Occupational Regulation and Immigrant Earnings:

Evidence from the EU

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Abstract

Immigrants face wage penalties vis-à-vis comparable natives commonly attributed to human capital depreciation, statistical discrimination and occupational mismatching. Using a representative sample of the EU labour force, we present the first study on the relationship between occupational regulation and immigrants' earnings and show that occupational regulation can partly correct for these processes.

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1. INTRODUCTION

The assimilation of immigrants to the labour market is a topic that has attracted considerable academic and policy interest. Well-documented in this strand of work is the inferior wage outcomes for immigrants, commonly attributed to the low transferability of the human capital they have acquired in their home country (e.g. Chiswick and Miller 2009; Friedberg 2000). Less developed in the literature is how institutional barriers in the labour market prevent immigrants from accessing work and affect their earnings thereafter. In this paper, we examine how legally enacted regulations that pertain entry to occupations affect the wages of immigrants. Occupational *licensing*, the strictest form that such regulations can take, entails that only those that meet certain prescribed standards of competence (usually in the form of educational credentials, work experience and examinations) can *legally* practice the occupation. This is different from *certification*, whereby practitioners may voluntarily apply to have their skills certified by a state-appointed regulatory body, a professional association, or other institution (Kleiner 2006). From a policy perspective, the impetus for regulating occupations derives from its ability to address information asymmetries between consumers and practitioners and standardise quality (Shapiro 1986; Akerlof 1970). However, occupational licensing may also generate monopoly power and provide economic rents to insiders (Kleiner 2000).

In spite of the importance of licensing, which is affecting about 22 percent of workers in the EU and the US alike (Koumenta and Pagliero 2019; Gittleman, and Kleiner 2016), there is little evidence on how occupational regulation affects the wages of immigrants. The wage premium associated with licensing (Kleiner and Krueger 2013; Koumenta and Pagliero 2019) and the wage disadvantage of immigrants compared to natives (e.g. Borjas 1985; Chiswick *et al*. 2008; Barrett *et al*. 2012) are well-documented, but whether occupational regulation impedes or favours the labour market integration of immigrants remains largely unexplored. The few existing papers on occupational regulation and migration focus on interstate mobility in the US (Pashigian 1979; Kleiner *et al*. 1982; Kleiner and Johnson 2017), but do not provide evidence on wages and wage differentials. The paucity of such evidence is particularly striking in the case of the European Union, since the free movement of labour and the right to practice one's profession in another member state are two of the pillars of the

Common Market (Article 3(2) of the Treaty on European Union), and a top policy priority for the European Parliament (Junker 2014).[4]

We draw on the EU Survey of Regulated Occupations (EU-SOR), the first data set consisting of a representative sample of the EU labor force with detailed information on occupational regulation. We contribute to the literature in the following ways. First, we show that while the wage gap between natives and immigrants is 7.1 percent among unregulated workers, it is about zero for licensed and certified workers. Second, we find that the wage effect of licensing is heterogeneous across the skills distribution, with the higher skilled groups benefiting by a wage premium of about 30-50 percent in magnitude. Third, we present various robustness checks that enable us to account for immigrant self-selection and labour market assimilation explanations of our baseline findings.

Our results complement some recent literature on the wage effect of licensing. Law and Marks (2017), for example, show that licensing rises the wages of minority workers faster than those of their nonminority counterparts, and improves the employment opportunities for women and minorities. Blair and Chung (2017) find that licensing reduces the racial wage gap between men and the gender wage gap between white men and women. We further contribute to the immigration literature and particularly to debates about host-country characteristics that can facilitate assimilation (Borjas 1985; Friedberg 2000). Empirically, one of the key strengths of our study is our ability to use a dataset that enables us to directly observe the regulation status of the individual, thus overcoming the difficulty of attributing licensing status using additional administrative data which are generally very difficult to match with labour force survey data.

The article is structured as follows. We begin with a discussion of the relevant theoretical perspectives underlying our analysis. This is followed by a description the data and our empirical strategy. We then present the results from our baseline models followed by various robustness checks. Conclusions and implications are discussed in the final section.

2. RELATED LITERATURE

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[4] More recently measures such as the system for recognition of professional qualifications (Directive 2005/36/EC; as modernised by Directive 2013/55/EU) and the European professional card have been adopted to create an environment conducive to mobility and labour market assimilation.

Signalling models have been commonly applied to explain adverse labour market outcomes for immigrants. Their starting point are human capital theory approaches positing that in the absence of perfect information about worker productivity, forms of human capital such as formal education and job experience are used as signals of worker productivity. However, to the extent that the signalling power of qualifications is labour market specific, when such qualifications have been obtained abroad their ability to address information asymmetries might be compromised, thus impacting on the labour market adjustment of immigrants (Chiswick and Miller 2009; Sanroma *et al.* 2015). In line we these assumptions, we would expect immigrants to experience a wage disadvantage vis-à-vis comparable natives. Does this hold however when the immigrant works in a regulated occupation? Since occupational regulation involves the formal recognition of educational and work experience credentials by the state or a professional body in the host country, it can enable immigrants to better signal their unobserved ability to firms. From an earnings perspective, such signalling can address the empirically documented wage gap between immigrants and comparable natives attributed to human capital signalling (Borjas 2014; Butcher and DiNardo 2002).

A complementary explanation why occupational regulation can positively affect the labour market position of immigrants rests on statistical discrimination approaches whereby ethnicity and immigrant status are used as proxies for productivity relevant characteristics that are hard to observe. Risk aversion and uncertainty leads firms to discriminate against certain individuals based on common stereotypical perceptions of group productivity (Arrow 1973; Phelps 1972; List 2004), and if sufficient numbers of firms discriminate on ethnicity grounds then the earnings of immigrants will be lower than those of natives regardless of their productive capacity (Becker 1957). The propensity for statistical discrimination can be especially prevalent in the case of human capital attained in a different country such that firms undervalue foreign credentials and labour market experience in reward allocation decisions, thus generating wage differentials between natives and immigrants (Grand and Szulkin 2002). When immigrants can demonstrate the transferability of their formal education, work experience and job training through the formal recognition route associated with licensure, employers might be less inclined to make productivity assessments based on ethnicity and foreign origin. Thus, based on signalling and statistical discrimination models, we would expect that occupational regulation reduces the wage differential between immigrants and comparable natives.

Finally, earnings differentials between immigrants and natives can arise from differences in the occupational distribution of immigrants compared to natives attributable to education-to-occupation or occupation-to-occupation mismatching. Mismatching occurs when the immigrants are overeducated in relation to the equilibrium skill stock in the occupation or when there are discrepancies in the immigrant's occupational classification between the home and host country. A common source of mismatching can be the imperfect transferability of human capital which drives immigrants to make inferior occupational choices which in turn affects returns to education as measured by wages (Alba-Ramirez 1993; Allen and van der Velden 2001; Simón *et al*. 2008; Liu *et al*. 2004; Green 1999). Occupational regulation can correct for this by sorting immigrants to occupations that match their skill sets and thus pushing their earnings upwards. Studies on the link between occupational regulation and immigrant occupational matching are inexistent, but Dahlstedt (2011) for example finds better education-to-job matches amongst the certified and licensed population compared to the generally educated counterparts.

3. DATA

We draw our data from the EU-SOR, a survey commissioned by the European Commission on occupational regulation in the EU[5]. The survey covers the EU civilian labour force. A total of 26,640 individuals were interviewed providing data on their regulation status, the characteristics of the regulation regime (e.g. entry and renewal requirements), as well as detailed information on a variety of individual characteristics.[6] In addition to our ability to directly observe the regulation status of the respondents, the detailed information about their labour market characteristics enables us to account for observable heterogeneity that might be correlated with regulation and immigration statuses and earnings.

We classify workers as licensed if (i) in addition to their education, practicing their occupation involves obtaining a license or certification, and (ii) if this was a *legal requirement* to practice the occupation. We classify workers as certified if (i) is true but not (ii), and unregulated otherwise. We define as immigrants those individuals that arrived in the

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[5] For a detailed description of the survey refer to Koumenta and Pagliero (2019)

[6] The number of interviews is about 1,000 for each country, but 500 for smaller countries like Cyprus, Luxembourg, and Malta.

country of destination after having achieved their highest level of education.[7] From our final sample we exclude those for which the age of completion of the highest level of education is greater than the age of arrival, those who report having a primary degree only and arrived before 11 years old, and all those with PhDs who arrived before 35. Finally, we compute the hourly net wage by dividing the reported wage by the estimated number of hours worked as reported by the respondents. Descriptive statistics are presented in the appendix.

4. EMPIRICAL STRATEGY

The empirical models are extensions of the conventional Mincerian wage function, in which the natural logarithm of wage is regressed on years of schooling, the linear and quadratic form of work experience, and a stochastic term. We augment the Mincerian wage equation by substituting years of schooling by levels of education and work experience by the quadratic form of age. The wage effects of self-employment, being a union member, industry, and occupation, as well as host country fixed effects are controlled for. The full model is specified as:

$$ln\,W = \propto_0 + \beta_1 AGE + \beta_2 AGE^2 + \beta_3 IMMGRATION + \beta_4 SELF\_EMPLOY + \beta_5 UNION$$
$$+ \beta_6 EDUCATION + \beta_7 OCCUPATION + \beta_8 SECTOR + \varepsilon$$

Where W and AGE denote wage and age, respectively. $IMMGRATION$ denotes individual immigrating status, with 1 for immigrant and 0 for local worker. $SELF\_EMPLOY$ indicates whether an individual is self-employed (1 for YES, and 0 for NO). $UNION$ takes the value of 1 if an individual is a member of a workers' union, and 0 otherwise. $EDUCATION$ is a vector for six types of educational qualification. $OCCUPATION$ contains a vector of 3-digit occupational codes, while $SECTOR$ includes twelve industry dummies.

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[7] Based on the standard EU age/education profiles, we assume for example that those reporting having a secondary degree only had finished their education at the age of 16 and we compare the age of completing education to the age they report arriving in the host country.

5. RESULTS

5.1 Licensing and the wages of immigrants

Table 1 presents the OLS estimates of the effect of regulation on the earnings of immigrants. In column (1), we first estimate the wage regression for the overall sample, while in columns (2) to (4) we apply the same model specifications on the subsamples of unregulated, licensed and certified workers. In line with the prevailing literature, we find that immigrants on average are subject to a wage penalty of a 7.1 per cent magnitude compared to their native counterparts, adjusting for several human capital, country, occupation and industry fixed effects. The negative effect of immigrant status on wages is higher for unregulated immigrants at nearly 9 per cent (column 2). However, the effect is smaller in magnitude and not significant on the case of licensed and certified workers.

(Table 1 about here)

We proceed our analysis by disaggregating the wage effects of licensing and certification for immigrants by educational levels. This enables us to explore whether the wage effect of regulation affects differentially immigrant groups depending on their education. As before, in columns (1) and (2) we find that the wage penalty for immigrants applies across the educational distribution for both the overall and the unregulated sample, and, as expected, that the coefficients are higher for lower skilled workers. However, the wage penalty disappears for all occupational groups in the case of certification, with the exception of those with advanced level qualifications who benefit from a wage premium of about 50 per cent. Licensing cancels out the wage penalty for those with lower secondary education, and confers a wage premium for the rest of the education groups that ranges between 30 and 50 per cent. Interestingly, immigrants with post-secondary education are the highest beneficiaries, while for the rest of the groups the wage premium increases with educational credentials.

(Table 2 about here)

5.2 Robustness checks

(a) Immigrant self-selection

According to choice-based models of immigration, immigrants are not a random sample of population from the home country (Borjas 1987; Chiswick 1999). The most common drive to economic immigration is the expectation of better employment and wage prospects, and thus immigrants might have higher skill stock or score higher on unobservables such as ambition and motivation. Given the cross-sectional nature of our estimates, our results can therefore be driven by hyper-selection into immigration of individuals with better career prospects and higher earrings potential. But immigration can also be for reasons other than employment, for example it can be driven by the employment prospects of one's spouse, or can be due family reunification or humanitarian reasons (e.g. asylum seekers or war refugees). Our dataset enables us to identify employment-driven immigration versus any other reasons that might have motivated such decisions, so we can go some way in examining whether self-selection into immigration is driving our results. Our estimation approach is similar to our previous models. Column (1) of Table 3 presents the OLS estimates on the overall sample, whereas column (2) to (4) of the table shows the estimates on subsample of unregulated, licensed or certified workers.

(Table 3 about here)

We find that both work-related immigration and immigration for other purposes are associated with lower wages compared to those of locals, but that the penalty for the former is lower that that of the latter (5 and 8 per cent respectively). This pattern persists amongst the unregulated worker subsample; immigrants not driven by work opportunities in host countries receive on average 10 per cent less than local workers whereas the average wage of work-driven immigrants is 5 percent less than that of local workers. Interestingly, for the licensed and certified subsamples we do not find statistically significant wage differentials between work-driven immigrants and non-work-driven immigrants and local workers, or else our baseline model findings in Table 1 persist when we account for self-selection bias.

(b) Effect of assimilation

An alternative explanation of what might be driving our baseline results is the effect of immigrant assimilation. Various studies have documented the contraction of the earnings gap between natives and immigrants as with time, immigrants accumulate local labour market experience and country-specific competencies (Friedberg 2000; Borjas 1995; Baker and Benjamin 1994; Lam and Liu 2002). We test this possibility by exploring the wages of immigrants that have been in the host country for different lengths of time. In particular, we run our baseline wage regression models for immigrants whose length of stay is 10 years, 5 year and 3 years. The results are shown in Tables 4-6. In line with our expectations based on the immigration literature, amongst our overall sample (columns 1) the longer immigrants have been in the labour market the closer their earnings to those of their native counterparts, with the coefficient decreasing by half or more in the case of those that have been in the host country for more than 3 and 5 years. For the licensed group however, there are no statistically significant differences between immigrant wages based on length of being in the host country, and the wages earned by natives (columns 3). We interpret this as evidence that while the assimilation hypothesis is plausible when we examine the entire sample (i.e. all workers in columns 1), in the case of licensed workers the length of stay does not affect our results. This pattern is somewhat different in the case of certified workers, where we find a statistically significant negative wage effect for immigrants that have been in the host country for less than 10, 5 and 3 years but not for those that have been in the host country for longer than these respective amounts of time while the magnitude of this effect also drops considerably (columns 4). A possible explanation for this finding is that the wages of certified immigrants take longer to assimilate with those of natives compared to licensed ones due to the non-legal basis of their qualifications and the time it takes for these workers to establish their reputation in the product market of the host country.

(Table 4 about here)

(Table 5 about here)

(Table 6 about here)

6 DISCUSSION AND CONCLUSION

The labour market adjustment of immigrants has attracted considerable academic and policy interest, especially in the EU context where obstacles to labour mobility are an important concern. We provide the first empirical evidence on how occupational regulation, a dominant labour market institution in the EU but also other labour market contexts such as the US, affects the wages of immigrants compared to natives. In line with existing empirical work on immigrant earnings, we find that on average immigrant wages are lower to those of comparable natives. While this holds for immigrants who are not covered by occupational regulation, we show that licensing and certification correct for the wage penalty associated with immigrant status for all occupational groups apart from those at the low end of the skills distribution (i.e. in elementary occupations). We rule out self-selection on the part of immigrants as an explanation of our findings, and we also show that our results with respect to licensing cannot be attributed to the assimilation hypothesis commonly put forward to show that with time the wages of immigrants and natives converge. However, in the case of certification, we find that the negative wage effect of immigration is faced out gradually as the immigrant spends more time in host country.

References

Alba-Ramirez, A. (1993). Mismatch in the Spanish labor market: overeducation?. *Journal of Human Resources*, 259-278.

Allen, J., & Van der Velden, R. (2001). Educational mismatches versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. *Oxford economic papers*,*53*(3), 434-452.

Arrow, Kenneth J. 1973. "The Theory of Discrimination." In *Discrimination in Labor Markets*, edited by Orley Ashonfelter and Albert Rees, 3–33. Princeton: Princeton University Press.

Baker, M., & Benjamin, D. (1994). The performance of immigrants in the Canadian labor market. *Journal of labor economics*, *12*(3), 369-405.

Barrett, A., McGuinness, S., & O'Brien, M. (2012). The immigrant earnings disadvantage across the earnings and skills distributions: The case of immigrants from the EU's New Member States. *British Journal of Industrial Relations*, *50*(3), 457-481.

Becker, G. S. (1957). The economics of discrimination Chicago. *University of Chicago*.

Borjas, G. J. (2014). *Immigration economics*. Harvard University Press.

Borjas G. J. (1985) 'Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants', Journal of Labor Economics 3: 463–489.

Butcher, K. F., & DiNardo, J. (2002). The immigrant and native-born wage distributions: Evidence from United States censuses. *ILR Review*, *56*(1), 97-121.

Chiswick, B. R., & Miller, P. W. (2009). The international transferability of immigrants' human capital. *Economics of Education Review*, *28*(2), 162-169.

Chiswick, B. R., Le, A. T., & Miller, P. W. (2008). How immigrants fare across the earnings distribution in Australia and the United States. *ILR Review*, *61*(3), 353-373.

Dahlstedt, I. (2011). Occupational Match. *Journal of International Migration and Integration*, *12*(3), 349-367.

Friedberg, R. M. (2000). You can't take it with you? Immigrant assimilation and the portability of human capital. *Journal of labor economics*, *18*(2), 221-251.

Friedman, Milton 1962. Capitalism and Freedom. Chicago: University of Chicago Press.

Gittleman, M., & Kleiner, M. M. (2016). Wage effects of unionization and occupational licensing coverage in the United States. ILR Review, 69(1), 142-172.

Grand, C. L., & Szulkin, R. (2002). Permanent disadvantage or gradual integration: explaining the immigrant–native earnings gap in Sweden. *Labour*, *16*(1), 37-64.

Green, D. A. (1999). Immigrant occupational attainment: Assimilation and mobility over time. *Journal of Labor Economics*, *17*(1), 49-79.

Johnson, J. E., & Kleiner, M. M. (2017). *Is Occupational Licensing a Barrier to Interstate Migration?* (No. w24107). National Bureau of Economic Research.

Juncker, J.-C. (2014, July 15). *A new start for Europe: My agenda for jobs, growth, fairness and democratic change*. Strasbourg: Political Guidelines for the next European Commission.

Kleiner, M. M. (2000). Occupational licensing. *Journal of Economic Perspectives*, *14*(4), 189-202.

Kleiner, M. and Krueger A. (2013) 'Analysing the Extent and Influence of Occupational Licensing on the Labor Market, Journal of Labor Economics, 31, (2), S173-S202.

Kleiner, Morris M., Robert S. Gay, and Karen Greene. 1982. Barriers to labor migration: The case of occupational licensing. Industrial Relations 21(3): 383–391.

Koumenta, M., & Pagliero, M. Occupational Regulation in the European Union: Coverage and Wage Effects. *British Journal of Industrial Relations*. (forthcoming)

Lam, K. C., & Liu, P. W. (2002). Earnings divergence of immigrants. *Journal of Labor Economics*, *20*(1), 86-104

Law, M. T., & Marks, M. S. (2017). The Labor-Market Effects of Occupational Licensing Laws in Nursing. *Industrial Relations: A Journal of Economy and Society*, *56*(4), 640-661.

List, John A. 2004. "The Nature and Extent of Discrimination in the Market Place: Evidence from the Field." *The Quarterly Journal of Economics* 119 (1): 49–89.

Liu, P. W., Zhang, J., & Chong, S. C. (2004). Occupational segregation and wage differentials between natives and immigrants: evidence from Hong Kong. *Journal of Development Economics*, *73*(1), 395-413.

Maurizi, A. (1974). Occupational licensing and the public interest. The Journal of Political Economy, 399-413

Pagliero, M. (2013) The Impact of Potential Labour Supply on Licensing Exam Difficulty, Labour Economics, 25, 141-152.

Pashigian, P. B. (1979) 'Occupational Licensing and the Interstate Mobility of Professionals,' Journal of Law and Economics. 22(1), pp. 1-25.

Phelps, Edmund S. 1972. "The Statistical Theory of Racism and Sexism." *The American Economic Review* 62 (4): 659–661.

Sjaastad, L. (1962) 'Costs and Returns of Human Migration'. The Journal of Political Economy, 60 (5), pp. 80- 93.

Sanroma E., Ramos R. and Simon H. (2015) 'How Relevant is the Origin of Human Capital for Immigrant Wages? Evidence From Spain', Journal of Applied Economics 18(1): 149–172.

Simón, H., Sanromá, E., & Ramos, R. (2008). Labour segregation and immigrant and native-born wage distributions in Spain: an analysis using matched employer–employee data. *Spanish Economic Review*, *10*(2), 135-168.

Weeden, K. A. (2002). Why do some occupations pay more than others? Social closure and earnings inequality in the United States. *American Journal of Sociology*, *108*(1), 55-101.

Tables

Table 1: Coefficients from log wage regressions.

	All workers (1)	Unregulated (2)	Licensed (3)	Certified (4)
Migrants	-0.071***	-0.089***	-0.017	-0.055
	(0.015)	(0.019)	(0.033)	(0.040)
Age	0.049***	0.053***	0.044***	0.037***
	(0.003)	(0.004)	(0.006)	(0.007)
Age^2	-0.001***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Self Employed	0.069***	0.059**	0.084**	0.047
	(0.019)	(0.025)	(0.037)	(0.049)
Union	0.083***	0.084***	0.084***	.0.040*
	(0.009)	(0.012)	(0.017)	(0.020)
Lower secondary education	0.089***	0.092**	0.129*	0.006
	(0.031)	(0.038)	(0.071)	(0.070)
Upper secondary education	0.189***	0.214***	0.175**	0.099
	(0.029)	(0.036)	(0.068)	(0.067)
Post-secondary	0.219***	0.215***	0.231***	0.182**
	(0.031)	(0.038)	(0.070)	(0.070)
University	0.408***	0.429***	0.402***	0.306***
	(0.030)	(0.038)	(0.070)	(0.070)
PhD	0.588***	0.694***	0.431	0.410***
	(0.047)	(0.058)	(0.112)	(0.106)
Country f.e?	yes	yes	yes	yes
Occupation controls?	yes	yes	yes	yes
Industry controls?	yes	yes	yes	yes
N	15,642	9,335	3,359	2,801
R^2	0.724	0.730	0.740	0.736

Note: The dependent variable is the log of hourly wage. Omitted indicator variables: Primary education, Employee in private firm or business. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2. Coefficients from wage equation (interaction between immigration and education)

VARIABLES	(1) All	(2) Unregulated	(3) Certified	(4) Licensed
Immigrant * lower secondary education	-0.286*	-0.244	0.071	0.204
	(0.154)	(0.186)	(0.238)	(0.163)
Immigrant * upper secondary education	-0.291**	-0.318*	0.042	0.305**
	(0.144)	(0.172)	(0.211)	(0.143)
Immigrant * post-secondary education	-0.386*	-0.680**	0.217	0.503***
	(0.224)	(0.301)	(0.222)	(0.161)
Immigrant * University	-0.321**	-0.417**	0.143	0.329*
	(0.151)	(0.179)	(0.259)	(0.174)
Immigrant * PhD/advanced research degree	-0.378**	-0.663***	0.498**	0.392*
	(0.177)	(0.211)	(0.238)	(0.208)

Note: Other covariates include age, gender, the linear and quadratic form of age, self-employed, union member, occupation dummies and industry dummies. The reference group for the above groups is local workers with primary education degree. Robust standard errors in parentheses. Significant level *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3: Coefficients from log wage regressions (reason for immigration)

	All workers (1)	Unregulated (2)	Licensed (3)	Certified (4)
Work Immigrants	-0.050*	-0.053*	-0.023	-0.003
	(0.026)	(0.031)	(0.062)	(0.067)
Non-Work Immigrants	-0.080***	-0.106***	-0.012	-0.071
	(0.018)	(0.022)	(0.038)	(0.046)
Age	0.049***	0.053***	0.044***	0.037***
	(0.003)	(0.004)	(0.006)	(0.007)
Age^2	-0.001***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Self Employed	0.069***	0.059**	0.084**	0.046
	(0.019)	(0.025)	(0.037)	(0.049)
Union	0.083***	0.083***	0.083***	.0.040*
	(0.009)	(0.012)	(0.017)	(0.020)
Lower secondary education	0.089***	0.092**	0.128*	0.005
	(0.031)	(0.038)	(0.071)	(0.070)
Upper secondary education	0.189***	0.215***	0.173**	0.098
	(0.029)	(0.036)	(0.068)	(0.067)
Post-secondary	0.219***	0.217***	0.229***	0.180**
	(0.031)	(0.039)	(0.072)	(0.071)
University	0.408***	0.430***	0.399***	0.304***
	(0.030)	(0.038)	(0.070)	(0.070)
PhD	0.589***	0.695***	0.429***	0.409***
	(0.047)	(0.058)	(0.112)	(0.107)
Country f.e?	yes	yes	yes	yes
Occupation controls?	yes	yes	yes	yes
Industry controls?	yes	yes	yes	yes
N	15,623	9,325	3,354	2,797
R^2	0.724	0.730	0.740	0.737

Note: The dependent variable is the log of hourly wage. Omitted indicator variables: Primary education, Employee in private firm or business. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Coefficients from log wage regressions (duration in host country)

	All workers (1)	Unregulated (2)	Licensed (3)	Certified (4)
Within 10 years	-0.083**	-0.041	-0.089	-0.195*
	(0.036)	(0.041)	(0.100)	(0.106)
More than 10 years	-0.069***	-0.097***	-0.015	-0.036
	(0.016)	(0.020)	(0.035)	(0.041)
Age	0.049***	0.053***	0.044***	0.037***
	(0.003)	(0.004)	(0.006)	(0.007)
Age^2	-0.001***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Self Employed	0.071***	0.062**	0.083**	0.049
	(0.019)	(0.025)	(0.037)	(0.049)
Union	0.083***	0.083***	0.084***	.0.038*
	(0.009)	(0.012)	(0.017)	(0.020)
Lower secondary education	0.090***	0.093**	0.125*	0.005
	(0.031)	(0.038)	(0.071)	(0.070)
Upper secondary education	0.189***	0.215***	0.172**	0.093
	(0.029)	(0.036)	(0.068)	(0.067)
Post-secondary	0.219***	0.217***	0.225***	0.177**
	(0.031)	(0.039)	(0.072)	(0.071)
University	0.407***	0.430***	0.399***	0.299***
	(0.031)	(0.038)	(0.070)	(0.070)
PhD	0.588***	0.694***	0.433***	0.401***
	(0.047)	(0.058)	(0.113)	(0.106)
Country f.e?	yes	yes	yes	yes
Occupation controls?	yes	yes	yes	yes
Industry controls?	yes	yes	yes	yes
N	15,616	9,319	3,354	2,796
R^2	0.724	0.731	0.740	0.737

Note: The dependent variable is the log of hourly wage. Omitted indicator variables: Primary education, Employee in private firm or business. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Coefficients from log wage regressions (duration in host country)

	All workers (1)	Unregulated (2)	Licensed (3)	Certified (4)
Within 5 years	-0.139*	-0.043	-0.039	-0.342*
	(0.068)	(0.072)	(0.178)	(0.190)
More than 5 years	-0.068***	-0.090***	-0.021	-0.041
	(0.015)	(0.019)	(0.034)	(0.040)
Age	0.049***	0.052***	0.044***	0.037***
	(0.003)	(0.004)	(0.006)	(0.007)
Age^2	-0.001***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Self Employed	0.071***	0.061**	0.084**	0.050
	(0.019)	(0.025)	(0.037)	(0.048)
Union	0.083***	0.083***	0.084***	.0.037*
	(0.009)	(0.012)	(0.017)	(0.020)
Lower secondary education	0.090***	0.092**	0.126*	0.008
	(0.031)	(0.038)	(0.071)	(0.070)
Upper secondary education	0.189***	0.215***	0.173**	0.097
	(0.029)	(0.036)	(0.068)	(0.067)
Post-secondary	0.220***	0.217***	0.226***	0.182**
	(0.031)	(0.039)	(0.072)	(0.071)
University	0.408***	0.429***	0.399***	0.302***
	(0.031)	(0.038)	(0.071)	(0.070)
PhD	0.589***	0.694***	0.430***	0.407***
	(0.047)	(0.058)	(0.113)	(0.106)
Country f.e?	yes	yes	yes	yes
Occupation controls?	yes	yes	yes	yes
Industry controls?	yes	yes	yes	yes
N	15,616	9,319	3,354	2,796
R^2	0.724	0.731	0.740	0.737

Note: The dependent variable is the log of hourly wage. Omitted indicator variables: Primary education, Employee in private firm or business. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Coefficients from log wage regressions (duration in host country)

	All workers (1)	Unregulated (2)	Licensed (3)	Certified (4)
Within 3 years	-0.172*	-0.127	-0.156	-0.512*
	(0.094)	(0.094)	(0.225)	(0.307)
Less than 3 years	-0.068***	-0.087***	-0.025	-0.043
	(0.015)	(0.019)	(0.034)	(0.039)
Age	0.049***	0.052***	0.044***	0.037***
	(0.003)	(0.004)	(0.006)	(0.007)
Age^2	-0.001***	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Self Employed	0.071***	0.061**	0.084**	0.051
	(0.019)	(0.025)	(0.037)	(0.048)
Union	0.083***	0.083***	0.085***	.0.038*
	(0.009)	(0.012)	(0.017)	(0.020)
Lower secondary education	0.090***	0.093**	0.125*	0.007
	(0.031)	(0.038)	(0.072)	(0.070)
Upper secondary education	0.189***	0.215***	0.172**	0.096
	(0.029)	(0.036)	(0.068)	(0.067)
Post-secondary	0.220***	0.218***	0.226***	0.180**
	(0.031)	(0.039)	(0.072)	(0.071)
University	0.408***	0.430***	0.398***	0.301***
	(0.031)	(0.038)	(0.071)	(0.070)
PhD	0.588***	0.695***	0.427***	0.397***
	(0.047)	(0.058)	(0.113)	(0.106)
Country f.e?	yes	yes	yes	yes
Occupation controls?	yes	yes	yes	yes
Industry controls?	yes	yes	yes	yes
N	15,616	9,319	3,354	2,797
R^2	0.724	0.731	0.740	0.737

Note: The dependent variable is the log of hourly wage. Omitted indicator variables: Primary education, Employee in private firm or business. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Appendix A.

Table A1. Summary statistics (all workers)

	Count	Mean	Std. Dev.
Wage	16,287	1,479	1,323
Immigrants	26,620	0.08	0.28
Age	26,640	44.57	11.86
Self-Employed	26,640	0.12	0.33
Union Member	23,164	0.29	0.46
Primary Education	26,587	0.03	0.17
Lower Education	26,587	0.10	0.30
Upper Secondary	26,587	0.38	0.49
Post-Secondary	26,587	0.11	0.32
University	26,587	0.36	0.48
PhD/Advanced	26,587	0.02	0.13
Agriculture	26,640	0.04	0.20
Manufacturing	26,640	0.13	0.34
Construction & Energy	26,640	0.09	0.29
Wholesale & Retail Trade	26,640	0.12	0.33
Hotels & Restaurants	26,640	0.04	0.20
Transportation & communication	26,640	0.06	0.24
Finance, real estate	26,640	0.04	0.20
Public administration	26,640	0.08	0.27
Education	26,640	0.10	0.31
Health and social work	26,640	0.12	0.32
Professional services	26,640	0.12	0.33
Cultural activities	26,640	0.04	0.20

Table A4 Summary statistics for local and immigrant workers

	Local		Immigrant		Diff.	
	Mean	Std. Dev.	Mean	Std. Dev.	Diff.	t-stats.
Wage	1,459.89	1,294.18	1,701.06	1,596.74	-241.17***	(-5.35)
Unregulated	0.61	0.49	0.64	0.48	-0.03**	(-2.85)
Certified	0.18	0.39	0.18	0.38	0.01	(0.70)
Licensed	0.21	0.41	0.18	0.39	0.02**	(2.84)
age	44.56	11.90	44.75	11.42	-0.19	(-0.75)
Self-emplo~d	0.12	0.33	0.12	0.33	0.00	(0.51)
Union	0.30	0.46	0.27	0.44	0.03*	(2.50)
educ_gr	1.51	0.53	1.53	0.54	-0.02	(-1.78)
Primary ed~n	0.03	0.16	0.04	0.18	-0.01	(-1.91)
Lower seco~n	0.10	0.30	0.12	0.33	-0.02**	(-2.83)
Upper seco~n	0.38	0.49	0.34	0.47	0.04***	(4.04)
Post-secon~n	0.11	0.31	0.12	0.32	-0.00	(-0.61)
University	0.36	0.48	0.37	0.48	-0.00	(-0.28)
PhD advanc~t	0.02	0.12	0.02	0.15	-0.01*	(-2.16)
Agriculture	0.04	0.20	0.03	0.16	0.02***	(4.86)
Manufacture	0.13	0.34	0.13	0.34	-0.00	(-0.02)
Constructi~y	0.09	0.28	0.10	0.30	-0.01	(-1.76)
Wholesale ~e	0.12	0.33	0.12	0.32	0.01	(0.94)
Hotels and~s	0.04	0.19	0.07	0.26	-0.04***	(-6.65)
Transporta~n	0.06	0.24	0.07	0.25	-0.00	(-0.85)
Finance, r~e	0.04	0.20	0.04	0.20	0.00	(0.27)
Public adm~n	0.08	0.28	0.05	0.22	0.03***	(6.68)
Education	0.11	0.31	0.09	0.28	0.02***	(3.30)
Health and~k	0.12	0.32	0.11	0.31	0.01	(1.40)
Profession~s	0.12	0.33	0.14	0.35	-0.02**	(-2.66)
Cultural a~s	0.04	0.20	0.05	0.23	-0.01**	(-2.89)
N	24375		2245		26620	