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DISCUSSION PAPER SERIES

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ABSTRACT

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This article is the first to examine how 1st-generation migrants affect the employment of workers born in the host country according to their origin, distinguishing between natives and 2nd-generation migrants. To do so, we take advantage of access to a unique linked employer-employee dataset for the Belgian economy enabling us to test these relationships at a quite precise level of the labour market, i.e. the firm level. Fixed effect estimates, including a large number of covariates, suggest complementarity between the employment of 1st-generation migrants and workers born in Belgium (both natives and 2nd-generation migrants, respectively). Several sensitivity tests, considering different levels of aggregation, workers' levels of education, migrants' region of origin, workers' occupations, and sectors corroborate this conclusion.

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1. Introduction

Over the last 50 years, the number of migrants around the world has more than tripled. In 2022, approximately 283 million people had emigrated from their country of origin to a foreign one, which represents 3.6% of the world's population (McAuliffe & Triandafyllidou, 2021). The impact of migrant workers on the labour market of host countries has garnered attention from natives, the media, political parties, and researchers alike. Researchers have assessed many times the effect of migrant workers, i.e. those born outside the country of residence, on the employment of workers born in the country of residence. The question of whether migrant workers substitute or complement workers born in the host country in the workplace has been hotly debated (Edo, 2019). However, there is no consensus in the literature regarding this relationship, with some studies suggesting substitutability, i.e. a higher number of migrants decreases the employment of workers born in the host country, while others suggest complementarity, i.e. a higher number of migrants increases the employment of workers born in the host country, as they are jointly hired or fired, and others conclude to a null relationship, suggesting a segmentation of the labour market. This lack of consensus may be due to the use of different methodologies and of quite aggregated data in existing studies (Dustmann et al., 2016), i.e. considering changes in labour supply only at the country, sectoral and/or regional level, to analyse the role of migrants on host country's labour market (Martins et al., 2018).

Another issue faced by these studies lays in the presence of diverse profiles in terms of migration background in the population born in the country of residence. Indeed, this population includes both workers with two parents also born in the country of residence, and migrants' children, who are also born in the country of residence, but have at least 1 parent born abroad. However, having a migration background appears to be an important determinant of workers' human capital. This is especially true in countries with low-educated migration, where "*disadvantages related to the poor educational background of many immigrant parents have often been passed on to their native-born children, whose educational outcomes lag behind those of their peers with no migrant background, although gaps have narrowed over the past decades*" (OECD & EU, 2018, p. 28).

Given these potential differences in human capital, it is likely that the complementarity-substitutability dynamics between migrants and workers born in the country of residence vary depending on the latter's migrant background, i.e. the country of birth of their parents. Hence, this article aims to contribute to the existing literature by examining and estimating the potential

complementarity or substitutability between migrants (further referred to as '1st-generation migrants'), native workers with both parents born in the host country (further referred to as 'natives') and native workers with at least 1 parent born abroad (further referred to as '2nd-generation migrants'), in the case of Belgium.

To achieve this objective, we take advantage of our access to detailed matched employer-employee data (i.e. the Structure of Earnings Survey) containing information about worker, job and firm characteristics, merged with information on workers' origin (extracted from the Belgian National Register). To assess the complementarity-substitutability relationship, these data have been collapsed at a quite precise level of analysis of the labour market, i.e. the firm level. By doing so, we thus seek to capture substitutability-complementarity mechanisms between workers at a more precise level of the labour market.

Our empirical strategy boils down to regressing with FE (i.e. a mean-differentiated model accounting for firm unobserved time-invariant heterogeneity) the number of hours worked by 1st-generation migrants on those of natives and 2nd-generation migrants at the firm level, while controlling for a large set of covariates reflecting worker, job and firm characteristics. We also provide estimates addressing endogeneity and whether results are sensitive to i) the labour market level under analysis (i.e. the sector-region-firm size level and the firm-occupation level), ii) workers' level of education (i.e. at most upper secondary degree or higher than secondary degree), iii) workers' origin (i.e. coming from developed or developing countries[1]), iv) workers' occupation (i.e. 8 occupations according to the International Labour Office (ILO) classification of occupations (2012) at the 1-digit level) and v) specific sectors (i.e. the manufacturing sector, the construction sector, the sector of accommodation and food service activities, and the sector of administrative and support service activities).

From an empirical side, Belgium is a particularly interesting country to investigate the complementarity/substitutability of migrants with natives. Indeed, since World War II, Belgium has signed numerous agreements with mostly European countries to promote labour migration to Belgium. Moreover, Belgium is part of the European Union, which favours the free movement of workers and has more flexible immigration policies than the Anglo-Saxon countries. As a result, 1st-generation migrants represented 20.8% of the Belgian population aged

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[1] By 'developing countries', we actually refer to both transition and developing countries listed in the UNCTAD (2020) classification.

20-64 in 2021, while 2nd-generation migrants represented 11.7% (Eurostat, 2024a). However, the situation of 1st- and 2nd-generation migrants' on the labour market differs from the one of natives: these are characterized by a lower employment rate (64.5 and 66.5% *vs* 74% for natives in the 3rd quarter of 2023 (Eurostat, 2024b)), a higher unemployment rate (11 and 10.7% *vs* 4.3% for natives in 2021 (Eurostat, 2024c)), all in all leading to a higher at-risk-of-poverty rate. These results are partly due to differences in their human capital (FPS Employment, Labour and Social Dialogue & Unia, 2019). Indeed, 30.6% of 1st-generation migrants, 18.5% of 2nd-generation migrants, and 13.3% of natives, aged between 20 and 64 respectively, had at most a degree from lower secondary school in 2021 in Belgium. In the same age group, 46.3% of natives, 37% of 1st-generation migrants, and 35.9% of 2nd-generation migrants, had a tertiary education in 2021 in Belgium (Eurostat, 2023).

Belgium also has a highly regulated labour market. Indeed, as noted by Du Caju et al. (2007), the Belgian labour market is characterized by rather strong downward wage rigidity due to a high minimum wage (estimated at almost 24 thousand euros a year (OECD, 2023a)), automatic wage indexation, and the presence of sectoral collective agreements (union density is estimated at 49.1% in 2019, which is just behind the Scandinavian countries (OECD & AIAS, 2021)), that are sometimes re-negotiated (i.e. improved) at the firm level. Moreover, the strictness of Belgian employment protection for collective dismissals under regular contracts is estimated to be the highest among OECD countries (at 4.88 in 2019 (OECD, 2023b)). Conversely, the level of employment protection for individual dismissals under regular contracts in Belgium is estimated at 2.72, while at 2.06 for temporary contracts in 2019 (OECD, 2023b). These various institutional dimensions should affect the wage setting mechanism (Babecký et al., 2010) and the bargaining settings on the Belgian labour market. Hence, mechanisms related to imperfections in the labour market should be more considered to grasp the impact of migrants on natives' employment rather than those based on theories which assume that wages can be downwardly adjusted on the labour market.

The remainder of this article is organized as follows. Next section presents the theoretical and empirical literature on the substitutability-complementarity between workers born in a host country and migrants. Section 3 introduces our dataset and descriptive statistics. Section 4 describes our methodology and econometric results. Section 5 shows our sensitivity tests, while Section 6 concludes.

2. Literature review

2.1 Theoretical background on the impact of 1st-generation migrants on native-born workers

Various theoretical models attempt to explain the relationship between the employment of 1st-generation migrants and workers born in the host country's labour market (i.e. natives and 2nd-generation migrants considered as a whole). One commonly used approach is the neoclassical model. According to this model, an increase in the number of 1st-generation migrant workers in the labour market leads to an increase in labour supply, which in turn increases employment and decreases equilibrium wages on the labour market. As a result, some workers born in the host country may leave their jobs, as their reservation wages now exceed the new, lower market wage, leading to a displacement of these workers.

Although this neoclassical model gives helpful insights on the impact of 1st-generation migrants on native-born workers, it is based on a strong assumption, i.e. perfect competition on the labour market. However, the Belgian labour market is characterized by relatively strong rigidities and might not strictly comply to this model's hypotheses. Another strand of economic thinking thus rather postulates that the labour market operates under imperfect competition. This literature suggests that there are various mechanisms by which an increase in 1st-generation migrant workers can affect the employment of native-born workers. One of these mechanisms is based on the Keynesian perspective that wages are downwardly rigid. In this case, an increase in 1st-generation migrant labour supply may lead to unemployment, accompanied either with a decrease in the employment of native-born workers if 1st-generation migrants find employment there (substitutability), or with a null impact on natives-born' employment if newcomers do not find a job (no impact on native-born workers) (Edo, 2019). Wage rigidities, as can be observed in continental Western European countries like Belgium (Babecký et al., 2010), may be related to institutional features such as the minimum wage, but also to the role of unions, which tend to protect the wages of insider workers, who are primarily native-born, against the outsiders, i.e. 1st-generation migrants (Lindbeck & Snower, 1989). In the latter case, the anticipated substitutability of native-born workers by 1st-generation migrants tends to be reduced or even eliminated if unions prevent these migrant workers from entering unionized firms. A second complementary reason is related to the dual labour market theory, according to which 1st-generation migrant workers tend to enter the secondary labour market which offers precarious and low-paid jobs, while native-born workers work in the primary labour market which is

protected by unions (Piore, 1979). If the two segments of the labour market are not connected, then an increase in immigration should have no effect on the employment of native-born workers. Conversely, if the jobs they are employed in are complementary, then native-born employment may even increase. A third explanation may come from the increase of monopsonistic power resulting from the increase in labour supply (Amior & Manning, 2020). As a result, firms can lower their wages and increase their mark-up. If the new wage is lower than the reservation wage of some native-born workers, there could be a substitution of the latter by 1ˢᵗ-generation migrants. However, it should be noted that the presence of unions often counterbalances this monopsonistic power by protecting workers' wages and reducing the substitution effect. Finally, a fourth mechanism helps to explain the existence of a potential complementarity between native-born and 1ˢᵗ-generation migrant workers, coming from their different skills and their specialization in complementary tasks in the production function (Manacorda et al., 2012). Complementarity between native-born workers and 1ˢᵗ-generation migrants may also be due to the fact that the two categories of workers are hired and fired indistinctly by companies in the case of scale effects (because companies perceive them as having the same skills).

Theoretical evidence suggests that the impact of 1ˢᵗ-generation migrant workers on the employment outcomes of natives all origins considered is influenced by labour market dynamics and the presence of market imperfections. For example, their influence may vary between labor markets characterized by perfect competition, as outlined in neoclassical theory, such as those prevalent in Anglo-Saxon nations, and those operating under conditions of imperfect competition and alternative theoretical frameworks, as observed in the labor markets of continental Western Europe. It is therefore important to consider the specific context when analysing and interpreting the effects of 1ˢᵗ-generation migrant workers on native-born workers' employment outcomes. In the end, theories based on labour market imperfections seem to be better suited to the case of Belgium and suggest a positive, negative or null relationship between native-born and 1ˢᵗ-generation migrant workers.

2.2 The impact of 1ˢᵗ-generation migrants on all native-born workers from an empirical perspective

Different approaches empirically address the issue of substitutability-complementarity between 1ˢᵗ-generation migrant and native-born workers. The first, the so-called "*spatial*

correlations approach" (Borjas, 1999), examines the flow of 1st-generation migrants within a geographical location and estimates the resulting impact on wages and employment when labour supply increases. Some empirical analyses using this approach show a significantly negative but small impact of migration on native-born workers. Using Austrian data, Winter-Ebmer and Zweimüller (1999) conclude that the negative impact of immigration on the employment of young male workers is minor. Similarly, Pischke and Velling (1997) find little empirical evidence to support the hypothesis that 1st-generation migrant workers displace native-born workers in the German labour market. Furthermore, Card (2001) estimates that migration flows to the United States during the 1980s reduced the wages and employment rates of low-skilled native-born workers in cities such as Miami and Los Angeles by only 1 to 3 percentage points. Other studies using the same approach find no impact of immigration on native-born employment. Using U.S. data from 120 cities, Altonji and Card (1991) suggest that immigration has no impact on labour force participation and employment rates of low-skilled native-born workers.

A second approach to estimating the impact of 1st-generation migrant workers on the local labour market is to examine episodes of unexpected and rapid mass migration. These episodes usually occur due to political or environmental problems in the countries of origin, leading to an emergency migration of the population. The natural experiment approach is advantageous in overcoming, or at least reducing, the problem of selective migration, as the choice of where to migrate is less likely to be based on the most prosperous places and more on places that offer a quick reception. However, these migration episodes are rare and may not be representative of the overall impact of immigration in host countries (Peri, 2016). Among the empirical research studying the impact of migration flows on the labour market in the case of natural experiments, the first examines the effect of the arrival by boat of 100,000 Cubans from the port of Mariel on Miami's labour market, who left Cuba in 1980 after Fidel Castro announced the possibility of emigrating through that port (Card, 1990; Borjas & Monras, 2017). The authors estimated a null impact of the increase in Cuban migration on the employment of non-Cubans in Miami, regardless of their education level. Yet, studying the return of expatriates from former Portuguese colonies to Portugal after their independence in the 1970s, Carrington and De Lima (1996) and Mäkelä (2017) both estimate a negative effect of these workers on Portuguese employment. Finally, focusing on the influx of Yugoslav workers into European countries after the dismantling of Yugoslavia in the early 1990s, Angrist and Kugler (2003) find a significant

and negative impact on native-born employment, which is exacerbated in countries with high labour market rigidities.

A third approach to estimate the impact of migration on native-born employment is to divide the labour market into skill categories/cells based on factors such as education and work experience, and to examine the effect of migration within each of these cells (Borjas, 2003). The first advantage of the skill cell approach is that it counteracts the problem of native-born workers moving to other geographical areas due to immigration. In addition, it reduces (at least in part) the problem of worker mobility between different skill cells, as it is more difficult and less common to change education or work experience to avoid immigration competition from a 1st-generation migrant influx into a particular skill group. However, its results may be biased because it relies on the assignment of workers to skill cells, especially since the higher probability of overeducation among 1st-generation migrant workers (as estimated in Belgium by Jacobs et al. (2021)) may lead to a misclassification of the latter. Results of empirical research using this approach are heterogeneous. Some suggest a significant and negative impact. Using U.S. data, Borjas (2003) and Ottaviano and Peri (2012) find, for example, some substitutability between 1st-generation migrant and native-born workers within skill cells defined on the basis of workers' education and work experience. A similar result is obtained by Edo (2015) with French data and by Angioloni and Wu (2020) with UK sectoral data. On the other hand, other results based on Portuguese (Martins et al., 2018) and French (Ortega & Verdugo, 2014) data suggest a positive impact of migration on native-born workers' employment. Finally, some results, presented by studies using Australian, Danish and Spanish data, support a null impact of migration on native-born workers' employment (Carrasco et al., 2008; Malchow-Moller et al., 2009; Breunig et al., 2017).

Overall, there is no consensus on how 1st-generation migrant workers impact the employment of native-born people of all origins. This may notably be because many empirical studies are based on broadly defined skill cells, often due to data limitations, which may mask the true incidence of 1st-generation migrants on native-born employment at the firm or even worker level. To our knowledge, only two studies have investigated this topic using micro-level analyses (Malchow-Moller et al., 2009; Martins et al., 2018). These studies have provided mixed results as regards the impact of 1st-generation migrants on the employment of native-born workers. The first study examines this relationship using matched employer-employee data at the firm and occupation level in Denmark using a competing risks duration model that distinguishes between job-to-job and job-to-unemployment transitions. It finds no evidence that

1st-generation migrants displace native-born in Denmark. The second study, which uses a different methodology from the first one, but close to the one in this article, evaluates the impact of an increase in 1st-generation migrants on native-born, without considering the country of birth of the latter's parents, using a matched employer-employee panel from Portugal. Its results suggest that hirings and separations of 1st-generation migrants and native-born workers are significantly positively correlated. Be that as it may, while the literature analysing the subject at the micro level is already limited, no study has yet estimated the impact of 1st generations migrants on native-born workers according to their migrant background, i.e. the country of birth of their parents.

2.3 Does the impact depend on the origin of workers born in the host country?

In the empirical literature, results regarding the impact of migrant workers on the employment of native-born (all origins considered) are heterogeneous, with studies suggesting a positive, negative, or null effect. An important limitation of these studies is that they do not differentiate between natives whose both parents were born in the country of residence, referred to as *natives*, and natives with at least one parent born abroad, referred to as *2nd-generation migrants*. However, not taking it into account may lead to imprecise estimations of the relationship between 1st-generation migrants, i.e. people born abroad, natives and 2nd-generation migrants, since the birth country of a worker's parents can have an impact on the human capital and labour market outcomes of these workers (OECD & EU, 2018).

According to the literature (Liebig & Widmaier, 2009; OECD & EU, 2018; OECD, 2019), it indeed appears that 2nd-generation migrants are characterised by a lower level of education than natives in OECD and EU countries, leading them to be employed into different sectors and occupations than natives. Belgium is no exception to the rule, since 2nd-generation migrants are generally less educated than natives (FPS Employment, Labour and Social Dialogue & Unia, 2019). Hence, to understand more precisely the relationship between 1st-generation migrants and workers born in Belgium, it may be useful to examine the impact of 1st-generation migrant workers on both natives and 2nd-generation migrants separately.

From a theoretical point of view, Belgium is characterized by strong labour market rigidities. Hence, above-mentioned mechanisms related to imperfect competition in the labour market should be used to grasp the impact of 1st-generation migrants on 2nd-generation migrants' employment rather than those based on theories which assume that wages can adjust downwards on the labour market. Consequently, as with the impact of 1st-generation migrants on all workers

born in Belgium, the impact of 1st-generation migrants on 2nd-generation migrants' employment may be either substitutionary, null, or complementary.

One might expect this impact to be close to the influence of 1st-generation migrants on native workers. Indeed, according to the literature on the classic assimilation theory, which focuses on the integration of 2nd-generation migrants, these individuals were born, educated and socialized in the host country (Card, 2005) and hence should, on average, perform better than their 1st-generation counterparts, and eventually reach skill levels comparable to those of natives (Mattoo et al., 2008; Nielsen, 2011). One might therefore expect 1st-generation migrants to influence the employment prospects of 2nd-generation migrants in the same way as native workers. However, most empirical research rather supports the segmented assimilation theory (e.g. Portes and Rumbaut, 2011). The latter suggests that descendants of immigrants may still be penalised by limited social mobility (e.g. difficulties in entering the labour market or being concentrated in less favourable segments of the labour market) and face integration barriers into the education and labour market systems (i.e. discrimination and segregation). One explanation for this view is the transmission of cultural capital, social norms, and physical characteristics from parents, which may vary depending on the immigrants' country of origin (Phalet & Heath, 2010; Blau et al., 2013; Blau, 2015). In Belgium, empirical evidence further supports the segmented assimilation theory by indicating that 2nd-generation migrants generally perform better than their parents but still fall behind natives. Indeed, i) in terms of education, 2nd-generation migrants do better than their 1st-generation counterparts, but still worse than natives (Eurostat, 2023); ii) in terms of employment, 2nd-generation migrants have better chances of being employed than 1st-generation migrants, but not as likely as natives, especially if they come from non-EU countries (Piton & Rycx, 2021), while iii) the real gross wage of 1st- and 2nd-generation migrants born in developing country is respectively 15.7 and 13.5% lower than that of workers born in a developed country (Pineda-Hernández et al., 2022).

Based on these abovementioned differences, especially in terms of educational attainment, the impact of 1st-generation migrants on the employment of 2nd-generation migrants may differ from their impact on natives. On the one hand, the effects of factors such as wage rigidity are expected to be similar *as such* for both 2nd-generation migrant and native workers, implying a comparable impact. However, other dynamics are at play that could lead to variations in the relationship between 1st- and 2nd-generation migrants, such as firms' monopsonistic power, union density, task specialization, and market segmentation. For instance, firms using their monopsonistic power may lead to a quicker substitution of natives than of 2nd-generation migrants of their

firms. Secondly, following immigration, unions may give greater priority to protecting the jobs of native 'insiders' instead of those of 2nd-generation migrants. As a result, the impact of 1st-generation migrants on 2nd-generation migrants could be more negative than their impact on native workers. Furthermore, due to some differences in human capital between 1st- and 2nd-generation migrants, the effects of task specialization and market segmentation may not be as pronounced as in the case of the relationship between 1st-generation migrants and natives. This could lead to reduced complementarity, no significant relationship, or even greater substitutability between 1st- and 2nd-generation migrants. In summary, in the case of an increasing presence of 1st-generation migrants in the labour market, 2nd-generation migrant workers could be more substitutable or less complementary than native workers. To our knowledge, so far, no empirical study has tackled the integration of 2nd-generation migrants in terms of substitutability/complementarity on the labour market, i.e. in terms of labour demand.

3. Data and descriptive statistics

In order to test the impact of 1st-generation migrants on both 2nd-generation migrants and natives, we base our empirical analyses on a combination of two large datasets. The first is the Structure of Earnings Survey (SES), which provides information on a large representative sample of workers employed in firms in Belgium over the period 1999-2016. The SES contains an array of information, provided by the human resources departments of firms, on the characteristics of both firms (e.g. sector of activity, level of collective wage bargaining, financial and economic control) and individuals working in those firms (e.g. age, level of education, tenure, gender, employment contract, working time, occupation). The second dataset contains information on workers' country of birth and on the country of birth of workers' parents. This information allows us to differentiate between i) workers born in Belgium with both parents born in Belgium (natives), ii) workers born in Belgium with at least one parent born abroad (2nd-generation migrants) and ii) workers born abroad (i.e. 1st-generation migrants). This information was extracted from the Belgian National Register (NR), merged with the first dataset by Statistics Belgium at the worker level. In order to test the impact of employment of 1st-generation migrants on the employment of natives and 2nd-generation migrants, we pooled the dataset obtained at the firm level[2], leading to a panel dataset of 61,779 firm-year observations that is representative

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[2] Identified thanks to their VAT number.

of all firms operating in Belgium, employing at least 10 workers, and whose economic activities fall within sections B to N of the NACE Rev. 2 nomenclature (i.e. the private sector).

[Insert Table 1 here]

Table 1 presents the means and standard deviations of selected variables for the firms' panel. First, we observe that, within a particular firm, the average monthly number of hours worked by all workers born in Belgium is equal to 2,699. Among these, 2,335 are worked by natives, while 364 are worked by 2nd-generation migrants. It appears that the proportion of hours worked by 2nd-generation migrants is lower than the one of natives, which is in line with their representation in the labour market. Within the category of 2nd-generation migrants, 270 hours are worked by workers originating from developed countries, while 94 are worked by workers originating from developing countries, within a particular firm. Finally, 398 hours are worked by 1st-generation migrants, and about half of them are worked by workers born in developed countries, while the other half are worked by workers born in developing countries.

As far as our firm control variables are concerned, most of hours in our sample are worked by workers with at most a degree from upper secondary education. Next, about 33.6% of hours of the sample are worked by workers with more than 10 years of tenure and 23.6% with less than 1 year of tenure. Most hours are worked by workers aged between 30 and 49, while workers aged over 49 are as expected working a smaller share of hours. Women represent around 30.4% of the sample and 12.9% of the contracts are part-time. The share of blue-collar contracts is equal to 47.3% while permanent contracts are prevalent. Then, most hours are worked in the manufacturing, construction and wholesale sectors, and in firms that are privately owned. Finally, most hours worked are in firms located in Flanders, while a minority is worked in firms located in Wallonia.

To examine potential differences between natives and 1st-and 2nd-generation migrant workers, we show their respective characteristics in columns (2) to (4) of Table 1. Regarding the individual-level differences between our main workers categories, 1st-generation migrants have a lower level of education, have less years of tenure, are slightly older and are more likely to be blue-collar, part-time workers and to have fixed-term contracts compared with 2nd-generation migrants, and even more with natives. Next, 1st-generation migrant workers tend to occupy less-skilled positions, such as elementary or craft and related trades occupations. Finally, they also are more concentrated in construction, accommodation and food service activities and administrative and support services.

4. Methodology and benchmark results

For comparison purposes (i.e. to be able to evaluate our results in light of those previously obtained in the literature), we first estimate the influence of migrants on the employment of workers born in Belgium taken as a whole. To do so, we model the following equation at the firm level:

$$\left(hours_{nat,j,t} + hours_{mig2,j,t}\right) = \beta_0 + \beta_1 hours_{mig1,j,t} + \beta_2 X_{j,t} + \beta_3 Y_{j,t} + \delta_t + \varepsilon_{j,t} \qquad (1)$$

where $hours_{nat,j,t}$ refers to the number of hours worked by natives in Belgium in firm j at time t and $hours_{mig2,j,t}$ is the number of hours worked by 2nd-generation migrants in Belgium in firm j at time t. Our variable of interest $hours_{mig1,j,t}$ is the number of hours worked by 1st-generation migrant workers in firm j at time t. $X_{j,t}$ is a vector of worker and job characteristics: 2 variables for education (i.e. for the shares of hours worked by workers with an upper secondary degree and workers with a tertiary education degree, respectively; workers with no degree, primary/lower secondary degree being the reference category), 3 variables for tenure (i.e. for the shares of hours worked by workers with 2 to 4, 5 to 9, and at least 10 years of tenure, respectively; workers with at most 1 year of tenure being the reference category), 2 variables for age (i.e. for the shares of hours worked by workers aged under 30 and workers over 49 years, respectively; workers aged between 30 and 49 being the reference category), a variable for the share of hours worked by female workers, 3 variables for the employment contract (i.e. for the shares of hours worked by workers with a fixed-term contract, workers under apprenticeship and workers under an interim contract, respectively; workers with an open-term contract being the reference category), a working-time variable (1 variable for the share of hours worked by part-time workers; full-time workers being the reference category), and an occupational variable (i.e. 1 variable for the share of hours worked by blue-collar workers; white-collars being the reference category). $Y_{j,t}$ is a vector including firm characteristics, i.e. 16 dummies for the sectors of activities (mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities; construction; wholesale and retail trade; transportation and storage; accommodation and food service activities; information and communication; financial and insurance activities; real estate activities; professional, scientific, and technical activities; administrative and support service activities; education; human health and social work activities; and arts, entertainment and recreation; other service activities being the reference category), a dummy for the presence

of a collective agreement at the firm level (being covered solely by an industry collective agreement is the reference category), 2 dummies for the region in which the firm is located (i.e. dummies for being located in Brussels and Wallonia, respectively; being located in Flanders being the reference category), and a dummy for the type of economic and financial control (i.e. a dummy for firms that are more than 50% privately-owned). δ_t is a set of 17 year dummies, and $\varepsilon_{j,t}$ is the error term.

[Insert Table 2 here]

The FE estimate of Equation (1)'s β_1 at the firm level, reported in Table 2, is statistically significant and amounts to 0.818. It means that if hours worked by migrants increase by 1 in a firm, the number of hours worked by natives will increase by 0.818. These results are in line with previous literature suggesting a complementarity between all natives and migrants.

Next, despite a significant amount of research on the impact of increased migration on native-born workers from all origins, particularly in OECD countries where there are differences in human capital among these groups, no study has estimated the substitutability or complementarity between natives, 1st-generation migrants, and 2nd-generation migrants. Thanks to our access to information about the country of birth of the workers' parents, we are able to examine this question by estimating the impact of the number of hours worked by 1st-generation migrants on hours worked by natives and by 2nd-generation migrants separately, using the following equations at the firm level:

$$hours_{nat,j,t} = \beta_0 + \beta_{1a}hours_{mig1,j,t} + \beta_{2a}X_{j,t} + \beta_{3a}Y_{j,t} + \delta_t + \varepsilon_{j,t} \tag{2}$$

$$hours_{mig2,j,t} = \beta_0 + \beta_{1b}hours_{mig1,j,t} + \beta_{2b}X_{j,t} + \beta_{3b}Y_{j,t} + \delta_t + \varepsilon_{j,t} \tag{3}$$

where $hours_{nat,j,t}$ and $hours_{mig2,j,t}$ refer to the numbers of hours worked by natives and 2nd-generation migrants in firm j at time t, respectively. Our variable of interest $hours_{mig1,j,t}$ is the number of hours worked by 1st-generation migrant workers in firm j at time t, respectively. $X_{j,t}$ and $Y_{j,t}$ have already been defined in Equation (1). For control purposes, $Y_{j,t}$ also contains the number of hours worked by 2nd-generation migrants in Equation (2) and the number of hours worked by natives in Equation (3).

The FE estimate of Equation (2)'s β_{1a}, reported in column (2) of Table 2, is statistically significant and amount to 0.181, respectively. This suggests that if hours worked by 1st-generation migrants increase by 1 in a firm, the number of hours worked by natives will increase by 0.181. This refined estimation indicates a lower positive impact of 1st-generation migrants

on the employment of natives than that previously estimated on workers from all origins born in Belgium (0.818). Thus, it improves the precision of our estimation of the influence of 1st-generation migrants on natives' employment by estimating a weaker complementarity between the former and natives whose parents are both born in Belgium.

FE estimates of Equation (3)'s β_{1b}, reported in column (3) of Table 2, are also statistically significant and suggest that if hours worked by 1st-generation migrants increase by 1 in a firm, the number of hours worked by 2nd-generation migrants will increase by 0.245. Therefore, our results support that 1st-generation migrants complement 2nd-generation migrants on the Belgian labour market, and that this complementarity is slightly higher than the one estimated between 1st-generation migrants and natives.[3]

5. Sensitivity tests

5.1 Level of analysis

While the analysis at the firm level offers a first interesting insight on the employment relationship between 1st-generation migrants and native-born workers, other levels of analysis may be considered to complementarily highlight the effect of an increased immigration on native-born employment on the Belgian labour market. Indeed, different results and mechanisms might occur either at the region-sector-firm size or at the firm-occupation levels, and analysing the labour market through these different levels can thus enhance our understanding of the mechanisms of substitutability/complementarity between native and migrant workers.

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[3] Even though Equations (1), (2) and (3) include a large number of covariates, we cannot exclude that our FE estimates may suffer from an endogeneity bias, as the employment of natives, 1st- and 2nd-generation migrants may be related to unobserved characteristics or may be affected by reverse causality. To address this potential issue, we adopted a two-stage least squares (2SLS) estimator calibrated in Fixed Effects using as instrumental variables (IVs) i) the lag of the number of hours worked by 1st-generation migrants, ii) its cube, iii) the lag of the percentage of hours worked by 1st-generation migrant in the region-sector where they work, excluding the firm where they are employed, as suggested by Garnero (2015), and iv) its cube. Our results, including an array of validity tests, are presented and discussed in Appendix 1. 2SLS-FE results go in line with previous ones. Indeed, they do not support a substitutability between 1st-generation migrants, 2nd-generation migrants and natives, but rather a complementarity or segmentation of the labour market between these categories of workers. However, this conclusion should be taken with caution. Indeed, it remains very difficult to find a valid instrument, i.e. a variable that is both relevant (i.e. a good predictor of the number of hours worked by 1st-generation migrants) and exogenous (i.e. uncorrelated with the dependent variable). Accordingly, while estimates presented so far supports a complementarity or a null relationship in the hiring of 1st-generation migrants, natives and 2nd-generation migrants, they should be interpreted as conditional correlations.

Comparing results at the firm and firm-occupation levels might indicate different hiring mechanisms in the firm. On the one hand, if the same levels of complementarity, substitutability or a null relationship are estimated between workers born in Belgium (either natives or 2nd-generation migrants) and 1st-generation migrants at both the firm and the firm-occupation levels, then the estimated impact at the firm level might be entirely explained by the impact estimated at the firm-occupation level. On the other hand, if different results emerge between the firm and firm-occupation levels, this could indicate a reorganisation of labour across firm-occupations. For instance, if there is no relationship between the employment of natives and 1st-generation migrants at the firm level, but a substitutability between these two groups at the firm-occupation level, this suggests that the substitutability found within a particular firm-occupation may lead to an increase in native employment in another firm-occupation, resulting in a null relationship at the firm level. Similarly, if complementarity is observed at the firm level but a null relationship is found at the firm-occupation one, this suggests that the increase in 1st-generation migrants' employment within a specific firm-occupation does not lead to a corresponding increase in native employment within the same occupation, but rather in other firm-occupations, resulting in a positive relationship at the firm level.

Next, different results at the firm and sector-region-firm size levels might indicate different hiring and firing mechanisms between firms. The intuition behind the similarity or dissimilarity between estimates at the firm and the region-sector-firm size levels is roughly the same as between the firm and the firm-occupation: if a similarity is found between the estimates at the two levels, then the estimated impact at the region-sector-firm size level might be entirely explained by the impact estimated at the firm level; while a dissimilarity between estimators of the two levels could indicate a reorganisation of labour across firms.

In order to estimate the impact of employment of migrants on the employment of workers born in Belgium at different levels of analysis, we first pooled the dataset obtained at the worker level at 2 additional levels: i) region-sector-firm size, and ii) firm-occupation[4], leading to panel datasets of i) 2,208 region-sector-firm size observations and ii) 47,092 firm-occupations observations. Appendix 2 presents the means and standard deviations of selected variables for the region-sector-firm size panel dataset in column (1), and for the firm-occupation panel dataset in column (2). Next, we re-estimated Equations (2) and (3) at these two levels using a Fixed

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[4] Occupations are defined according to the ILO classification of occupations (2012) at the 1-digit level.

effects estimator (i.e. a mean-differentiated model accounting for firm unobserved time-invariant heterogeneity).[5]

[Insert Table 3 here]

FE estimates of Equation (2)'s β_{1a} at the region-sector-firm size, firm and firm-occupation levels, reported in columns (1) to (3) of Table 3, are all statistically significant and amount to 0.343, 0.181 and 0.326. This suggests that if hours worked by 1st-generation migrant workers increase by 1 at the i) region-sector-firm size, ii) firm, or iii) firm-occupation level, the hours worked by native workers will increase by 0.343, 0.181 and 0.326 hours, respectively. Hence, our results suggest that 1st-generation migrants complement natives at each level of analysis. Next, it seems that this complementarity is statistically slightly greater at the firm-occupation than at the firm level ($t=306$). This suggests that the hiring of a 1st-generation migrant for a specific occupation in a firm induces a reorganisation of native labour between firm-occupations, i.e. an increase of native employment in the same firm-occupation and, to a smaller extent, a decrease of native employment in another firm-occupation. Finally, the complementarity between native and migrant workers seems to be greater at the region-sector-firm size level than at the firm one. This suggests that the hiring of a migrant within a firm leads to the hiring of a native in the same firm but also in another firm located in the same sector-region-firm size.

FE estimates of Equation (3)'s β_{1b} at the 3 different levels, reported in columns (4) to (6) of Table 3, are all statistically significant and suggest that if hours worked by 1st-generation migrant workers increase by 1 at the i) region-sector-firm size, ii) firm, or iii) firm-occupation level, the number of hours worked by 2nd-generation migrant workers will increase by 0.329, 0.245 and 0.216 hours, respectively, still suggesting a complementarity between these workers at each level of analysis. However, when contrasted with prior findings, this complementarity is not always higher than the one estimated between 1st-generation migrants and natives. Indeed, the complementarity between 1st- and 2nd-generation migrants is only more pronounced at the firm level analysis, while being close at the region-sector-firm size level of analysis and smaller within a firm-occupation, compared with that between 1st-generation and natives. Also, it seems that the complementarity is fairly identical between the firm-occupation than at the firm level, suggesting no reallocation of 2nd-generation migrants between firm-occupations. In other words,

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[5] As it is difficult to find instruments that are both relevant and exogenous for each of our sensitivity tests, we only present FE estimates in this section. Therefore, they should be interpreted as conditional correlations and not as causal effects.

the complementarity estimated at the firm level is explained by the complementarity estimated at the firm-occupation level. Next, the complementarity between 1st- and 2nd-generation migrant workers seems to be greater at the region-sector-firm size than at the firm level. This suggests that the hiring of a 1st-generation migrant within a firm leads to the hiring of a 2nd-generation migrant in the same firm but also in another firm within the same sector-region-firm size.

All in all, our results still suggest a complementarity between 1st-generation migrants and workers born in Belgium using a more aggregated or disaggregated approach than in our benchmark regressions. However, comparing results at different levels allows us to grasp potential reallocation of work between firms and between firm-occupations. In the end, our results support that 1st-generation migrants within a firm leads to a reallocation of natives both between firm-occupations and firms, but only to a reallocation of 2nd-generation migrant workers between firms.

5.2 Is complementarity education-dependent?

According to the literature (Liebig & Widmaier, 2009; OECD & EU, 2018; OECD, 2019), it appears that migrants are characterised by a lower level of education than natives in OECD and EU countries, leading them to be employed into different sectors and occupations. Belgium is no exception to the rule, since natives are generally more educated than 1st- and 2nd-generation migrants (FPS Employment, Labour and Social Dialogue & Unia, 2019). Indeed, respectively 30.6% of 1st-generation migrants, 18.5% of 2nd-generation migrants, and 13.3% of natives, aged between 20 and 64, had at most a degree from lower secondary education in 2021 in Belgium. In the same age group, 46.3% of natives, 37% of 1st-generation migrants, and 35.9% of 2nd-generation migrants, had a tertiary education in 2021 in Belgium (Eurostat, 2023). Descriptive statistics (see Appendix 3) about the level of education of workers in our dataset are in line with these figures. They show that the proportion of workers with at most a degree from lower secondary education is the highest among 1st-generation migrant workers, followed by 2nd-generation migrants and then native workers. Conversely, the proportion of workers with a tertiary diploma is highest among natives, followed by 2nd-generation migrants and then 1st-generation migrants.

The substitutability-complementarity relationship between 1st-generation migrants, natives and 2nd-generation migrant workers is likely to depend on their educational attainment. On the one hand, if we consider the relationship between workers with the same level of education, the impact of 1st-generation migrant workers on workers born in Belgium might be the same as

previously suggested in the case of labour market rigidities, i.e. substitutability, complementarity or no relationship might prevail. On the other hand, if we consider that 1st-generation migrants possess a level of education similar to 2nd-generation migrants and lower to the one of natives and that low and highly educated workers are complementary in the production function, 1st-generation migrant workers could then be more complementary to natives than to 2nd-generation migrant workers (Lazear, 1999; Akerlof & Kranton, 2000).

In order to verify these assumptions, we re-estimated Equations (2) and (3) by differentiating workers according to their level of education, i.e. at most upper secondary degree or tertiary education degree, respectively.

[Insert Table 4 here]

Table 4 shows, in columns (1) and (2), FE estimates of β_{1a}, i.e. the impact of 1st-generation migrants on natives according to their level of education, respectively. The only statistically significant estimate suggests a complementarity between 1st-generation migrants and natives with more than an upper secondary degree, respectively. However, since other estimates are not significant, our results rather suggest an absence of relationship in the employment of workers with different levels of education and when 1st-generation migrant and natives are less educated. In columns (3) and (4) of Table 4 are presented the estimates of β_{1b}, the impact of 1st-generation migrants on 2nd-generation migrants. Results suggest a complementarity between workers, especially when they possess the same level of education.

All in all, our findings first suggest that workers with the same educational level tend to complement each other. These results are consistent with the theory of imperfect competition in the labour market, which suggests that 1st-generation migrants and natives with the same level of education complement each other due to their distinct skillsets (e.g. knowledge of foreign languages and markets, networks). Results also support the assumption that the two categories of workers with the same level of education are hired or fired indistinctly by firms in the case of scale effects (because firms perceive them as having the same skills). Moreover, our results do not report any relationship in the hiring and firing of 1st-generation migrant and native workers with different educational levels. Hence, these rather suggest that the labour market is segmented, leading to no significant relationship in the hiring and firing decisions of 1st-generation migrant and native workers with different educational levels.

5.3 Does the origin of 1st- and 2nd-generation migrants matter?

The impact of the number of hours worked by 1st-generation migrants on the employment of natives and 2nd-generation migrants may significantly vary whether both generations of migrants come from a developed or a developing country, as these workers might be different in terms of human capital and productivity. Indeed, our descriptive statistics (see Appendix 3) suggest that i) 1st-generation migrants coming from developing countries are much less educated than the ones coming from developed ones (13.8% *vs.* 26.6% of them are tertiary educated, respectively), that are themselves slightly less educated than natives, and that ii) 2nd-generation migrants achieve similar levels of education regardless of their origin, whether they come from developed or developing countries. In line with segmented assimilation theory, these descriptive statistics suggest that 2nd-generation migrants perform better than their parents in terms of education in our dataset but do not quite reach the same level as natives. Moreover, migrants coming from developing countries are characterized by a less efficient school-to-work transition (Nielsen et al., 2003; Baert et al., 2016) and are more likely to be over-educated (Jacobs et al., 2021). Thus, migrants coming from developing countries tend to be differently educated and skilled than the ones coming from developed countries, and hence might impact natives differently.

To examine this issue, we further divide 1st- and 2nd-generation migrants depending on whether they originate from a developed or a developing country. To determine the origin of 2nd-generation migrants, following common practice (FPS Employment & Unia, 2019; Pineda-Hernández et al., 2022), we use the father's country of birth. Put differently, the father's country of birth is used to define the origin of a 2nd-generation migrant, unless the father was born in Belgium and the mother abroad. In this case, the mother's country of birth is retained.

[Insert Table 5 here]

FE estimates of β_{1a}, i.e. the impact of 1st-generation migrant workers according to their region of birth on natives, are presented in column (1) of Table 5. They suggest that 1st-generation migrants born in developed countries are complementary to native workers while there is no relationship between 1st-generation migrants born in developing country and natives. FE estimates of β_{1b}, i.e. the impact of 1st-generation migrant workers by region of birth on 2nd-generation migrants considered as a whole, are presented in column (2) of Table 5. They suggest that 1st-generation migrants born in developed and in developing countries are (fairly equally) complementary to 2nd-generation migrant workers. When dividing 2nd-generation migrants

according to their region of origin, our results suggest that 1st- and 2nd-generation migrants originating from the same region of the world are complementary to each other and that 1st-generation migrants born in developed countries are complementary to 2nd-generation migrants originating from developing countries.

5.4 Substitutability or complementarity according to workers' occupation and sector of employment

In order to test whether the general complementarity suggested by our previous results differs according to workers' occupation, we first divide the number of hours worked by our different categories of workers according to the occupation they fill in, using the ILO International Standard Classification of Occupations (2012) at the 1-digit level.

[Insert Tables 6 and 7 here]

Results presented in columns (1) to (8) of Tables 6 and 7 show FE estimates of the impact of 1st-generation migrants on native and 2nd-generation migrant workers with the same occupation, respectively. They suggest that 1st-generation migrants remain complementary to native and 2nd-generation migrant workers, even when they have the same occupation.

In order to test whether the general complementarity suggested by our previous results differs according to the sector of employment of workers, we also estimated the impact of 1st-generation migrants on natives' and 2nd-generation migrants' employment in 4 specific sectors, where the number of hours worked by 1st-generation migrants are the highest, namely i) the manufacturing sector, ii) the construction sector, iii) the sector of accommodation and food service activities, and iv) the sector of administrative and support service activities.

[Insert Tables 8 and 9 here]

When analysing the relationship between natives, 1st-generation migrants and 2nd-generation migrants within different sectors, results presented in Tables 8 and 9 either suggest complementarity or a null relationship. More precisely, estimates regarding the impact of 1st-generation migrants on their 2nd-generation colleagues suggest a complementarity in all 4 sectors. Those regarding the impact of 1st-generation migrants on natives suggest a complementarity in the manufacturing sector only, while non-significant relationships are found in construction, accommodation and food service activities, and administrative and support service activities.

6. Conclusion

An extensive literature has investigated the impact of 1st-generation migrants on the employment of native-born workers all origins considered. Their results lead to heterogeneous results, ranging from a negative, positive or null relationship between the employment of these workers. These divergent results might be due first to the use of quite aggregated data (at the exception of Malchow-Moller et al. (2009) and Martins et al. (2018)), and second, to the failure to considering workers of different origins among the native-born population. Regarding this second pitfall, it has been established by various studies that native-born people with both parents born in the host country (referred to as '*natives*') and native-born people with at least one parent born abroad (referred to as '*2nd-generation migrants*') do not have the same productive characteristics (assessed through their human capital) (OECD & EU, 2018), as it is the case in Belgium (Pina et al., 2015; FPS Employment, Labour and Social Dialogue & Unia, 2019; Piton & Rycx, 2021). Hence, it is very likely that the complementarity-substitutability between 1st-generation migrants and native-born workers might change when considering the latter's migration background, i.e. the country of birth of their parents.

Therefore, in this paper, we contribute to the existing literature by focusing on the impact of 1st-generation migrants on natives' and 2nd-generation migrants' employment separately. We study this topic for the Belgian labour market at the firm level to report a more precise effect of migrants on the employment of workers born in country where labour market rigidities prevail. In order to grasp possible movements of workers between firms and firm-occupations due to an increase of migration, we also estimate this relationship at different levels of the labour market (i.e. region-sector-firm size level and firm-occupation level). We also analyse the potential impact of workers' level of education, migrants' region of birth, workers' occupation and sector of employment. To do so, we rely on a detailed linked employer-employee dataset for the Belgian labour market, which has been merged with information on the origin of workers, extracted from the Belgian National Register.

Our benchmark results, based on FE estimators, show that the relationship between 1st-generation migrants, on the one hand, and natives and 2nd-generation migrants, on the other hand, is statistically significant and positive, suggesting that there is a complementarity in the hirings or firing of these different categories of workers in Belgium at a fairly precise level of analysis, i.e. the firm level. This complementarity might first originate from their different skills and their specialization in complementary tasks in the production function. It might also be due to the

fact that the two categories of workers are hired or fired indistinctly by companies in the case of scale effects, because companies perceive them as having the same skills.

Several sensitivity tests have been performed, considering different levels of aggregation (i.e. sector-region-firm size and firm-occupation levels), workers' levels of education (i.e. at most secondary degree *vs.* tertiary degree), migrants' region of origin (i.e. developed *vs.* developing countries), workers' occupations, and particular sectors of the Belgian labour market (in which migrants tend to be over-represented). These tests support the hypothesis of complementarity between 1st-generation migrants on the one hand, and native and 2nd-generation migrant workers on the other. Moreover, they mostly show that this complementarity is reinforced when workers have the same (high or low) level of education and when 1st-generation migrant workers come from developed countries.

Overall, this study fills a gap in the literature by providing a fine-grained analysis of the impact of migrants on the employment of workers born in Belgium of different origins and highlights the importance of considering workers' migration background in labour market analyses.

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Tables

Table 1. Firm- and worker-level descriptive statistics

Variables	Firm level	Worker level		
		Natives	**2nd-generation migrants**	**1st-generation migrants**
Average monthly hours worked by workers:	**(1)**	**(2)**	**(3)**	**(4)**
Born in Belgium:	2,698.9	-	-	-
	(3,305.3)			
Natives	2,335.2	100	-	-
	(2,967.4)			
2nd-generation migrants from a	363.8	-	100	-
	(567.2)			
- Developed country	270.3	-	*73.3*	-
	(441.7)			
- Developing country	93.5	-	*26.7*	-
	(234.8)			
1st-generation migrants born in a:	398.1	-	-	100
	(664.8)			
- Developed country	197.8	-	-	*48.5*
	(346.7)			
- Developing country	200.3	-	-	*51.5*
	(465.1)			
Workers and job characteristics (%)				
No degree, primary/lower secondary	30.5	28.0	31.8	43.7
General upper secondary, technical/artistic/professional upper secondary	42.9	43.5	44.9	35.7
Higher non university, university and postgraduate	26.6	28.5	23.3	20.1
Up to 1 year of tenure	23.6	23.0	29.0	30.2
From 2 to 4 years of tenure	22.3	20.8	22.6	24.9
From 5 to 9 years of tenure	20.5	19.8	19.7	19.7
10 years or more of tenure	33.6	36.4	28.7	25.2
Younger than 30 years	22.2	24.8	31.6	16.2
Between 30 and 49 years	59.5	60.2	56.9	64.1
Older than 49 years	18.3	15.0	11.5	19.7
Women	30.4	32.9	31.1	32.2
Part-time work	12.9	18.1	21.9	25.3
Blue-collar work	47.3	42.6	45.6	57.8
Manager	4.1	3.8	2.8	3.6
Professional	11.2	12.3	9.7	9.6
Technicians and associate professionals	9.5	10.5	9.6	6.4
Clerical support workers	19	20.6	19.3	13.1

Services and sales workers	8.9	10.1	13.0	9.5
Craft and related trades workers	20.7	17.7	18.7	20.2
Plant and machine operators and assemblers	16.0	16.0	15.2	14.1
Elementary occupations	10.5	8.9	11.6	23.4
Open-term contract	95.6	93.5	90.3	90.9
Fixed-term contract	3.8	5.1	8.2	8.2
Apprenticeship contract	0.1	0.2	0.3	0.1
Interim contract	0.5	1.2	1.2	0.8
Firm characteristics				
Mining and quarrying (NACE B) (%)	0.4	0.4	0.4	0.3
Manufacturing (NACE C) (%)	37.0	36.7	34.1	30.9
Electricity, gas, steam and air conditioning supply (NACE D) (%)	0.6	1.6	1.3	0.4
Water supply, sewerage, waste management and remediation activities (NACE E) (%)	1.3	1.4	1.2	1.3
Construction (NACE F) (%)	9.7	7.6	7.2	9.0
Wholesale and retail trade (NACE G) (%)	18.8	18.3	19.0	14.3
Transportation and storage (NACE H) (%)	7	9.0	8.7	7.4
Accommodation and food service activities (NACE I) (%)	3	1.9	3.1	5.6
Information and communication (NACE J) (%)	4	4.7	4.5	3.5
Financial and insurance activities (NACE K) (%)	1.5	1.4	1.7	1.3
Real estate activities (NACE L) (%)	0.5	0.3	0.4	0.3
Professional, scientific, and technical activities (NACE M) (%)	5.6	5.1	4.5	5.1
Administrative and support service activities (NACE N) (%)	7.5	8.5	11.1	17.6
Education (NACE P) (%)	0.3	0.3	0.6	0.3
Human health and social work activities (NACE Q) (%)	1.8	2.1	1.6	1.5
Arts, entertainment, and recreation (NACE R) (%)	0.3	0.2	0.3	0.2
Other service activities (NACE S) (%)	0.6	0.5	0.6	0.7
Firm-level collective agreement (%)	20.2	25.8	26.5	21.8
Private sector (%)	97.2	93.9	94.4	96.7
Flanders	58.3	66.0	39.5	45.4
Wallonia	25.2	21.4	39.5	25.9
Brussels	16.5	12.6	21	28.7
Number of observations	61,779	950,902	152,489	170,186

Data source: SES-National Register 1999–2016

Table 2. FE estimates of the impact of hours worked by 1ˢᵗ-generation migrants on hours worked by workers born in Belgium, considered as a whole and separately

Number of hours worked by:	(1)	(2)	(3)
Dependent variable:	All workers born in Belgium	Natives	2ⁿᵈ-generation migrants
1ˢᵗ-generation migrants	0.818***	0.181**	0.245***
	(0.103)	(0.071)	(0.019)
Control variables[A]	Yes	Yes	Yes
(Within) Adjusted R²	0.46	0.48	0.32
Number of observations	61,779	61,779	61,779
Sig. Model (*p*-value)	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Table 3. FE estimates of the impact of hours worked by 1ˢᵗ-generation migrant workers on hours worked by native and 2ⁿᵈ-generation migrant workers at different levels of the labour market

Dependent variable: Number of hours worked by:	Natives			2ⁿᵈ-generation migrants		
	Region-sector-firm size level	Firm level	Firm-occupation level	Region-sector-firm size level	Firm level	Firm-occupation level
	(1)	(2)	(3)	(4)	(5)	(6)
1ˢᵗ-generation migrants	0.343*	0.181**	0.326***	0.329***	0.245***	0.216***
	(0.197)	(0.071)	(0.070)	(0.061)	(0.019)	(0.018)
Control variables[A]	Yes	Yes	Yes	Yes	Yes	Yes
Within adjusted R²	0.75	0.48	0.41	0.75	0.32	0.30
Number of observations	2,208	61,779	47,092	2,208	61,779	47,092
Sig Model (*p*-value)	0.0	0.0	0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Table 4. FE estimates of the impact of hours worked by 1ˢᵗ-generation migrant workers on hours worked by native and 2ⁿᵈ-generation migrant workers according to their level of education, respectively

Number of hours worked by		Natives		2ⁿᵈ-generation migrants	
		with at most an upper secondary degree	with more than an upper secondary degree	with at most an upper secondary degree	with more than an upper secondary degree
		(1)	(2)	(3)	(4)
1ˢᵗ-generation migrants	with at most an upper secondary degree	0.149 (0.127)	0.020 (0.015)	0.221*** (0.018)	0.011** (0.004)
	with more than an upper secondary degree	0.013 (0.050)	0.386*** (0.090)	0.038** (0.019)	0.202*** (0.034)
Control variablesᴬ		Yes	Yes	Yes	Yes
Within adjusted R² (within)		0.69	0.55	0.32	0.31
Number of observations		61,779	61,779	61,779	61,779
Sig. Model (*p*-value)		0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. ᴬ All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Table 5. FE estimates of the impact of hours worked by 1ˢᵗ-generation migrant workers on hours worked by native and 2ⁿᵈ-generation migrant workers, according to their region of origin, respectively

		Natives	2ⁿᵈ-generation migrants		
		All	All	Developed countries	Developing countries
		(1)	(2)	(3)	(4)
1ˢᵗ-generation migrants born in	Developed countries	0.443*** (0.121)	0.294*** (0.040)	0.230*** (0.037)	0.040*** (0.013)
	Developing countries	0.075 (0.096)	0.215*** (0.018)	0.001 (0.012)	0.182*** (0.014)
Control variablesᴬ		Yes	Yes	Yes	Yes
Within adjusted R² (within)		0.58	0.32	0.29	0.21
Number of observations		61,779	61,779	61,779	61,779
Sig. Model (*p*-value)		0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. ᴬ All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Table 6. FE estimates of the impact of hours worked by 1st-generation migrants on hours worked by natives according to their occupation, respectively

Dependent variable: Number of hours worked by natives with the following occupation:	Manager	Professional	Technicians and associate professionals	Clerical support workers	Services and sales workers	Craft and related trades workers	Plant and machine operators and assemblers	Elementary occupations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1st-generation migrants with the same occupation	0.732***	0.859***	0.912***	0.856***	0.681***	0.393***	0.465***	0.233***
	(0.073)	(0.114)	(0.164)	(0.129)	(0.189)	(0.114)	(0.093)	(0.071)
Control variables[A]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within adjusted R^2	0.24	0.33	0.30	0.46	0.43	0.35	0.31	0.28
Number of observations	61,779	61,779	61,779	61,779	61,779	61,779	61,779	61,779
Sig. Model (*p*-value)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering the number of hours worked by native and migrant workers with different occupations than the one studied in each column, but also worker characteristics, firm characteristics and year dummies.

Table 7. FE estimates of the impact of hours worked by 1st-generation migrants on hours worked by 2nd-generation migrants according to their occupation, respectively

Dependent variable: Number of hours worked by 2nd-generation migrants with the following occupation:	Manager	Professional	Technicians and associate professionals	Clerical support workers	Services and sales workers	Craft and related trades workers	Plant and machine operators and assemblers	Elementary occupations
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1st-generation migrants with the same occupation	0.076***	0.181***	0.288***	0.305***	0.339***	0.258***	0.286***	0.115***
	(0.014)	(0.034)	(0.043)	(0.026)	(0.045)	(0.024)	(0.029)	(0.015)
Control variables[A]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within adjusted R^2	0.15	0.30	0.31	0.41	0.44	0.30	0.25	0.27
Number of observations	61,779	61,779	61,779	61,779	61,779	61,779	61,779	61,779
Sig. Model (*p*-value)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering the number of hours worked by native and migrant workers with different occupations than the one studied in each column, but also worker characteristics, firm characteristics and year dummies.

Table 8. FE estimates of the impact of hours worked by 1st-generation migrants on hours worked by natives in specific sectors

Number of hours worked by:	Manufacturing (1)	Construction (2)	Accommodation and food service activities (3)	Administrative and support service activities (4)
Natives	Dependent variable	Dependent variable	Dependent variable	Dependent variable
1st-generation migrants	0.157** (0.067)	0.055 (0.140)	-0.060 (0.047)	0.205 (0.144)
Control variables[A]	Yes	Yes	Yes	Yes
Within adjusted R²	0.29	0.12	0.57	0.42
Number of observations	22,878	5,987	1,835	4,653
Sig. Model (*p*-value)	0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Table 9. FE estimates of the impact of hours worked by 1st-generation migrants on hours worked by 2nd-generation migrants in specific sectors

Number of hours worked by:	Manufacturing (1)	Construction (2)	Accommodation and food service activities (3)	Administrative and support service activities (4)
2nd-generation migrants	Dependent variable	Dependent variable	Dependent variable	Dependent variable
1st-generation migrants	0.323*** (0.054)	0.222*** (0.052)	0.158*** (0.018)	0.180*** (0.027)
Control variables[A]	Yes	Yes	Yes	Yes
Within adjusted R²	0.18	0.14	0.35	0.40
Number of observations	22,878	5,987	1,835	4,653
Sig. Model (*p*-value)	0.0	0.0	0.0	0.0

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Appendices

Appendix 1

Although we use many covariates and FE estimators in our previous estimations, our estimates may suffer from an endogeneity bias, as the hirings and lay-offs of 1st-generation migrants and workers born in Belgium might be related to time-varying unobserved firm characteristics or reverse causality. Indeed, time-varying unobserved firm characteristics could play a role in shaping workforce diversity. For instance, the management's agenda with respect to diversity could influence the hiring decisions for respectively natives, 1st- and 2nd-generation migrants, leading to a positive or negative correlation between them. Additionally, the number of hours worked by 1st-generation migrants could impact the employment of natives and 2nd-generation migrants, while at the same time being influenced by it, thus leading to reverse causality issues. To address these potential problems, we rely on a two-stage least squares (2SLS) approach calibrated in Fixed Effects using instrumental variables.

For the level under analysis (i.e. the firm level), we selected instrumental variables (IVs) that tend to explain the number of hours worked by 1st-generation migrants. More specifically, we selected the following 4 IVs: i) the lag of the number of hours worked by 1st-generation migrants, ii) its cube, iii) the lag of the percentage of hours worked by 1st-generation migrant in the region-sector where they work, excluding the firm where they are employed, and iv) its cube. The implicit assumption behind the first two instruments is that the number of hours worked by 1st-generation migrants in a previous period might be correlated with contemporaneous numbers of hours worked by these workers, but not with the contemporaneous number of hours worker by natives. Next, the rationale behind the last two instruments is that firms within a sector or region are usually limited by the same production constraints (technology, work content) that in turn may require hiring specific types of workers. This suggests that the lagged value of the percentage of migrant workforce composition in each regions-sectors can be correlated with the current migrant workforce in each firm we focus on (Garnero, 2015). However, we cannot reasonably expect that the lag of the percentage of hours worked by 1st-generation migrants to be directly linked to the current number of hours worked by workers born in Belgium.

2SLS-FE estimates, using the same covariates as in benchmark Equations (1) to (3), are presented in Appendix 1 Table 1. They show that, if the number of hours worked by 1st-generation migrant workers increases by 1, the number of hours worked by all native-born workers increase by 1.283 unit. However, our results suggest that there is no relationship

between the employment of 1st-generation and natives and 2nd-generation migrants considered separately. In the end, these results do not support a substitutability between 1st-generation migrants, 2nd-generation migrants and natives, but rather a complementarity or the segmentation of the labour market between these categories of workers.

To assess the soundness of the 2SLS approach, we perform an array of statistical tests. We first estimate the first stages of the 2SLS for each equation, respectively. Results are presented in Appendix 1 Table 2. Overall, the estimates of the 1st-stages are significant, thus suggesting that our IVs are not weak, which is also corroborated by the Kleibergen-Paap rk Wald F statistics for weak identification in columns (1) to (3) at the end of Appendix 1 Table 1. The latter is indeed above 10, i.e. the standard rule of thumb's critical value (van Ours & Stoeldraijer, 2011), in all specifications. Moreover, we can reject the null hypothesis that our first-stage equation is under-identified, as the *p*-values of Kleibergen-Paap rk LM statistics that are presented at the end of Appendix 1 Table 1 are found to be highly significant. Concerning the quality of our instruments, we further find that the *p*-values associated with the χ^2 statistic of the Sargan overidentification test are all above 0.1, which suggests that our instruments are valid. Finally, regarding the Durbin-Wu-Hausman endogeneity tests, the *p*-values associated with the χ^2 statistic are all smaller than 0.10. Overall, this implies that the null hypothesis of no endogeneity should be rejected, i.e. that our main explanatory variables cannot actually be treated as exogeneous and that 2SLS-FE estimates should be preferred to those obtained by FE. To sum up, our results suggest that 1st-generation migrants are complementary to workers born in Belgium as considered as a whole but do not have any positive or negative impact on the number of hours worked by natives and by 2nd-generation migrants as taken separately, rather suggesting a segmentation of the labour market. These results can be linked to theories suggesting the presence of imperfections on the labour market, leading to a null relationship or a complementarity between natives and 1st- and 2nd-generation migrants on the Belgian labour market.

Appendix 1 Table 1. 2SLS-FE estimates of the impact of hours worked by 1ˢᵗ-generation migrants on hours worked by workers born in Belgium, considered as a whole and separately

Number of hours worked by:	(1)	(2)	(3)
Dependent variable:	All workers born in Belgium	Natives	2ⁿᵈ-generation migrants
1ˢᵗ-generation migrants	1.283**	0.862	0.137
	(0.600)	(0.686)	(0.186)
Control variables	Yes	Yes	Yes
Adjusted R²	0.31	0.33	0.14
Number of observations	21,693	21,693	21,693
Sig. Model (*p*-value)	0.0	0.0	0.0
Diagnoses tests for 2SLS:			
Underidentification test: *p*-value Kleibergen-Paap rk LM statistic	0.0	0.0	0.0
Weak identification test: Kleibergen-Paap rk Wald F statistic	100.5	95.4	93.4
Overidentification test: *p*-value Sargan-Hansen's χ² statistic	0.34	0.11	0.14
Endogeneity test: *p*-value Durbin-Wu-Hausman χ² statistic	0.03	0.00	0.00

Data source: SES-National Register 1999-2016. Bootstrap standard errors are in parentheses, which are estimated using 100 repetitions. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Appendix 1 Table 2. First-stage estimates of the 2SLS for all specifications

Dependent variable: Number of hours worked by 1st-generation migrants	(1)	(2)	(3)
Lag of the number of hours worked by 1st-generation migrants	0.177***	0.160***	0.170***
	(0.030)	(0.027)	(0.030)
Lag of the percentage of hours worked by 1st-generation migrants in the sector-region except in the firm under analysis	48.613*	39.882	46.764*
	(24.752)	(24.850)	(24.688)
Cube of the lag of the number of hours worked by 1st-generation migrants	-5.63e-10***	-5.18e-10***	-5.29e-10***
	(1.03e-10)	(1.23e-10)	(1.15e-10)
Cube of the lag of the percentage of hours worked by 1st-generation migrants in the sector-region except in the firm under analysis	-0.023**	-0.018	-0.022**
	(0.011)	(0.011)	(0.011)
Control variables[A]	Yes	Yes	Yes
Adjusted R²	0.08	0.20	0.10
Number of observations	21,693	21,693	21,693
Sig. Model (*p*-value)	.	.	.

Data source: SES-National Register 1999-2016. Robust standard errors in brackets. ***, **, * significant at 1, 5 and 10% levels, respectively. [A] All specifications include control variables, covering worker characteristics, firm characteristics and year dummies.

Appendix 2. Descriptive statistics at the region-sector-firm size and firm-occupation levels

Variables	Region-sector-firm size level (1)	Firm-occupation level (2)
Average monthly hours worked by employees:		
Born in Belgium:	78,455.3	2,189.1
	(171,148.9)	(2,516.8)
Natives	67,812.2	1,883.8
	(155,408)	(2,274.1)
2nd-generation migrants from a	10,643	305.3
	(18980.2)	(452.7)
Developed country	7,921.2	222.4
	(15,232.9)	(348.1)
Developing country	2,721.8	82.9
	(4,555.6)	(208.7)
1st-generation migrants born in a:	11,649.9	340,2
	(19,430.8)	(591.8)
Developed country	5,822.6	159.6
	(9,931.5)	(303.7)
Developing country	5,827.2	180.7
	(10,381.5)	(434.8)
Workers and job characteristics (%)		
No degree, primary/lower secondary	27.7	35.5
General upper secondary, technical/artistic/professional upper secondary	40.5	43.8
Higher non university, university and postgraduate	31.8	20.7
Up to 1 year of tenure	23.7	23.9
From 2 to 4 years of tenure	21.6	21.8
From 5 to 9 years of tenure	20.0	19.9
10 years or more of tenure	35.7	34.4
Younger than 30 years	21.5	23.8
Between 30 and 49 years	58.6	59.0
Older than 49 years	19.9	17.2
Women	32.3	29.3
Part-time work	11.0	15.1
Blue-collar work	33.7	56.3
Open-term contract	94.3	94.0
Fixed-term contract	4.5	5.1
Apprenticeship contract	0.1	0.1
Interim contract	1.1	0.8
Firm characteristics		
Mining and quarrying (NACE B) (%)	5	0.4
Manufacturing (NACE C) (%)	7.3	36.5
Electricity, gas, steam and air conditioning supply (NACE D) (%)	6.4	1.2

Water supply, sewerage, waste management and remediation activities (NACE E) (%)	6.9	1.3
Construction (NACE F) (%)	17.3	10.0
Wholesale and retail trade (NACE G) (%)	7.3	15.4
Transportation and storage (NACE H) (%)	7.3	8.7
Accommodation and food service activities (NACE I) (%)	7.3	2.8
Information and communication (NACE J) (%)	7.3	4.7
Financial and insurance activities (NACE K) (%)	7.3	1.5
Real estate activities (NACE L) (%)	5.5	0.3
Professional, scientific, and technical activities (NACE M) (%)	7.3	5.3
Administrative and support service activities (NACE N) (%)	7.3	9
Education (NACE P) (%)	3.6	0.3
Human health and social work activities (NACE Q) (%)	1.2	0.2
Arts, entertainment, and recreation (NACE R) (%)	1.2	0.1
Other service activities (NACE S) (%)	4	0.6
Firm-level collective agreement (%)	21.2	24.6
Private sector (%)	90.0	95.9
Flanders	34.4	60.5
Wallonia	34.1	23.9
Brussels	31.5	15.6
Number of observations	2,208	47,092

Data source: SES-National Register 1999–2016

Appendix 3. Worker-level descriptive statistics on the educational attainment of workers

Variables	(1)
Workers born in Belgium (Total):	*1,103,391*
No degree, primary/lower secondary (%)	28.5
General upper secondary, technical/artistic/professional upper secondary (%)	43.7
Higher non university, university and postgraduate (%)	27.8
Natives	*950,902*
No degree, primary/lower secondary (%)	28.0
General upper secondary, technical/artistic/professional upper secondary (%)	43.5
Higher non university, university and postgraduate (%)	28.5
2nd-generation migrants	*152,489*
No degree, primary/lower secondary (%)	31.8
General upper secondary, technical/artistic/professional upper secondary (%)	44.9
Higher non university, university and postgraduate (%)	23.3
with at least 1 parent born in a developed country	111,814
No degree, primary/lower secondary (%)	32.7
General upper secondary, technical/artistic/professional upper secondary (%)	44.6
Higher non university, university and postgraduate (%)	22.7
with at least 1 parent born in a developing country	40,675
No degree, primary/lower secondary (%)	29.2
General upper secondary, technical/artistic/professional upper secondary (%)	44.8
Higher non university, university and postgraduate (%)	25
1st-generation migrants (Total):	170,186
No degree, primary/lower secondary (%)	43.7
General upper secondary, technical/artistic/professional upper secondary (%)	35.7
Higher non university, university and postgraduate (%)	20.6
born in a developed country:	*82,285*
No degree, primary/lower secondary (%)	38.0
General upper secondary, technical/artistic/professional upper secondary (%)	35.4
Higher non university, university and postgraduate (%)	26.6
born in a developing country:	*87,701*
No degree, primary/lower secondary (%)	49.2
General upper secondary, technical/artistic/professional upper secondary (%)	36.0
Higher non university, university and postgraduate (%)	14.8
Number of observations	1,273,577

Data source: SES-National Register 1999–2016