035) | (0.072) |
| Received full recognition | 0.177*** | 0.143 | 0.149*** | 0.138* |
| | (0.052) | (0.100) | (0.035) | (0.077) |
| Received full recognition | -0.000 | -0.016** | 0.001 | 0.000 |
| × GDP/capita 2015 (demeaned) | (0.004) | (0.007) | (0.004) | (0.003) |
| Mean GDP/capita | 5.49 | 5.80 | 5.56 | 5.76 |
| Individuals | 1,140 | 780 | 1,140 | 1,014 |
| with recognition | 133 | 107 | 133 | 125 |
| without recognition | 1,007 | 673 | 1,007 | 889 |
| Observations | 124,982 | 46,925 | 118,439 | 68,362 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. Estimates based on specification (1) including a dummy for the application period and an interaction term with demeaned GDP per capita. The dependent variable is the share of days in employment per month in column (1), log real wages for full-time employees in column (2), the index of occupational regulation, assigning a value of zero to the non-employed in column (3), and the index of occupational regulation in column (4). Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. The mean GDP/capita is the average among included individuals weighted by their number of observations (in $1,000). GDP information is taken from World Bank database.
Standard errors in parentheses are clustered at the individual level: * p<0.10, ** p<0.05, *** p<0.01.

ployment effect for recognitions from the Chamber of Industry and Commerce is 25.8 percentage points.[26] Together with the positive wage effects estimated for recognitions from the Office for the Recognition of Foreign University Degrees, these results suggest that even for unregulated occupations a formal recognition in Germany has significant positive effects on subsequent labor market outcomes, possibly due to its role in signalling immigrants' skills to potential employers.

An important finding in the literature on immigrant assimilation is that the transferability of immigrants' skills depends on the closeness between the education system of the origin country and the host country. A natural question in this context is whether the effect of occupational recognition also varies with the characteristics of the immigrants' home countries. Using GDP per capita as a proxy for the closeness between the home country and Germany, the estimates in Table 6 show that the effect of recognition is quite homogeneous across home countries. By demeaning the interaction variable, the coefficient on the main recognition dummy is close to the average effect we estimate in our baseline specification. The coefficients of the interaction terms, in turn, are very close to zero, with the only exception being the impact on wages, where an increase

[26]Different labor market institutions, such as unionization and other occupation-specific regulations, might explain why recognitions from the Chamber of Crafts primarily affect wages while recognitions from the Chamber of Industry and Commerce mostly affect the employment margin.

of GDP per capita by $1,000 leads to a 1.6 percent smaller increase in wages. This is not surprising since immigrants from richer countries are likely to earn higher wages in the German labor market to start with due to the better quality and transferability of their home country specific human capital, so that they have less to gain from obtaining occupational recognition than immigrants from poorer countries.

# 6 Implications for Immigrant Earnings Assimilation

Our results so far have shown significant positive long-run effects of occupational recognition on immigrants' employment and wage outcomes. In this section, we put these gains into perspective by relating them to standard earnings assimilation profiles of immigrants in Germany. For this purpose, we merge a 1 percent random sample of native German workers in the IEB to our IAB-SOEP Migration Sample and jointly estimate the following immigrant and native earnings equations:

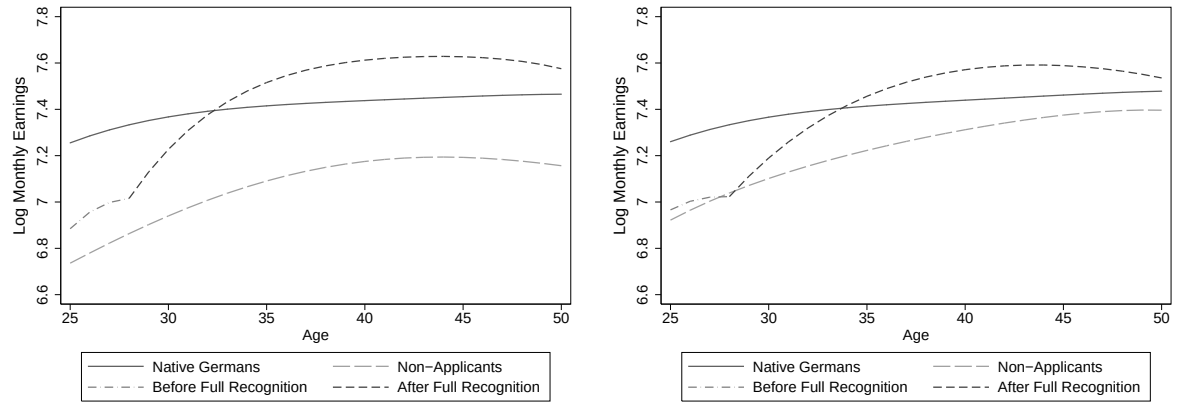
$$\begin{aligned} &\text{Immigrants:} && \log w_{it} = \phi_m' X_{it} + \alpha_m \cdot \text{age}_{it} + \beta \cdot \text{ysm}_{it} + \gamma \cdot \text{ysr}_{it} + \delta C_i + \theta_m \pi_t + \varepsilon_{it} \\ &\text{Natives:} && \log w_{it} = \phi_n' X_{it} + \alpha_n \cdot \text{age}_{it} + \theta_n \pi_t + \varepsilon_{it}, \end{aligned} \tag{3}$$

where $w_{it}$ are total monthly earnings of individual $i$ at time $t$, $X_{it}$ is a vector of socioeconomic characteristics (educational attainment[27], gender, federal state of residence), $\text{age}_{it}$ represents a quartic function of the individual's age, $\text{ysm}_{it}$ represents a quartic function of the number of years since migration, $\text{ysr}_{it}$ represents a quartic function of the number of years passed since the result of the recognition process was obtained (set to zero for all immigrants who never applied for recognition), $C_i$ is a vector of dummy variables indicating an immigrant's arrival cohort (1970-1994, 1995-2005, 2005-2013), and $\pi_t$ is a vector of year fixed effects. Since aging, cohort and period effects are perfectly collinear, we impose the standard assumption that period effects are the same for immigrants and natives ($\theta_m = \theta_n$) as suggested by Borjas (1995). We estimate this model using all available monthly native and immigrant observations, clustering our standard errors at the individual level. The immigrants in the sample belong to four distinct groups: immigrants who never applied for recognition, immigrants who applied but were denied recognition, immigrants who applied and gained partial recognition, and immigrants who applied and gained full recognition. We drop immigrants who applied for recognition but whose decision is pending at the time of the survey from the sample. In the estimation, we allow the age, years since migration and years since recognition profiles to vary between each of the four immigrant groups.

Rather than presenting the full regression results, which can be found in Table A.5 in the appendix, we use the estimates from the two-equation regression model in (3) to

[27] We use the imputed education variable obtained by applying the IP1 algorithm developed by Fitzenberger et al. (2005).

Figure 2: Effect of Recognition on Immigrant Assimilation Profiles




Note: The displayed simulations of earnings profiles in the left and right panel are based on parameter estimates reported in columns (2) and (4) of Table A.5, respectively. Immigrants are assumed to enter Germany at the age of 25, with the comparison being relative to natives of the same age. We compute each profile for the mean values of all socioeconomic characteristics in the sample, thus accounting for observable differences in educational attainment, gender, federal state of residence and time period between the different immigrant groups and natives. The intercepts of the different immigrant groups reflect their weighted mean cohort effects. The left panel shows the predicted earnings profiles without controlling for occupations, the right panel the profiles after controlling for 3-digit occupations in the IEB data.

predict native and immigrant earnings profiles (compare column (2) of Table A.5). We simulate earnings profiles for immigrants who enter Germany at the age of 25 and compare them to the corresponding earnings profile of natives of the same age. We compute each profile for the mean values of all socioeconomic characteristics in the sample, thus netting out the effects arising from observable differences in educational attainment, gender, federal state of residence and time period between the different immigrant groups and natives. The intercepts of the four immigrant groups reflect the weighted means of their cohort effects.[28] For clarity, the left panel of Figure 2 only depicts the predicted log earnings profiles of native Germans, immigrant non-applicants, and immigrants who eventually receive full recognition, suppressing the corresponding profiles for immigrants whose application is denied and immigrants who only receive partial recognition, which together make up only a small fraction of the overall sample.

Immigrants who never apply for recognition (who make up 81.5 percent of the immigrant sample) initially face an earnings gap relative to native Germans of 40.5 percent (51.9 log points) which steadily declines over time, levelling off at around 22.5 percent (25.5 log points) after 15 years of residence in Germany. The earnings of immigrants who eventually obtain full recognition (11.6 percent of the immigrant sample) grow initially at a similar rate but start from a more advantageous position, with an earnings gap upon arrival of only 31.0 percent (37.1 log points). After obtaining full recognition, which for these simulations we assume to occur after three years of residence in Germany (the mean duration between arrival and recognition in the assimilation sample), the speed of

[28]Similarly to Bratsberg et al. (2006), we allow the returns to education and gender to vary between natives and immigrants, but not between different immigrant groups. We further assume that the region effects are the same for immigrants and natives.

convergence of these immigrants' earnings increases substantially (dashed line), leading to a catch-up and eventual overtaking of native earnings after about 8 years, with a maximum positive earnings advantage of around 19.8 percent (18.0 log points) observed after 17 years in the country. However, due to the small sample size, we lack precision in the estimates for the immigrant group with full recognition, so that from 5 years since migration onwards, their earnings gap relative to natives is no longer statistically significant. These findings suggest that occupational recognition has a significant effect on the speed of immigrants' economic assimilation in Germany.

Part of the reason for why immigrants who obtain full recognition may outperform the average native in the left panel of Figure 2 is their greater likelihood of working in high-paying occupations, for example in the health sector. Controlling for educational attainment partly accounts for such heterogeneity but even within the group of say university-educated workers, immigrants with occupational recognition are likely to be working in more attractive occupations. In the right panel of Figure 2, we depict predicted assimilation profiles from an extended specification in which we control for a full set of 3-digit occupation dummies (compare column (4) of Table A.5). Since part of the growth in immigrants' earnings over time is due to their climbing of the occupational ladder, one would generally not want to control for occupation in these types of assimilation regressions. Including occupation fixed effects, however, improves the comparability of natives and immigrants in our sample and, importantly, reveals information about the relative earnings of immigrants and natives within the same occupations, which could be interpreted as a proxy for the quality of the services provided by immigrants relative to natives in the same types of jobs.

As the right panel of Figure 2 shows, holding the occupational distribution constant across groups, reduces somewhat the earnings gaps of the different immigrants groups relative to natives. The initial gaps for non-applicants and immigrants who eventually obtain full recognition are now almost identical, 28.7 percent (33.8 log points) and 25.4 percent (29.4 log points) respectively. As before, we do observe an acceleration of the speed of assimilation at the time recognition is obtained and an eventual overtaking of native earnings after 10 years, with the maximum gap amounting to a statistically not significant 14.9 percent (13.9 log points) 17 years after arrival. The good relative performance of immigrants who obtain full recognition for their foreign qualifications is therefore not just due to their advantageous distribution across occupations relative to the representative sample of natives that serves as the comparison group. Rather, it appears that even conditional on occupation, these immigrants perform at least at the same level as their native counterparts, mitigating concerns that occupational recognition leads to a dilution of occupational standards and suggesting that the formal recognition process in Germany does a reasonable job in ensuring the equivalence of foreign qualifications with their native counterparts.

# 7 Conclusion

In this paper, we analyze how the formal recognition of immigrants' foreign qualifications affects their subsequent labor market outcomes. For our analysis, we exploit a novel linked survey-social security data set which, besides including comprehensive information about workers' entire work histories, explicitly asks participants, if applicable, about the timing of their recognition process in Germany. This allows us to assess in detail how occupational recognition affects immigrant labor market outcomes, both from a static and dynamic point view. Comparing the labor market outcomes of immigrants who obtain full recognition to those of immigrants who either never apply or have not yet received full recognition themselves, the evidence from our dynamic difference-in-differences specification suggests large and long-lasting positive effects of occupational recognition on immigrants' labor market outcomes, with a 24.5 percentage point higher employment rate and a 19.8 percent higher hourly wage three years after obtaining recognition. We further document that occupational recognition indeed induces workers to enter regulated occupations, both directly out of non-employment and, with some delay, through horizontal movements of employed workers from unregulated into regulated occupations.

Further heterogeneity analysis suggests that formal recognition is not only beneficial with respect to regulated occupations but also when it comes to occupations that are freely accessible even in the absence of recognition. This important finding suggests that, besides granting access to regulated occupations, the certification of foreign qualifications also plays a signalling role in the German labor market, eliminating uncertainty about an immigrant worker's occupational skills. The signalling value of formal recognition appears to be particularly large for immigrants from less developed countries, who, at least in terms of wages, benefit significantly more from the recognition of their qualifications. This could be due to the higher initial degree of uncertainty in the German labor market regarding these immigrants' qualifications, which means there is more to gain from a formal certification of these qualifications' equivalence with their native counterparts.

We conclude by showing that occupational recognition leads to a significant acceleration of immigrants' earnings growth relative to natives. Recognizing immigrants' foreign credentials may thus be an effective way of tapping into their human capital and fostering their integration into the host country's economy. More generally, our results suggest that part of the substantial employment and wage gaps between natives and immigrants around the world may be due to the lack of formal recognition of the latter's occupational qualifications. The large positive wage effects and the eventual full convergence to native earnings indicate that, at least in Germany, foreign credentials, once declared equivalent to native ones, are indeed valued in the labor market, mitigating fears of a watering-down of occupational standards.

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# Appendix

## A.1 Tables and Figures

Table A.1: Distribution of Occupations for Requested Recognition

| Occupation | % |
|---|---|
| Doctor | 13.16 |
| Engineer | 13.16 |
| Nurse | 10.53 |
| Veterinary | 10.53 |
| Teacher | 7.89 |
| Civil Servant (executive officer) | 2.63 |
| Pharmacist | 2.63 |
| Midwife | 2.63 |
| Shop Assistant | 2.63 |
| Physioterapist | 2.63 |
| Correspondent in foreign language | 2.63 |
| Agrotechnical Assistant (state approved) | 2.63 |
| IT-Assistant (state approved) | 2.63 |
| Vocational College in Electronics (state approved) | 2.63 |
| Business Economist | 2.63 |
| Biologic Laboratory Technician (state approved) | 2.63 |
| Marketing Specialist | 2.63 |
| Cook | 2.63 |
| Food Inspector | 2.63 |
| Financial advisor | 2.63 |
| Manufacturer | 2.63 |
| Reseacher | 2.63 |
| Total | 100.00 |

Note. Data source: IAB-SOEP Migration Sample, third wave. The table refers to the distribution of occupations for which recognition was requested. Only individuals obtaining full recognition are considered.

Table A.2: Impact of Different Sample Selection Procedures

| | Migration after 18yr (1) | (1) + w/o incapacity (2) | (2) + working age (3) | (3) + stay in Germany (4) |
|---|---|---|---|---|
| **Employment** | | | | |
| Application period | -0.008 | 0.023 | 0.051 | 0.024 |
| | (0.058) | (0.055) | (0.060) | (0.067) |
| Received full recognition | 0.149*** | 0.172*** | 0.162*** | 0.165*** |
| | (0.055) | (0.049) | (0.055) | (0.052) |
| Individuals | 1,470 | 1,412 | 1,346 | 1,218 |
| with recognition | 166 | 159 | 158 | 140 |
| without recognition | 1,304 | 1,253 | 1,188 | 1,078 |
| Observations | 189,027 | 176,994 | 155,566 | 136,306 |
| **Log Real Wage** | | | | |
| Application period | -0.139 | -0.117 | -0.113 | -0.053 |
| | (0.097) | (0.098) | (0.102) | (0.105) |
| Received full recognition | 0.070 | 0.089 | 0.086 | 0.141 |
| | (0.096) | (0.103) | (0.106) | (0.103) |
| Individuals | 1,019 | 976 | 924 | 830 |
| with recognition | 135 | 129 | 128 | 114 |
| without recognition | 884 | 847 | 796 | 716 |
| Observations | 62,982 | 59,280 | 55,765 | 50,971 |
| **Regulation Index** | | | | |
| Application period | 0.020 | 0.025 | 0.028 | 0.009 |
| | (0.029) | (0.030) | (0.033) | (0.035) |
| Received full recognition | 0.144*** | 0.153*** | 0.157*** | 0.152*** |
| | (0.032) | (0.033) | (0.037) | (0.035) |
| Individuals | 1,470 | 1,412 | 1,346 | 1,218 |
| with recognition | 166 | 159 | 158 | 140 |
| without recognition | 1,304 | 1,253 | 1,188 | 1,078 |
| Observations | 181,088 | 169,313 | 148,378 | 129,471 |
| **Regulation Index (Employed)** | | | | |
| Application period | 0.041 | 0.045 | 0.040 | 0.065 |
| | (0.051) | (0.053) | (0.057) | (0.065) |
| Received full recognition | 0.118** | 0.123** | 0.123** | 0.129* |
| | (0.054) | (0.056) | (0.059) | (0.068) |
| Individuals | 1,316 | 1,268 | 1,198 | 1,081 |
| with recognition | 159 | 152 | 150 | 132 |
| without recognition | 1,157 | 1,116 | 1,048 | 949 |
| Observations | 92,140 | 87,004 | 80,782 | 74,003 |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. All estimations based on specification (1) including a dummy for the application period. The dependent variable is the share of days in employment per month in Panel A, log real hourly wages for full-time employees averaged over all spells in a given month in Panel B, the index of occupational regulation, assigning a value of zero to the non-employed, in Panel C, and the index of occupational regulation in Panel D. Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. The sample comprises immigrants who either receive full recognition or never apply. Additional selection rules are described in the heading.
Standard errors in parentheses are clustered at the individual level. * p<0.10, ** p<0.05, *** p<0.01.

Table A.3: Impact of Control Variables

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Employment** | | | | | |
| Application period | -0.237*** | -0.108* | 0.032 | 0.027 | 0.024 |
| | (0.066) | (0.065) | (0.066) | (0.066) | (0.067) |
| Received full recognition | 0.153*** | 0.127*** | 0.170*** | 0.166*** | 0.165*** |
| | (0.034) | (0.035) | (0.051) | (0.051) | (0.052) |
| Individuals | 1,218 | 1,218 | 1,218 | 1,218 | 1,218 |
| with recognition | 140 | 140 | 140 | 140 | 140 |
| without recognition | 1,078 | 1,078 | 1,078 | 1,078 | 1,078 |
| Observations | 136,306 | 136,306 | 136,306 | 136,306 | 136,306 |
| **Log Real Wages (Full-time)** | | | | | |
| Application period | -0.061 | -0.026 | -0.034 | -0.047 | -0.053 |
| | (0.167) | (0.161) | (0.101) | (0.105) | (0.105) |
| Received full recognition | 0.242*** | 0.242*** | 0.136 | 0.148 | 0.141 |
| | (0.056) | (0.055) | (0.101) | (0.104) | (0.103) |
| Individuals | 830 | 830 | 830 | 830 | 830 |
| with recognition | 114 | 114 | 114 | 114 | 114 |
| without recognition | 716 | 716 | 716 | 716 | 716 |
| Observations | 50,971 | 50,971 | 50,971 | 50,971 | 50,971 |
| **Regulation Index** | | | | | |
| Application period | 0.019 | 0.023 | 0.013 | 0.011 | 0.009 |
| | (0.018) | (0.019) | (0.035) | (0.035) | (0.035) |
| Received full recognition | 0.117*** | 0.117*** | 0.155*** | 0.153*** | 0.152*** |
| | (0.022) | (0.021) | (0.035) | (0.035) | (0.035) |
| Individuals | 1,218 | 1,218 | 1,218 | 1,218 | 1,218 |
| with recognition | 140 | 140 | 140 | 140 | 140 |
| without recognition | 1,078 | 1,078 | 1,078 | 1,078 | 1,078 |
| Observations | 129,471 | 129,471 | 129,471 | 129,471 | 129,471 |
| **Regulation Index (Employed)** | | | | | |
| Application Period | 0.096* | 0.082 | 0.068 | 0.066 | 0.065 |
| | (0.054) | (0.053) | (0.066) | (0.066) | (0.065) |
| Received full recognition | 0.149*** | 0.150*** | 0.131* | 0.130* | 0.129* |
| | (0.030) | (0.029) | (0.068) | (0.068) | (0.068) |
| Individuals | 1,081 | 1,081 | 1,081 | 1,081 | 1,081 |
| with recognition | 132 | 132 | 132 | 132 | 132 |
| without recognition | 949 | 949 | 949 | 949 | 949 |
| Observations | 74,003 | 74,003 | 74,003 | 74,003 | 74,003 |
| Time since migration fixed effects | | Yes | Yes | Yes | Yes |
| Individual fixed effects | | | Yes | Yes | Yes |
| Time fixed effects | | | | Yes | Yes |
| Controls | | | | | Yes |

Note. Data source: IAB-SOEP Migration Sample linked to IEB data. All estimations based on specification (1) including a dummy for the application period. The dependent variable is the share of days in employment per month in Panel A, log real hourly wages for full-time employees averaged over all spells in a given month in Panel B, the index of occupational regulation, assigning a value of zero to the non-employed, in Panel C, and the index of occupational regulation in Panel D. Sample selection is according to the results in Table 3. Additional controls are specified for each column in the table. The category *Controls* includes age squared and German language proficiency.
Standard errors in parentheses are clustered at the individual level. * p<0.10, ** p<0.05, *** p<0.01.

Table A.4: Static Effects of Occupational Recognition - Excluding Non-Applicants

| | Employment (1) | Log Wage (Full-time) (2) | Regulation Index (3) | Regulation Index (Employed) (4) |
|---|---|---|---|---|
| **Panel A** | | | | |
| Received full recognition | 0.186*** | 0.154* | 0.137*** | 0.105 |
| | (0.062) | (0.081) | (0.037) | (0.064) |
| **Panel B** | | | | |
| Application period | 0.020 | 0.031 | -0.007 | 0.048 |
| | (0.067) | (0.097) | (0.040) | (0.071) |
| Received full recognition | 0.191*** | 0.163 | 0.136*** | 0.116 |
| | (0.065) | (0.105) | (0.041) | (0.077) |
| Individuals | 140 | 114 | 140 | 132 |
| Observations | 17,170 | 8,563 | 16,405 | 10,581 |

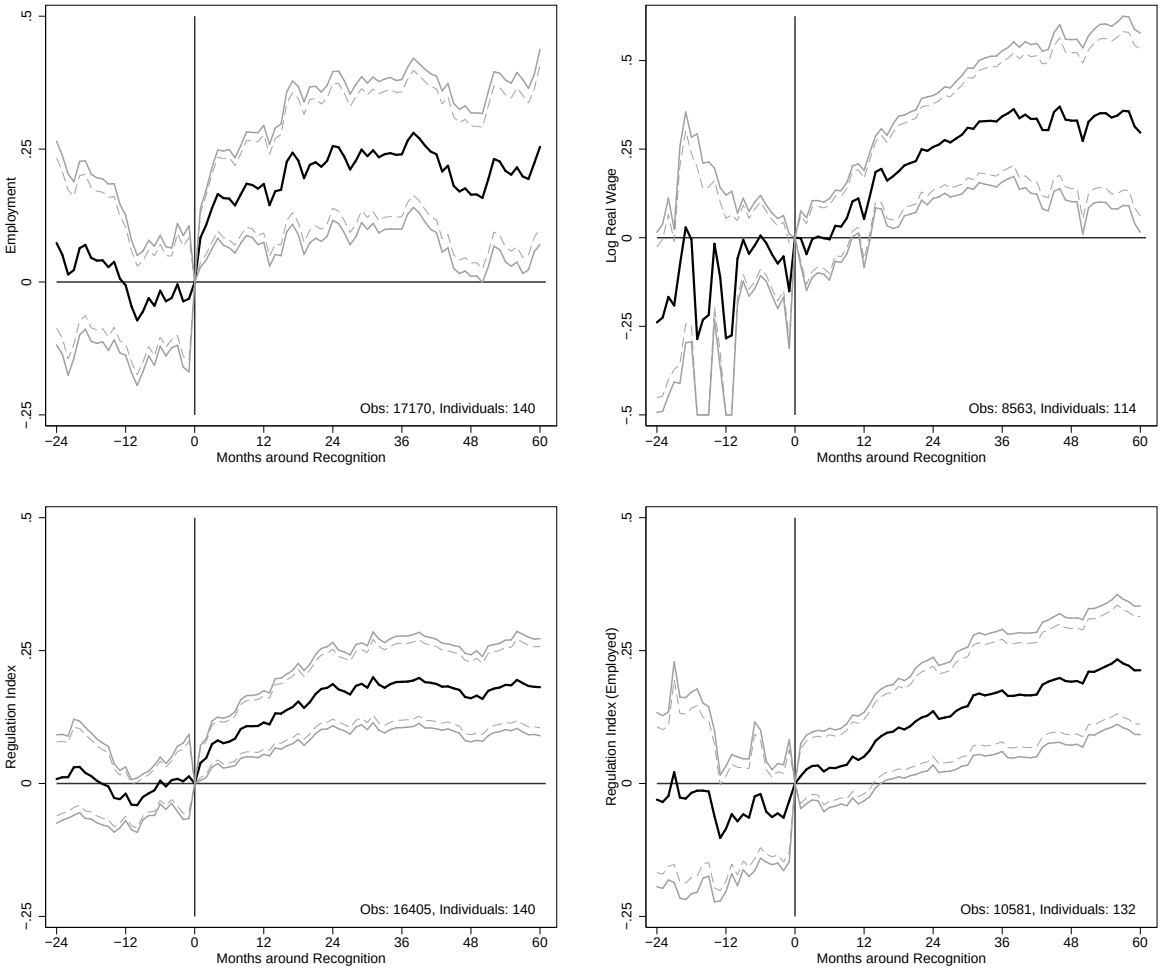
Note. Data source: IAB-SOEP Migration Sample linked to IEB data. Panel A reports the estimates based on specification (1), Panel B adds a dummy variable for the application period as discussed in the text. The dependent variable is the share of days in employment per month in column (1), log real hourly wages for full-time employees averaged over all spells in a given month in column (2), the index of occupational regulation, assigning a value of zero to the non-employed, in column (3), and the index of occupational regulation in column (4). Additional controls are individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. The sample comprises only immigrants who eventually receive full recognition, and who migrated to Germany at the age of at least 18, stayed in Germany after arrival and do not have any reported incapacity for work. Observations are only included when migrant's age is at least 25 and less than 60.
Standard errors in parentheses are clustered at the individual level: * p<0.10, ** p<0.05, *** p<0.01.

Table A.5: Assimilation Regressions

| | No Occupation Controls | | | | With Occupation Controls | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3 | | (4) | |
| Never | 1.184 | (6.285) | 1.138 | (6.285) | -1.366 | (5.923) | -1.379 | (5.925) |
| Denied | 24.739 | (30.449) | 33.459 | (35.290) | 39.808 | (31.468) | 56.424 | (34.324) |
| Partial | 7.880 | (29.353) | 17.998 | (28.714) | 36.511 | (25.968) | 42.049 | (26.109) |
| Full | -18.379 | (14.747) | -12.493 | (14.999) | -12.638 | (12.603) | -9.005 | (12.717) |
| Never × YSM | 0.004 | (0.028) | 0.002 | (0.028) | 0.004 | (0.025) | 0.004 | (0.025) |
| Denied × YSM | -0.045 | (0.197) | 0.071 | (0.198) | -0.074 | (0.239) | 0.152 | (0.248) |
| Partial × YSM | 0.235 | (0.151) | 0.190 | (0.172) | 0.341* | (0.172) | 0.328 | (0.175) |
| Full × YSM | -0.003 | (0.058) | -0.031 | (0.058) | -0.037 | (0.051) | -0.061 | (0.051) |
| Never × $YSM^2/10$ | 0.014 | (0.040) | 0.017 | (0.040) | 0.007 | (0.036) | 0.007 | (0.036) |
| Denied × $YSM^2/10$ | 0.230 | (0.353) | 0.011 | (0.365) | 0.268 | (0.424) | -0.090 | (0.439) |
| Partial × $YSM^2/10$ | -0.330 | (0.245) | -0.278 | (0.254) | -0.473 | (0.256) | -0.436 | (0.252) |
| Full × $YSM^2/10$ | 0.044 | (0.075) | -0.073 | (0.074) | 0.071 | (0.068) | -0.029 | (0.070) |
| Never × $YSM^3/100$ | -0.005 | (0.021) | -0.007 | (0.021) | -0.003 | (0.019) | -0.003 | (0.019) |
| Denied × $YSM^3/100$ | -0.203 | (0.235) | -0.066 | (0.243) | -0.230 | (0.277) | -0.015 | (0.285) |
| Partial × $YSM^3/100$ | 0.208 | (0.161) | 0.168 | (0.147) | 0.268 | (0.156) | 0.228 | (0.149) |
| Full × $YSM^3/100$ | -0.022 | (0.035) | 0.088* | (0.041) | -0.034 | (0.033) | 0.052 | (0.038) |
| Never × $YSM^4/1000$ | 0.000 | (0.003) | 0.001 | (0.003) | 0.000 | (0.003) | 0.000 | (0.003) |
| Denied × $YSM^4/1000$ | 0.050 | (0.050) | 0.023 | (0.052) | 0.057 | (0.058) | 0.015 | (0.060) |
| Partial × $YSM^4/1000$ | -0.043 | (0.035) | -0.036 | (0.030) | -0.051 | (0.032) | -0.041 | (0.031) |
| Full × $YSM^4/1000$ | 0.003 | (0.005) | -0.018* | (0.007) | 0.005 | (0.005) | -0.011 | (0.006) |
| Age | 0.412*** | (0.011) | 0.412*** | (0.011) | 0.388*** | (0.011) | 0.388*** | (0.011) |
| $Age^2/10$ | -0.144*** | (0.004) | -0.144*** | (0.004) | -0.137*** | (0.004) | -0.137*** | (0.004) |
| $Age^3/1000$ | 0.226*** | (0.007) | 0.226*** | (0.007) | 0.216*** | (0.006) | 0.216*** | (0.006) |
| $Age^4/100000$ | -0.134*** | (0.004) | -0.134*** | (0.004) | -0.128*** | (0.004) | -0.128*** | (0.004) |
| Never × Age | -0.244 | (0.647) | -0.240 | (0.647) | 0.081 | (0.605) | 0.081 | (0.605) |
| Denied × Age | -2.318 | (3.165) | -3.249 | (3.647) | -3.940 | (3.239) | -5.704 | (3.545) |
| Partial × Age | -1.130 | (2.956) | -2.189 | (2.869) | -4.078 | (2.621) | -4.668 | (2.632) |
| Full × Age | 1.722 | (1.510) | 1.082 | (1.533) | 1.120 | (1.288) | 0.719 | (1.297) |
| Never × $Age^2/10$ | 0.120 | (0.243) | 0.119 | (0.243) | -0.026 | (0.226) | -0.026 | (0.226) |
| Denied × $Age^2/10$ | 0.739 | (1.205) | 1.093 | (1.371) | 1.384 | (1.224) | 2.044 | (1.337) |
| Partial × $Age^2/10$ | 0.514 | (1.090) | 0.924 | (1.049) | 1.615 | (0.966) | 1.846 | (0.970) |
| Full × $Age^2/10$ | -0.583 | (0.565) | -0.329 | (0.573) | -0.358 | (0.482) | -0.198 | (0.485) |
| Never × $Age^3/1000$ | -0.243 | (0.399) | -0.241 | (0.399) | 0.038 | (0.367) | 0.038 | (0.367) |
| Denied × $Age^3/1000$ | -0.968 | (1.992) | -1.547 | (2.235) | -2.081 | (2.015) | -3.142 | (2.190) |
| Partial × $Age^3/1000$ | -0.975 | (1.749) | -1.666 | (1.660) | -2.768 | (1.549) | -3.162* | (1.550) |
| Full × $Age^3/1000$ | 0.839 | (0.919) | 0.403 | (0.930) | 0.483 | (0.785) | 0.205 | (0.788) |
| Never × $Age^4/100000$ | 0.171 | (0.240) | 0.170 | (0.240) | -0.022 | (0.219) | -0.022 | (0.219) |
| Denied × $Age^4/100000$ | 0.428 | (1.208) | 0.773 | (1.335) | 1.131 | (1.219) | 1.754 | (1.315) |
| Partial× $Age^4/100000$ | 0.647 | (1.032) | 1.077 | (0.963) | 1.727 | (0.912) | 1.974* | (0.908) |
| Full × $Age^4/100000$ | -0.438 | (0.548) | -0.166 | (0.554) | -0.233 | (0.470) | -0.060 | (0.472) |
| Medium Edu | 0.262*** | (0.002) | 0.262*** | (0.002) | 0.119*** | (0.002) | 0.119*** | (0.002) |
| High Edu | 0.673*** | (0.003) | 0.673*** | (0.003) | 0.347*** | (0.003) | 0.347*** | (0.003) |
| Immigrant × Medium Edu | -0.055 | (0.054) | -0.053 | (0.053) | 0.035 | (0.048) | 0.036 | (0.048) |
| Immigrant × High Edu | 0.190** | (0.072) | 0.184* | (0.073) | 0.218*** | (0.060) | 0.216*** | (0.060) |
| Female | -0.515*** | (0.002) | -0.515*** | (0.002) | -0.441*** | (0.002) | -0.441*** | (0.002) |
| Immigrant × Female | -0.111* | (0.048) | -0.100* | (0.049) | -0.014 | (0.041) | -0.007 | (0.041) |
| Cohort 1970-1994 | 0.123 | (0.087) | 0.145 | (0.087) | 0.103 | (0.075) | 0.105 | (0.075) |
| Cohort 1995-2004 | 0.050 | (0.057) | 0.054 | (0.057) | 0.059 | (0.053) | 0.061 | (0.053) |
| Denied × YSR | | | -0.017 | (0.044) | | | -0.050 | (0.048) |
| Partial × YSR | | | 0.027 | (0.026) | | | -0.001 | (0.023) |
| Full × YSR | | | 0.117*** | (0.026) | | | 0.097*** | (0.023) |
| Denied × $YSR^2/10$ | | | 0.023 | (0.026) | | | 0.031 | (0.023) |
| Partial × $YSR^2/10$ | | | -0.018 | (0.048) | | | 0.009 | (0.045) |
| Full × $YSR^2/10$ | | | -0.010 | (0.012) | | | 0.002 | (0.009) |
| Denied × $YSR^3/100$ | | | 0.018 | (0.031) | | | 0.018 | (0.029) |
| Partial × $YSR^3/100$ | | | 0.005 | (0.013) | | | 0.008 | (0.010) |
| Full × $YSR^3/100$ | | | -0.057*** | (0.014) | | | -0.046*** | (0.012) |
| Denied × $YSR^4/1000$ | | | -0.012 | (0.012) | | | -0.012 | (0.011) |
| Partial × $YSR^4/1000$ | | | 0.008 | (0.014) | | | -0.002 | (0.012) |
| Full × $YSR^4/1000$ | | | 0.014*** | (0.004) | | | 0.011*** | (0.003) |
| Constant | 2.227*** | (0.110) | 2.227*** | (0.110) | 1.859*** | (0.192) | 1.859*** | (0.192) |
| R-squared | 0.27 | | 0.27 | | 0.39 | | 0.39 | |
| Observations | 88,283,926 | | 88,283,926 | | 86,444,335 | | 86,444,335 | |

Note: The dependent variable are log monthly earnings, conditional on working at least one day in a given month. The omitted categories are males, low educational attainment, immigrant cohort 2005-2014, period 1975. Standard errors are clustered at the individual level. The sample comprises monthly observations of 571,581 individuals in columns (1) and (2) and 569,104 individuals in columns (3) and (4).

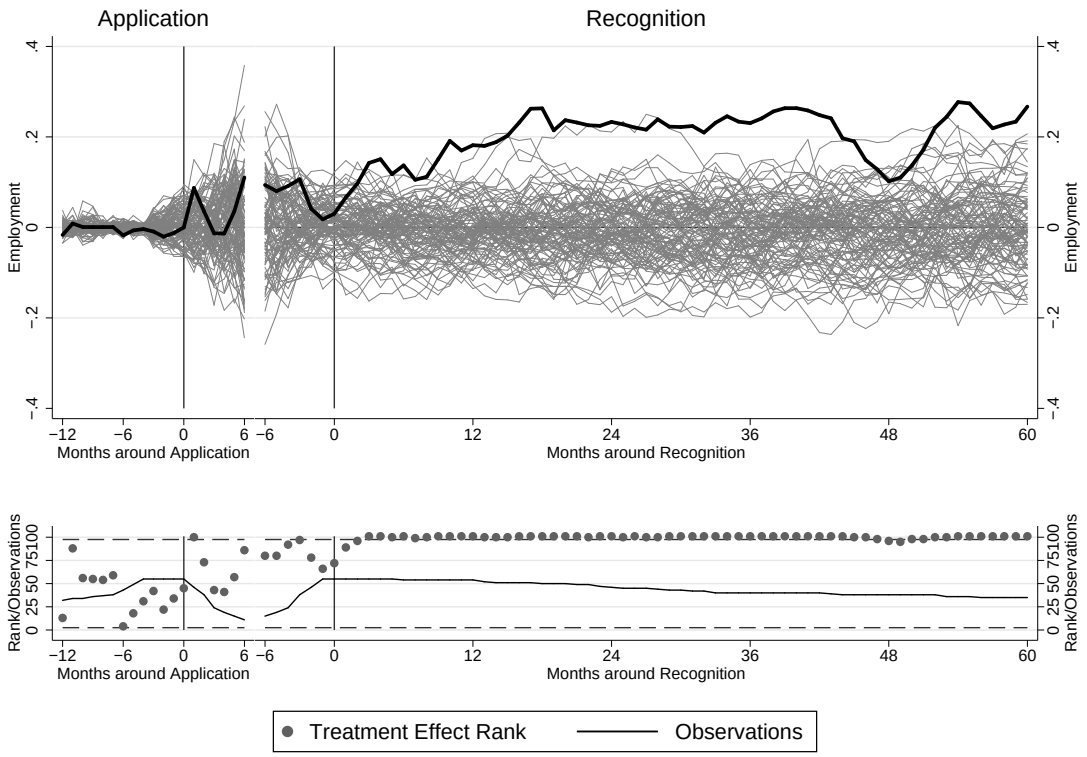
Figure A.1: Dynamic Effects of Occupational Recognition - Excluding Non-Applicants




Note. Data source: IAB-SOEP Migration Sample linked to IEB data. The figures report the coefficients of the period dummies obtained from estimating regressions of specification (2) including a dummy for the application period. The dependent variable is the share of days in employment per month (upper left panel), log real wages for full-time employees (upper right panel), the index of occupational regulation, assigning a value of zero to the non-employed (lower left panel) and the index of occupational regulation (lower right panel). Additional controls are: the long-run average effect after recognition ($\text{CertRecog}_{i,t-61}$), the long-run average effect before recognition ($\text{CertRecog}_{i,t+25}$) an indicator for the application period, individual fixed effects, time fixed effects, time since migration fixed effects, age squared, and German language proficiency. The sample only comprises immigrants who eventually receive full recognition, and who migrated to Germany at the age of at least 18, stayed in Germany after arrival and do not have any reported incapacity for work. Observations are only included when migrant's age is at least 25 and less than 60. 90% and 95% confidence intervals displayed using clustered standard errors at the individual level. Values of the confidence interval in the wage graph are cut at -0.5 for presentation purposes.

## A.2 Synthetic Control Method

Figure A.2: Dynamic Employment Effects of Occupational Recognition

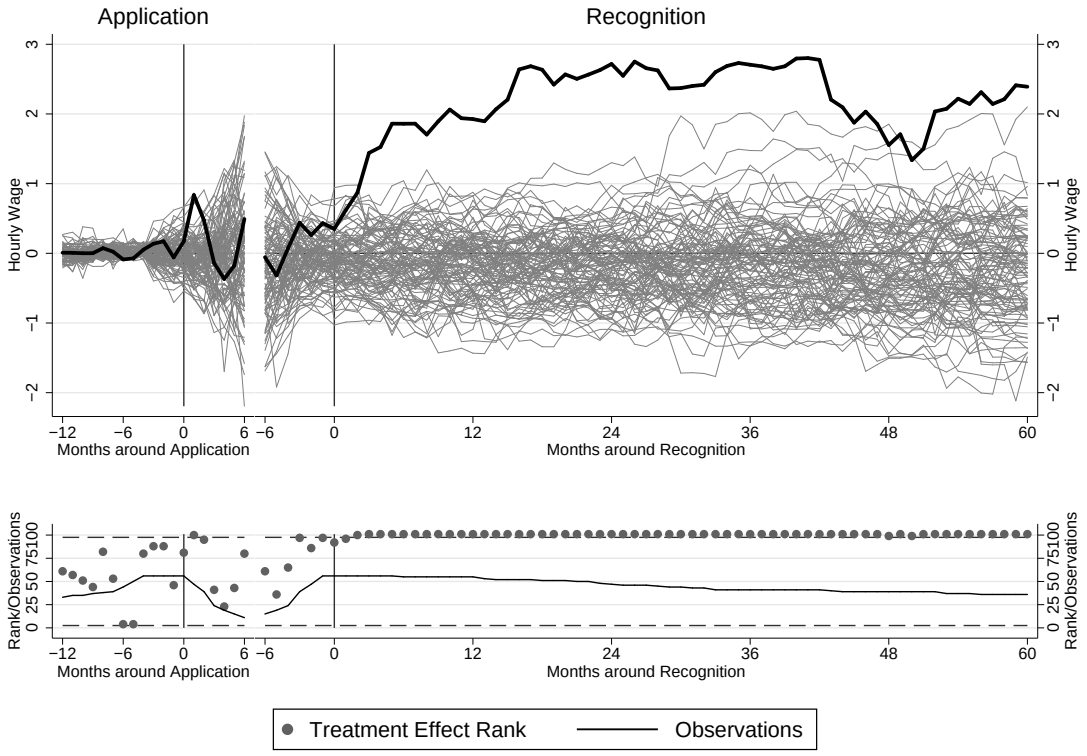



Note: Data source: IAB-SOEP Migration Sample linked to IEB data. The displayed estimates along the thick black lines are the average differentials in employment in each pre- and post-treatment period between all treated units and their synthetic control groups. The thin gray lines depict 100 placebo estimations, in which we iteratively apply the synthetic control method to randomly picked non-treated immigrants in each treated immigrant's donor pool.

As a robustness check for our dynamic estimation, we apply a pooled version of the synthetic control method proposed by Abadie et al. (2010). In contrast to our main approach, each immigrant who receives recognition (the treatment) is here matched to a set of other immigrants who never applied for recognition but whose labor market outcomes in the period prior to application are similar to those of the treated immigrant. We obtain a synthetic control group for each treated immigrant and then average the dynamic treatment effects in each pre- and post-treatment month across all treated individuals in the sample in those months. Note that we match directly on the corresponding outcome variables in the year prior to application, excluding the last three months to test for anticipation effects.

The thick black lines in Figures A.2 and A.3 show the resulting dynamic impacts of occupational recognition on employment and hourly wages between 12 months before the application period and 60 months after recognition. We look at hourly wages rather than log hourly wages since otherwise it would be difficult to find potential control individuals

Figure A.3: Dynamic Wage Effects of Occupational Recognition

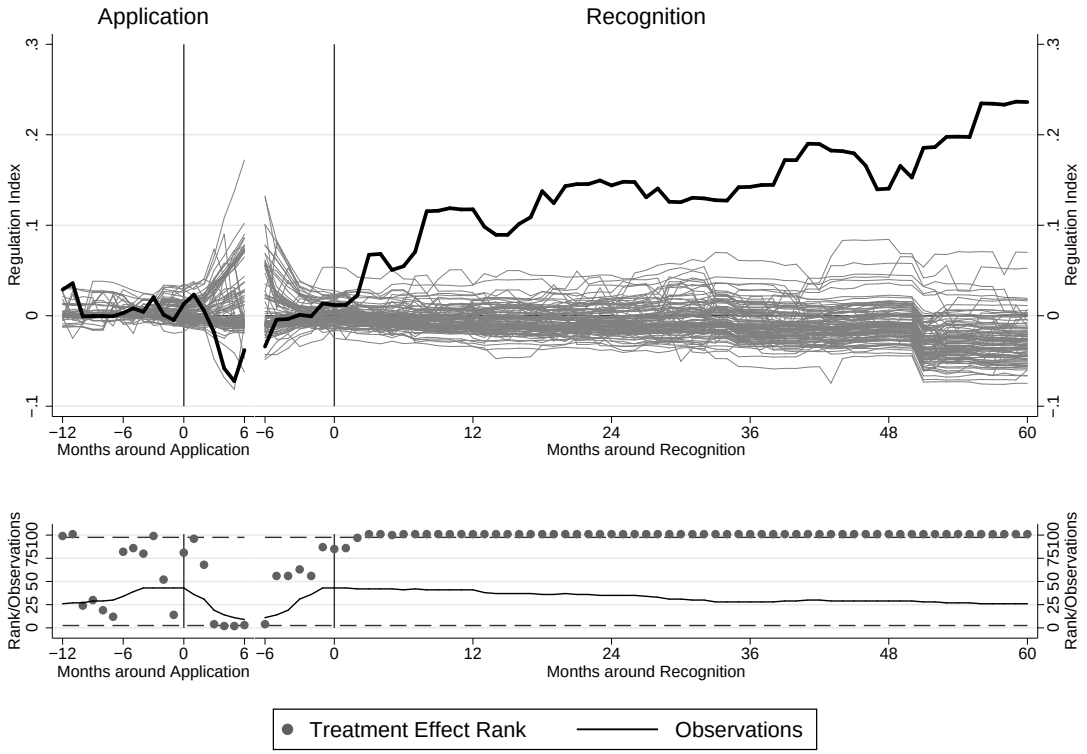



Note: Data source: IAB-SOEP Migration Sample linked to IEB data. The displayed estimates along the thick black lines are the average differentials in hourly wages in each pre- and post-treatment period between all treated units and their synthetic control groups, including zeros for non-employed individuals. The thin gray lines depict 100 placebo estimations, in which we iteratively apply the synthetic control method to randomly picked non-treated immigrants in each treated immigrant's donor pool.

with positive wages in precisely the same months as the treated individuals. This implies that part of the estimated impacts on hourly wages are driven by individuals finding employment and starting to earn non-zero wages. Overall, the dynamic patterns are similar to those obtained from our regression-based approach, with substantial and relatively quick increases in both employment and hourly wages in the months immediately after recognition, continuing divergence at a slower pace for a couple of years, and a flattening out of the two profiles thereafter.

To assess the statistical significance of the dynamic effects from the synthetic control group method, we perform 100 placebo estimations in which, for each iteration, we randomly pick for each treated immigrant an untreated immigrant from his or her donor pool, assign the same hypothetical application and recognition dates as for the treated immigrant, find a suitable synthetic control group for this placebo immigrant, and then aggregate all dynamic impact estimates across all placebo immigrants. As illustrated by the thin gray lines in Figures A.2 and A.3, the estimated effects of actual occupational recognition are large relative to the distribution of dynamic placebo effects, suggesting that they pick up real employment and wage effects. Contrary to the regression-based

Figure A.4: Dynamic Effects of Occupational Recognition on the Degree of Regulation




Note: Data source: IAB-SOEP Migration Sample linked to IEB data. The displayed estimates along the thick black lines are the average differentials in the regulation index in each pre- and post-treatment period between all treated units and their synthetic control groups, including zeros for non-employed individuals. The thin gray lines depict 100 placebo estimations, in which we iteratively apply the synthetic control method to randomly picked non-treated immigrants in each treated immigrant's donor pool.

results reported in Table 3, we find some indication for a significant positive effect of applying itself on the probability of being employed although this effect only extends to the first month after submitting the application.

To facilitate the assessment of the statistical significance of the estimated treatment effects in each period, we depict their rank among the distribution of placebo effects (gray dots) and the underlying number of treated individuals (black line) for each period in a separate plot underneath the main graphs. Note that the sample size of treated individuals used in these estimations is substantially smaller than in our main approach since we need to condition on observing individuals for at least one period prior to their application and for at least one period between their application and their recognition date. Individuals who apply in the month they are first observed in the IEB data or individuals who obtain the result of their application in the same month in which they apply are thus excluded from the estimation sample.

Figure A.4 displays the corresponding dynamic effects for the average occupational regulation index, where the index is set to zero for non-employed individuals as in our main approach without conditioning on employment. The latter is not feasible under the

synthetic control approach as it would require finding suitable control individuals with exactly the same monthly employment histories as the treated individuals. Similar to the pattern documented in the bottom left panel of Figure 1, there is a swift increase in the regulation index after obtaining full recognition which continues more or less uninterruptedly throughout the entire post-recognition period, amounting to a value of almost 0.25 after five years.

Overall, while not entirely comparable in terms of the outcome variables considered, we view the evidence from the synthetic control method as supportive of the main findings from our regression-based difference-in-differences approach, indicating significant and quantitatively large effects of occupational recognition on immigrants' labor market outcomes.