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Valentine Jacobs
Université Libre de Bruxelles (CEB and DULBEA) and humanOrg

François Rycx
Université Libre de Bruxelles (CEB and DULBEA), humanOrg, IRES and IZA

Benoît Mahy
Université de Mons (humanOrg) and DULBEA

Mélanie Volral
Université de Mons (humanOrg) and DULBEA

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

The Heterogeneous Effects of Workers' Countries of Birth on Over-Education

This paper examines the relationship between immigration and over-education, taking advantage of access to rich matched employer-employee data for the Belgian private sector for the period 1999-2010. Covering more than 1.2 million workers, the data enable the authors to: i) measure over-education with higher precision, ii) examine the heterogeneous effects of detailed countries of birth, and iii) test the role of key moderating factors. More precisely, this paper is not only the first to investigate the effect of citizenship acquisition and workers' tenure on the nexus between immigration and over-education, but also one of the few to study the moderating roles of gender and education for detailed categories of immigrants. With ordered probit estimates, the authors highlight that immigrant workers are much more likely to be over-educated than their native counterparts, especially when the former originate from the Maghreb or Asia. Over-education also appears to be particularly critical among higher-educated immigrants. Gender-based differences in immigrants' penalties, in contrast, are found to be quite modest overall. Results further show that tenure has a strong moderating effect on the likelihood for immigrants born in developing countries to be over-educated and that citizenship acquisition is also associated with substantially improved job matches.

JEL Classification: I21, J15, J24, J61, J71

Keywords: immigrants, over-education, gender, tenure, citizenship acquisition.

Corresponding author:
François Rycx
Université libre de Bruxelles
50 avenue F. Roosevelt
CP114/03 B-1050 Brussels
Belgium
E-mail: frycx@ulb.ac.be

1 Introduction

Immigration has become a major challenge for advanced economies, and this is particularly the case in Belgium. At the beginning of the 20th century, many foreigners entered the Belgian territory to meet the country's demand for low-skilled labour. Starting in the 1970s, family reunification has been the main reason for immigration, and since the 1990s, the bulk of immigration has consisted of asylum seekers (Martiniello and Rea, 2012). At the end of 2018, the total number of immigrants in Belgium represented no less than 17% of the total population (Eurostat, 2019a). This phenomenon makes this country one of the most multicultural countries in the European Union (Martiniello, 2003). Yet, at the same time, it is ranked as one of the worst OECD countries when assessing the employment performance of immigrants. In 2017, the employment rate for foreign-born individuals was about 57%, compared to about 65% for natives (OECD, 2019a; OECD, 2019b). For immigrants born outside Europe, this rate drops even further, to about 50% (Eurostat, 2019b).

The under-utilisation and/or non-recognition of immigrants' education credentials has been documented in the literature. A growing number of studies indeed emphasize that immigrants are more likely to be over-educated for their jobs (i.e. to have a higher level of education than the one required in their job) than their native counterparts. Discrimination and limited transferability of human capital are the main reasons that have been put forward to explain this phenomenon (e.g. Chiswick and Miller, 2009a; Aleksynska and Tritah, 2013; Matano *et al.*, 2015).

The first objective of this paper is to put the relationship between immigration and over-education to an updated test, taking advantage of our access to detailed Belgian linked employer-employee data for the years 1999-2010. The data come from the combination of i) the "Structure of Earnings Survey (SES)", which contains relevant information on the characteristics of establishments (e.g. sector of activity, number of employees, level of collective agreement) and on their workers (e.g. age, education, occupation, gender, tenure, working time), and ii) the Belgian National Register (NR), which provides relevant information on the nationality of workers (e.g. country of birth, current nationality and nationality at birth). This dataset, covering more than 1.2 million workers, offers several advantages. First, it enables us to measure over-education using the 'realized matched method' in a more detailed and hence more accurate manner than most previous studies. According to this method, a worker is considered as over-educated if her/his educational attainment is higher than the one required for her/his job. Traditionally, the required education for a job is estimated using the mode (Kiker *et al.*, 1997) or the mean (Verdugo and Verdugo, 1989) of the education levels by occupation. However, this approach does not account for cohort effects, i.e.

the fact that levels of education have substantially increased over time and that the education credentials of older workers can therefore hardly be compared directly with those of their younger co-workers. Furthermore, the education requirements for a given occupation are likely to vary across sectors. For example, the requirements for a project manager position in the nuclear industry will likely be very different from those for a job in retailing. To account for both issues, we compute the education requirements for a job by taking the mode of the education levels by detailed occupation, workers' age, and sectoral category. The required education is thus estimated by measuring the mode of the education levels in more than 5,400 occupation/age/industry cells for each period. Our first contribution to the existing literature – besides being the first study to examine this issue in the Belgian context – is thus to rely on a more fine-grained approach to measure education requirements and mismatch.[1]

Next, our dataset enables us to categorize immigrants according to whether they were born in a developed, transition or developing country (following the United Nations (2014) nomenclature), but also according to more detailed geographical areas. Immigrants born in different regions have different characteristics in terms of human capital, culture, and/or languages (FPS Employment and Unia, 2017). Heterogeneity in immigrants' regions of birth is thus likely to be a key moderator in the relationship between immigration and over-education. Surprisingly, though, the bulk of existing studies investigate this issue for immigrants overall (e.g. Chiswick and Miller, 2009b; Dell'Aringa and Pagani, 2011; Maani and Wen, 2018), by skin colour (e.g. Battu and Sloane, 2004; Dex and Lindley, 2007; Lindley, 2009), or for quite broad subgroups (e.g. Green *et al.*, 2007; Kler, 2007; Byrne and McGuinness, 2014; Matano *et al.*, 2015; Kifle *et al.*, 2018). To our knowledge, there is still scant evidence on the moderating role of immigrants' regions of birth (e.g. Nielsen, 2007; Schwientek, 2016; Kalfa and Piracha, 2017).

More research is also needed to get a better understanding of key moderating factors in the relationship between over-education and detailed categories of immigrants. The third objective of our paper is thus to examine the potential roles played by education, gender, tenure (i.e. the number of years an employee has been working for her/his current employer), and citizenship acquisition. Though there is a growing literature studying i) the effect of citizenship take-up on immigrants' labour market status (e.g. Corluy *et al.*, 2011; Fougère and Safi, 2011) and ii) the influence of the duration of residence on over-education (e.g. Joona *et al.*, 2014; Kalfa and Piracha, 2017), this paper is the first, to our knowledge, to examine how immigrants' likelihood of being over-educated is

[1] To our knowledge, the study by Lindley (2009) is the only one, in the literature on over-education and immigration, to use workers' age in addition to occupational categories to compute jobs' education requirements.

affected by tenure and naturalisation. It is also one of the few to study the moderating roles of education and gender for detailed categories of immigrants.

The remainder of this paper is organised as follows. In the next section, we review the literature on the relationship between over-education and immigration. Sections 3 and 4 describe our methodology, dataset, and descriptive statistics. Econometric results are presented in section 5, and the last section concludes.

2 Review of the literature

2.1. Immigrants and over-education

Theoretically, two main reasons have been put forward to explain why immigrants are more likely to be over-educated than their native counterparts. The first explanation is the imperfect transferability of human capital, which suggests that the more the home and the host country contexts differ, the greater the likelihood that immigrants will be over-educated (e.g. Friedberg, 2000; Chiswick and Miller, 2009a; Aleksynska and Tritah, 2013; Kalfa and Piracha, 2017). Transferability of human capital is expected to be smoother for immigrants from advanced economies and from countries with similar cultures and languages (Ramos *et al.*, 2015). Indeed, the difficulty for immigrants to get their diplomas or certificates recognised in the host country varies substantially depending on the country in which those were obtained (Nielsen, 2007). The second reason why the incidence of over-education might be higher among immigrants is related to statistical and/or taste-based discrimination. If immigrants suffer from negative stereotypes or if employers/customers/providers/co-workers prefer collaborating with natives, immigrants will have greater difficulty in finding a job that matches their education and will thus be more likely to accept jobs for which they will be over-educated (Lindley, 2009).[2]

[Insert Tables 1 and 2 about here]

From an empirical point of view, a first group of studies, summarized in Table 1, analyse whether immigrants, overall or by skin colour, are more likely to be over-educated than their native

[2] A complementary explanation is that many immigrants might already be over-educated in their home country, which in turn reduces their probability to be adequately educated in their host country (Piracha *et al.*, 2012; Kalfa and Piracha, 2017). Firms' monopsonistic behaviour might also be to blame if immigrants are subject to more frictions than natives in the host labour market (Hirsch and Jahn, 2015).

or white-skinned counterparts. Most results suggest that immigration increases the probability of over-education among workers. Only Battu and Sloane (2004) indicate the opposite. Table 2 presents another group of studies in which immigrants are divided into sub-groups, though still often quite aggregated. Focusing on Australia, Green *et al.* (2007) and Kifle *et al.* (2018) show that immigrants born in non-English speaking countries are the most likely to be over-educated. Kifle *et al.* (2018) also point out that this is particularly the case for workers born in Asia. Considering European countries as host countries, all studies find that immigrants are more likely to be over-educated than natives. Aleksynska and Tritah (2013) and Griesshaber and Seibel (2015) use the European Social Survey (ESS) to estimate the probability of over-education across different sub-groups of immigrants based on their regions of birth. Griesshaber and Seibel (2015), studying the period 2002-2003, indicate that those born in Latin America and the Caribbean or in Asia and the Pacific are the most likely to be over-educated. Aleksynska and Tritah (2013), focusing on a longer period, from 2002 to 2009, find that over-educated immigrants are more likely to be born in the Middle East and Africa. These outcomes are partly corroborated by Matano *et al.* (2015), who use the Adult Education Survey (AES) for the period 2005-2008 to show that workers born outside European countries are more likely to be over-educated. Ramos et al. (2015) find a higher likelihood of over-education among immigrants in Spain, especially for those originating from the Maghreb or Eastern Europe. In contrast, Schwientek (2016), using the German Socio-Economic Panel (GSOEP), obtains non-significant differences in her calculations of over-education probability across immigrants originating from different regions, except for those born in former Yugoslavia. Yet, she also shows that over-education is less prevalent among native-born workers than among immigrants.

2.2. Immigrants' characteristics

A third group of studies, presented in Table 3, considers workers' heterogeneity in terms of countries of birth and take their analyses further by also examining the potential roles played by specific immigrants' characteristics, such as education, gender and (correlates of) the amount of time spent in the host country, such as labour market experience and duration of residence.

[Insert Table 3 about here]

2.2.1. The roles of education and gender

Theoretically, higher-educated and female workers are expected to have a higher probability of being over-educated. The argument goes as follows: higher-educated workers can generally compete for jobs designed for lower-educated workers (while the reverse is often not true) and are therefore more likely to be over-educated, especially in times of high unemployment (e.g. Kler, 2007; Chiswick and Miller, 2009b; Piracha *et al.*, 2012). Following the same reasoning (and considering the above-cited potential issues of human capital transferability and discrimination), we expect the incidence of over-education to be higher among higher-educated immigrants than among both: i) lower-educated immigrants and ii) higher-educated native colleagues. This prediction is notably supported by Kler (2007) and Chiswick and Miller (2009b). In addition to the level of education, the place of acquisition of education is also likely to matter. Indeed, Nielsen (2007) and Maani and Wen (2018) point out that immigrants' likelihood of being over-educated in the host country is significantly higher when their education credentials have been acquired in the home country.

As for gender, it is expected that women will face geographical mobility and family constraints to a higher extent than men. Indeed, more often than men, women still tend to sacrifice their professional ambitions in order to work closer to their homes and to care for their families. As a result, they are also more likely to accept jobs for which they are over-educated. Moreover, in the case of gender discrimination (e.g. a glass-ceiling), women might end up competing with lower-educated men (McGoldrick and Robst, 1996; Karakaya *et al.*, 2007). These arguments, however, are not supported by the few existing studies analysing the role of gender in the relationship between immigration and over-education. Joona *et al.* (2014), for instance, find a higher probability of over-education among male immigrants in Sweden, whereas Byrne and McGuinness (2014) show that gender has no significant influence on immigrants' probability of being over-educated in Europe.

2.2.3. The role of time: tenure and citizenship acquisition

The length of time spent by immigrants in the host country since their arrival has no clear-cut effect on their likelihood of being over-educated. On the one hand, time enables immigrants to gain labour market experience and to adapt to the requirements of the host country. Information asymmetry also tends to decrease as their duration of stay increases (Aleksynska and Tritah, 2013). Accordingly, some studies show that immigrants get better integrated and are less likely to be over-educated as time goes by (e.g. Piracha *et al.*, 2012; Kalfa and Piracha, 2017). On the other hand,

several studies show that the over-education phenomenon among immigrants is very persistent over time (e.g. Joona *et al.*, 2014; Maani and Wen, 2018). Dell'Aringa and Pagani (2011), for instance, show that labour market experience acquired in the host country has little impact on immigrants' probability of over-education. Some studies further highlight that not all immigrants benefit equally from the time spent in the host country. Looking at Sweden, Joona *et al.* (2014) notably find that the benefits are significantly larger for immigrants born in Western countries than for those born in non-Western countries.

In this paper, we address the question of the time spent in the host country first by focusing on workers' tenure (i.e. the number of years an employee has been working for her/his current employer), a key variable that has not been tested in the literature so far. If the higher incidence of over-education among immigrants is driven by statistical discrimination, i.e. stereotypes and asymmetrical information on immigrants' true productivity, or by firms' monopsonistic discrimination towards new immigrants, which subjects the latter to more frictions in the host labour market than natives, then we expect over-education among immigrants to decrease as years of tenure increase (e.g. Aiger and Cain, 1977; Rubb, 2013; Hirsch and Jahn, 2015). However, if over-education among immigrants is due to other phenomena (such as taste-based discrimination or unobserved differences between natives and immigrants in terms of preferences and/or actual skills), then the effect of tenure should be non-significant or at least quite limited.

Next, we investigate whether citizenship acquisition matters. Our data's time span (1999-2010) mostly corresponds to a period during which Belgian nationality acquisition[3] was very easy. Access to citizenship was basically open to all immigrants with a minimum period of lawful residence in the country. Until 2013, no specific requirements in terms of integration or knowledge of languages had to be fulfilled. Belgium's liberal naturalisation policy was designed as a tool to foster immigrants' social inclusion and employment prospects.[4] There is a growing literature analysing the influence of naturalisation on immigrants' labour market status (e.g. Bevelander and Veenman (2006) for the Netherlands; Corluy *et al.* (2011) for Belgium; Fougère and Safi (2011) for France; Steinhardt (2011) for Germany and Switzerland), but to the best of our knowledge, none of them

[3] In this paper, we use the terms citizenship and nationality as synonymous.

[4] The Belgian Nationality Code, created in 1984, has been subject to several reforms. Before 2000, candidates for the Belgian nationality had to meet all the following criteria at the time of the declaration: to be between 18 and 30 years of age, to have been born in Belgium, and to have their main residence there. Since 1991, the Code enables children born in Belgium from parents who were themselves born there to obtain the Belgian nationality. The 2000 reform, known as the 'Snel Belg wet', greatly eased the criteria for acquiring the Belgian nationality. The maximum age limit (30) was abolished. Moreover, the Belgian nationality could be obtained in the three following situations: a) being born in Belgium and having the main residence there since birth, b) being born abroad and having one parent with the Belgian nationality at the time of the declaration, c) having been a resident in Belgium for 7 years and having an unlimited right of residence. In 2013, the Code was amended again, but this time the criteria for acquiring the nationality were tightened up (Conseil supérieur de l'emploi, 2018).

examine the relationship between naturalisation and immigrants' over-education. Our paper is thus also the first to examine this issue. Moreover, it has the specific feature of examining this issue in a quite liberal context.

3 Methodology

3. 1 Measuring over-education

In the literature, there are three main approaches to measuring over-education: job analysis (JA), realized matches (RM), and worker self-assessment (WA) approaches. The JA approach is an objective measure based on analysts' criteria to determine the education requirement for a job to be compared with workers' educational attainments; the RM is a statistical approach that compares workers' educational attainments with those of workers in the same occupation using the mean (Verdugo and Verdugo, 1989) or modal value (Kiker *et al.*, 1997) as reference; the WA is a subjective measure based on surveys in which workers are asked to evaluate the level of education required to do their jobs.

These measures all have advantages and shortcomings (see e.g. Hartog, 2000, for a discussion), so that the approach chosen in practice is often driven by data availability. In this paper, we rely on the RM approach. Traditionally, this approach boils down to defining the level of education required for a job by computing the mode of the education levels by occupation, and then classifying a worker as over-educated if her/his level of education exceeds that required for her/his job. We refine this approach by considering, besides the worker's occupation, her/his age (following Lindley, 2009) and the sector in which she/he is employed. More precisely, we define the required level of education by taking the mode of the education levels (ISCED: 7 categories)[5] by occupation (ISCO 3-digits: 150 categories), age group (14-29, 30-49, 50+), and sector (NACE Rev. 2 at 1-digit level: 13 categories).[6] This results in 5,420 groups instead of around 150 if the analysis had been based on ISCO 3-digits occupations only. This fine-grained approach enables us to control for cohort

[5] Information on workers' educational attainments, available in 7 categories in our dataset, has been reported by firms' HR departments (based on their registers). We converted that information into years of education, applying the following rule: (i) primary education: 6 years of education; (ii) lower secondary education: 9 years; (iii-iv) general, technical and artistic upper secondary education: 12 years; (v) higher non-university education, short type: 15 years; (vi) university and non-university education, long type: 17 years; (vii) postgraduate education: 18 years. Given that information on workers' levels of education have been provided by firms' HR departments, the latter might be somewhat under-estimated for immigrants. The findings reported in this paper should therefore be considered as a lower bound.

[6] We restricted our sample to occupation-age-sector cells containing at least 10 observations. However, given the large number of observations on which our study is based, this restriction had very little impact on sample size.

effects, the increasing supply of education credentials, and education requirements that are very likely to vary across sectors in given occupations.

3. 2 The relationship between immigration and over-education

To get a better understanding of whether and how workers' likelihood of being over-educated is affected by their regions of birth, we rely on an ordered probit model. The dependent variable takes the value 0, 1 or 2 depending on whether the worker is recorded as under-, adequately, or over-educated, respectively.[7,8] As highlighted by equations (1) to (3), the outcome of our model is a linear function of covariates between two cut points:

$$\Pr(under\ educated_i = 0) = \Pr(\beta_{1i} region\ of\ birth_i + \beta_{2i} X_i + u_i < cut1) \quad (1)$$

$$\Pr(adequately\ educated_i = 1) = \Pr(cut1 < \beta_{1i} region\ of\ birth_i + \beta_{2i} X_i + u_i < cut2) \quad (2)$$

$$\mathbf{Pr}(\boldsymbol{over\ educated_i = 2}) = \mathbf{Pr}(\boldsymbol{cut2 < \beta_{1i} region\ of\ birth_i + \beta_{2i} X_i + u_i}) \quad \mathbf{(3)}$$

The cutting points, *cut1* and *cut2*, are the thresholds separating adequately educated workers from over- and under-educated ones, respectively. Our main variable of interest is the region of birth of worker *i*. We first include three dummies, identifying respectively whether workers were born in developed, transition or developing countries. To do so, we follow the United Nations' (2014) classification, which is built on basic economic conditions such as geographical location and similarities in economic structure. The reference category consists of workers born in Belgium. In equation (3), a positive *(negative)* coefficient β_{1i} indicates that immigrants are more *(less)* likely to be over-educated than their opposite numbers born in Belgium. Next, in order to assess the role played by workers' regions of birth more precisely, we consider 10 dummies. To this end, we divide immigrants into sub-groups according to whether they were born in: i) Western Europe, ii) Eastern Europe (EU-13), iii) Eastern Europe (non-EU), iv) Japan, v) North America and the South Pacific, vi) Latin and Central America, vii) the Maghreb, viii) Sub-Saharan Africa, ix) the Middle and Near

[7] A worker is considered as under-educated if her/his level of education is lower than that required for her/his job. Under-education may notably result from labour shortages (i.e. bottleneck vacancies) and technologically-induced changes in job content and complexity.

[8] Our focus is on over-education only. Estimates associated with under-education are available on request.

East, and x) Asia. Covariates, included in the vector X_i, regroup detailed worker, job and firm characteristics. More precisely, we control for gender, education (2 dummies), years of tenure (1 dummy), type of employment contract (3 dummies), working hours (1 dummy), the region where the establishment is located (2 dummies), the size of the establishment (2 dummies), public ownership (1 dummy), the level of collective bargaining (1 dummy), and 11 year dummies. u_i is the usual error term.

To examine the role of moderating factors, this model has been re-estimated separately by level of education (sample of tertiary-educated workers *vs.* those with at most a degree from lower secondary education) and gender, but also according to whether immigrants acquired the Belgian nationality or not, and whether they had more or less than 10 years of tenure with their current employer.

4 Data

Our empirical analysis is based on a combination of two large datasets covering the period 1999-2010. The first, carried out by Statistics Belgium, is the "Structure of Earning Survey" (SES). It covers all firms that are operating in Belgium, employ more than 10 workers and have economic activities within sections B to N of the NACE Rev. 2 nomenclature. The SES contains a wealth of information on both the characteristics of firms (e.g. size of the establishment, sector of activity, level of collective bargaining) and the individuals working in those firms (e.g. education, gender, age, occupation, tenure, working time), as provided by the firms' HR departments. However, it contains no information on workers' countries of birth. Therefore, Statistics Belgium has merged the SES dataset with data from the Belgian National Register (NR) in order to provide information on each worker's country of birth, current nationality and nationality at birth.

After cleaning the data[9], we end up with a final sample of 1,235,399 workers. Our dataset is cross-sectional and covers more than a decade (1999-2010).[10] Descriptive statistics are reported in Table 4. They show that about 89% of workers in our sample were born in Belgium, 6% in other developed countries, 0.5% in transition economies, and 5% in developing countries.[11] We further observe that around 68% of workers in our sample are men, 59% are aged between 30 and 49, 44% are blue collars, and 26% have a tertiary-education degree. As regards the sectors of activity, most workers are employed in manufacturing (32%); transportation and storage (17%); professional,

[9] A very small number of observations had to be deleted for lack of information on some key variables.
[10] It does not enable us to follow workers over time though.
[11] More detailed descriptive statistics of workers by country of birth are reported in Appendix 1.

scientific and technical activities (13%); and wholesale and retail trade, including repair of motor vehicles and motorcycles (10%).

[Insert Table 4 about here]

The share of over-educated workers, by region of birth, is reported at the top of Table 4. Around one in five workers born in Belgium appears to be over-educated. We find a similar share (from 18% to 20%) for workers born respectively in developed, transition and developing countries. The reason for this outcome is that this share is computed across all workers, regardless of their level of education. When we restrict our sample to tertiary-educated workers only, i.e. to those that are the most likely to be over-educated, we observe a very different picture, as shown in column (2) of Table 5. The incidence of over-education is then found to be significantly higher among workers born in developing countries and especially in transition economies. These contrasting results highlight that workers born in developed countries (including Belgium) are, on average, much more educated than those born in transition and developing countries (as shown in Table 4). Table 5 also shows the incidence of over-education among more disaggregated groups of immigrants. This incidence is found to be particularly high for tertiary-educated workers born in Eastern Europe (non-EU) and in the Maghreb, respectively at 57 and 60%. Overall, Table 5 further suggests that women are more likely to be over-educated[12] and that workers having more years of tenure and those that have obtained the Belgian nationality are, on average, less likely to be over-educated.[13]

[Insert Table 5 about here]

5 Results

5.1. The role of the region of birth

Table 6 presents the estimation of equation (3) and shows how likely immigrants are to be over-educated compared to workers born in Belgium, first categorizing immigrants according to the

[12] Except for those born in Japan or Latin and Central America.
[13] Yet, the results for those with more than 10 years of tenure born in Eastern Europe (both EU-13 and non-EU), North America and South Pacific, Latin and Central America or Sub-Saharan Africa and those naturalised born in Eastern Europe (both EU-13 and non-EU) do not support this average outcome.

United Nations' (2014) classification, in column (1), and then considering more detailed groups of immigrants, in column (2). The first column reports all positive and significant coefficients.[14] All else equal, being born outside Belgium is thus found to increase workers' likelihood of being over-educated. More precisely, our estimates show that a worker born in a developing (transition) country faces a 4% (4.8%) points higher probability of being over-educated than a worker born in Belgium, whose likelihood of being over-educated is already estimated at around 20%. Looking at more disaggregated results, in column (2) of Table 6, we find substantial heterogeneity in the magnitude of estimates. Among developing countries, the penalty is found to be more moderate for workers born in the Middle and Near East or Sub-Saharan Africa (1.8-2.1% points). In contrast, it appears to be more pronounced for those born in Latin and Central America (4.9% points), the Maghreb (5.5 % points), and especially Asia (6.8 % points). Among those born in developed countries, the penalty is the highest for those born in Eastern EU countries (3.9% points).

[Insert Table 6 about here]

5.2. Immigrants' characteristics

5.2.1 The roles of education and gender

To examine the moderating role of education, we conducted separate estimations of our model for tertiary-educated workers on the one hand, and for workers having at most a degree from lower secondary education on the other hand. The results, reported in columns (3) and (4) of Table 6, show that the previous findings were mainly driven by tertiary-educated workers. Indeed, estimates indicate that lower-educated immigrants are about as likely to be over-educated as their lower-educated opposite numbers born in Belgium. In contrast, we find that tertiary-educated immigrants are overall significantly more likely to be over-educated than both: i) tertiary-educated workers born in Belgium, and ii) lower-educated immigrants.[15] Again, strong heterogeneity is observed across

[14] Appendix 2 shows the full range of estimates, including those related to the covariates. In line with the literature, we notably find that the probability of over-education increases with education credentials and decreases with establishment size and the presence of a firm-level collective agreement (Karakaya *et al.*, 2007). The results also show that the probability of over-education is lower among women. However, this outcome is reversed when focusing on tertiary-educated workers only (see discussion in section 4).

[15] It should be recalled that workers with at most lower secondary education are substantially less likely to be over-educated than their tertiary-educated opposite numbers (see Appendix 2). The same outcome is found when focusing solely on workers born in Belgium (see Appendix 3). Accordingly, given that the regression coefficients are generally much smaller in column (3) than in column (4) of Table 6, we can indeed conclude that lower-educated immigrants are significantly less likely to be over-educated than tertiary-educated immigrants.

regions. For tertiary-educated workers born in developed countries, the penalty is not significant, except for those born in Eastern EU countries. The latter's penalty reaches 7.5% points compared to higher-educated workers born in Belgium. For tertiary-educated people born in transition economies, the penalty stands as high as 11.8% points. As for developing countries, the penalty is lower for workers born in Asia or in Sub-Saharan Africa (4-4.5% points), intermediate for those born in the Middle and Near East or in Latin and Central America (5.6-6.9% points), and particularly high for those born in the Maghreb (15.3% points).

As for the moderating role of gender, the estimates reported in columns (5) and (6) show that both female and male immigrants are significantly more likely to be over-educated than their same-sex counterparts born in Belgium. Whether female immigrants are more likely to be over-educated than male immigrants depends not only on the magnitude of the regression coefficients in columns (5) and (6) of Table 6, but also on the probability of over-education for the reference categories. On the one hand, we find higher regression coefficients among female than among male immigrants. The value of this differential generally stands at around 2% points, as reported in columns (5) and (6) of Table 6. On the other hand, the estimates in Appendix 3 show that women born in Belgium are *ceteris paribus* 2.1% points less likely to be over-educated than men born in Belgium. Overall, this leads to the conclusion that, among most categories of immigrants, the likelihood of being over-educated is almost identical for women and men. The two main exceptions are women born in the Middle and Near East or in the Maghreb, who face a 2% points penalty on top of that recorded for male immigrants born in the same regions.

5.2.2. The role of time: tenure and citizenship acquisition

Next, we analysed whether years of tenure enable immigrants to improve their situation on the labour market. We thus estimated our model again separately for workers having less and more than 10 years of tenure with their current employer. The results presented in columns (7) and (8) of Table 6 show that, for all categories of immigrants born in developing countries, the penalty is significantly smaller for those having more than 10 years of tenure.[16] All else equal, the latter's tenure reduces their likelihood of being over-educated by a percentage varying from 25% to (more than) 100%, depending on their region of birth. The absolute reduction is the greatest for workers

[16] Taken altogether, workers with more than 10 year of tenure have *ceteris paribus* virtually the same probability of over-education than those with fewer years of tenure (see Appendix 2). Given that the same outcome is found among workers born in Belgium (see Appendix 3), the regression coefficients in columns (7) and (8) directly enable us to compare immigrants' likelihood of being over-educated according to their years of tenure.

born in Sub-Saharan Africa, Asia and the Maghreb. These findings suggest that statistical/monopsonitic discrimination explains, at least partly, why the incidence of over-education is significantly higher among workers born in developing countries. However, it does not appear to be the whole story. Indeed, we still find a significant penalty for immigrants with over 10 years of tenure originating from Asia, the Maghreb, or Latin and Central America.

Finally, we examined the role of citizenship acquisition in the relationship between over-education and workers' countries of birth. For that purpose, we relied on workers' nationality at birth and on their current nationality (i.e. at the time of the survey). The results, presented in Table 7, show the probability for non-naturalised, in column (1), and naturalised immigrants, in column (2), to be over-educated, in comparison with workers born with the Belgian nationality respectively in Belgium (reference category) and abroad. Our estimates first indicate that all immigrants (except those from Japan, North America and the South Pacific), naturalised or not, have a significantly higher probability of being over-educated than workers born in Belgium with the Belgian nationality. They also show that, for workers born with the Belgian nationality, there is no significant difference between those born in Belgium and those born abroad. These observations highlight the role of workers' citizenship at birth in terms of employment outcomes.

All else equal, we further find that citizenship acquisition has a mixed effect on immigrants' probability of over-education. On the one hand, it significantly improves the situation of all those originating from developing countries (with the exception of Sub-Saharan Africa).[17] Citizenship acquisition notably reduces the penalty for workers born in the Maghreb, the Middle and Near East or Asia by a percentage between 36% and 53%. On the other hand, the estimates show that citizenship take-up is associated with a slightly higher probability of over-education among workers born in both Western and Eastern European countries. This outcome could be explained by the fact that immigrants born in those countries have less incentives to ask for the Belgian nationality as many of them already benefit from EU membership advantages. It might also support the hypothesis, notably put forward by FPS Employment and Unia (2017), that European immigrants with a strong inclination to obtain the Belgian nationality tend to have, on average, less 'attractive' labour characteristics and, accordingly, consider the naturalisation process as a strategy to improve their employability.

[17] Due to potential self-selection issues, our results should not be interpreted as causal.

6 Conclusion

Foreign-born people account for 17% of the total population in Belgium. This makes Belgium one of the most multicultural country in the OECD. At the same time, Belgium is often depicted as one of the worst OECD country in terms of employment outcomes for immigrants (OECD, 2019a). This is notably illustrated by the employment rate of immigrants born in developing countries, which reaches no more than 50%. This critical situation is also reflected in immigrants' working conditions, such as lower wages (e.g. Kampelmann and Rycx, 2016). An additional feature that has not been investigated yet in the Belgian context is whether foreign-born workers are more likely to be over-educated, i.e. to have a higher level of education than that required for their jobs, compared to their native counterparts.

While evidence for other advanced economies suggests that over-education is indeed generally more prevalent among foreign-born workers, our paper aims to go a step further and more precisely to deepen the nexus between over-education and people's migration background in three complementary ways. First, by using a sizeable, detailed matched employer-employee dataset, covering the Belgian private sector over more than a decade, we rely on a more fine-grained realized matches approach than the one generally used in the literature. Our approach enables us to measure education requirements and over-education while controlling for cohort effects and for the fact that the requirements for a given occupation are very likely to differ across sectors. More specifically, we estimate the required levels of education for jobs by taking the mode of the education levels in more than 5,400 occupational/age/industry cells. Secondly, our study provides evidence on the moderating role of immigrants' countries/regions of birth in a much more detailed manner than most previous studies. We are thus able to overcome important aggregation biases and to identify with increased precision which immigrants are most affected by this issue. Finally, our study is, to our knowledge, the first to investigate the effects of citizenship acquisition and tenure on the nexus between immigration and over-education. It is also among the few to study the moderating roles of gender and education for detailed categories of immigrants.

The marginal effects from our ordered probit regressions indicate that foreign-born workers are *ceteris paribus* much more likely to be over-educated than their native counterparts. As expected, our results also show strong variability in outcomes depending on immigrants' countries of birth. The over-education penalty is found to be: i) not significant for people from North America, the South Pacific and Japan, ii) moderate for those born in Western Europe and Sub-Saharan Africa, iii) more pronounced for workers originating from Eastern Europe, Latin and Central America, and iv) the strongest for people born in the Maghreb and Asia.

Moreover, our results show that the native-immigrant gap in over-education is essentially driven by tertiary-educated workers. Again, strong heterogeneity is observed across workers' regions of birth. Tertiary-educated immigrants born in developed countries (except for Eastern Europe) do not differ from their opposite numbers born in Belgium. In contrast, among tertiary-educated immigrants from transition and developing economies, the penalty varies from 4% points to more than 15% points (for workers born in the Maghreb). As regards the moderating role of gender, the estimates show that the likelihood for women and men to be over-educated is almost identical in all categories of immigrants. Immigrant women from the Middle and Near East and the Maghreb are exceptions in this respect: they face a significant penalty (of around 2% points) on top of that recorded for their male counterparts.

Our results further show that workers' years of tenure have a significant moderating effect on the probability of over-education for immigrants born in developing countries. This moderating effect, particularly pronounced among workers born in the Maghreb or in the Middle and Near East, is compatible with a statistical/monopsonistic discrimination story. In other words, it supports the hypothesis that asymmetrical information on those immigrants' true productivity diminishes as years of tenure increase and/or that new immigrants born in developing countries are subject to more frictions in the host labour market than natives. However, other explanations may probably be put forward (including taste-based discrimination or native-immigrant unobserved differences in preferences and actual skills) as immigrants with over 10 years of tenure born in the Maghreb, Asia or in Latin and Central America still encounter a significant penalty.

Finally, our estimates show that citizenship acquisition is almost always associated with a significant and largely positive effect among immigrants born in developing countries. We find, notably, that citizenship take-up reduces the penalty for workers from the Maghreb, the Middle and Near East, and Asia by a percentage between 36 and 53%. This is particularly interesting considering Belgian's relatively liberal naturalisation policy over the period under investigation.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Table 1: Educational mismatch according to workers' countries of birth: studies considering immigrants as a whole or by skin colour

Study	Country	Data/ Coverage	Over-education measure	Methodology	Immigrants divided in sub-groups	Moderators	Results
Battu and Sloane (2004)	UK	Cross-sectional data, 1993-1994	Realized matches method (occupation)	Multinomial logit model	NO	NO	Natives are more likely to be over-educated.
Dex and Lindley (2007)	UK	Panel data, 2001-2004	Realized matches method (occupation)	Multinomial logit model	NO [only ethnicity]	Gender	Non-white workers are more likely to be over-educated, to a larger extent in the case of female workers.
Chiswick and Miller (2009a)	US	Cross-sectional data, 2000	Realized matches method (occupation)	Descriptive statistics	NO	Education	Higher-educated workers are more likely to be over-educated, especially when they are immigrants.
Lindley (2009)	UK	Cross-sectional data, 1993-2003	Realized matches method (occupation and age)	Ordered logit model	NO [only ethnicity]	Gender	Non-white workers are more likely to be over-educated than their white counterparts, to a larger extent for female workers.
Dell'Aringa and Pagani (2011)	Italy	Cross-sectional data, 2005-2007	Realized matches method (occupation)	Probit model	NO	Experience	*At arrival*: Immigrants are more likely to be over-educated. *Later on*: Experience in the host labour market does not decrease immigrants' probability to be over-educated.

Notes: Over-education can be measured with three specific approaches: i) the "job analysis method", which is based on analysts' criteria; ii) the "realized matches' method", which compares workers' educational attainments with those of workers in the same occupation (in general) and age cohort (exceptionally); and iii) the "self-assessment method", where workers are asked to evaluate the required level and type of education necessary to perform their job.

Table 2: Educational mismatch according to workers' countries of birth: studies considering immigrants divided into sub-groups

Study	Country	Data/ Coverage	Over-education measure	Methodology	Immigrants divided into sub-groups	Moderators	Results
Green, Kler and Leeves (2007)	Australia	Cross-sectional data, 1996 and 2001	Job analysis method	Bivariate probit model	YES (ESB; Asian NESB; Other NESB)[a]	NO	Immigrants are more likely to be over-educated, especially if they were born in NESB countries.
Aleksynska and Tritah (2013)	Europe	Cross-sectional data, 2002-2009	Realized matches method (occupation)	Multinomial logit model	YES (Middle East and North Africa (MENA); other African countries; Latin America and the Caribbean; East Asia Pacific; South Asia; East Central Europe)	NO	Immigrants are more likely to be over-educated, especially if they were born in Africa or Middle East.
Griesshaber and Seibel (2015)	Europe	Cross-sectional data, 2002-2003	Realized matches method (occupation)	Logit model	YES (Latin America and the Caribbean; Africa and the Middle East; Asia and the Pacific)	NO	Immigrants are more likely to be over-educated, especially if they were born in Latin America, in the Caribbean, in Asia or in the Pacific.
Matano, Nieto and Ramos (2015)	Europe	Cross-sectional data, 2005-2008	Realized matches method (occupation)	Bivariate probit model	YES (European Union; Non-European Union)	NO	Immigrants are more likely to be over-educated, especially if they were born in non-EU countries.
Ramos, Sanroma and Simon (2015)	Spain	Cross-sectional data, 2001	Realized matches method (occupation)	Ordered logit model	YES (Developed economies; Eastern Europe; Southern Cone of Latin America; Rest of Latin America; Maghreb; Rest of the World)[b]	NO	Immigrants are more likely to be over-educated, especially if they were born in the Maghreb or in Eastern Europe.
Schwientek (2016)	Germany	Panel data, 1991-2013	Realized matches method (occupation)	Linear probability model	YES (Turkey; former Yugoslavia; Greece; Italy; Spain; other Europe; Asia; other)	NO	Immigrants are more likely to be over-educated, but there is no significant difference among regions.
Kifle, Kler and Flemming (2018)	Australia	Panel data, 2001-2014	Job analysis method	Generalised least squares	YES (ESB; NESB; Europe NESB; Asian NESB; Other NESB)	NO	Immigrants are more likely to be over-educated, especially if they were born in Asia or other NESB.

Notes: Over-education can be measured with three specific approaches: i) the "job analysis method", which is based on analysts' criteria; ii) the "realized matches' method", which compares workers' educational attainments with those of workers in the same occupation (in general) and age cohort (exceptionally); and iii) the "self-assessment method", where workers are asked to evaluate the required level and type of education necessary to perform their job. [a] ESB and NESB refers to English and Non-English Speaking Background. ESB groups UK and Ireland; Canada and America; South Africa and Zimbabwe. For Asian NESB: North East Asia; Central and South Asia; South East Asia and for Other NESB: Europe; North Africa and the Middle and Near East; Other countries. [b] Southern Cone of Latin America regroups Argentina, Chile and Uruguay; the rest of Latin America groups immigrants from Ecuador and Colombia; and the Rest of the world includes Sub-Saharan Africa and Asia as the main groups.

Table 3: Educational mismatch according to workers' countries of birth: studies considering immigrants divided into sub-groups and moderators

Study	Country	Data/ Coverage	Over-education measure	Methodology	Immigrants divided into sub-groups	Moderators	Results
Kler (2007)	Australia	Cross-sectional data, 1993-1995; 1999-2000	Job analysis method	Bivariate probit model	YES (ESB; Asian NESB; Other NESB)[a]	Education	Higher-educated immigrants are more likely to be over-educated, especially if they were born in NESB countries.
Nielsen (2007)	Denmark	Panel data, 1995-2002	Realized matches method (occupation)	Random effects logit model	YES (Turkey; Pakistan; Vietnam; Iran; Iraq; Ex-Yugoslavia; Somalia; Stateless)	Education	Immigrants are more likely to be over-educated, especially if they present foreign-acquired education.
Piracha, Tani and Vadean (2012)	Australia	Cross-sectional data, 1993-1995; 1999-2000; 2004-2005	Job analysis method	Binomial probit model	YES (NESB OECD; South, East, South-East Asia and Oceania; Sub-Saharan Africa; Other)	Experience	*At arrival*: Immigrants are more likely to be over-educated, especially if they were born in South-East Asia, Oceania or Sub-Saharan Africa. *Later on*: Experience in the host labour market decreases the probability to be over-educated.
Byrne and McGuinness (2014)	Europe	Cross-sectional data, 2005	Self-assessment method	Probit model	YES (EU15; EU other; high income countries; Rest of the world)	Gender	Immigrants (both women and men) are not more likely to be over-educated.
Joona, Gupta and Wadensjö (2014)	Sweden	Cross-sectional data, 2001-2008	Realized matches method (occupation)	Multinomial logit model	YES (Other Nordic countries; EU15; Rest of Europe; Africa; North America; South America; Asia; Oceania; Soviet Union)	(1) Gender (2) Time	*At arrival:* Immigrants are more likely to be over-educated, especially if they were born in Africa or in the rest of Europe, and to a larger extent in the case of men. *Later on*: Stronger persistency in over-education among immigrants
Kalfa and Piracha (2017)	Spain	Cross-sectional data, 2006-2007	Job analysis method	Binomial probit model	YES (Latin America; Africa; Other developing countries)	Experience	*At arrival*: Immigrants are more likely to be over-educated, especially if they were born in developing countries. *Later on*: Experience in the host labour market decreases the probability to be over-educated.
Maani and Wen (2018)	Australia	Panel data, 2001-2009	Realized matches method (occupation)	Logit Model	YES (ESB; NESB)[b]	(1) Duration of residence (2) Education	Immigrants are more likely to be over-educated, especially if they were born in NESB countries. The probability of over-education does not decrease with duration of residence in the host country.

Notes: Over-education can be measured with three specific approaches: i) the "job analysis method", which is based on analysts' criteria; ii) the "realized matches' method", which compares workers' educational attainments with those of workers in the same occupation (in general) and age cohort (exceptionally); and iii) the "self-assessment method", where workers are asked to evaluate the required level and type of education necessary to perform their job. [a] ESB and NESB refers to English and Non-English Speaking Background. ESB groups UK and Ireland; Canada and US; South Africa and Zimbabwe. Asian NESB groups North East Asia; Central and South Asia; South East Asia and Other NESB groups Europe; North Africa and the Middle and Near East; Other countries. [b] ESB groups UK, New Zealand, South Africa, and the US. NESB gathers over 60 different countries, including mainly Vietnam, China, Hong Kong and Taiwan, India, Philippines and the Netherlands.

Table 4: Means of selected variables, 1999-2010

Variables:	Sample of workers born in:				Overall sample
	Belgium	Developed countries[a]	Countries in transition	Developing countries	
	(1)	(2)	(3)	(4)	(5)
Over-educated workers	19.7	20.4	18.0	18.1	19.6
Age					
Young (15-29)	23.6	14.9	24.9	20.6	23.0
Prime (30-49)	58.7	60.8	64.3	67.8	59.3
Old (50+)	17.7	24.4	10.8	11.6	17.7
Men	67.6	67.6	64.6	74.1	67.9
Education					
Lower secondary at most	31.3	37.2	49.6	49.0	32.6
Upper secondary	42.1	34.6	35.5	33.4	41.2
Tertiary	26.7	28.2	14.9	17.6	26.2
More than 10 years of tenure	38.6	32.6	9.7	20.2	37.2
Full-time	59.9	60.9	59.2	56.8	59.8
Occupation (ISCO1)					
Managers	3.7	5.6	0.9	2.0	3.7
Professionals	11.2	13.7	6.2	7.5	11.2
Technicians and associate professionals	9.3	7.3	3.4	5.1	9.0
Clerical support	22.5	16.2	10.2	12.7	21.6
Service occupation	10.4	10.2	12.6	10.8	10.4
Craft and related trades workers	18.2	21.8	23.4	20.4	18.6
Machine operators	16.0	13.2	16.0	15.4	15.8
Elementary occupations	8.6	11.9	27.3	26.2	9.8
Size of the establishment (FTE number of workers)					
Small (1-49)	35.9	36.3	39.5	32.0	35.8
Medium (50-249)	30.2	31.5	31.3	31.5	30.4
Big (250+)	33.5	31.9	28.6	36.0	33.5
Sector (NACE1)					
Mining and quarrying (B)	0.0	0.0	0.0	0.0	0.0
Manufacturing (C)	32.0	30.6	25.8	25.7	31.6
Electricity, gas, steam and air conditioning supply (D)	1.9	1.3	0.8	0.8	1.8
Water supply, sewerage, waste management and remediation activities (E)	1.2	0.7	0.6	0.9	1.1
Construction (F)	1.4	1.4	2.2	1.8	1.4
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	9.9	11.1	12.1	10.0	10.0
Transportation and storage (H)	17.7	16.0	15.6	12.3	17.3
Accommodation and food service activities (I)	3.5	6.2	10.0	11.0	4.0
Information and communication (J)	7.9	7.0	7.0	7.6	7.9
Financial and insurance activities (K)	10.0	6.4	3.0	5.5	9.6
Real estate activities (L)	0.0	0.0	0.0	0.0	0.0
Professional, scientific and technical activities (M)	12.7	16.8	17.0	19.5	13.3
Administrative and support service activities (N)	1.8	2.5	5.9	4.8	2.0
Firm-level collective agreement	26.8	24.7	18.1	22.6	26.4
Number of observations	1,097,200	71,208	6,105	60,886	1,235,399
Share of sample (%)	88.8	5.8	0.5	4.9	100.0

Note: [a] excluding workers born in Belgium.

Table 5: Incidence of over-education by region of birth: overall and for sub-groups

	Overall sample	Tertiary educated	Women	More than 10 years of tenure	Naturalised
	(1)	(2)	(3)	(4)	(5)
Incidence of over-education by region of birth (%):					
Belgium	**19.7**	**45.7**	**20.5**	**17.4**	**17.5**
Developed countries	**20.4**	**43.6**	**22.2**	**17.5**	**18.3**
North America and South Pacific	31.3	42.5	32.1	31.9	28.4
Eastern Europe (EU-13)	20.7	52.3	22.6	23.4	22.3
Japan	36.2	46.1	31.7	24.5	25.5
Western Europe	20.0	42.9	21.8	17.1	17.2
Countries in transition	**18.0**	**57.2**	**20.3**	**18.3**	**18.1**
Eastern Europe (non-EU)	18.0	57.2	20.3	18.3	18.1
Developing countries	**18.1**	**51.3**	**20.0**	**16.0**	**16.7**
Asia	27.0	49.3	28.0	23.3	25.0
Latin and Central America	25.2	50.5	23.0	26.3	21.0
Maghreb	16.4	59.7	16.7	13.2	15.9
Middle and Near East	11.5	48.8	12.5	8.9	11.4
Sub-Saharan Africa	21.1	48.2	21.1	21.6	20.7
Total	**19.6**	**45.8**	**20.6**	**17.4**	**17.3**
Number of observations	1,235,399	335,826	396,280	450,577	108,209

Table 6: Immigrants' probability to be over-educated by region of birth and according to education, gender and tenure (marginal effects from ordered probit regressions)

	Full sample		Education		Gender		Tenure	
	Aggregated groups of immigrants (1)	Disaggregated groups of immigrants (2)	At most lower secondary education (3)	Tertiary educated workers (4)	Women (5)	Men (6)	Less than 10 years of tenure (7)	More than 10 years of tenure (8)
Workers born in:								
Belgium	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Developed countries	0.019***							
	(0.001)							
North America and South Pacific		0.000	-0.009***	0.003	-0.009	0.004	-0.002	0.003
		(0.010)	(0.003)	(0.016)	(0.013)	(0.014)	(0.013)	(0.017)
Eastern Europe (EU-13)		0.039***	0.002**	0.075***	0.050***	0.025***	0.038***	0.055***
		(0.005)	(0.001)	(0.016)	(0.007)	(0.006)	(0.005)	(0.010)
Japan		0.019	0.017**	0.028	0.041	0.007	0.031	-0.021
		(0.021)	(0.008)	(0.054)	(0.028)	(0.034)	(0.027)	(0.035)
Western Europe		0.018***	0.003***	-0.006	0.026***	0.014***	0.020***	0.015***
		(0.001)	(0.000)	(0.005)	(0.003)	(0.002)	(0.002)	(0.002)
Countries in transition	0.048***							
	(0.004)							
Eastern Europe (non-EU)		0.048***	0.003***	0.118***	0.061***	0.037***	0.051***	0.052***
		(0.004)	(0.001)	(0.020)	(0.008)	(0.005)	(0.004)	(0.011)
Developing countries	0.040***							
	(0.001)							
Asia		0.068***	0.009***	0.040**	0.083***	0.059***	0.078***	0.035***
		(0.005)	(0.001)	(0.017)	(0.008)	(0.006)	(0.006)	(0.009)
Latin and Central America		0.049***	0.005***	0.069***	0.063***	0.041***	0.052***	0.040***
		(0.006)	(0.001)	(0.018)	(0.010)	(0.008)	(0.007)	(0.015)
Maghreb		0.055***	0.003***	0.153***	0.088***	0.046***	0.064***	0.036***
		(0.002)	(0.000)	(0.013)	(0.006)	(0.002)	(0.003)	(0.004)
Middle and Near East		0.018***	-0.001	0.056***	0.052***	0.007**	0.026***	-0.000
		(0.003)	(0.001)	(0.017)	(0.007)	(0.003)	(0.004)	(0.006)
Sub-Saharan Africa		0.021***	0.005***	0.045***	0.034***	0.017***	0.035***	-0.012**
		(0.003)	(0.001)	(0.010)	(0.006)	(0.003)	(0.003)	(0.005)
Control variables[a]	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,235,399	1,235,399	395,870	335,826	396,280	839,119	784,822	450,577

Notes: [a] Regressions include covariates for gender, education, tenure, part-time, type of employment contract, region where the establishment is located, size of the establishment, ownership, level of collective agreement, year dummies. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Immigrants' probability to be over-educated by region of birth and according to citizenship acquisition (marginal effects from ordered probit regressions)

	Workers born with the Belgian nationality compared to:	
	Not naturalised immigrants	Naturalised immigrants
	(1)	(2)
Belgian nationality at birth		
& Born in Belgium	Reference	Reference
& Born outside Belgium	0.055	-0.004
	(0.034)	(0.003)
Non-Belgian nationality at birth		
& Born in **developed country**:		
North America and South Pacific		
Naturalised		0.016
		(0.065)
Not naturalised	0.004	
	(0.014)	
Eastern Europe (EU-13)		
Naturalised		0.046***
		(0.006)
Not naturalised	0.033***	
	(0.007)	
Japan		
Naturalised		0.060
		(0.051)
Not naturalised	0.021	
	(0.023)	
Western Europe		
Naturalised		0.026***
		(0.004)
Not naturalised	0.021***	
	(0.002)	
& Born in **countries in transition**:		
Eastern Europe (non-EU)		
Naturalised		0.054***
		(0.005)
Not naturalised	0.042***	
	(0.006)	
& Born in **developing country**:		
Asia		
Naturalised		0.052***
		(0.006)
Not naturalised	0.108***	
	(0.009)	
Latin and Central America		
Naturalised		0.049***
		(0.009)
Not naturalised	0.055***	
	(0.010)	
Maghreb		
Naturalised		0.047***
		(0.003)
Not naturalised	0.074***	
	(0.004)	
Middle and Near East		
Naturalised		0.014***
		(0.004)
Not naturalised	0.030***	
	(0.005)	
Sub-Saharan Africa		
Naturalised		0.056***
		(0.005)

	Not naturalised	0.046***	
		(0.005)	
& Born in **Belgium**			
	Naturalised		0.004***
			(0.001)
	Not naturalised	0.005**	
		(0.002)	
Control variables[a]		YES	YES
Observations		1,110,408	1,136,722

Notes: [a] Regressions include covariates for gender, education, tenure, part-time, type of employment contract, region where the establishment is located, size of the establishment, ownership, level of collective agreement, year dummies. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 1: Number of observations in sample by country of birth

Regions		Countries	n	Countries	n
Belgium (n = 1,097,200)		Belgium	1,097,200		
Developed countries, *excluding Belgium* (n = 71,208)	Western Europe (n = 64,341)	Andorra	3	Luxembourg	616
		Austria	266	Malta	16
		Denmark	216	Monaco	9
		Finland	149	Netherlands	7,404
		France	17,895	Norway	94
		Germany	8,645	Portugal	3,596
		Greece	1,363	San Marino	3
		Iceland	5	Spain	5,594
		Ireland	291	Sweden	421
		Italy	14,669	Switzerland	448
		Liechtenstein	1	United Kingdom	2,637
	Eastern Europe (EU-13) (n = 5,010)	Bulgaria	426	Latvia	16
		Czech Republic	349	Lithuania	18
		Estonia	14	Poland	2,480
		Hungary	331	Romania	1,376
	North America and South Pacific (n = 1,571)	Australia	151	New Caledonia	5
		Canada	524	Papua New Guinea	3
		French Polynesia	6	Tahiti	2
		Hawaii	2	U.S.A.	840
		New Zealand	37	Wallis and Futana	1
	Japan (n=286)	Japan	286		
Countries in transition (n = 6,105)	Eastern Europe (non-EU) (n = 6,105)	Albania	364	Kosovo	9
		Armenia	1	Russia	2,077
		Kazakhstan	1	Serbia	3,653
Developing countries (n = 60,886)	Maghreb (n = 24,168)	Algeria	2,300	Morocco	19,931
		Libya	418	Tunisia	1,425
		Mauritania	94		
	Middle and Near East (n = 12,061)	Afghanistan	167	Kuwait	16
		Brunei Darussalam	2	Palestine	5
		Cyprus	10	Saudi Arabia	6
		Egypt	202	Syria	260
		Iran	594	Turkey	10,362
		Iraq	204	United Arab Emirates	8
		Israel	153	Yemen	6
		Jordan	66		

Appendix 1 (Cont.): Number of observations in sample by country of birth

Regions		Countries	n	Countries	n
Developing countries, continued (n = 60,886)	Sub-Saharan Africa (n = 15,199)	Angola	347	Mali	39
		Benin	61	Mauritius	316
		Botswana	1	Mozambique	45
		Burkina Faso	5	Namibia	1
		Burundi	418	Niger	87
		Cabinda	1	Nigeria	377
		Cameroon	482	Reunion	38
		Cape Verde Islands	98	Rhodesia	26
		Central African Republic	28	Rwanda	721
		Chad	23	Sao Tome et Principe	1
		Comoro Island	2	Senegal	239
		Congo	8,928	Seychelles	2
		Cote d'Ivoire	302	Sierra Leone	113
		Djibouti	20	Somalia	48
		Ethiopia	87	South Africa	446
		Gabon	32	Sudan	55
		Gambia	52	Swaziland	2
		Ghana	714	Tanzania	28
		Guinee	269	Togo	333
		Upper Volta	54	Uganda	48
		Kenya	39	Urundi	22
		Liberia	96	Zambia	33
		Madagascar	100	Zimbabwe	15
		Malawi	5		
	Latin and Central America (n = 3,087)	Antilles	36	Guadeloupe	13
		Argentina	235	Guatemala	48
		Bahamas	4	Guyana	7
		Barbados	4	Haiti	80
		Bermuda	1	Honduras	7
		Bolivia	54	Jamaica	27
		Brazil	520	Martinique	7
		Chile	467	Mexico	147
		Colombia	350	Nicaragua	13
		Costa Rica	10	Panama	18
		Cuba	101	Paraguay	23
		Dominican Rep	142	Peru	271
		Dutch Guiana	9	Suriname	77
		Ecuador	227	Trinidad and Tobago	8
		El Salvador	39	Uruguay	45
		French Guiana	6	Venezuela	88
		Grenade	3		
	Asia (n = 6,371)	Bangladesh	137	Nepal	106
		Bhutan	27	North Korea	2
		Cambodia	186	Pakistan	355
		China	409	Philippines	884
		Hong Kong	90	Singapore	23
		India	1,076	South Korea	660
		Indonesia	263	Sri Lanka	83
		Laos	288	Taiwan	60
		Malaysia	47	Thailand	379
		Mongolia	29	Vietnam	1,262
		Myanmar	5		

Appendix 2: Immigrants' probability to be over-educated by region of birth (marginal effects from ordered probit regressions)

	Workers born in Belgium compared to:	
	Aggregated groups immigrants (1)	Detailed groups of immigrants (2)
Workers born in:		
Belgium	Reference	Reference
Developed countries	0.019***	
	(0.001)	
North America and South Pacific		0.000
		(0.010)
Eastern Europe (EU-13)		0.039***
		(0.005)
Japan		0.019
		(0.021)
Western Europe		0.018***
		(0.001)
Countries in transition	0.048***	
	(0.004)	
Eastern Europe (non-EU)		0.048***
		(0.004)
Developing countries	0.040***	
	(0.001)	
Asia		0.068***
		(0.005)
Latin and Central America		0.049***
		(0.006)
Maghreb		0.055***
		(0.002)
Middle and Near East		0.018***
		(0.003)
Sub-Saharan Africa		0.021***
		(0.003)
Control variables:		
Women	-0.020***	-0.020***
	(0.001)	(0.001)
Education (ref. upper secondary)		
Lower secondary at most	-0.321***	-0.321***
	(0.001)	(0.001)
Tertiary education	0.113***	0.114***
	(0.001)	(0.001)
More than 10 years of tenure (Yes)	-0.005***	-0.005***
	(0.001)	(0.001)
Part time (Yes)	-0.007***	-0.007***
	(0.001)	(0.001)
Contract (ref. open-ended contract)		
Fixed term	0.001	0.001
	(0.001)	(0.001)
Apprenticeship	-0.060***	-0.060***
	(0.007)	(0.007)
Interim	0.041***	0.041***
	(0.002)	(0.002)
Region of the establishment (ref. Flanders)		
Brussels	-0.050***	-0.050***
	(0.001)	(0.001)
Wallonia	0.001*	0.001*
	(0.001)	(0.001)
Size of the establishment (ref. small establishment)		
Medium establishment	-0.013***	-0.013***
	(0.001)	(0.001)
Big establishment	-0.030***	-0.030***
	(0.001)	(0.001)
More than 50% publicly owned (Yes)	0.067***	0.067***
	(0.001)	(0.001)
Firm-level collective agreement (Yes)	-0.019***	-0.019***
	(0.001)	(0.001)
Year dummies (ref. 1999)	YES	YES
Observations	1,235,399	1,235,399

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 3: Determinants of over-education among workers born in Belgium (marginal effects from ordered probit regressions)

	Workers born in Belgium only (1)
Explanatory variables:	
Women	-0.021***
	(0.001)
Education (ref. upper secondary)	
Lower secondary at most	-0.321***
	(0.001)
Tertiary education	0.118***
	(0.001)
More than 10 years of tenure (Yes)	-0.004***
	(0.001)
Part time (Yes)	-0.009***
	(0.001)
Contract (ref. open-ended contract)	
Fixed term	-0.000
	(0.002)
Apprenticeship	-0.061***
	(0.008)
Interim	0.044***
	(0.002)
Region of the establishment (ref. Flanders)	
Brussels	-0.058***
	(0.001)
Wallonia	0.001
	(0.001)
Size of the establishment (ref. small establishment)	
Medium establishment	-0.013***
	(0.001)
Big establishment	-0.029***
	(0.001)
More than 50% publicly owned (Yes)	0.071***
	(0.002)
Firm-level collective agreement	-0.018***
	(0.001)
Year dummies (ref. 1999)	YES
Observations	1,097,200

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.