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D5.3 Labour Inequality in the EU and labour assimilation of immigrants

WP5 Migration and impact on skills and inequality

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Document Summary

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Summary

This report consists of four papers. All of them deal with the labour market impacts of large-scale migration flows in the EU, painting a complex picture.

The report provides insights into how migration drives inequality looking into several aspects: i) labour niches and occupational segregation by origin and gender, ii) occupational mobility of natives and immigrants, iii) changes on wages, iv) alleviation of skill shortages, and v) consumer price reduction.

Focusing on the EU level, as well as on the country level (i.e. Hungary and Spain), the report delivers more insight into the impacts of migration and mobility. Specifically, it provides information on migration flows considering different skill-levels. Understanding the consequences of migration can help to develop policy implications more consistently.

The first paper, by Aldaz, Eguía and Aizpurua, looks at origin and gender as sources of inequality in the labour market. Focusing on the European Union, it studies labour niches and occupational segregation by origin and gender. Moreover, it analyses the effect of migration on the occupational mobility of unskilled native workers. In addition, focusing on Spain, it examines the insertion, occupational integration and wage assimilation of immigrants. The paper remarks the different outcomes of immigrants in comparison to natives. Immigrants fill the lower rungs of the occupational ladder and suffer a wage gap which, although it diminishes with their length of stay, does not disappear over time. It also states that immigrants stimulate the labour supply of natives, who move into non-manual occupations. Furthermore, it highlights the existence of important differences by gender and country of origin, being third-country national female migrants the most vulnerable group. In turn, it points out heterogeneity as a key feature of inequality in the EU and stresses the need for tailor-made integration policies.

The second paper, by Konya, investigates the impact of immigration on wages and wage inequality. It develops an immigration model that encompasses different channels through which immigration impacts native wages: bargaining power in wage negotiations, local demand conditions for goods and services produced by workers in different occupations, and possible changes in the capital-labour ratio. It focuses on the four largest European Union economies, France, Germany, Italy and Spain. Three counterfactual scenarios are explored, where the adjustment speed of the capital stock and the sensitivity of domestic relative prices to immigration differ. Results show that the impact of immigration on wages and wage inequality depends crucially on the relative prices determined by local versus global conditions.

The third paper, by Smolka, focuses on Spain. Immigrants are not evenly distributed across locations, but instead cluster in some places, so the regional level (NUTS3) is considered. The paper supports the idea that immigration can reduce consumer prices (CPI) through both supply-side (Frattini, 2008, 2014) and demand-side channels (Lach, 2007), although the effect strongly depends on the product, the economic situation and the immigrants' origin. The price reduction is concentrated on non-tradable goods and services, and goods intensive in migrant labour. These negative effects are shown during the economic recession of 2008 and are mainly due to the arrival

of migrants from outside Western Europe. Even though all households (native and immigrant) benefit from these immigrant-induced price reductions, those who spend a larger share of their income on these goods (i.e. immigrants) will benefit more. Prices are, therefore, a new channel through which inequality between immigrants and natives can be influenced.

In the fourth paper, Seghir and Nezhyvenko construct an occupational shortage indicator to identify occupations facing shortages. Furthermore, they empirically examine the impact of migration on these occupational shortages in Western European countries over the period 2006-2018, differentiating between EU-born migrants and third-country nationals. They find evidence that immigrants play a significant role in alleviating occupational shortages in Western European countries, where precisely immigration rates are rising, and labour shortages persist. This effect is more pronounced with non-EU migrants. The relevance of these findings should prompt reflection from policymakers.

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Occupational integration and labour assimilation of immigrants in the European Union

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Abstract

This paper studies origin and gender as sources of inequality in the labour market. Using the European Union Labour Force Survey, it focuses on the labour niches and occupational segregation by origin and gender in the EU. Moreover, it analyses the occupational mobility of unskilled native workers caused by the entry of immigrants into the labour market. In addition, based on the Spanish Continuous Working Life Survey, it examines the insertion, occupational integration and wage assimilation of immigrants. It concludes that, indeed, foreign-born workers do not behave as natives do in the labour market, but they mainly enter occupations lower down the occupational ladder and suffer a wage gap with respect to natives which, although it diminishes with their length of stay, does not disappear over time. It also states that immigrants stimulate the labour supply of natives, who move into non-manual occupations. Furthermore, it highlights the existence of important differences by gender and country of origin, being third-country national female migrants the most vulnerable group. Finally, it points out heterogeneity as a key feature of inequality in the EU and stresses the need for tailor-made integration policies.

Keywords: Immigration, gender, segregation, occupational mobility, assimilation

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1. Introduction

Human mobility is a continuing phenomenon that affects every country in the world. Migration refers to the movement of people from one state to another for a minimum length of time, due to reasons that range from economic, family, or studies, to armed conflicts, persecution and natural disasters (IOM, 2020). The United Nations (2020) estimates that approximately 281 million people were living outside their countries of birth in 2020, accounting for about 3.6% of the global population of 7.8 billion. This figure has increased over the last twenty years, when there were 173 million international migrants.

According to Eurostat, the European Union has also experienced an increase in the number of foreign-born people, which reached 55 million in 2022, 12.3% of the total EU population. Slightly over half of these were women (51.9%). Nevertheless, there are internal spatial disparities within EU member states in terms of migration distribution, since the growing number of migrants has not been evenly distributed among the different states. Germany receives the largest number of foreign-born people, followed by France, Spain and Italy. However, Luxembourg, Malta and Cyprus have the highest immigrant weights, whereas Romania, Bulgaria and Poland are at the bottom of the list.

In the EU context, a distinction should be made between mobility and migration. Mobility refers to the movement of labour from one member state to another, as part of the four freedoms (goods, capital, services and labour) of the European Single Market. Migration refers to the entry of individuals born outside the EU. Therefore, a clear difference between movers (EU-born) and third-country nationals (TCN) arises, since they generally exhibit different behaviour patterns.

Nevertheless, both extra-European migration and intra-EU mobility are caused by several factors and have implications for various spheres of economic and social reality, including the labour market. Although migration flows due to armed conflicts have risen recently, the majority of those who migrate to other countries do so for reasons related to work, studies or family reunification. As stated by Eurostat, in 2022, 13.6% of the employed population (15-64 years old) in the EU was foreign-born, 45.2% of them females. In relation to the origin, 31.1% of the employed foreign-born workers were movers, while 68.9% were third-country nationals.

Legal barriers to labour mobility in Europe have been dismantled, allowing European citizens to live, work without a permit, and access employment and public services in other member states, receiving an equal treatment with natives. Nonetheless, the European labour market is still not entirely integrated and homogeneous (Dorn and Zweimüller, 2021). The migrant population experiences disadvantages based mainly on gender and country of origin. Immigrants of all educational levels tend to have higher unemployment rates and lower employment probabilities compared to their native counterparts, and they are generally concentrated in low-level occupations, with lower earnings and high over qualification rates (Palencia-Esteban and Del Río, 2020). Yet, there are different patterns, as these gaps in the labour market outcomes vary across EU countries and population groups (Cangiano, 2014; De la Rica et al., 2013).

Regarding gender, despite the increase of women's participation in the labour market in the last decades, their activity does not reach men's level. At the same time, they have to deal with occupational segregation, the larger share of household duties (Eurofound and European

Commission Joint Research Centre, 2021), fewer paid working hours, and discrimination in their career progression (Ortensi and Tosi, 2021).

In relation to the country of origin, immigrants' performance is worse than that of natives, but non-EU immigrants (TCN) generally have poorer labour outcomes than EU immigrants or movers (Dustmann and Frattini, 2011; Platt et al., 2022). TCN migrants show the largest gap with respect to natives (Stirling, 2015), while movers' circumstances depend on their EU birth country. People born in other Western European countries have similar outcomes to those of natives, whereas Eastern Europeans, citizens of the newest member states, perform worse than natives (Dorn and Zweimüller, 2021).

Taking both gender and origin into account, women and immigrants are penalised on the labour market (Schieckoff and Sprengholz, 2021). In particular, migrant women are the most disadvantaged and vulnerable group, since they have to meet the specific challenges of immigrants and women simultaneously (Hamedanian, 2022), especially women from outside the EU: they are more likely to be unemployed and do worse in terms of employment compared to migrant men and female movers. In addition, this population group is overrepresented in low-paid occupations, and it is part of the informal economy, where human rights abuses often occur (European Institute for Gender Equality, 2020).

It exists a significant gap in the access to employment of migrant men and women, as well as in the transition rate into a first job. According to Hamedanian (2022), among the immigrants who arrived in Europe between 2012 and 2018, two years after moving, only 5% of women were employed, which rose to 29% after five years of residence. On the contrary, 25% of men were working after two years, and 57% after five years. Thus, female immigrants have a slower transition into their first job in Europe.

This study is based on the heterogeneity manifested by the labour force, whereby the labour market is composed by workers who differ in their level of qualification, productivity, wages or type of occupation. As a consequence of this heterogeneity, the different demographic groups participating in the labour market are not on an equal footing. This inequality can take different forms, such as wage differentials, labour niches, occupational segregation or different promotion opportunities. Moreover, these manifestations of inequality are a persistent phenomenon over time and have been detected, to a greater or lesser extent, in all developed countries.

Considering the historical context of migration in Europe is essential for the analysis of the integration of immigrants in the labour market, as it allows understanding the different internal patterns. European countries have had diverse and heterogeneous migration experiences due to their geographical location and their different historical, political and economic contexts, as well as their notions of nationhood and organization of governments (Garcés-Mascareñas and Penninx, 2016). Over the years, the influence of decolonization, demographic variations, economic development, changes in the structure of labour demand and the creation of the EU have transformed Europe into a major global migration destination (De Haas, 2018). As a result, the composition and origin of each country's immigrant population differ from the others, and the immigration policies and communities that migrants encounter are a critical part for their integration (Schieckoff and Sprengholz, 2021).

With this reality in mind, this paper focuses on whether the inflow of immigrant population leads to unequal labour market opportunities between native and foreign-born workers in the EU. For this purpose, several studies are conducted.

The first study is based on gender and country of origin as a source of inequality in the labour market, and it looks at the occupational distribution of different groups in the EU. In this process, we identify the labour niches corresponding to each demographic group and analyse their level of segregation, measuring the degree of inequality corresponding to each one of them. Our objective is to recognise the most vulnerable population in order to be able to present actions aimed at this group. In turn, we examine the overall segregation in the EU, as well as its evolution over time. Finally, we study internal differences within the EU, trying to identify different patterns of behaviour.

The second study focuses on the impact of migratory flows on the labour conditions of the native population. In particular, it analyses the effect of immigrants on the vertical occupational mobility of unskilled native workers, following Peri and Sparber (2009). We test whether the inflow of immigrants causes an upward mobility of natives in the occupational ladder. The analysis is carried out for the EU regions and only takes into account the effect produced by TCN immigrant workers, given the similar behaviour between movers and natives.

The last study analyses the occupational mobility and wage assimilation of immigrants in the host country. We focus on Spain, a country that has received a large number of immigrants in a short period of time. In the last 15 years, the foreign-born population has increased by 12 points (currently almost 17% of the population is foreign-born), making it an interesting case study to examine the labour assimilation of immigrants in host countries. Consequently, it can be used as a natural experiment to shed light on the labour assimilation process of foreign-born workers in hosting labour markets.

This paper helps to better understand the complex process of integration of foreign-born workers into the labour market. It contributes to the literature by including several novelties. First, we assume that the behaviour of foreign-born workers varies according to their country of birth and therefore, we differentiate between EU-born movers and third-country nationals (TCN). In this way, the mobility of workers within the EU, as well as external migration flows are studied. Second, the geographical scope also differs from previous papers. Most of the studies analyse labour inequalities in a limited number of countries in Western Europe (De la Rica et al., 2013, and Dueñas-Fernández and Llorente-Heras, 2021), or in the EU15 countries (Dustmann and Frattini, 2011, and Lee et al., 2020). This study is conducted for the former EU28 and explores different internal patterns depending on the geographical area. Third, as far as we know, this is the first time that the model developed by Peri and Sparber (2009) is tested for the EU. Furthermore, this model is extended to include different aspects: the level of regional economic and technological development, as well as the different response to the occupational mobility of natives according to their gender. Finally, we analyse the occupational mobility and wage assimilation of immigrants in Spain over 15 years, a long period that has not yet been discussed by other authors.

The paper is structured as follows. The second section reviews existing studies on both labour niches and occupational segregation by origin and gender. It also includes literature on the impact of migration on the occupational mobility of natives, as well as on the labour and wage assimilation of immigrants. The third section presents the data and the applied methodology. The fourth section shows the main results obtained in the three analyses performed. The fifth section provides concluding remarks.

2. Literature review

2.1. Labour niches and occupational segregation by origin and gender

Employment inequality in Europe has been the subject of multiple studies over the last few decades, focusing, among others, on the participation of different groups in the labour market (Moreno, 2008), occupational segregation (Dueñas-Fernández and Llorente-Heras, 2021; Palencia-Esteban, 2022), wage gaps (Dustmann and Frattini, 2011; Cantalini et al., 2023), and the conditions of temporality and partiality (Campaña et al., 2023; Seo, 2023).

Numerous studies, considering the gender perspective, highlight the worse conditions of women in comparison to men (Bettio, 2002; Moreno, 2008; Larrañaga-Sarriegui et al., 2012; Dueñas-Fernández and Llorente-Heras, 2021; Seo, 2023). Others analyse labour inequalities from the point of view of the employees' country of birth, comparing the situation of natives and immigrants, as is the case of Dustmann and Frattini (2011). However, recent studies have integrated both dimensions, jointly examining inequality based on gender and country of origin. In this way, the work of the European Institute for Gender Equality (2020) and Ortensi and Tosi (2021) focus especially on immigrant women's perspective, while De la Rica et al. (2013), Lee et al. (2020), Schieckoff and Sprengholz (2021) and Palencia-Esteban (2022) analyse the situation of native and immigrant women and men.

Hence, the labour market is segmented by gender and by origin, with male- and female-dominated jobs, as well as labour niches for immigrants and natives. According to Eurofound and the European Commission Joint Research Centre (2021), women predominantly hold employment in low-paying jobs in France, Italy, Spain and Sweden. Furthermore, the sectors with the highest female presence are medium-skilled manual occupations developed mainly in traditional tertiary and social sectors (Dueñas-Fernández and Llorente-Heras, 2021). In this way, women are overrepresented in household activities and service sectors such as education, human health and social work activities, while the main employment sectors for men are manufacturing and construction (European Commission et al., 2009; Eurofound and the European Commission Joint Research Centre, 2021; Ortensi and Tosi, 2021).

In relation to the country of origin, several studies find that immigrants are overrepresented in the lowest skilled jobs in different European countries, and even though it is more probable for high-educated migrants to progress to high-skilled work, they tend to remain overrepresented in low-skilled jobs (Benton et al., 2014; Stirling, 2015). The OECD states that 26% of migrant women in the Eurozone are employed in low-skilled occupations (Hamedanian, 2022), highlighting the double penalisation suffered by this group.

In the same way, Dustmann and Frattini (2011) differentiate immigrant workers according to the country of birth and show that natives are more concentrated than migrants in high-skilled jobs and, among the latter, third-country nationals are more concentrated than EU immigrants in less skilled jobs. Stirling (2015) denotes that EU15-born migrants are mainly concentrated in hospitality and administrative support services, Eastern European migrants in construction, and both third-country nationals and Eastern Europeans are highly concentrated in hospitality and the household sector. Studies conducted by Hamedanian (2022) and Lee et al. (2020) coincide that female migrants work predominantly in sectors such as housekeeping, cleaning, social care, education, food preparation and hospitality, while migrant men mainly work in the hotel

and restaurant sector, as well as stock management, construction, and post and delivery. Ortensi and Tosi (2021) also find that migrant women concentrate in domestic care but, unlike other research, describe that they have scarce access to education occupations.

In addition to labour niches, occupational segregation by origin and gender has been the subject of several studies. The labour force is not equally distributed across occupations, and from a macroeconomic perspective, restricting population groups from pursuing particular occupations leads to inefficiencies and rigidities in the labour market (Palencia-Esteban and Del Río, 2020). Some authors follow a unidimensional perspective considering gender (European Commission et al. 2009; Eurofound and the European Commission Joint Research Centre 2021, Dueñas-Fernández and Llorente-Heras, 2021) or origin (Dustmann and Frattini, 2011) as the source of segregation. Others adopt a multidimensional approach, integrating both aspects. These latter authors state that immigrant women are generally more segregated than their male counterparts. Likewise, Palencia-Esteban (2022) shows that there are countries with high overall segregation, where the immigrant population experiences low segregation (Luxembourg, for example), and vice versa. For instance, despite the low overall segregation, immigrants in Czechia, Finland and Hungary present high local segregation. Migrant women have the highest segregation values in Greece and Italy, and the lowest in the Netherlands and the UK, differentiating the high and low segregation areas by North-West and South-East. She also finds evidence of a higher concentration of females in a more limited number of occupations than men.

2.2. Impact of migration on occupational mobility of natives

The impact of migration on the labour conditions of natives has also been a topic of major interest. If immigrants substitute native employees, their arrival could reduce wages and employment rates for the latter, while, if they are complementary, they could stimulate supply of native labour.

The literature on this topic has three distinct lines. The first focuses on the effects of immigration on natives' wages, with studies from authors such as Card (2005), Borjas (1994, 2003), Card and Di Nardo (2000), Lewis (2003), Borjas and Katz (2007), and Card and Lewis (2007) for the USA; Manacorda et al. (2012) for the UK; Pischke (1993), Pischke and Velling (1994), and D'Amuri et al. (2010) for Germany; and Casado et al. (2005), González and Ortega (2008), and Carrasco et al. (2008) for Spain. All these papers conclude that immigration has little or no impact on the wages of less skilled natives, since the two workforces do not compete for the same jobs. Indeed, newly arrived immigrants mainly affect previous waves of immigrants for whom they are perfect substitutes.

The second line of research examines the repercussions of immigration on native workers' job opportunities, including analyses to determine whether it reduces the chances of unskilled natives finding a job. Examples of these studies include Ortega and Peri (2009) for OECD countries; Vedder et al. (2000) for the USA; Gang et al. (1999) for the EU; and Amuedo-Dorantes and De la Rica (2007), Iglesias and Llorente-Heras (2008), and Carrasco et al. (2008) for Spain. All the above-mentioned authors come to the conclusion that the negative effects have been reduced.

The third line of research, which is the focus of our analysis, studies the effects of the presence of immigrants on the vertical occupational mobility of native workers. Peri and Sparber (2009) find for the United States that an increase in the number of less educated immigrant workers

leads less educated natives to change their task specialisation, shifting to lower manual occupations. The reason lies in immigrants' comparative advantage in manual tasks that do not require interactive and communication skills, due to the lack of proficiency in the host country language (Amuedo-Dorantes and De la Rica, 2011).

D'Amuri and Peri (2010) and Cattaneo et al. (2013) do the research for some European countries. Foged and Peri (2016) study the case of Denmark, a country with a refugee dispersal policy designed to distribute immigrants without regard to their preferences and economic considerations. Other papers analyse the case of Spain (Amuedo-Dorantes and De la Rica, 2011; De la Rica and Polonyankina, 2013; Aldaz and Eguía, 2016). All authors find that an increase in the share of foreign-born workers induces natives to relocate to jobs with lower manual content and more interactive tasks. The studies conducted in Europe are completely gender-neutral. Nevertheless, the Spanish cases take into consideration of the gender dimension and coincide that the effect of immigration on task specialisation is greater for native women than men.

However, in contrast to these authors, Jiang (2021) observes only an insignificant negative effect for Canada, with natives performing fewer manual tasks as the share of less-educated foreign-born workers increases. This fact can be explained by the small population of low-skilled immigrants going to Canada. Thus, a different system of immigration from the USA may generate a different task supply transition in the labour market.

2.3. Labour assimilation of immigrants

Immigrants' economic assimilation to the host country has also been extensively studied. The evolution of immigrants' wages has been one of the most recurrent topics since Chiswick's (1978) work for the USA, where he found that immigrants initially earned less than natives, but their earnings equalled and then exceeded those of natives after 10 to 15 years. Borjas (1985) questions these findings, pointing out the problems of using cross-sectional data and proposing the creation of specific immigrant cohorts. According to this author, earnings assimilation was not happening as rapidly as previously believed.

Several studies on wage assimilation have been conducted for different geographical areas: Friedberg (1992), Borjas (1995), Card (2005), and Peri and Rutledge (2020) for the USA; Dustmann (1993), Pischke (1993), Constant and Massey (2003), and Okoampah (2016) for Germany; Clark and Lindley (2005) for the UK; Rodríguez-Planas (2012) for Spain; and Aleksynska and Algan (2010) for Western Europe. All the aforementioned pieces reach the same conclusions. There is a significant initial earning gap between immigrants and natives, which progressively narrows over time. Even though they find a positive earning assimilation, immigrants do not reach natives' wage levels during their working lives.

Another research line focuses on immigrants' employment probabilities and unemployment rates. Examples of this topic are Chiswick et al. (1997), and Peri and Rutledge (2020) for the USA; Price (2001), and Clark and Lindley (2005) for the UK; Amuedo-Dorantes and De la Rica (2007), and Fernández and Ortega (2008) for Spain; and Aleksynska and Algan (2010), Gorodzeisky and Semyonov (2017), and Lee et al. (2020) for Western Europe. The majority of these studies have the same findings, showing that immigrants have a lower likelihood of employment at the time of arrival and face much higher unemployment rates than comparable natives. Most authors agree that immigrants' employment rates attain those of natives and that there is economic convergence and positive assimilation over years spent in the host

country. The employment gap tends to be greater depending on the origin of the immigrants, and Clark and Lindley (2005) even detect dis-assimilation for some particular immigrant groups in the UK, employment rates being lower after some years. Peri and Rutledge (2020), however, do not find employment probability disadvantage upon arrival.

The number of papers in the field of occupational assimilation is scarce. There are Amuedo-Dorantes and De la Rica (2007), and Rodríguez-Planas (2012) for Spain; and Aleksynska and Algan (2010), and Gorodzeisky and Semyonov (2017) for Western European countries. The Spanish cases show that immigrant men and women have a lower occupational attainment than their native counterparts. Moreover, both native men and women hold higher ranked jobs than foreign-born people, with the exception of EU15 movers, even after various years of residence. According to Rodríguez-Planas (2012), the assimilation patterns of female and male immigrants, with high school and university degrees, are very similar; they all start working in low-qualified jobs in the first year and shift to more qualified occupations after 3 or 4 years. The only difference is the greater assimilation speed for university-educated immigrants. Concerning the European cases, the authors demonstrate that, although first-generation immigrants are less likely to attain high-skilled jobs, second-generation migrants have a higher probability of accessing highly ranked occupations.

There are different theories that try to give an explanation to employment differences in relation to individuals' attributes and skills. The classic assimilation model states that the reasons behind immigrants' disadvantages in the labour market are the following: limited access to information and social networks, lack of knowledge of the culture and language of the receiving country, inadequate professional skills, unrecognised foreign qualifications, and lack of host country work experience (Lee et al., 2020). Nevertheless, according to this theory, migrants do not achieve natives' labour market outcomes even if their level of education and experience are taken into account. However, after spending time in the destination country and acquiring relevant human capital and knowledge of the country, immigrants generally converge with natives in terms of labour outcomes, as a result of host-country education and labour market experience, language learning, the establishment of social networks, and other socio-cultural capital (Schieckoff and Sprengholz, 2021).

In the case of the segmented assimilation model, there are different patterns of assimilation, related to the degree of opportunities or disadvantages depending on the origin country of the migrants. This theory focuses on differences by country of origin, race and ethnicity, not considering immigrants to be homogeneous (Lee et al., 2020). Likewise, it explains that group-specific reception contexts are important, in addition to migrants' labour market capital endowments (Portes and Zhou, 1993, as cited in Schieckoff and Sprengholz, 2021).

3. Data and methodology

3.1. Data

The paper relies on two databases. On the one hand, the study on labour niches and occupational segregation, as well as on the impact of migration on occupational mobility of natives, use microdata from the European Union Labour Force Survey (EU-LFS) for the years

2004, 2008, 2012, 2016 and 2019. We use the second quarters to improve comparability and avoid possible seasonality problems.[1] The study is carried out for the former EU28.

Within the foreign-born population, we define an EU-mover as a person born in an EU country other than the one in which he or she works, and an immigrant or third-country national (TCN) an individual born outside the EU.[2] This allows us to study both intra-EU labour mobility and immigration. We use those definitions together with information on gender (male or female) to create the six groups of interest: male and female natives (NM and NF), male and female movers (MoM and MoF), and male and female immigrants (MiM and MiF). We also use age and labour status to include the working population aged 15 to 64.

We consider occupational categories according to the International Standard Classification of Occupations (ISCO) at three-digit level. The EU-LFS changed the ISCO classification in 2011, since ISCO-08 replaced ISCO-88. Therefore, for the long-term analysis of the 15-year period, we convert ISCO-08 to ISCO-88 using the harmonization codes made available by Falcon (2015).

We define skill-levels of the occupations according to the International Labour Organization (ILO) classification of occupations. We distinguish among low (ISCO 900, LS), medium (ISCO 400-800, MS) and high-skilled (ISCO 100-300, HS) occupations.[3] Additionally, we consider the activity sector according to the Statistical Classification of Economic Activities in the European Community (NACE Rev.1 for the years 2004 and 2008, and NACE Rev. 2 for the years 2012, 2016 and 2019).

On the other hand, as the study of the labour assimilation of immigrants focuses on Spain, we use the Spanish Continuous Working Life Survey, 2019 edition (MCVL-2019). This is a set of anonymised microdata of the Spanish Social Security System that constitutes a representative sample of all persons who were affiliated to the Social Security in 2019.

This database contains information on each individual, considering aspects such as personal characteristics and work activity. In addition, the MCVL provides access to the complete employment history of the worker as well as their contribution bases since their entry into the labour market (since 1981), allowing the study of the labour and wage assimilation of the immigrants, something that is lacking in other databases (cross-sectional).[4]

The MCVL-2019 represents nearly 4% of the reference population (31,743,051 individuals), which equals 1,268,856 individuals, 14.51% of immigrant origin, who may contribute as workers or unemployed, or receiving a pension. This paper focuses only on active affiliates, excluding unemployed people who receive benefits and pensioners.

Immigrants (and EU-movers) are defined as foreign-born individuals, following the above definitions.

[1] Although annual data are available in the EU-LFS, the construction of the annual sample differs across countries.

[2] For Bulgaria and Croatia in 2004 and 2008, and for Germany in 2004 and 2008, we define foreign-born workers by nationality rather than country of birth, due to the availability of data in the EU-LFS.

[3] We exclude armed forces occupations from the study.

[4] However, the administrative data from Social Security Records only cover legal workers, as employment relationships in the informal sector are not registered.

3.2. Methodology

This section details the different methodologies applied in the three studies carried out in this paper.

Labour niches and occupational segregation by origin and gender

In order to determine the labour market position of the different demographic groups, we apply a correspondence analysis. Thus, we obtain information about the labour integration of foreign-born workers in the host labour markets.

In addition, we use the representation index to identify the main labour niches for foreign-born workers, which allows observing if a group is over- or underrepresented in an occupation. The representation index is obtained as the quotient between the percentage of individuals of a group in a given occupation and the percentage of individuals of that same group in total employment in the economy.[5]

In the study of occupational segregation by origin and gender, we use the various tools proposed by Del Río and Alonso-Villar (2022) to measure segregation in a multigroup context. First, we draw local segregation curves, to compare graphically the occupational distribution of multiple groups. The curve is equal to a 45^{o} line if the population group is evenly distributed across occupations. Otherwise, the curve departs from that line. One group is less segregated than another when its curve is closer to the diagonal. Local segregation curves are very useful to illustrate the effect of a group's size on its maximum segregation level.[6] Therefore, we also draw local curves of maximum segregation.

Second, we calculate the local dissimilarity index (Alonso-Villar and Del Río, 2010) to measure local segregation as follows:

$$D^g = \frac{1}{2}\sum_i \left|\frac{c_i^g}{C_g} - \frac{t_i}{T}\right|$$

where, c_i^g represents workers of group *g* in occupation *i;* C^g, total workers of group *g;* t_i, employment in occupation *i;* and T, total employment. The index ranges from 0 to 1 and expresses the percentage of group *g* that would have to change occupations in order to eliminate segregation while keeping the occupational structure of the economy unchanged.

Additionally, we obtain complementary information standardising the index, since D^g does not consider the weight of each group in total employment. That is, we compare each scenario with the maximum segregation, as proposed by Del Río and Alonso-Villar (2022). We standardise the local dissimilarity index as follows:

[5] Following Hakim (1993), values greater than 1.25 reflect an overrepresentation of the group and consequently, the occupation can be considered a labour niche. Values below 0.75 reflect an underrepresentation of the group.

[6] The maximum segregation of a group is attained when it is fully concentrated in one occupation with no members of other groups. In the real world, full segregation may not be possible.

$$\widetilde{D}^g = \frac{D^g}{D^{g*}} = \frac{\frac{1}{2}\sum_i \left| \frac{c_i^g}{C_g} - \frac{t_i}{T} \right|}{1 - \frac{C^g}{T}}$$

where $D^{g*} = 1 - \frac{C^g}{T}$, represents the maximum segregation for each group.

Lastly, in order to quantify the overall segregation existing in the labour market by gender and origin, we use the I_p index (Silber, 1992), which corresponds to the weighted average of the local dissimilarity index. This index is calculated as follows:

$$Ip = \sum_g \frac{C^g}{T} D^g$$

We also standardise the I_p index as follows:

$$D = \frac{Ip}{Ip^*} = \frac{Ip}{\sum_g \frac{C^g}{T}\left(1 - \frac{C^g}{T}\right)}$$

where $Ip^* = \sum_g \frac{C^g}{T}\left(1 - \frac{C^g}{T}\right)$, represents the maximum overall segregation.[7]

Impact of migration on occupational mobility of natives

We follow Peri and Sparber (2009) to quantify the possible effect of immigrants on the mobility of unskilled native workers from manual to non-manual occupations.

Developing a general equilibrium model, these authors show that low-skilled natives and low-skilled foreigners are not perfect substitutes. Similar results are obtained by Aldaz and Eguía (2016), who extend their model to consider a gender-segmented labour market. Among low-skilled workers, these authors distinguish between natives (N) and foreign-born workers (I), two groups that differ in their average relative efficiency.

These workers can perform two types of tasks in the production of goods and services. Manual tasks (M) require some physical effort and coordination. Non-manual tasks (NM), such as management, training and organisation of personnel, require more interactive skills, such as interpersonal communication.

Native workers have a comparative advantage in performing non-manual tasks, and foreign-born workers in manual tasks. This assumption is reasonable, as non-manual tasks require skills that involve language proficiency and knowledge of certain issues related to the labour market and the productive fabric, skills more favourable to natives than to immigrants.

[7] To check the robustness of our findings, we also calculate the local Gini index and the local generalised entropy family index to measure local segregation, as well as the Gini index and the Mutual information index for overall segregation. See Appendix B for more information.

Based on their theoretical model, it can be empirically tested whether the relative provision of manual versus non-manual tasks by low-skilled native workers, both male and female, decreases as the share of immigrants in the labour force increases. Based on previous results, we assume that the labour market is segmented by gender. We therefore estimate the following econometric model, distinguishing between men and women:

$$Ln\left(\frac{M_N}{NM_N}\right)_{g,it} = \alpha_{g,i} + \delta_{g,t} + \beta_g \left(\frac{L_I}{L}\right)_{g,it} + Z'_{g,it}\boldsymbol{\gamma}_g + \varepsilon_{g,it} \quad (1)$$

where subindex g denotes the gender (m males, f females), subindex i the region, and subindex t the year (t= 2008, 2012, 2016, 2019).[8] Data are grouped at regional level (NUTS2) and cover 155 EU regions. α_i includes time-invariant unobservable effects specific to each region, and δ_t represents regional-invariant time effects. L is the total number of low-skilled workers in the economy, both immigrants (I) and natives (N), $L = L_I + L_N$. The econometric model also shows an additional term, Z, that includes information related to average worker characteristics, such as age and educational attainment, in each region. It also collects data on regional economic development and the level of technological development. We expect that a higher level of economic and technological development will lead to a higher presence of natives in non-manual occupations.[9]

The supply of labour by natives can be affected by several factors. The presence of immigrants in the labour market is one. Nevertheless, it may also be strongly influenced by the labour demand of firms, which due to technological change, increasingly require labour in non-manual occupations. This may affect the different European regions to a greater or lesser extent. For this reason, and to avoid a bias in the estimation of the coefficients, an explanatory variable has been included to capture this different technological development (Górka et al., 2017).

[8] We exclude 2004 due to statistical reasons, on account of the low presence of immigrants in several European regions for this year. We also exclude Bulgaria, Hungary, Poland, Romania and Slovakia for the same reason (less than 1% of immigrants). For Croatia, Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Luxembourg, Malta and Netherlands we consider the country level. Data for Austria, Germany and United Kingdom are at NUTS1 level in the EU-LFS.

[9] The average age of the region and the average percentage of the population with a university degree are used. We expect that an older and more educated regional labour force will lead to a reduction in the proportion of native workers employed in manual occupations. Alternatively, to ensure the robustness of the results, average worker characteristics are also captured using dummy variables. Age equals one if the average age in the region is higher than the EU average. Educational attainment equals one if the regional share of workers without a university degree is higher than the national average.
Regional economic development is included as GDP per capita in percentage of the EU28 average. We also include the share of tertiary educated persons employed in science and technology to capture the Human Resources in Science and Technology in the region.

Moreover, given (1), it is possible to estimate separately (2) and (3) to determine whether the effect of immigrants has a greater impact on the relative provision of manual tasks or the relative provision of non-manual tasks, by the native labour force:[10]

$$Ln\left(\frac{M_N}{M_N+NM_N}\right)_{g,it} = \alpha_{g,i}^{M} + \delta_{g,t}^{M} + \beta_g^{M}\left(\frac{L_I}{L}\right)_{g,it} + Z'_{g,it}\boldsymbol{\gamma}_g^{M} + \varepsilon_{g,it}^{M} \quad (2)$$

$$Ln\left(\frac{NM_N}{M_N+NM_N}\right)_{g,it} = \alpha_{g,i}^{NM} + \delta_{g,t}^{NM} + \beta_g^{NM}\left(\frac{L_I}{L}\right)_{g,it} + Z'_{g,it}\boldsymbol{\gamma}_g^{NM} + \varepsilon_{g,it}^{NM} \quad (3)$$

Estimating these equations allows us to test the relationship between the proportion of immigrant workers and the relative provision of manual (and non-manual) tasks by native workers. We expect that, as the proportion of immigrants in the labour force increases, the relative provision of manual tasks by native workers decreases ($\beta^M < 0$), and the relative provision of non-manual tasks by native workers increases (β^{NM}>0), and hence, $\beta < 0$. This applies to male and female coefficients alike, although we expect to find gender-related differences in the relative provision of tasks.

Labour assimilation of immigrants

Not only natives, but also immigrants, experience changes as their permanence in the labour market increases. Our objective is precisely to analyse their occupational mobility and wage assimilation, focusing on the Spanish labour market, and using the MCVL-2019.

The analysis of the occupational mobility of the immigrant population is centred on vertical mobility, treated through the change of positions (ascending or descending) in the scale of professional categories, which we construct based on the contribution groups registered in the Social Security. These groups are numbered from 1 to 10 and are associated with a certain level of qualification.[11] Low-numbered groups correspond to higher-skilled jobs (*G1-Engineers and University Graduates*, *G2-Engineering Technicians, Experts and Qualified Assistants, G3-Administrative and Workshop Managers*) and high-numbered groups to lower-skilled jobs (*G8-First and Second degree Skilled Workers, G9- Third degree Skilled Workers and Specialists, G10-Unskilled Workers*).

This indicator of the type of work (skilled and unskilled) does not necessarily correspond to the worker's qualification, since some workers may be registered with the Social Security in a lower category than the one corresponding to their qualification.[12]

[10] Note that $Ln\left(\frac{M_N}{NM_N}\right)_{g,it} = Ln\left(\frac{\frac{M_N}{M_N+NM_N}}{\frac{NM_N}{M_N+NM_N}}\right)_{g,it} = Ln\left(\frac{M_N}{M_N+NM_N}\right)_{g,it} - Ln\left(\frac{NM_N}{M_N+NM_N}\right)_{g,it}$. Therefore, it should be fulfilled that $\beta_g = \beta_g^M - \beta_g^{NM}$.

[11] Group 11 (or group 12) is not considered, as this group includes those under 18 (17) years of age "whatever their occupational category", and hence we do not know what would be the implications of a mobility of these workers to any professional group (1-10). They account for only 0.07% of the total sample (0.01% of immigrant workers).

[12] For example, 17% of immigrants registered in the MCVL have a university degree, but of these, just over 20% get a first contract in the three highest contribution groups, while 30% are concentrated in the lowest groups G8-G10. This suggests a certain degree of over-education of immigrants when accessing the Spanish Labour market. These data, although revealing, should be interpreted with some caution

In addition to these 10 contribution groups, we include domestic employees (GD) and self-employed workers (GSW) who, in the Social Security records, are not associated with a specific contribution group. We consider their inclusion relevant, as around 20% of immigrant affiliates in 2019, a significant percentage, belong to these two groups.

We consider that any change of GD (associated with a low qualification) to another occupational group means an improvement in the employee's employment situation. Self-employed workers, nonetheless, being a group that may have different levels of training, should be treated separately.[13] With the information of the sample, we do not know whether these individuals have been able to move up or down the career ladder, nor whether a change from self-employment to employment (or vice versa) has led to an improvement or worsening of their working conditions.

In order to estimate occupational mobility of immigrant workers, we compare each individual's first occupation to their current occupation in 2019, through their changes of position on the scale of the 10 (+2) occupational groups. Thus, mobility tables are created to study this occupational progression or regression of immigrants.

In the wage assimilation analysis, we consider the contribution base to the Social Security system as a suitable proxy of the worker's salary.[14] However, we focus only on the Social Security General Regime, including contribution groups 1 to 10. In this case, we do not include self-employed workers, since they can choose their contribution base regardless of their activity and the income they earn and, therefore, the contribution bases may not be closely associated to wages.

The analysis is conducted for the period 2004-2019 which, although it begins in a favourable economic context with positive growth rates, also includes the period of economic crisis and subsequent recovery. 15 years may be a sufficiently long period to be able to answer questions related to the assimilation of wages by immigrant workers.

As an indicator, we rely on the ratio between the average contribution base of immigrants and the average contribution base of natives over three lustrums. A ratio equal to (or very close to) one implies the absence of an immigrant-native wage gap in the Spanish labour market. Ratios far from the unity entail the opposite.

since the educational level of some individuals is not recorded in the sample (10%). In this sense, they are mere approximations.

[13] Around 20% of those who enter the labour market as self-employed workers have no education, around 30% have only primary education and just over 20% have a university degree.

[14] From now on, we will use both terms (contribution base and salary) interchangeably.

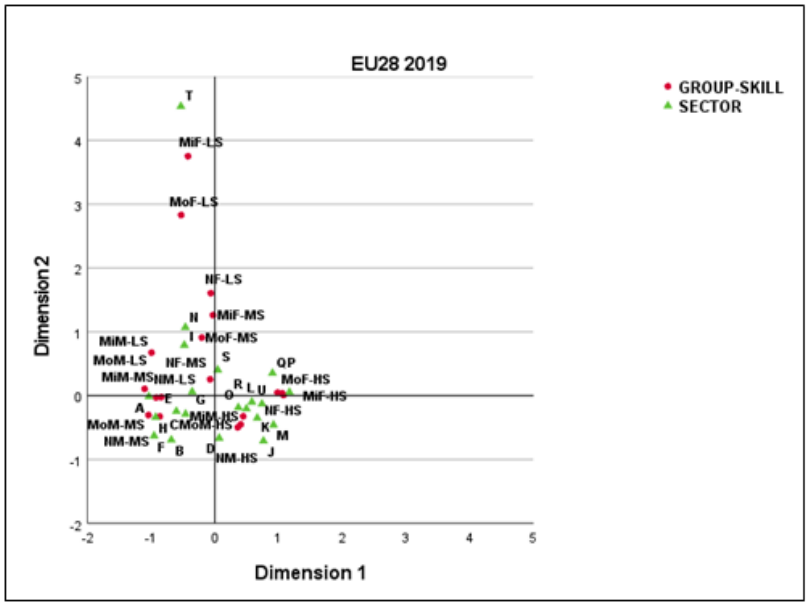
4. Results

4.1. Labour niches and occupational segregation by origin and gender

The origin and gender of workers can be a source of inequality in the labour market. Under this assumption, we study whether this inequality occurs in the EU; that is, whether there are differences in the sectors and occupations in which native and foreign-born workers are employed, taking gender differences into account.

For this purpose, we first analyse the labour market participation of each group of workers in the EU28 in 2019 by applying a correspondence analysis. We look at the skill-level of the occupation (LS: low-skill, MS: medium-skill, HS: high-skill), as well as the activity sector (A to U, according to NACE) in which the six demographic groups (NM, NF, MoM, MoF, MiM and MiF) are employed.

Figure 1. Labour market participation by origin and gender in the EU, 2019.



Source: EU-LFS microdata

Red dots in Figure 1 represent groups of workers by origin and gender in different skill-level occupations. For example, MiF-LS refers to TCN females in low-skill occupations. In turn, green triangles correspond to the activity sector. This analysis allows us to observe the sectors where each group is employed and shows that extra-EU migrant females in low-skill occupations are very close to the household activities sector and far behind both native women and immigrant men.

In addition, we get the relative position of each group on the basis of two dimensions. Dimension 1 (on the X-axis) corresponds to the skill-level, being all high-skill workers on the positive side. Dimension 2 (on the Y-axis) is indicating gender differences. Greater values entail a more feminised occupation and the lower ones a more masculinised occupation. Thus, we observe that the workforce in high-skilled occupations does not show significant differences by

origin, nor do we detect large differences by gender among them. Yet, when we analyse the less qualified population, we notice that there are discrepancies, in which differences by gender increase.

Furthermore, this pattern of behaviour is common to all EU countries (see Figures in Appendix A). We can state that there are no major differences between high-skilled workers in these countries, which suggests that segregation affects lower-skilled workers to a greater extent.

Next, we aim to determine foreign-born workers' labour niches. We define a labour niche for a group as an occupation with a high overrepresentation of workers from this particular group.

To this end, we calculate the representation index for all the foreign-born groups, in order to analyse the possible differences between EU-movers and TCN migrants. In Tables 1 to 4, we can observe that foreign-born workers are mainly employed in low and medium-skilled occupations. Moreover, their labour niches tend to be gendered occupations. Likewise, we perceive the existence of specific labour niches for the foreign-born population.

Starting with TCN male migrants, among their labour niches, we can highlight "Construction", a masculinised occupation since all groups of men, both native and foreign-born workers, are overrepresented in it. Nevertheless, "Accommodation and food service activities" also stands out, being an occupation with high overrepresentation for all foreign-born groups.

Table 1. Main labour niches of male TCN migrant in the EU, 2019. Representation Index.

Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
Transportation and storage	H-LS	1.1793	3.5092	2.9919	0.3319	0.8185	2.0219
Activities of extraterritorial organisations and bodies	U-MS	0.7945	3.2101	1.5469	0.7332	1.5777	3.6457
Agriculture, forestry and fishing	A-LS	1.0453	3.1443	2.4161	0.6087	0.7556	1.3627
Construction	F-LS	1.5483	2.6122	3.3163	0.1119	0.3631	0.7337
Accommodation and food service activities	I-LS	0.4426	2.4142	1.0581	1.0721	3.9084	3.1384
Wholesale and retail trade; repair of motor vehicles and motorcycles	G-LS	1.0188	2.3081	1.5616	0.6937	1.5024	1.8383
Accommodation and food service activities	I-HS	0.9258	2.1648	1.8873	0.8479	1.1098	1.5813
Manufacturing	C-LS	0.9455	2.0853	1.8987	0.8019	1.3260	1.7874
Transportation and storage	H-MS	1.4373	1.9433	1.8455	0.4293	0.3361	0.4560
Accommodation and food service activities	I-MS	0.7260	1.8954	1.3389	1.0464	1.9479	1.8956
Construction	F-MS	1.6693	1.8605	2.6583	0.1610	0.1032	0.1593
Water supply; sewerage, waste management and remediation activities	E-LS	1.5449	1.8296	1.0387	0.3849	0.2314	0.3783
Administrative and support service activities	N-MS	1.1170	1.6254	1.4863	0.7818	0.8281	0.9361
Activities of extraterritorial organisations and bodies	U-LS	0.6250	1.6250	0.0000	0.9517	5.9891	1.0297
Administrative and support service activities	N-LS	0.4369	1.6071	1.1128	1.0615	4.6797	3.7589
Real estate activities	L-LS	0.7441	1.4910	1.3343	0.9215	3.1726	2.5376
Information and communication	J-HS	1.3851	1.3206	1.4331	0.5546	0.5953	0.6151
Manufacturing	C-MS	1.3169	1.2648	1.3017	0.6535	0.5104	0.6481

Source: EU-LFS microdata

The same is true for TCN female migrants. We see that only two of their main labour niches are high-skill occupations. In this case, the gender pattern is repeated again. For example, "Activities of households" and "Human Health" are notably feminised occupations, as all groups of women are overrepresented in them. Likewise, they share specific labour niches with the rest of foreign-born workers, like "Accommodation and food services", among others.

Table 2. Main labour niches of female TCN migrant in the EU, 2019. Representation Index.

Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-LS	0.0649	0.8580	0.1768	1.0262	9.7417	6.0830
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-MS	0.2583	1.2064	0.6659	0.8953	8.3393	5.5475
Activities of extraterritorial organisations and bodies	U-LS	0.6250	1.62499	0.0000	0.95166	5.9891	1.0297
Administrative and support service activities	N-LS	0.4369	1.60714	1.11275	1.06152	4.6797	3.7589
Accommodation and food service activities	I-LS	0.4426	2.4142	1.05813	1.07209	3.9084	3.1384
Other service activities	S-LS	0.4785	1.22486	0.51511	1.14616	3.8958	4.1644
Human health and social work activities	Q-LS	0.2878	0.58787	0.30321	1.59698	3.4357	2.4223
Real estate activities	L-LS	0.7441	1.49096	1.33431	0.92155	3.1726	2.5376
Education	P-LS	0.2842	0.22619	0.11057	1.79017	2.3885	1.7925
Financial and insurance activities	K-LS	0.4762	0.5511	0.9916	1.1825	2.3641	6.8753
Human health and social work activities	Q-MS	0.3427	0.4574	0.28095	1.72065	2.2664	1.3827
Activities of extraterritorial organisations and bodies	U-HS	0.3665	1.18769	7.09326	0.51143	2.2622	12.7893
Professional, scientific and technical activities	M-LS	0.8420	0.78966	1.3451	0.98318	2.1642	2.5717
Accommodation and food service activities	I-MS	0.7260	1.89543	1.33895	1.04637	1.9479	1.8956
Other service activities	S-MS	0.4831	0.70836	0.45639	1.55545	1.7792	1.5462
Public administration and defence; compulsory social security	O-LS	0.9384	0.71896	0.30971	1.11383	1.6187	0.5814
Activities of extraterritorial organisations and bodies	U-MS	0.7945	3.21008	1.54687	0.73315	1.5777	3.6457
Arts, entertainment and recreation	R-LS	0.7798	1.01059	1.0415	1.16532	1.5585	1.5255
Wholesale and retail trade; repair of motor vehicles and motorcycles	G-LS	1.0188	2.30807	1.56161	0.69374	1.5024	1.8383
Education	P-MS	0.4567	0.34863	0.21571	1.70314	1.4195	1.0924
Information and communication	J-LS	0.9358	1.23124	0.4933	0.97193	1.3694	2.2345
Manufacturing	C-LS	0.9455	2.08533	1.89866	0.80186	1.3260	1.7874
Human health and social work activities	Q-HS	0.4401	0.49445	0.36881	1.69683	1.2875	1.2771

Source: EU-LFS microdata

If we look at male movers, the number of high-skill niches increases compared to TCN migrants, but their labour niches are similar to those of TCN immigrants. It is noteworthy that there are no major gender differences within this group, since male and female movers are overrepresented in practically the same occupations.

Table 3. Main labour niches of male EU-movers in the EU, 2019. Representation Index.

Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
Activities of extraterritorial organisations and bodies	U-HS	0.3665	1.1877	7.0933	0.5114	2.2622	12.7893
Construction	F-LS	1.5483	2.6122	3.3163	0.1119	0.3631	0.7337
Transportation and storage	H-LS	1.1793	3.5092	2.9919	0.3319	0.8185	2.0219
Construction	F-MS	1.6693	1.8605	2.6583	0.1610	0.1032	0.1593
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-HS	0.3174	0.4474	2.5703	1.4580	0.0000	7.5441
Agriculture, forestry and fishing	A-LS	1.0453	3.1443	2.4161	0.6087	0.7556	1.3627
Manufacturing	C-LS	0.9455	2.0853	1.8987	0.8019	1.3260	1.7874
Accommodation and food service activities	I-HS	0.9258	2.1648	1.8873	0.8479	1.1098	1.5813
Transportation and storage	H-MS	1.4373	1.9433	1.8455	0.4293	0.3361	0.4560
Construction	F-HS	1.5663	1.0699	1.5887	0.4168	0.2383	0.3288
Wholesale and retail trade; repair of motor vehicles and motorcycles	G-LS	1.0188	2.3081	1.5616	0.6937	1.5024	1.8383
Activities of extraterritorial organisations and bodies	U-MS	0.7945	3.2101	1.5469	0.7332	1.5777	3.6457
Administrative and support service activities	N-MS	1.1170	1.6254	1.4863	0.7818	0.8281	0.9361
Information and communication	J-HS	1.3851	1.3206	1.4331	0.5546	0.5953	0.6151
Professional, scientific and technical activities	M-LS	0.8420	0.7897	1.3451	0.9832	2.1642	2.5717
Accommodation and food service activities	I-MS	0.7260	1.8954	1.3389	1.0464	1.9479	1.8956
Real estate activities	L-LS	0.7441	1.4910	1.3343	0.9215	3.1726	2.5376
Manufacturing	C-MS	1.3169	1.2648	1.3017	0.6535	0.5104	0.6481

Source: EU-LFS microdata

Finally, female movers also present similarities with their migrant counterparts.

Table 4. Main labour niches of female EU-movers in the EU, 2019. Representation Index.

Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
Activities of extraterritorial organisations and bodies	U-HS	0.3665	1.1877	7.0933	0.5114	2.2622	12.7893
Activities of households as employers; undifferentiated goods- and service	T-HS	0.3174	0.4474	2.5703	1.4580	0.0000	7.5441
Financial and insurance activities	K-LS	0.4762	0.5511	0.9916	1.1825	2.3641	6.8753
Activities of households as employers; undifferentiated goods- and service	T-LS	0.0649	0.8580	0.1768	1.0262	9.7417	6.0830
Activities of households as employers; undifferentiated goods- and service	T-MS	0.2583	1.2064	0.6659	0.8953	8.3393	5.5475
Other service activities	S-LS	0.4785	1.2249	0.5151	1.1462	3.8958	4.1644
Administrative and support service activities	N-LS	0.4369	1.6071	1.1128	1.0615	4.6797	3.7589
Activities of extraterritorial organisations and bodies	U-MS	0.7945	3.2101	1.5469	0.7332	1.5777	3.6457
Accommodation and food service activities	I-LS	0.4426	2.4142	1.0581	1.0721	3.9084	3.1384
Professional, scientific and technical activities	M-LS	0.8420	0.7897	1.3451	0.9832	2.1642	2.5717
Real estate activities	L-LS	0.7441	1.4910	1.3343	0.9215	3.1726	2.5376
Human health and social work activities	Q-LS	0.2878	0.5879	0.3032	1.5970	3.4357	2.4223
Information and communication	J-LS	0.9358	1.2312	0.4933	0.9719	1.3694	2.2345
Transportation and storage	H-LS	1.1793	3.5092	2.9919	0.3319	0.8185	2.0219
Real estate activities	L-MS	0.7761	1.0252	0.7264	1.2158	1.0083	1.9255
Accommodation and food service activities	I-MS	0.7260	1.8954	1.3389	1.0464	1.9479	1.8956
Wholesale and retail trade; repair of motor vehicles and motorcycles	G-LS	1.0188	2.3081	1.5616	0.6937	1.5024	1.8383
Education	P-LS	0.2842	0.2262	0.1106	1.7902	2.3885	1.7925
Manufacturing	C-LS	0.9455	2.0853	1.8987	0.8019	1.3260	1.7874
Accommodation and food service activities	I-HS	0.9258	2.1648	1.8873	0.8479	1.1098	1.5813
Other service activities	S-MS	0.4831	0.7084	0.4564	1.5554	1.7792	1.5462
Arts, entertainment and recreation	R-LS	0.7798	1.0106	1.0415	1.1653	1.5585	1.5255
Professional, scientific and technical activities	M-MS	0.6693	0.5956	0.5663	1.4412	0.8801	1.3995
Human health and social work activities	Q-MS	0.3427	0.4574	0.2809	1.7206	2.2664	1.3827
Agriculture, forestry and fishing	A-LS	1.0453	3.1443	2.4161	0.6087	0.7556	1.3627
Human health and social work activities	Q-HS	0.4401	0.4945	0.3688	1.6968	1.2875	1.2771

Source: EU-LFS microdata

Bearing in mind that one of the consequences of the existence of labour niches may be over-qualification, we analyse the percentage of high-skilled workers in low and medium-skilled occupations. We observe that such over-qualification may exist, and it seems that it may affect women to a greater extent. Table 5 shows that almost 13% of female migrants who are employed in low-skill occupations are high-skilled, increasing the value to more than 14% for movers. Moreover, we find higher values of over-qualification in medium-skill occupations, where more than a quarter of the highly skilled foreign-born women are employed. These values are higher than those of natives.

Table 5. Percentage of workers by demographic group and educational level in low-skill and medium-skill occupations in the EU, 2019.

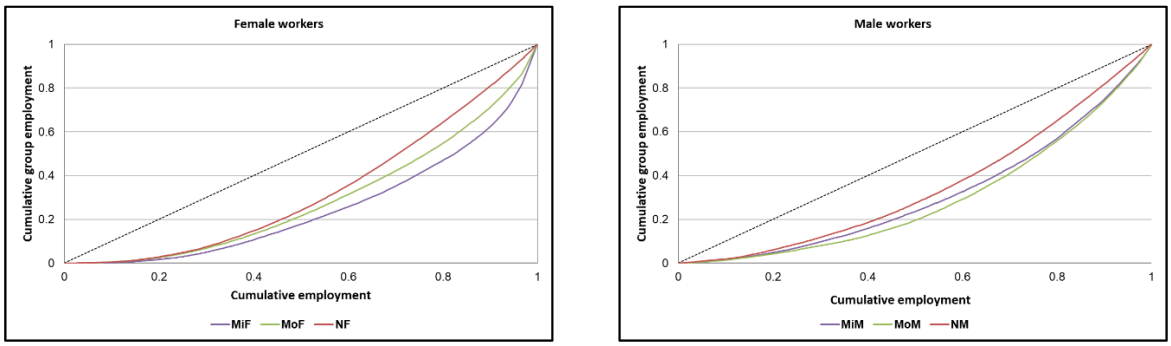
Low-Skill occupations	Educational level			Medium-Skill occupations	Educational level		
	Low	Medium	High		Low	Medium	High
MiF	52.4%	34.7%	**12.9%**	**MiF**	27.7%	47.0%	**25.3%**
MiM	59.9%	30.2%	**9.9%**	**MiM**	39.8%	44.2%	**16.0%**
MoF	38.6%	47.1%	**14.3%**	**MoF**	19.8%	52.3%	**27.9%**
MoM	41.3%	49.0%	**9.7%**	**MoM**	28.5%	55.9%	**15.7%**
NF	44.4%	50.9%	**4.7%**	**NF**	17.3%	63.8%	**18.9%**
NM	47.1%	47.5%	**5.4%**	**NM**	23.4%	64.7%	**11.9%**
Total	47.1%	45.9%	**7.0%**	**Total**	22.2%	62.2%	**15.6%**

Source: EU-LFS microdata

Hereafter, we want to identify the most vulnerable group to ensure that public policies are targeted at the most disadvantaged groups. To this end, we make use of local segregation curves, since they allow us to compare graphically the segregation levels of different groups.

If we look at local segregation curves by gender, Figure 2 exhibits that, among both men and women, foreign-born workers suffer higher levels of segregation than natives (plotted in red). Their curve is farther away from the diagonal. In addition, differences between movers and migrants increase in women's case. Thus, we confirm that extra-EU migrants are more segregated than movers.

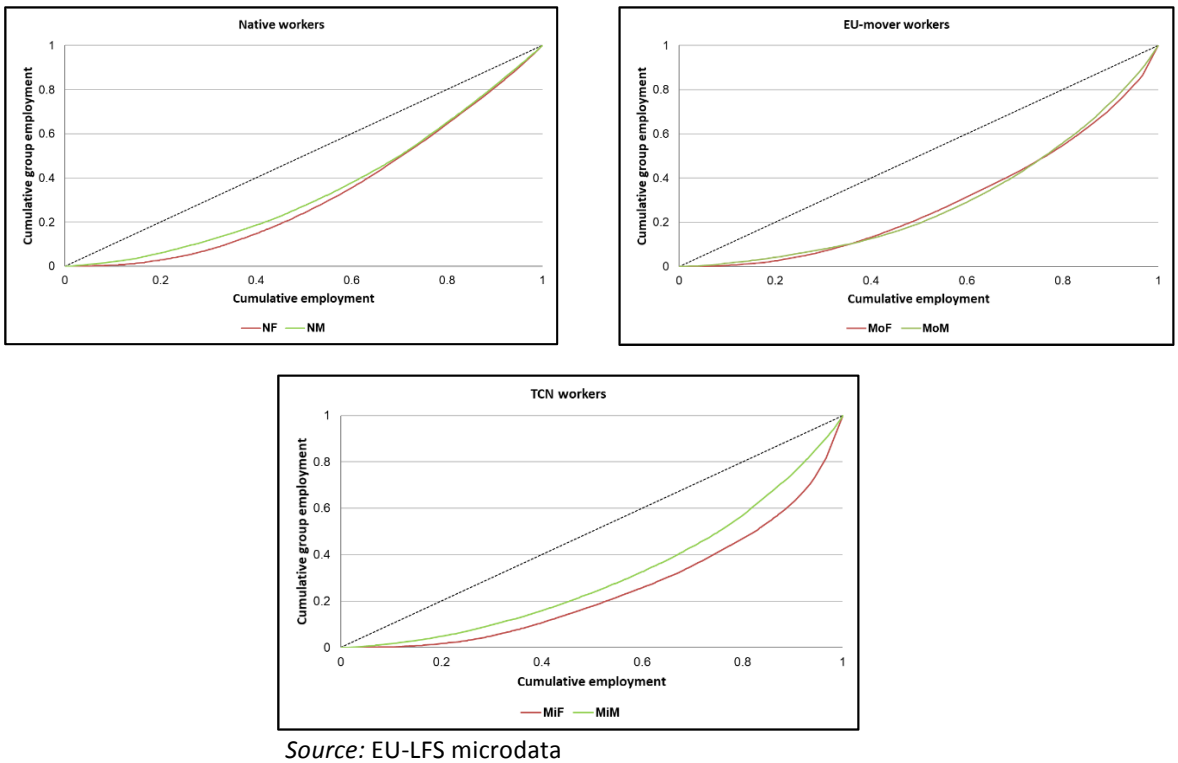
Figure 2. Segregation curves by gender, 2019.



Source: EU-LFS microdata

If we analyse the curves in terms of origin, Figure 3 shows that women (plotted in red) suffer, in general, higher levels of segregation, and the biggest difference is observed in the migrant population. In conclusion, female migrants seem to be the most segregated group.

Figure 3. Segregation curves by origin, 2019.



Source: EU-LFS microdata

To deepen the study, we use the local dissimilarity index to measure the degree of inequality for each group. Table 6 demonstrates again that immigrant women are the most vulnerable population, while native men suffer by far the lowest level of segregation. In fact, we can see that nearly 35% of TCN women would have to change their occupation to eliminate their segregation, compared to 22.72% of native men.[15]

Table 6. Local segregation in the EU, 2019. Local dissimilarity index.

	Unstandardised, D^g	**Standardised, $\widetilde{D}^g$**	**Maximum value, D^{g*}**
MiF	0.3493	0.3631	0.9622
MiM	0.2743	0.2880	0.9524
MoF	0.2872	0.2941	0.9764
MoM	0.3093	0.3175	0.9744
NF	0.2599	0.4358	0.5964
NM	0.2272	0.4222	0.5382

Source: EU-LFS microdata

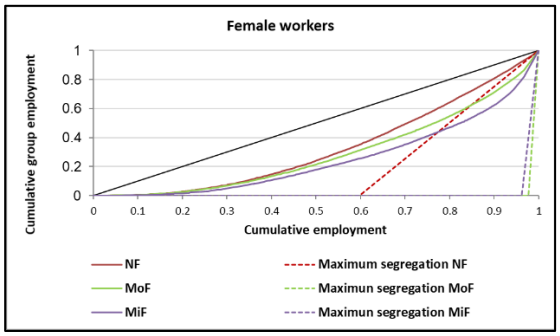
Additionally, we get complementary information by standardising the index (comparing each scenario with the maximum segregation) and so, taking into account the weight of each group in total employment. The standardised value indicates that the current level of segregation suffered by immigrant women represents 36.31% of their maximum segregation (see Table 6). In other words, this is the most segregated group and with a significant potential for deterioration.

Concerning native women, their current level of segregation is equivalent to 43.58% of their maximum segregation and, therefore, they have a lower level of segregation than immigrants and are closer to their ceiling. This confirms the situation of vulnerability faced by immigrant groups, especially women.

The maximum segregation curves allow us to visualise this fact graphically. Solid lines refer to the current segregation, while dot lines correspond to the maximum segregation. It can be observed that the potential for deterioration of immigrants is much greater than that of natives, as their current curve is further away from their maximum segregation curve. This difference can be appreciated when plotting the curves by both gender (Figure 4) and origin (Figure 5).

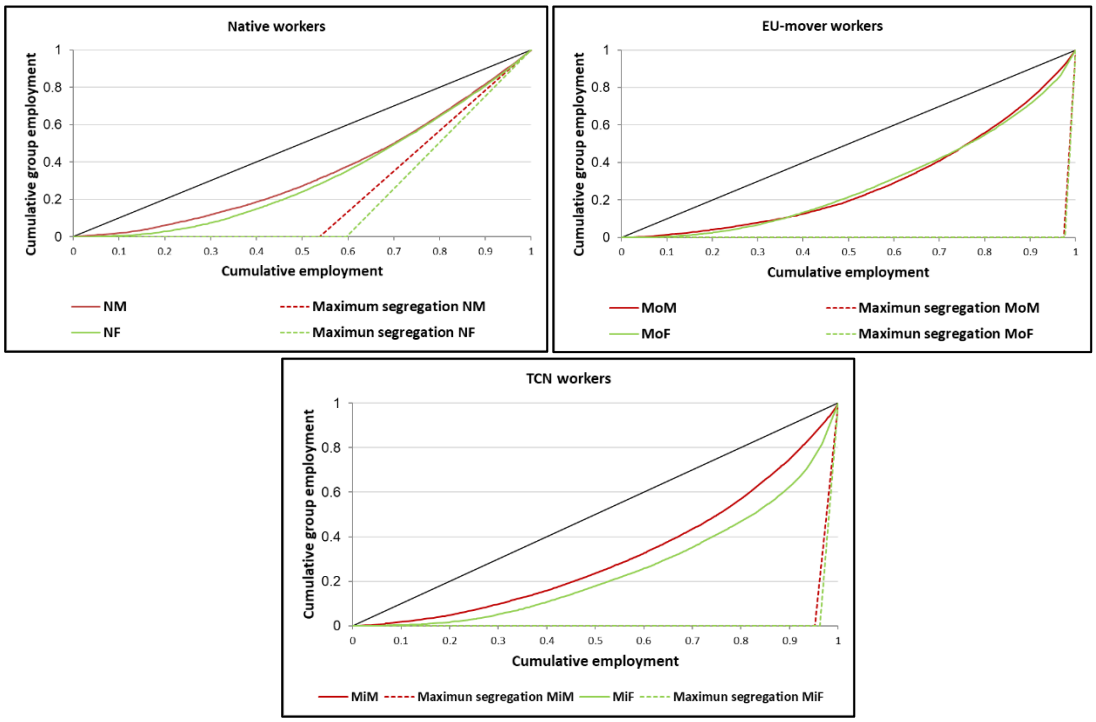
[15] Values obtained in the robustness check support our findings. Results are available in Appendix B.

Figure 4. Segregation curves and maximum segregation curves by gender, 2019.



Source: EU-LFS microdata

Figure 5. Segregation curves and maximum segregation curves by origin, 2019



Source: EU-LFS microdata

These analyses provide an overview of what is happening in the EU, but different countries in the EU may behave differently. For this reason, we measure the level of segregation of each group of workers in each EU member state in order to study possible internal discrepancies.[16]

[16] We exclude Bulgaria, Poland, Romania and Slovakia because the presence of foreign-born workers in the labour force is less than 1%. We use ISCO data for Malta at one-digit level.
AT: Austria, BE: Belgium, HR: Croatia, CY: Cyprus, CZ: Czech Republic, DK: Denmark, EE: Estonia, FI: Finland, FR: France, DE: Germany, EL: Greece, HU: Hungary, IE Ireland, IT: Italy, LV: Latvia, LT: Lithuania,

As displayed in Table 7, in the vast majority of countries, the lowest level of segregation corresponds to native male workers, whereas female extra-EU immigrants are the most segregated group. For the latter, the dissimilarity index values range from 27.06% (United Kingdom) to 57.68% (Hungary), and refer to the percentage of workers in this group who would have to change occupation to eliminate their segregation (in contrast, the values for native males vary between 11.51% (Malta) and 31.33% (Luxembourg)). Using the standardised index, we can compare the level of inequality across countries. Values range from 28.41% (United Kingdom) to 61.48% (Cyprus) for female migrants, corroborating previous findings.

Table 7. Local segregation in the EU by country, 2019. Local dissimilarity index.

	Unstandardised, D^g						Standardised, $\tilde{D}^g$					
Country	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**
AT	0.2603	0.2907	0.3348	0.3129	0.3981	0.4114	0.4475	0.4602	0.3522	0.3295	0.4247	0.4336
BE	0.2467	0.2738	0.3845	0.3499	0.3718	0.4616	0.4353	0.4491	0.4016	0.3651	0.3925	0.4806
HR	0.2665	0.3201	0.6916	0.7515	0.4924	0.5513	0.5289	0.5443	0.6968	0.7573	0.5142	0.5708
CY	0.2737	0.3063	0.4142	0.4142	0.5147	0.5693	0.4474	0.4681	0.4422	0.4440	0.5485	0.6148
CZ	0.2570	0.3144	0.4144	0.4536	0.4308	0.5022	0.5484	0.5480	0.4198	0.4575	0.4358	0.5071
DK	0.2459	0.2563	0.3929	0.3327	0.3731	0.4044	0.4589	0.4518	0.4008	0.3383	0.3865	0.4179
EE	0.2804	0.3149	0.7936	0.8926	0.4838	0.4603	0.5250	0.5422	0.7969	0.8960	0.5091	0.4883
FI	0.2768	0.2856	0.4402	0.4439	0.4067	0.4556	0.5319	0.5268	0.4462	0.4489	0.4151	0.4638
FR	0.2412	0.2593	0.4028	0.3428	0.3442	0.3564	0.4344	0.4565	0.4096	0.3484	0.3624	0.3715
DE	0.2304	0.2699	0.3444	0.3061	0.3390	0.3581	0.3989	0.4413	0.3596	0.3170	0.3627	0.3758
EL	0.1655	0.2351	0.5013	0.5697	0.5184	0.5111	0.3468	0.3883	0.5046	0.5736	0.5408	0.5259
HU	0.2566	0.3078	0.4892	0.5288	0.5626	0.5768	0.5479	0.5505	0.4937	0.5331	0.5659	0.5795
IE	0.2519	0.2806	0.3174	0.2825	0.3509	0.3689	0.4152	0.4348	0.3493	0.3078	0.3663	0.3830
IT	0.2120	0.2862	0.4869	0.4515	0.4250	0.5204	0.4131	0.4523	0.4976	0.4623	0.4523	0.5424
LV	0.3079	0.3101	0.8393	0.7712	0.5365	0.4769	0.5689	0.5755	0.8417	0.7744	0.5536	0.4979
LT	0.2897	0.2853	0.8076	0.7632	0.5064	0.4817	0.5488	0.5463	0.8099	0.7646	0.5172	0.4939
LU	0.3133	0.4542	0.3250	0.3149	0.4660	0.4338	0.4019	0.5621	0.4397	0.3999	0.4952	0.4591
MT	0.1151	0.1857	0.2777	0.1629	0.1957	0.3618	0.2111	0.2594	0.2970	0.1741	0.2092	0.3879
NL	0.2327	0.2656	0.3654	0.2649	0.3203	0.2834	0.4335	0.4562	0.3715	0.2702	0.3351	0.2949
PT	0.2723	0.2641	0.3988	0.3912	0.3225	0.3759	0.4911	0.4758	0.4037	0.3966	0.3363	0.3926
SI	0.1953	0.2468	0.4109	0.4275	0.4412	0.4402	0.3729	0.4247	0.4139	0.4320	0.4672	0.4545
ES	0.2431	0.2798	0.3508	0.3628	0.3399	0.4747	0.4451	0.4421	0.3610	0.3721	0.3640	0.5049
SE	0.2499	0.2543	0.3954	0.3473	0.2904	0.4129	0.4226	0.4119	0.4070	0.3575	0.3169	0.4430
GB	0.2289	0.2567	0.3514	0.2816	0.2591	0.2706	0.3996	0.4228	0.3658	0.2925	0.2744	0.2841

Source: EU-LFS microdata

All this evidence reinforces our initial assumption and confirms that extra-EU immigrant women are the most vulnerable group. Consequently, we conclude that origin and gender are sources of inequality and that immigrant women suffer double discrimination in their occupational distribution in the EU labour market (for being a woman and an immigrant).

LU: Luxembourg, MT: Malta, NL: Netherlands, PT: Portugal, SI: Slovenia, ES: Spain, SE: Sweden, GB: United Kingdom.

Lastly, we quantify the level of overall inequality that exists in the EU labour market as a consequence of both origin and gender, using the I_p index. Table 8 shows that a value close to 25% is obtained for the EU, which according to the standardised index represents 40.52% of the maximum overall segregation.

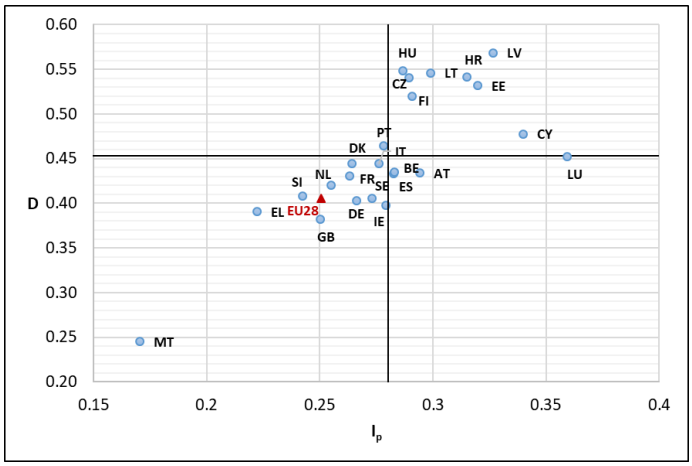
Table 8. Overall segregation in the EU by country, 2019. I_p index.

	Unstandardised, I_p	**Standardised, D**	**Maximum value, I_P^***
MT	0.1706	0.2454	0.6954
EL	0.2222	0.3909	0.5686
SI	0.2423	0.4082	0.5935
GB	0.2503	0.3821	0.6549
EU28	**0.2508**	**0.4052**	**0.6189**
NL	0.2551	0.4204	0.6068
FR	0.2632	0.4307	0.6111
DK	0.2643	0.4445	0.5945
DE	0.2663	0.4027	0.6613
SE	0.2730	0.4054	0.6733
IT	0.2761	0.4441	0.6217
PT	0.2783	0.4640	0.5997
IE	0.2790	0.3978	0.7014
BE	0.2825	0.4333	0.6519
ES	0.2828	0.4352	0.6499
HU	0.2867	0.5484	0.5228
CZ	0.2895	0.5406	0.5355
FI	0.2907	0.5197	0.5594
AT	0.2942	0.4340	0.6778
LT	0.2991	0.5462	0.5477
HR	0.3148	0.5418	0.5811
EE	0.3198	0.5317	0.6015
LV	0.3265	0.5687	0.5740
CY	0.3400	0.4776	0.7120
LU	0.3594	0.4522	0.7948

Source: EU-LFS microdata

Luxembourg, Cyprus, and Latvia are the countries with the highest segregation, in contrast to Malta, Greece, and Slovenia, which are the least segregated ones (Table 8). However, if we use a standardised measure, the ranking undergoes some changes, and we find Latvia, Hungary and Lithuania in the first positions of high segregation, and Malta, the UK, and Greece in the last. The population size of different EU countries varies greatly, and so, it is relevant to take into account standardised measures as well. In any case, large differences between EU countries can be observed (see also Figure 6).

Figure 6. Unstandardised and standardised overall segregation in the EU, 2019.



Source: EU-LFS microdata

Hence, heterogeneity is a key characteristic of segregation in Europe, fact that leads us to study internal differences within the EU.

Patterns by EU countries

Considering the observed heterogeneity, we aim to identify different patterns of inequality by origin and gender within the EU. For this purpose, we examine the labour niches and the levels of segregation of each demographic group in each EU country.

We apply the correspondence analysis and measure both the representation index and the local and overall segregation indices for each country. We study the years 2004 and 2019 to avoid looking at cyclical behaviour.[17] We are able to distinguish different patterns across the European countries, identifying four groups with a geographical component:

- **Group 1: Austria, Germany, Belgium, Luxembourg, Ireland and Malta (in general, Western European countries)**. In these countries, movers tend to be less segregated than TCN and closer to natives. At the same time, no major gender differences are found.

- **Group 2: France, the Netherlands, Denmark, Finland, Sweden, UK and Portugal (mostly in Northern Europe).** Foreign-born workers in this group, especially male movers, are overrepresented in a lower number of occupations.

- **Group 3: Estonia, Latvia, Lithuania and Croatia (Eastern Europe)**. This group is characterised by movers' high segregation levels (higher than those of TCN), mainly due to their low presence.

- **Group 4: Cyprus, Hungary, Slovenia, Czech Republic, Spain, Greece and Italy (mainly Southern Europe).** In these countries, there are greater gender differences and segregation levels tend to be higher for both TCN and movers. One of the most notable

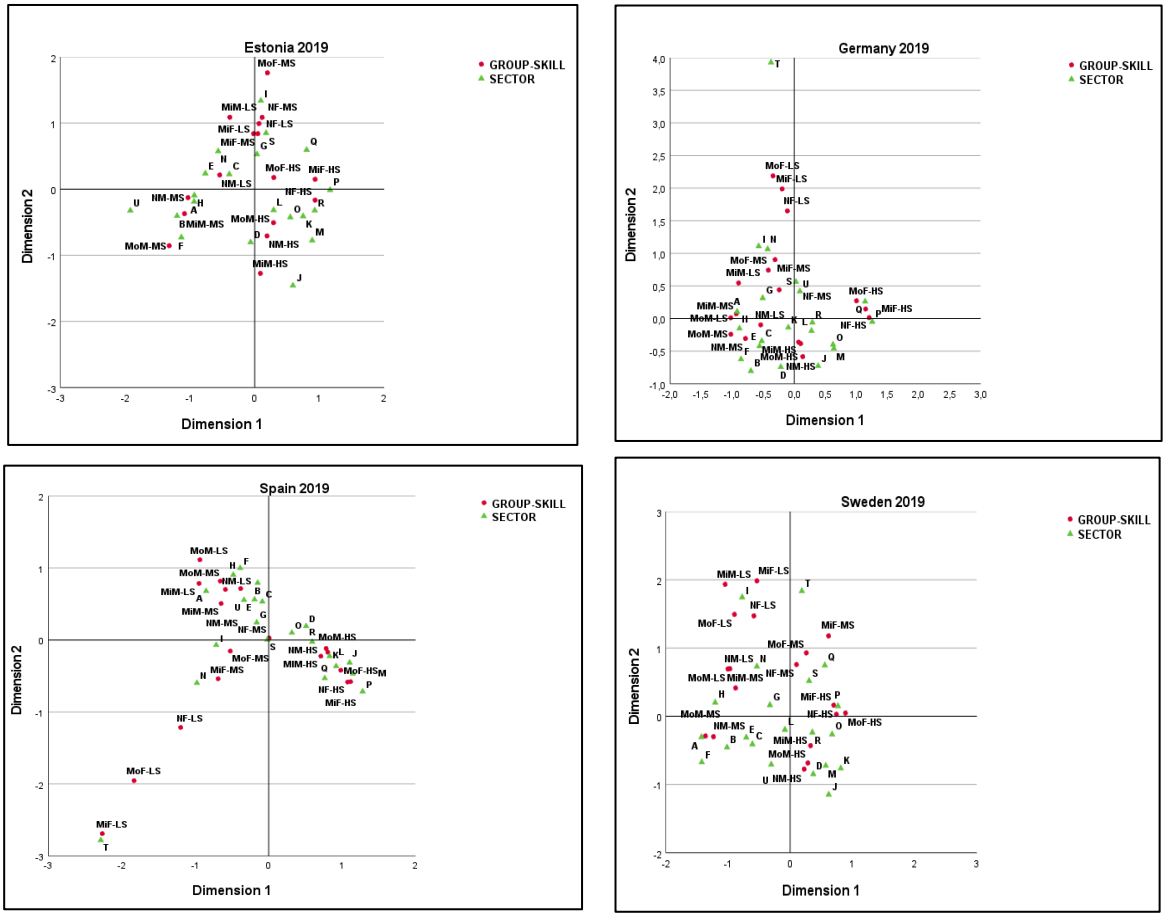
[17] Results are available upon request.

patterns in this group is the overrepresentation of TCN women in activities of households.

To further explore the behaviour of these groups of countries, we focus on one representative country from each group: Germany, Sweden, Estonia and Spain. We examine in more detail their labour niches and segregation levels over the period 2004-2019.

The selected countries have different receiving contexts for foreign-born people. Germany and Sweden are historical receiving countries. Nonetheless, while immigration in Germany is mainly work-related, Sweden receives large numbers of asylum seekers. In contrast, Spain became a destination country at a later stage, in the 1990s. Lastly, Estonia does not have an extensive history as a recipient country, having a low percentage of immigrants.

Figure 7. Labour market participation by origin and gender in Estonia, Germany, Spain and Sweden, 2019.



Source: EU-LFS microdata

Looking at the occupational distribution of different groups of workers in the selected countries, we observe that there are no major differences by origin and gender in high-skilled occupations, as is the case in the EU (Figure 7). Estonia, however, presents greater gender differences and movers' behaviour differs slightly from the rest. This fact is justified by the low presence of movers in this territory. The results show that, as workers move down the skill-level scale, the differences by origin and gender increase, especially in Estonia and Spain, and

the population groups shift to jobs characterised by gender norms. In Spain, the gender difference is greater for workers in medium and low-skilled occupations, and natives' behaviour differs from movers' and, even more, from TCNs'. In Germany and Sweden, foreign-born women and men, especially movers, tend to be close to their native counterparts in the different skill-levels.

With reference to the representation of each group in each occupation, we notice that the labour niches for foreign-born workers vary by country. Foreign-born workers in Estonia (Table 9) tend to concentrate in service activities, but movers are employed in higher skill-level occupations than TCN immigrants.

Table 9. Main labour niches by demographic group in Estonia, 2019. Representation Index.

Group	Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
MoM	Real estate activities	L-MS	1.0307	7.4054	36.8618	0.0000	0.0000	0.0000
	Administrative and support service activities	N-HS	1.1236	0.6403	6.8354	0.8962	0.0000	10.5122
MoF	Administrative and support service activities	N-HS	1.1236	0.6403	6.8354	0.8962	0.0000	10.5122
	Human health and social work activities	Q-MS	0.3835	0.2480	0.0000	1.4972	2.6489	7.6228
MiM	Water supply; sewerage, waste management and remediation activities	E-LS	0.6820	8.9045	0.0000	0.5727	0.0000	0.0000
	Real estate activities	L-MS	1.0307	7.4054	36.8618	0.0000	0.0000	0.0000
MiF	Real estate activities	L-LS	1.0055	1.4888	0.0000	0.0987	7.2732	0.0000
	Education	P-LS	0.0980	1.1906	0.0000	1.6113	3.8366	0.0000

Source: EU-LFS microdata.
Note: for each group only the two occupations with the highest value in the representation index are shown.

For Germany, only female movers enter high-skill occupations (Table 10). Moreover, we detect gender differences among foreign-born workers, as male workers concentrate in construction, agriculture and transportation, and female workers access to household and service activities.

Table 10. Main labour niches by demographic group in Germany, 2019. Representation Index.

Group	Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
MoM	Construction	F-LS	0.8763	2.9344	5.0271	0.2457	1.3786	1.8911
	Agriculture, forestry and fishing	A-LS	0.8345	1.1776	3.1973	0.9169	0.6465	1.4174
MoF	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-HS	0.2792	0.8941	2.1849	0.6616	0.0000	13.7749
	Activities of extraterritorial organisations and bodies	U-HS	0.4792	0.0000	0.0000	1.0910	0.0000	10.8571
MiM	Transportation and storage	H-LS	0.9043	3.3445	2.1732	0.4196	1.2188	2.5292
	Accommodation and food service activities	I-LS	0.2528	3.0846	1.0146	0.7702	4.3864	4.1405
MiF	Real estate activities	L-LS	0.3420	1.1643	0.0000	0.6442	8.6373	3.5321
	Administrative and support service activities	N-LS	0.2196	1.3235	1.3032	0.8690	5.6779	4.6517

Source: EU-LFS microdata.
Note: for each group only the two occupations with the highest value in the representation index are shown.

In the case of Spain (Table 11), the main labour niches of the foreign-born workforce are low-skill occupations. At the same time, there is a clear segmentation by gender, being foreign women mainly employed in activities of household.

Table 11. Main labour niches by demographic group in Spain, 2019. Representation Index.

Group	Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
MoM	Mining and quarrying	B-LS	1.1141	0.0000	6.3909	0.8647	0.0000	0.0000
	Mining and quarrying	B-MS	1.7468	0.7298	4.7933	0.0703	0.1939	0.0000
MoF	Professional, scientific and technical activities	M-LS	0.9477	0.0000	0.0000	1.0333	0.8353	5.4781
	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-LS	0.0133	0.3215	0.0000	0.9619	8.2627	4.9247
MiM	Activities of extraterritorial organisations and bodies	U-MS	0.4998	5.9771	0.0000	0.7986	0.0000	3.5496
	Construction	F-LS	1.1748	5.3340	3.7826	0.0531	0.0708	0.0000
MiF	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-LS	0.0133	0.3215	0.0000	0.9619	8.2627	4.9247
	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T-MS	0.4906	1.8801	0.9285	0.6073	5.9069	2.2243

Source: EU-LFS microdata.
Note: for each group only the two occupations with the highest value in the representation index are shown.

Finally, looking at Sweden, foreign-born workers enter low-skill occupations, with the exception of some high-skilled male movers (Table 12). In this case, foreign-born workers are mainly employed in service activities, but we do not perceive large gender differences.

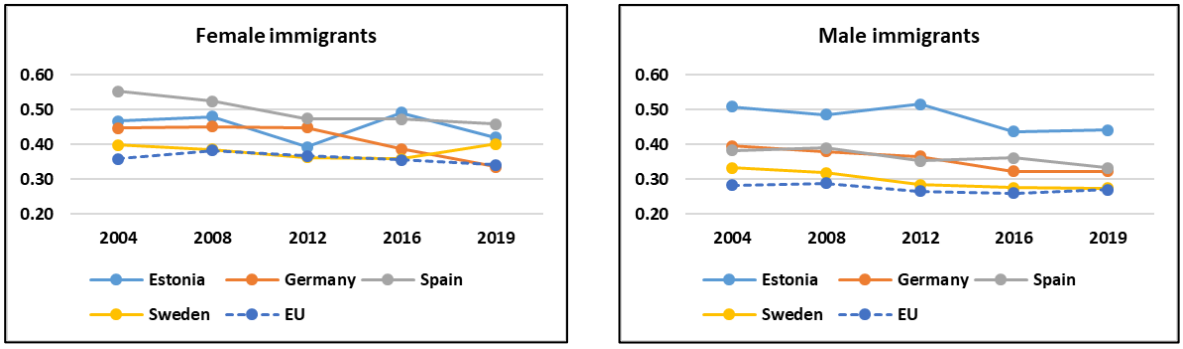
Table 12. Main labour niches by demographic group in Sweden, 2019. Representation Index.

Group	Activity	Activity-Skill	NM	MiM	MoM	NF	MiF	MoF
MoM	Activities of extraterritorial organisations and bodies	U-HS	0.8987	0.0000	22.4539	0.0000	0.0000	0.0000
	Information and communication	J-LS	1.2926	0.0000	16.7321	0.0000	0.0000	0.0000
MoF	Other service activities	S-LS	0.4715	2.9084	0.0000	0.4779	3.8387	4.1719
	Administrative and support service activities	N-LS	0.6505	2.4300	1.5481	0.5320	2.9939	2.7736
MiM	Activities of extraterritorial organisations and bodies	U-MS	0.0000	11.9281	0.0000	0.0000	0.0000	0.0000
	Accommodation and food service activities	I-LS	0.2770	4.2567	0.6256	0.7115	3.2854	0.5635
MiF	Education	P-LS	0.0000	1.2292	0.0000	1.5114	4.6779	0.0000
	Other service activities	S-LS	0.4715	2.9084	0.0000	0.4779	3.8387	4.1719

Source: EU-LFS microdata.
Note: for each group only the two occupations with the highest value in the representation index are shown.

All this evidence points to the existence of different patterns for foreign-born workers within the EU. Therefore, we explore these differences further by measuring the level of segregation of each group in each representative country.

Figure 8. Local segregation of immigrants (females and males) in Estonia, Germany, Spain and Sweden, 2004-2019. Local dissimilarity index.

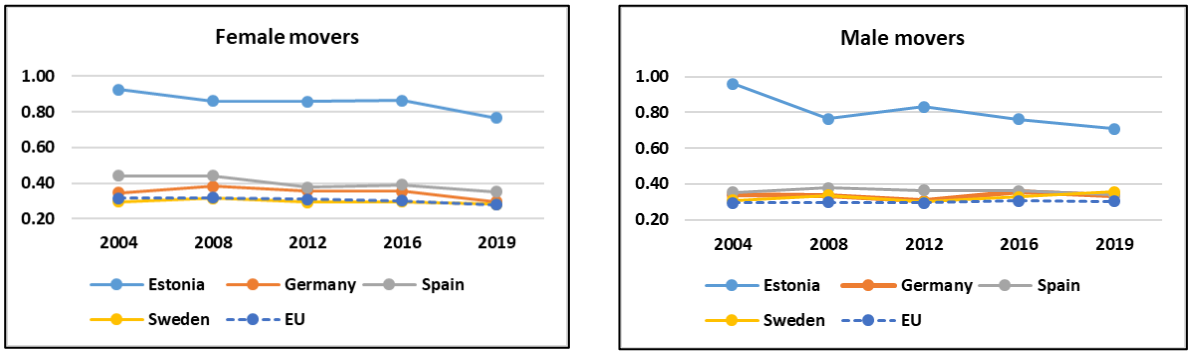


Source: EU-LFS microdata

Figure 8 shows that TCN women experience higher segregation than TCN men throughout the whole period in every country, except Estonia. Extra-EU women are found to be most segregated in Spain. By 2019, segregation levels of immigrant women fall by 10 points in Spain and Germany but increase in Sweden (with the lowest segregation in 2004). In this way, Germany is the country where TCN women are least segregated in 2019, in contrast to Spain.

TCN men's positions differ from that of women. Their segregation levels have been decreasing moderately in the last 15 years. As opposed to women, extra-EU men are least segregated in Sweden and highly segregated in Estonia. Their situation in Spain and Germany resemble.

Figure 9. Local segregation of movers (females and males) in Estonia, Germany, Spain and Sweden, 2004-2019. Local dissimilarity index.



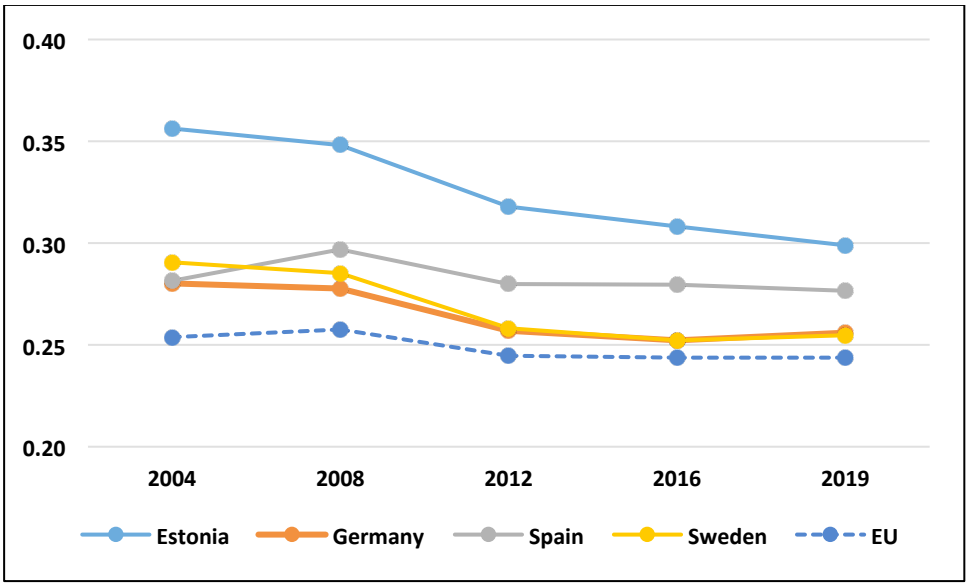
Source: EU-LFS microdata

Regarding EU movers, men and women follow practically the same pattern, being the most segregated in Estonia and the least in Sweden (Figure 9).

Last, we look at the evolution of the overall segregation in the period 2004-2019. In Figure 10, we observe a downward trend in all countries. Estonia has the highest segregation, but it is also the country where the index has fallen the most. By 2019, Sweden is the least segregated

country, along with Germany, with I_P values around 0.26, still higher than the overall EU segregation level.

Figure 10. Overall segregation in Estonia, Germany, Spain and Sweden, 2004-2019. I_p index.



Source: EU-LFS microdata

Based on these results, we confirm that gender, as well as the country of origin, are dimensions that certainly influence occupational segregation, since women are generally more segregated than their male counterparts, and extra-EU migrants tend to have more unequal distributions than movers, except in eastern countries. We find that TCN women are the most segregated group in the majority of countries, while native men and women have the lowest segregation levels. TCN men and movers have different positions in the hierarchy depending on the country. For instance, movers in Western Europe countries are closer to natives' segregation levels.

Over the years, occupational segregation has followed a downward trend. Yet, geographic differences exist. Segregation levels of foreign-born workers are lower in Northern and Western Europe countries, with longer immigration experiences, while Southern and Eastern countries, more recent destinations, still show higher levels of occupational segregation. Furthermore, the gender gap is most pronounced in the South.

These internal differences are justified by the historical, political and economic context of each geographical area. EU member states have experienced different migration flows throughout history, which led to different policies and compositions of foreign-born population within Europe. In consequence, there is significant heterogeneity across countries in relation with colonial heritage and cultural ties (Dustmann and Frattini, 2011).

Western and northern countries made the integration of immigrants a political priority in the 1980s (Schieckoff and Sprengholz, 2021), which has contributed to reduce the levels of segregation. Nevertheless, southern countries, as new recipients of migrants, lacked recruitment schemes, and, until there was a progressive harmonisation of policies in Europe, a

large proportion of migrants were in an illegal situation (Schieckoff and Sprengholz, 2021). Regarding Eastern Europe, their accession to the EU also increased migration flows. However, the presence of migrants in those countries is scarce, and they come mainly from neighbouring countries (Schieckoff and Sprengholz, 2021).

Thus, it would be advisable for countries with recent migration experiences, as well as for the overall EU, to continue developing integration schemes in the future, in order to gradually reduce inequalities in the future occupational distribution of foreign-born workers, especially in the case of women.

4.2. Impact of migration on occupational mobility of natives

Immigrants and natives seem to have unequal occupational distributions. In such a case, we can question whether the arrival of newcomers can induce occupational mobility among natives, from jobs more specific to immigrants to jobs more specific to natives.

We refer only to third-country national migrants, as EU-born workers tend to behave similarly to natives. For this reason, we assume that the internal mobility of workers within the EU does not affect significantly native workers, and so, this section studies the effect of migration on the occupational mobility of natives.

Moreover, our hypothesis is that foreign-born workers do not compete with university-educated natives (recall that foreign-born are mainly employed in low and medium-skilled occupations). Therefore, the study focuses on native workers without a university degree.

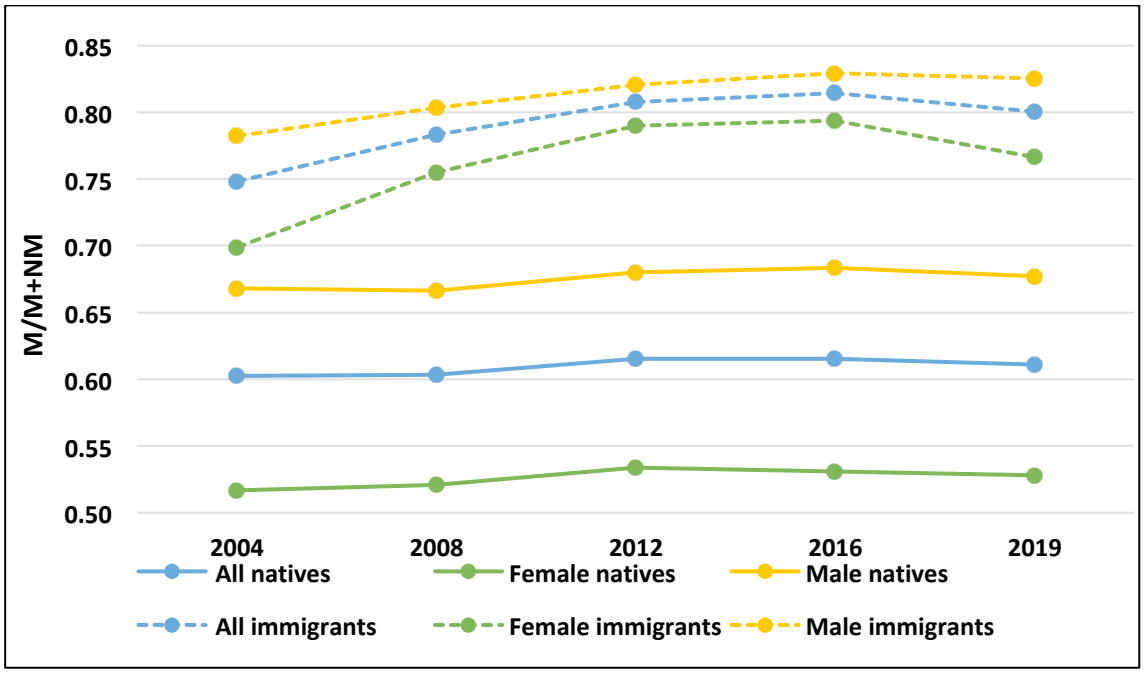
We have previously seen that the occupational distribution pattern of immigrants is different from that of natives and, hence, the European labour market is segregated by origin. Thus, immigrants specialise in manual tasks and have a low presence in non-manual occupations. We therefore hypothesise that their integration into the labour market in these manual occupations may displace less-educated natives from these occupations to others that require different types of skills. We have also seen that gender differences are more pronounced among less skilled workers and many immigrants move to those occupations characterized by gender norms. In consequence, we can expect the effect of immigrants on natives to differ among men and women.

The test of this hypothesis is based on microdata from the EU-LFS. Data are grouped at the regional level (NUTS2 level) and cover 155 European regions. It covers the period 2008-2019: considering the years 2008, 2012, 2016 and 2019 in the analysis.

The study considers occupational categories according to the International Standard Classification of Occupations (ISCO) at the three-digit level. We use two different classification criteria to define manual and non-manual occupations. First, the standard blue-collar jobs (manual, M) are distinguished from white-collar jobs (non-manual, NM) as follows: codes 111 to 422 are considered white-collar jobs and codes 511 to 933 blue-collar jobs (M-NM definition 1). Second, we apply the ILO classification on skill-levels, distinguishing high-skill occupations as non-manual (skill-levels 1 and 2) and medium and low-skill occupations as manual (skill-levels 3 and 4) (M-NM definition2).

Using the first definition, Figure 11 provides evidence that immigrants entering the EU labour market over the period 2004-2019 have a comparative advantage over native workers in performing manual tasks, for both male and female labour force. Consequently, immigrants are more likely than natives to specialise in the performance of manual tasks.

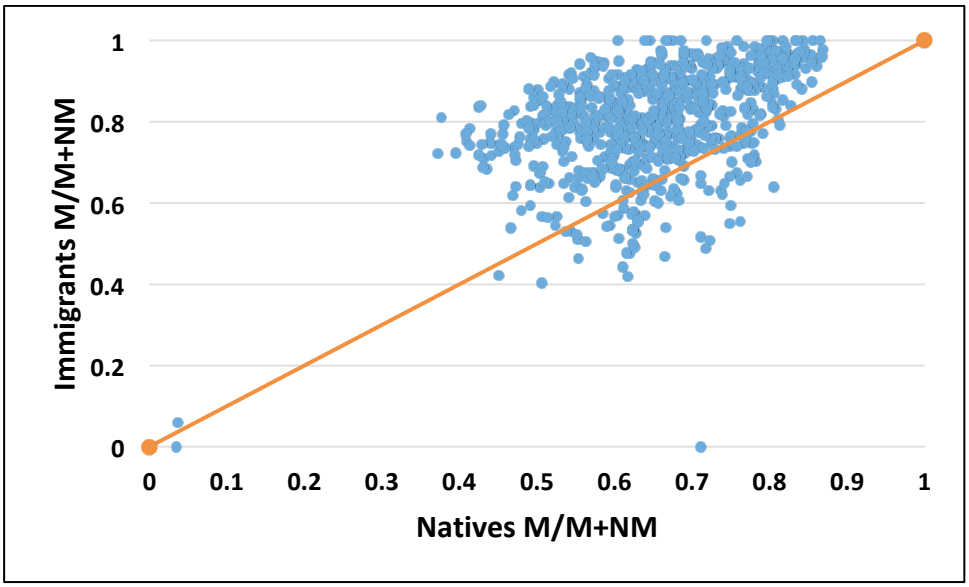
Figure 11. Relative provision of manual occupations (natives and immigrants), 2004-2019.



Source: EU-LFS microdata

Figure 12 provides additional evidence of this higher proportion of immigrants versus natives in manual occupations. Each dot on the graph represents a "region-year" percentage ratio of immigrants to natives employed in manual occupations. Most of the dots are to the left of the diagonal, indicating that in these regions the concentration of immigrants in manual occupations is higher than that of natives.

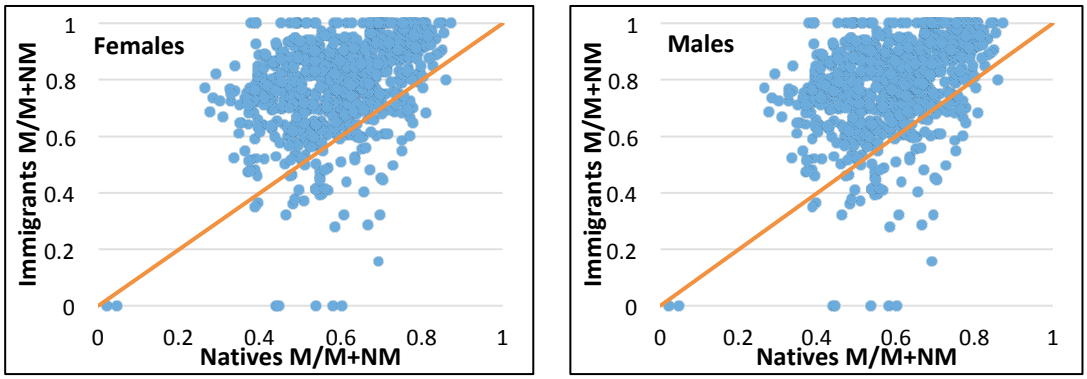
Figure 12. Native versus immigrant relative manual labour supply, 2004-2019.



Source: EU-LFS microdata

In Figure 13, we can observe that the same is true among men and among women, respectively.

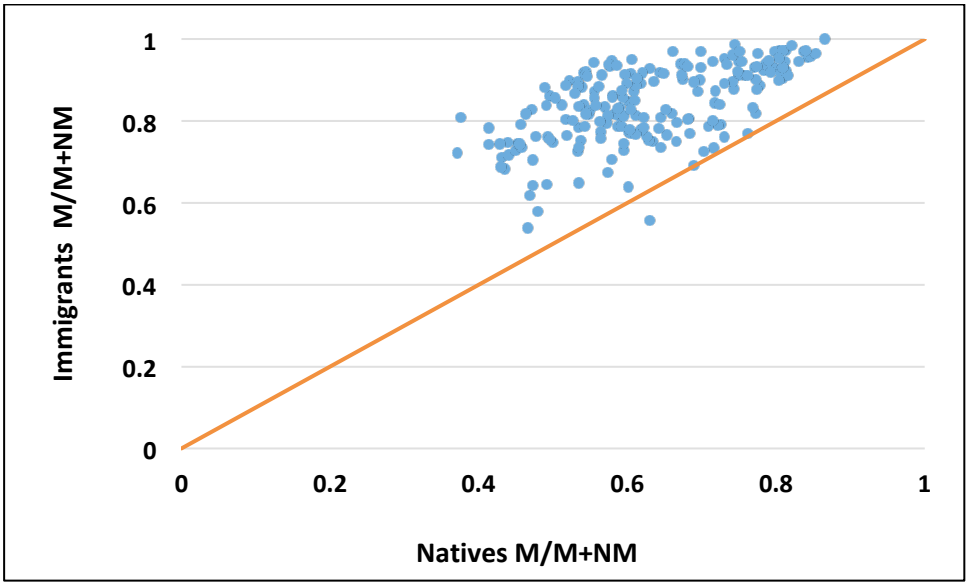
Figure 13. Native versus immigrant relative manual labour supply, females and males.



Source: EU-LFS microdata

This comparative advantage is more evident if only regions where migrants account for more than 10% of their labour force are considered (Figure 14).

Figure 14. Native versus immigrant relative manual labour supply (regions with more than 10% immigrants in the labour force).



Source: EU-LFS microdata

All these facts support our initial assumption. Our aim, then, is to quantify the possible effect of immigrants (who are concentrated in manual jobs) on the mobility of unskilled native workers from manual to non-manual occupations.

Following Peri and Sparber (2009), we estimate the three models (1)-(3) for the two different definitions of manual and non-manual occupations. First, we look at the impact of non-university-educated TCN migrants. We then analyse the effect of the university and non-university-educated recent TCN migrants. We assume that newly arrived (5-year residence or less in the host country) may have early language difficulties and lack skills for certain non-manual tasks, and they are therefore more likely to be employed in manual tasks. In addition, they tend to accept any work regardless of their level of education. Thus, the university-educated immigrants are also included, as they are in a position to compete with less qualified native workers, at least in the years immediately following their arrival. We estimate all models for both male and female workers.[18]

[18] These models are estimated using panel data covering 155 European regions for 4 years (a total of 620 observations), and both sexes. We have tested previously whether a pooled panel data model proves suitable, but the specification of the model is improved if heterogeneity among regions and periods is taken into account. Both effects, individual and temporal, are significant. The choice between a fixed effects model and a random effects model is based on the results of the Hausman test. Overall, a fixed model proves more suitable. Standard errors are heteroscedasticity-robust and clustered by region.

Table 13. Impact of non-university-educated TCN migrants on the relative provision of manual (and non-manual) occupations by native workers.

		Males			Females	
		M-NM Definition1	M-NM Definition2		M-NM Definition1	M-NM Definition2
$Ln\left(\frac{M_N}{M_N+NM}\right.$	$\hat{\beta}_m^M$	-0.1338 (-1.440)	-0.1432 (-1.837)*	$\hat{\beta}_f^M$	-0.2847 (-1.982)**	-0.2223 (-2.412)**
$Ln\left(\frac{NM_N}{M_N+NM}\right.$	$\hat{\beta}_m^{NM}$	0.6324 (2.402)**	0.7641 (2.259)**	$\hat{\beta}_f^{NM}$	0.0806 (0.159)	0.2293 (0.194)
$Ln\left(\frac{M_N}{NM_N}\right)$	$\hat{\beta}_m$	-0.7661 (−2.209)**	-0.9073 (−2.232)**	$\hat{\beta}_f$	-0.3653 (−0.507)	-0.4516 (−0.3386)

Source: EU-LFS microdata.
Note: t statistics are shown in parentheses. All regressions include age, educational attainment, level of regional economic and technological development as control variables, as well as time effects (620 observations).
* Rejection of null hypothesis at the 10% significance level.
** Rejection of null hypothesis at the 5% significance level.

Table 13 shows the estimates of β, β^M and β^{NM} for two different definitions of manual and non-manual occupations (for male and female workers, respectively).

Some key findings emerge. First, the estimates suggest that a 10% increase in the share of less-educated male immigrant workers in the overall male labour force causes a 7.6%-9.0% decrease in the relative provision of manual versus non-manual tasks among low-skilled native workers ($\hat{\beta}_m$). Moreover, this 10% increase in the proportion of these immigrants is associated with a low 1.5% decrease in native's supply of manual occupations ($\hat{\beta}_m^M$), and with a significant 6.3%-7.6% rise in native's supply of non-manual occupations ($\hat{\beta}_m^{NM}$).[19]

Second, the results for women are quite different. In this case, significant effects are only found in the model (2). The estimates suggest that a 10% increase in the female foreign-born share leads to a 2.2%-2.8% decrease in native's manual occupations. However, the effect on non-manual occupations does not seem to be large enough to be detected by the model as significant, although the estimates have the expected sign. The low relative weight of female immigrants in some European regions may explain this result.

Therefore, we obtain the initially expected results. The impact of the presence of immigrants on lower-educated natives in the different European regions depends on gender. It is significant and of expected sign for male workers, but the effects on female workers are less clear. The estimates suggest that the displacement of native-born women from manual occupations is significant, and that this displacement is greater than for men (Amuedo-Dorantes and De la Rica, 2011; De la Rica and Polonyankina (2013) and Aldaz and Eguia (2016) find similar results for Spain). These results may suggest that native and immigrant women workers do not play as competitive a role as men. This means that men (natives and immigrants) can compete for the same jobs, and thus, the displacement of natives to other

[19] Aldaz and Eguía (2016) find a slightly higher effect on the supply of manual occupations to natives in Spain, due to an increase in the share of male non-university-educated foreign-born workers. However, a slightly smaller impact was estimated in Canada (Jiang, 2021) and in the USA (Peri and Sparber, 2009) when considering all workers (male and female jointly).

jobs is not so significant. Women, however, are less competitive and show a certain degree of complementarity.

Table 14. Impact of recent TCN migrants on the relative provision of manual (and non-manual) occupations by male native workers.

		Explanatory variable: L_I/L			
		L_I: university and non-university-educated recent TCN migrants		L_I: non-university-educated recent TCN migrants	
		M-NM Definition1	M-NM Definition2	M-NM Definition1	M-NM Definition2
$Ln\left(\frac{M_N}{M_N + NM_N}\right)_m$	$\hat{\beta}_m^M$	−0.3405 (−1.684)*	−0.3921 (−1.767)*	-0,0347 (-0.1399)	−0.2129 (−1.025)
$Ln\left(\frac{NM_N}{M_N + NM_N}\right)_m$	$\hat{\beta}_m^{NM}$	0.9941 (2.093)**	1.5420 (2.149)**	0.6183 (0.877)	1.3281 (1.370)
$Ln\left(\frac{M_N}{NM_N}\right)_m$	$\hat{\beta}_m$	-1.3346 (−2.018)**	−1.9342 (−2.133)**	−0.6530 (−0.704)	−1.5409 (−1.271)

Source: EU-LFS microdata.

Note: t statistics are shown in parentheses. All regressions include age, educational attainment, level of regional economic and technological development as control variables, as well as time effects (616 observations, because data on immigrants by length of residence are not available for Malta).

* Rejection of null hypothesis at the 10% significance level.

** Rejection of null hypothesis at the 5% significance level.

Third, Table 14 presents estimates of the effect of recent TCN immigrants on the occupational mobility of male natives. Firstly, by including newcomers (immigrants with 5-year residence or less), we do not discriminate by educational attainment. We believe that their behaviour should be the same, as the university degree of many immigrants is often not recognised by the labour market in the short term. Therefore, all these newcomers may experience early difficulties in certain non-manual tasks; hence, they are expected to be hired for manual jobs, potentially displacing natives. The results confirm our hypothesis. The effects are significant and larger than initially reported, suggesting that the occupational mobility of unskilled male native workers is affected by university and non-university-educated recent immigrants.

Nonetheless, when considering only non-university-educated recent TCN migrants, the effect is not significant, although the signs of the estimates are as expected. The weight of immigrants is small in some European regions, and even smaller when the group is restricted by length of residence and educational level (as well as by gender). We consider that these results do not necessarily lead to a rejection of our initial expectations. The lack of statistical significance could be due to the small relative weight of these recent immigrants in the sample, which means that their effect is not detected by the model. The same lack of significance is found for the impact of recent TCN female immigrants (regardless of educational level) on native female workers.

Finally, these results are robust to different definitions used for manual and non-manual occupations.[20] The inflow of immigrants into the European regions causes a shift of natives towards non-manual occupations at the expense of manual occupations. In consequence, these results seem to suggest an occupational mobility of natives due to the entry of immigrants in the EU.

4.3. Occupational mobility and wage assimilation of immigrants in Spain

Finally, our aim is to analyse the employment situation of migrants in the host country with regard to their insertion, occupational mobility and wage assimilation.

Immigrants' insertion in the labour market is analysed from two points of view: professional category and wage level. In general, this group accesses the lowest categories of the occupational scale and presents an entry wage gap in relation to natives. This result raises two questions: does their permanence in the labour market include mobility that allows their integration into the labour market under similar conditions to natives? Is there a wage convergence that causes the wage gap by origin of the worker to close over time?

Our initial hypotheses are based on previous results. The labour market is segmented by origin and gender. Immigrants' insertion in the host labour market occurs mainly in the lowest categories of the occupational scale, with some occupations being more specific to immigrant women.

Nevertheless, as suggested by other authors, after the initial occupational downgrading upon arrival from their country of origin, occupational progress is expected as the residence lengthens (Chiswick, 1978 for the USA, Vidal-Coso (2019) for Switzerland).

Likewise, even though immigrants' wage at entry into the host labour market is lower than that of natives, we expect this wage gap to close over time, achieving a labour and wage assimilation of immigrants (Chiswick (1978) for men in the USA, Izquierdo et al. (2009) for Spain).

Insertion, occupational mobility and wage assimilation of immigrants are analysed with data from Spain, a country that has welcomed large migratory flows in a short period, positioning itself among the first EU member states with the highest levels of foreign-born individuals.

4.3.1. Immigrant insertion in the labour market

Settled immigrant workers in Spain, and affiliated to the Social Security system, come mostly from countries outside the EU (around 70%), although 12% are born in the EU-15 countries. Romania, Morocco, Ecuador and Colombia are the main origin of these workers (36.4%). Even though gender differences are not significant, Latin America sends more women than men to Spain, while the EU does the opposite. The differences are more pronounced if the immigrant is of African origin, since slightly over 70% are male. This immigrant profile influences their insertion into the labour market.

Focusing on the Social Security contribution groups, more than a half of immigrants are concentrated in the categories that require less qualification (50.3% in G8-G10; 57.31%

[20] These results are also robust to different definitions of the control variables (average age, education and activity level).

including *GD-Domestic Employees*). Only in G10 (*Unskilled Workers*), we find 23.33% of immigrants, while just 6% work in G1 and G2 (Table 15).

Table 15. Distribution of the employed population affiliated to the Social Security (native and immigrant) by contribution group, 2019.

Group	Concentration index		Representation index	
	Immigrant	Native	Immigrant	Native
G1-Engineers and University Graduates	4.20%	8.39%	55.19%	110.21%
G2-Engineering Technicians and Qualified Assistants	1.84%	6.83%	31.20%	115.68%
G3-Administrative and Workshop Managers	1.89%	4.06%	51.61%	111.03%
G4-Unqualified Assistants	2.11%	3.44%	66.22%	107.70%
G5-Administrative Officials	5.27%	10.82%	53.80%	110.53%
G6-Subordinates	3.22%	3.84%	86.57%	103.06%
G7-Administrative Assistants	10.16%	12.16%	86.16%	103.15%
G8-First and second degree skilled workers	14.15%	13.95%	101.14%	99.74%
G9-Third degree skilled Workers and Specialists	12.80%	8.37%	139.30%	91.04%
G10-Unskilled Workers	23.33%	11.59%	169.41%	84.18%
GD-Domestic Employees	7.01%	0.80%	359.37%	40.89%
GSW-Self-employed Workers	14.04%	15.77%	90.85%	102.08%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: MCVL-2019
Note: categories of immigrants, categories with underrepresentation of immigrants, categories not characterised by origin of the worker

Nevertheless, 15.2% of natives belong to the two highest groups on the professional ladder, and around 34% to the lowest groups (G8-G10). G1 (*Engineers and University Graduates)* accounts for 8.39% and group 2 (*Engineering Technicians and Qualified Assistants)* for 6.83%, substantially higher percentages than those of the immigrant population (4.2% and 1.84%, respectively). The distribution of natives among the different contribution groups is, therefore, far from being uniform, but the differences are more pronounced among immigrants.

The Representation Index (RI), in turn, supports these results. Following Hakim (1993), we find as categories of immigrants precisely those that require less qualification: *GD-Domestic Employees, G10-Unskilled Workers* and *G9-Third degree Skilled Workers and Specialists.* On the contrary, this group is underrepresented in the categories that occupy the first positions (G1-G5). The rest of the categories *(GSW-Self-employed workers, G6-Subordinates, G7-Administrative Assistants* and *G8-First and Second degree Skilled Workers)*, however, cannot be characterised by the worker's origin. In the case of natives, the notable underrepresentation of the group among domestic workers stands out (Table 15).

Looking at the representation of this immigrant group according to gender, *GD-Domestic Employees* is female-dominated, followed by *G7-Administrative Assistants, G5-Administrative*

Officials and *G2-Engineering Technicians* (Table 16). In contrast, the group *G8-First and Second degree Skilled Workers* is male-dominated. The other categories are gender integrated.[21]

Table 16. Distribution of the employed immigrant population by gender and contribution group, 2019.

Group	Concentration index		Representation index	
	Female	Male	Female	Male
G1	4.06%	4.32%	96.72%	102.87%
G2	2.33%	1.42%	126.32%	76.94%
G3	1.65%	2.09%	87.58%	110.88%
G4	2.28%	1.96%	107.97%	93.02%
G5	6.71%	4.00%	127.42%	75.99%
G6	3.50%	2.97%	108.76%	92.33%
G7	13.42%	7.30%	132.10%	71.88%
G8	7.92%	19.59%	56.02%	138.52%
G9	11.46%	13.98%	89.52%	109.18%
G10	20.80%	25.54%	89.18%	109.48%
GD	14.23%	0.68%	203.05%	9.74%
GSW	11.63%	16.14%	82.89%	114.99%
Total	**100%**	**100%**	**100%**	**100%**

Source: MCVL-2019

Note: feminine category, masculine category, integrated category

The concentration indices reinforce the presented results.[22] It is observed that, even though men and women are concentrated in the categories that require less qualification, the percentages are higher for men than for women: 59.1% of men and 40.2% of women are in the groups G8-G10. Notable differences can be seen in *GD-Domestic Employees*, although the presence of men is testimonial (0.68%), 14.23% of women concentrate in this activity. The female concentration is also substantially higher in *G7-Administrative Assistants* (13.42% versus 7.3%). It is evident, then, that GD is a labour niche for immigrants and, particularly, for female immigrants: domestic care is the most common gateway for non-EU immigrant women into the Spanish labour market.

The Spanish labour market is, in consequence, segmented according to the origin of the worker. While foreign-born people are more concentrated (and overrepresented) in the lower groups of the professional categories, natives have a greater presence in those positions that require higher qualifications. Focusing on foreigners, there is also a clear segmentation by gender. Several questions emerge from these results: first, if immigrants fit into some labour niches (the lowest on the occupational scale), do they converge towards natives (labour

[21] We consider feminised (masculinised) groups those that present an overrepresentation (underrepresentation) of the respective group in relation to their weight in total employment, a RI>125 (RI<75). A 0.75<RI<125 index would imply that the groups are not characterised by the gender of the workers (gender integrated).

[22] The concentration index is calculated as the quotient between the number of workers of a demographic group in an occupation and the total number of employed workers in that group.

integration)? Are there differences by entry cohort? Second, do they assimilate with natives over time? Third, are there gender differences? And by country of origin?

4.3.2. Immigrant occupational mobility

In order to answer these questions, we compare each individual's first occupation to their current occupation in 2019 through their changes of position in the scale of professional groups, and we create mobility tables (Table 17).

Table 17. Percentage of Immigrant workers by Initial Contribution Group and Current Contribution Group. Mobility Table.

	LAST CONTRACT/CURRENT STATUS													
	Group	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**	**2.15**	0.10	0.07	0.03	0.09	0.01	0.06	0.02	0.01	0.02	0.00	0.32	**2.89**
	G2	0.20	**0.58**	0.05	0.01	0.06	0.01	0.05	0.02	0.01	0.01	0.00	0.13	**1.14**
	G3	0.13	0.06	**0.48**	0.03	0.08	0.01	0.05	0.05	0.03	0.03	0.00	0.18	**1.15**
	G4	0.10	0.05	0.05	**0.43**	0.10	0.04	0.15	0.14	0.18	0.17	0.02	0.21	**1.64**
	G5	0.29	0.15	0.16	0.11	**1.28**	0.09	0.41	0.26	0.21	0.21	0.03	0.56	**3.77**
	G6	0.05	0.06	0.04	0.06	0.15	**0.59**	0.24	0.24	0.28	0.30	0.04	0.25	**2.32**
	G7	0.48	0.25	0.29	0.25	1.08	0.27	**3.06**	0.64	0.64	0.70	0.12	1.14	**8.91**
	G8	0.14	0.09	0.16	0.19	0.37	0.29	0.64	**3.84**	1.12	1.15	0.11	1.52	**9.62**
	G9	0.18	0.13	0.20	0.32	0.63	0.46	1.06	2.30	**4.23**	2.11	0.26	1.79	**13.68**
	G10	0.28	0.22	0.25	0.44	0.88	0.80	3.07	4.96	4.36	**15.32**	0.74	3.01	**34.33**
	GD	0.06	0.08	0.06	0.18	0.36	0.54	1.09	1.06	1.33	2.66	**5.62**	0.88	**13.92**
	GSW	0.14	0.07	0.07	0.07	0.17	0.11	0.27	0.61	0.40	0.63	0.06	**4.04**	**6.63**
	Total	**4.20**	**1.84**	**1.89**	**2.11**	**5.27**	**3.22**	**10.16**	**14.15**	**12.80**	**23.33**	**7.01**	**14.04**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column

The data grouped in Table 18 provide evidence of occupational mobility in the immigrant group. Even though 41.62% remain in the same contribution group with which they entered the labour market (see the elements along the main diagonal of Table 17), 58.38% change groups.[23] Of the latter, 34.12% experience progress in their professional group (left of the main diagonal), and only 11.67% have vertical downward mobility (right of the main diagonal). In addition, 2.59% of those who entered as self-employed went on to work as employees and 9.99% of those who started in the G1-G10 opted to end up working as self-employed.

[23] Aysa-Lastra and Cachón-Rodríguez (2013), using the 2007 National Immigrant Survey, find that almost half of immigrants remain in the same occupational group when comparing their first and last contracts in Spain. The discrepancy with our results lies in the period under study. Given that the great waves of immigrants arrived at the beginning of the 21st century, in 2007 they had little time to move up the career ladder.

Table 18. Type of occupational mobility by gender, cohort and origin.

	Stay	Rise	Descend	From other groups to GSW	From GSW to other groups
TOTAL	**41.62**	**34.12**	**11.67**	**9.99**	**2.59**
GENDER					
MEN	40.80	33.51	11.01	11.64	3.05
WOMEN	42.57	34.83	12.43	8.11	2.07
COHORT					
2004-2007	32.12	41.53	11.62	12.43	2.30
2008-2013	39.43	34.40	12.80	10.31	3.06
2014-2019	59.34	23.04	11.77	3.43	2.43
ORIGIN					
EU15	45.67	27.34	10.62	12.78	3.59
Enlargement countries	47.99	30.17	9.47	7.18	5.19
Latin America	38.33	38.40	13.23	8.35	1.69
Africa	47.88	33.75	10.06	6.36	1.95

Source: MCVL-2019

Therefore, the data proves that a significant percentage of immigrants advance up the occupational ladder. In fact, there are currently lower concentrations in the lower categories and higher concentrations in the higher ones. Thus, 71.55% started their contracts in the groups G8-G10 and GD, while only 57.29% are currently employed in these groups. The concentration in the top three groups (G1-G3), nonetheless, has gone from 5.18% to almost 8%. Hence, these immigrants appear to be managing to distribute themselves more evenly along the occupational ladder as they integrate into the labour market.

The most stable group is *G1-Engineers and University Graduates*. *Senior management personnel*, since 74.39% of the immigrants who entered this group remain in it at present.[24] Another 11.07% choose to be self-employed. The rest is distributed among the other categories. However, almost 2% have entered the four lowest groups (G8-G10 and GD).

Of those who joined *G2-Engineering Technicians, Experts and Qualified Assistants,* which also requires high qualifications, 68.42% remain in or climb to the higher group, with a transfer of 11.4% to the group of self-employed workers.

In *G4-Unqualified Assistants* and *G6-Subordinates* only one in four of those who entered these groups currently remain, and around 48% regress to the lower categories. Besides, 12.19% and 15.52% of those who entered categories G4 and G6, respectively, have advanced in the professional category.

In the lower category, only 44.62% of those who joined *G10-Unskilled Workers* remain in it after a certain period of time. Whereas 2.16% go to GD, the rest go on to occupy positions mainly in groups G8-G9 (27.15%) and self-employed workers group (8.77%).

[24] Note that they cannot move up the career ladder, as G1 is the highest. Likewise, those who enter in the lowest category cannot be relegated further. In other words, there is a "ceiling effect" and a "floor effect".

Regarding domestic employees, 40.37% of those who entered this category remain as such nowadays, 36.28% have moved to groups G8-G10, and even 1.44% are now employed in the three highest groups (G1-G3).

Therefore, career progression occurs mostly among contiguous groups, in the same "labour segment". Nevertheless, 2.18% managed to place themselves in the top 3 contribution groups.[25]

Our results are in line with Aysa-Lastra and Cachón-Rodríguez (2013), Arranz et al. (2017) and Simon et al. (2014) who detect that once they are in the host labour market, immigrants experience vertical mobility, not along the entire occupational ladder but within a specific segment. The Spanish case contrasts with previous evidence for other advanced countries, where immigrants experience an initial downgrading on arrival in the host labour market but a later occupational progress during their stay in the host country (Chiswick (1978) for the USA, and Vidal-Coso (2019) for Switzerland).

If we perform the analysis taking the last contract as a reference, we can observe that a high percentage of workers who are currently in the highest groups, entered as administrative workers in G7 (11.43% in G1, 13.59% in G2 and 15.34% in G3). Furthermore, a high percentage who are currently in groups G1 to G7 entered groups G8-G10 and GD as well. It is clear, then, that a large number of immigrants enter the labour market in the lowest groups in the professional category, which is their gateway to higher categories. Although mobility occurs mainly between contiguous groups, other workers have also made significant progress up the career ladder.

Focusing on the opposite pole, the lower category groups have nurtured each other.[26]

In addition, almost 30% of the current self-employed workers were also self-employed in their first contract, and 45% were in the G8-G10 groups. It is evident, therefore, that this group has been nourished mainly by the groups with the lowest qualifications, although it should be noted that not exclusively, since around 5% come from the first three groups in the professional hierarchy. Self-employed workers play an important role in the immigrant labour market and become more entrenched as they familiarise with the labour market.

These mobility patterns and assimilation differ by gender, as we observe in Tables 19 and 20.

[25] Despite that, several immigrants advance in the career ladder, downward occupational mobility is also present in some of them (14.53% of those who joined G1 or-17.32% of those who entered G9).

[26] 65.55% of the current labourers (G10) started with the same category, another 11.4% as domestic workers and 9.04% in the group G9 (the immediately preceding group in the professional hierarchy). Likewise, 80.17% of the current domestic workers were in the same position when they signed their first contract, and 10.56% belonged to the G10 group.

Table 19. Percentage of Immigrant female workers by Initial Contribution Group and Current Contribution Group. Mobility Table.

	LAST CONTRACT/CURRENT STATUS													
	Group	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**	**1.94**	0.11	0.06	0.03	0.11	0.01	0.08	0.02	0.01	0.01	0.00	0.24	**2.63**
	G2	0.20	**0.74**	0.06	0.02	0.08	0.02	0.08	0.02	0.01	0.02	0.00	0.12	**1.37**
	G3	0.09	0.06	**0.41**	0.03	0.08	0.01	0.07	0.04	0.02	0.03	0.00	0.14	**0.97**
	G4	0.10	0.07	0.04	**0.47**	0.13	0.06	0.18	0.11	0.18	0.16	0.04	0.21	**1.73**
	G5	0.31	0.19	0.20	0.14	**1.60**	0.12	0.62	0.23	0.21	0.21	0.05	0.49	**4.37**
	G6	0.05	0.10	0.04	0.06	0.18	**0.59**	0.31	0.16	0.22	0.26	0.08	0.21	**2.27**
	G7	0.57	0.34	0.37	0.33	1.58	0.35	**4.33**	0.61	0.78	0.85	0.24	1.35	**11.70**
	G8	0.13	0.10	0.09	0.16	0.39	0.22	0.76	**1.93**	0.80	0.75	0.20	0.92	**6.44**
	G9	0.17	0.16	0.13	0.30	0.77	0.44	1.40	1.40	**3.98**	1.90	0.52	1.43	**12.59**
	G10	0.26	0.23	0.14	0.37	0.93	0.66	3.18	1.66	2.78	**11.50**	1.42	1.66	**24.78**
	GD	0.11	0.14	0.09	0.33	0.68	0.92	2.09	1.48	2.17	4.66	**11.55**	1.35	**25.57**
	GSW	0.13	0.08	0.04	0.06	0.18	0.10	0.32	0.27	0.30	0.46	0.11	**3.52**	**5.59**
	Total	**4.06**	**2.33**	**1.65**	**2.28**	**6.71**	**3.50**	**13.42**	**7.92**	**11.46**	**20.80**	**14.23**	**11.63**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Table 20. Percentage of Immigrant male workers by Initial Contribution Group and Current Contribution Group. Mobility Table.

	LAST CONTRACT/CURRENT STATUS													
	Group	**G1**	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**	**2.33**	0.09	0.08	0.03	0.08	0.01	0.04	0.03	0.02	0.02	0.00	0.39	**3.12**
	G2	0.19	**0.44**	0.04	0.01	0.05	0.01	0.02	0.02	0.00	0.01	0.00	0.15	**0.95**
	G3	0.16	0.07	**0.55**	0.03	0.08	0.01	0.04	0.06	0.04	0.04	0.00	0.22	**1.30**
	G4	0.10	0.04	0.07	**0.39**	0.08	0.03	0.11	0.16	0.17	0.19	0.00	0.22	**1.56**
	G5	0.27	0.11	0.13	0.08	**1.00**	0.07	0.23	0.30	0.22	0.20	0.00	0.62	**3.24**
	G6	0.06	0.03	0.05	0.06	0.12	**0.59**	0.18	0.32	0.33	0.34	0.01	0.28	**2.36**
	G7	0.40	0.17	0.22	0.19	0.64	0.19	**1.95**	0.66	0.51	0.58	0.01	0.96	**6.48**
	G8	0.15	0.08	0.22	0.21	0.36	0.34	0.55	**5.51**	1.40	1.51	0.03	2.04	**12.40**
	G9	0.19	0.10	0.27	0.33	0.51	0.47	0.77	3.09	**4.46**	2.30	0.04	2.10	**14.63**
	G10	0.31	0.21	0.35	0.50	0.84	0.92	2.97	7.84	5.75	**18.66**	0.15	4.20	**42.70**
	GD	0.03	0.02	0.04	0.06	0.07	0.21	0.21	0.69	0.60	0.91	**0.42**	0.46	**3.71**
	GSW	0.15	0.05	0.09	0.07	0.17	0.12	0.23	0.91	0.48	0.78	0.01	**4.50**	**7.55**
	Total	**4.32**	**1.42**	**2.09**	**1.96**	**4.00**	**2.97**	**7.30**	**19.59**	**13.98**	**25.54**	**0.68**	**16.14**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

While one in four immigrant women belongs to the domestic care scheme when they sign their first contract in the host country, after integrating into the labour market they access other jobs that require more qualifications. This leads to the concentration in this group to fall from 25.57% to 14.23% (even so, 95% of migrants who dedicate themselves to these household tasks are women in 2019). Almost another 25% of the female group is absorbed by Group 10. Nonetheless, this percentage, although somewhat lower, is similar when analysing the current situation (20.80%).[27]

Regarding men, it is also G10 where migrants work most frequently when they formalise their first contract (42.70%). In fact, almost 70% work in the three lowest groups (8, 9 and 10). Nevertheless, they show progress in their career, as this percentage is not so high at present.

Taking the last contract as a reference, a high percentage of female workers who are currently in the highest categories entered as administrative workers (G7), a percentage that in some cases doubles the number of men in these categories (22.42% of women compared to 10.53% of men in the group G3, for instance). In consequence, it seems that the G7 group is the origin

[27] Although the percentages of concentration in group 10 do not differ substantially, what does change is the sector of activity in which this group is concentrated. Thus, being in G10, when they enter the labour market, around half of the employees are engaged in three activities (agriculture 18.93%, hospitality 18.30%, and administrative activities and auxiliary services 14.64%). However, this percentage increases to 70% when looking at their current contract.

of a notable percentage of immigrant women who are currently in the highest categories (even though it is also the destination of some who entered the lower categories).

Note also that both women and men double their concentration in the Special Regime for Self-Employed Workers if we compare their first and last contracts.

Table 21. Distribution of the immigrant population according to entry cohort by contribution group in their first and last contracts.

Entry in:	2004-2007		2008-2013		2014-2019	
Group	First Contract	Last Contract	First Contract	Last Contract	First Contract	Last Contract
G1	1.45	2.59	3.00	4.03	3.94	4.75
G2	0.54	1.20	0.92	1.44	1.34	1.81
G3	0.78	1.57	0.86	1.50	1.43	1.76
G4	1.02	1.70	1.57	1.87	2.43	2.52
G5	2.64	4.29	3.07	4.19	4.45	5.71
G6	1.65	3.20	2.25	2.94	2.84	3.16
G7	6.26	8.82	7.10	9.28	11.37	12.65
G8	11.19	18.01	8.11	12.43	9.43	10.96
G9	13.32	13.23	12.97	12.80	14.16	14.76
G10	38.09	23.90	34.57	24.40	31.31	26.28
GD	18.75	7.04	19.16	11.45	8.75	6.09
GSW	4.31	14.45	6.41	13.66	8.56	9.56
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Source: MCVL-2019

The moment of entry into the labour market could, however, condition the current situation of immigrants in the Social Security system. Our starting hypothesis is based precisely on the existence of greater labour integration of immigrants the longer they remain in the labour market, and less integration for those who have entered more recently. Based on the last 15 years, we distinguish several periods of entry: 2004-2007 (22.21% of migrant arrivals), 2008-2013 (21.44%) and the post-crisis 2014-2019 (33.17%). 23.18% were settled in the previous years.

How does newly arrived immigrants' integration evolve over time? There are clear changes in the patterns of immigrants' insertion, depending on their period of entry. Even though the G10 group is the main recipient of newcomers,-as the century progresses, there is a change in trend that tends to distribute new workers among the different groups (Table 21). Thus, for example, only 1.45% of those who entered between 2004 and 2007 were hired in the group G1, but this percentage rose to 3.94% for those who entered after the crisis. On the contrary, in the group G10, the percentages went from 38.09% to 31.31%.

The more they know about the labour market, the more the presence of immigrants in the lower groups is reduced. Progress can also be seen in the higher groups.

It should be noted that immigrants who joined Social Security between 2004 and 2007 have managed, in addition to resisting the impact of the crisis, to advance in their professional categories. Nonetheless, although only 4% started out as self-employed workers, at present

they are about 15%, and so, the use of self-employment has been present among these immigrants, probably as a reaction to an adverse economic and labour context.

The mobility tables by entry cohort shed a little more light (see Appendix C): a longer length of service in the labour market implies a greater upward mobility of the worker. Even though almost 60% of the workers in the 2014-2019 cohort remain in the same professional category, this percentage drops to 32.12% for the 2004-2007 cohort, a cohort that achieves 41.53% experiencing upward mobility and 12.43% opting for self-employment. Only 23.04% of those who entered between 2014 and 2019 managed to move up the category. It is clear that those who have entered the labour market more recently have had less time to move up the career ladder.

The insertion and progress of immigrants in the Spanish labour market is also conditioned by their country of origin. In fact, the EU15 nationals show a profile closer to native-born workers.

Table 22. Distribution of the immigrant population affiliated to the SS according to contribution group and origin in their first and last contracts. Concentration Index.

	EU15		Enlargement Countries		Africa		Latin America		Rest of the World	
Group	**First contract**	**Last contract**	**First contract**	**Last contract**	**First contract**	**Last contract**	**First contract**	**Last contract**	**First contract**	**Last contract**
G1	7.94	10.54	0.78	1.21	0.59	0.90	2.76	4.08	3.59	5.64
G2	3.68	4.64	0.35	0.72	0.34	0.58	0.85	1.71	1.46	2.29
G3	3.39	4.57	0.38	0.92	0.37	0.76	0.99	1.72	1.30	2.25
G4	2.57	2.76	0.87	1.21	0.82	1.20	1.72	2.29	2.24	2.90
G5	8.45	10.46	1.54	2.73	1.27	1.83	3.76	5.69	4.72	5.95
G6	2.25	2.31	1.55	2.51	1.32	1.84	2.71	4.31	3.06	3.22
G7	15.71	11.48	4.12	8.46	3.73	8.73	9.85	11.40	10.92	9.05
G8	12.39	12.92	10.17	17.99	6.19	13.46	9.77	14.17	9.91	12.08
G9	12.89	7.83	12.47	12.68	10.77	14.04	14.57	14.02	15.94	12.50
G10	15.05	7.81	48.85	34.20	61.92	44.85	26.96	19.13	27.19	14.75
GD	1.15	0.95	10.79	7.22	8.76	3.47	21.96	10.72	11.62	5.62
GSW	14.54	23.73	8.15	10.15	3.93	8.33	4.10	10.76	8.05	23.75
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: MCVL-2019

The highest categories (G1-G5) are workplaces for immigrants from EU15 (Table 22). Nevertheless, Africans and affiliates coming from enlargement countries are underrepresented in these categories, but they are overrepresented in the lowest group (G10). The group of domestic employees is a work space for Latin Americans, as Africans are underrepresented in this activity and those from the EU15 even more so.

Permanence in the labour market entails, however, progress for all groups, as they tend to be more homogeneously distributed among the various professional categories. Even so, according to their latest contract, the lowest groups (G8-G10) include 72% of Africans, 65% of

those from the enlargement countries, and 47% of Latin Americans (see mobility tables in Appendix C).

In conclusion, the data reveal some integration of immigrants into the Spanish labour market. On the one hand, their permanence in the labour market allows them to advance, to a certain extent, in the professional ladder, and to achieve a slightly more uniform distribution among the different contribution groups. On the other hand, the insertion of the new cohorts of workers is not so concentrated in the lowest groups. Their entry during the period of economic prosperity facilitated the filling of those positions least valued by the native population (in construction and services). It also facilitated the incorporation of native women into the labour market, by being able to outsource part of the domestic and care work to foreign labour. Nevertheless, the present reality is different. There is currently a shortage of some skills that are in demand in the market and cannot be satisfied by local workers. The change of perception in society towards the arrival of these immigrants, not as a threat, but as an opportunity to solve some problems, contributes to the greater acceptance of these groups in different occupations that until now were covered almost exclusively by national labour. Barriers to entry, hitherto unthinkable, are breaking down and giving way to workers (some highly qualified) who can fill currently vacant positions in the labour market.

4.3.3. Immigrant wage assimilation

The analysis of immigrants' integration into the labour market should include, in addition to their insertion and occupational mobility, aspects related to their wage assimilation.

The MCVL reveals an average total contribution base of 1,904.34€ in 2019, although with notable differences depending on the worker's origin. Natives, in general, are above average and immigrants are below it (Table 23).[28]

Foreigners have a contribution base of 1,575.6€, almost 20% lower than that of natives (1,966.34€). Romania, Morocco, Colombia and Ecuador, main suppliers of workforce to the Spanish society, provide workers with gross salaries far below average. In fact, along with China and Bolivia, they are at the bottom of the ranking (the Asian country occupies the last place, with a contribution base of 1,184.96€).

At the opposite side, we find EU15 nationals, who earn gross salaries similar to or above the average. France is at the top of the ranking, while the UK, Italy and Portugal are at the bottom, although, in any case, with higher salaries than the average for the immigrant group.

Hence, it is indisputable that immigrants behave differently in the Spanish labour market depending on their origin. Considering the extremes, around 1,000€ separate the average salaries of French and Chinese in Spain.

[28] These results are consistent with the data published by the Social Security for December 2019: an average total contribution base in the system of 1,875.67€, being 22.66% lower for those of foreign nationality. It should be noted, however, that the Social Security uses nationality as a criterion to define the immigrant, but this research uses origin and, therefore, the results are not entirely comparable.

Table 23. Contribution bases by Contribution Group, 2019.

Group	Natives	Migrants (total)	EU15	TCN
G1-Engineers and University Graduates	3259.62	3265.03	3337.36	3243.37
G2-Engineering Technicians and Qualified Assistants	2808.71	2643.05	2696.56	2610.29
G3-Administrative and Workshop Managers	2870.53	2619.48	2991.17	2449.59
G4-Unqualified Assistants	2444.81	1872.38	2339.83	1743.16
G5-Administrative Officials	2236.34	2012.96	2255.54	1917.04
G6-Subordinates	1760.86	1518.79	1747.00	1488.95
G7-Administrative Assistants	1642.06	1454.35	1721.15	1416.99
G8-First and second degree skilled workers	1932.18	1665.58	1769.79	1650.97
G9-Third degree skilled Workers and Specialists	1726.13	1518.46	1596.97	1511.88
G10-Unskilled Workers	1435.86	1363.49	1426.58	1368.35
Total system mean	**1966.34**	**1575.60**	**1888.47**	**1530.72**
Total system mean-male	**2014.74**	**1608.71**	**1935.48**	**1561.38**
Total system mean-female	**1903.89**	**1529.39**	**1823.88**	**1487.14**
Gender gap (total system)	**5.50**	**4.93**	**5.76**	**4.75**

Source: MCVL-2019

Note: gender gap= (males Contribution Base - females Contribution Base)/ males Contribution Base

The results by contribution group reproduce the general patterns: higher contribution bases for natives than for immigrants, with the exception of the group *G1-Engineers and University Graduates*, where university graduates are concentrated. Moreover, the differences are more pronounced if only non-EU workers are taken into account (Table 23).

If we include gender in the analysis, contribution bases are higher for men than for women, although non-EU nationals have a much narrower gap than those from the EU15 and natives.

Has this wage gap by origin and gender been of equal intensity in the previous years? Can we talk about wage assimilation for the immigrant community in Spain? As a starting point, we consider the year 2004 and we study the wage evolution of immigrant workers in relation to their native counterparts until 2019. The analysis of wage convergence is based on the evolution of the ratio between the average contribution bases of immigrants and natives. The aim is to investigate the distance that separates them, and whether it has been widening or narrowing as the immigrants' permanence in the Spanish labour market increases.

Table 24. Immigrant's Contribution Base / Native's Contribution Base Ratio, 2004-2019.

Group	2004	2008	2012	2016	2019
G1	0.9900	0.9790	0.9790	0.9938	1.0017
G2	0.9704	0.9526	0.9451	0.9387	0.9410
G3	0.9674	0.9228	0.9218	0.9100	0.9125
G4	0.8725	0.7999	0.7896	0.7731	0.7659
G5	0.9583	0.8896	0.8963	0.9079	0.9001
G6	0.8718	0.8288	0.8358	0.8475	0.8625
G7	0.9150	0.8646	0.7737	0.8468	0.8857
G8	0.8981	0.8810	0.8571	0.8526	0.8620
G9	0.8908	0.8764	0.8477	0.8564	0.8797
G10	1.0182	1.0023	0.9356	0.9304	0.9496
Total system mean	**0.8464**	**0.8002**	**0.7674**	**0.7740**	**0.8013**

Source: MCVL-2019

The situation in 2004, when the economic situation was favourable, reveals wage parity in the extreme groups: *G1-Engineers and University Graduates* and *G10-Unskilled Labourers*, and a greater distance between the central groups. In fact, the greatest differences appear between workers in group *G6-Subordinates* and group *G4-Unqualified Assistants*, whose ratios are the furthest away from the unit (Table 24).

The crisis has affected immigrants to a greater extent than natives, as differences have widened between 2004 and 2012, regardless of the contribution group to which the worker belongs, although with a greater intensity in the lowest groups. In 2016, we notice some recovery which continues in 2019, but without reaching the ratio that existed in 2004. The group *G1-Engineers and University Graduates* is the only exception, fully assimilated in 2019, given that natives and immigrants have practically equal contribution bases.

In addition, except in positions requiring higher qualifications (G1 and G2), the ratios are higher among women than among men. This implies that there is a greater approximation in the wages of immigrant and native women than in the wages of men (Tables 25 and 26), who seem to have been more intensely affected by the economic crisis of 2008 (ratios experience greater declines). The greater weight of this group in the construction sector, one of the most affected by the crisis, may, in part, justify this behaviour.

Table 25. Immigrant's Contribution Base / Native's Contribution Base Ratio (female, 2004-2019).

Group	2004	2008	2012	2016	2019
G1	0.9649	0.9731	0.9713	0.9888	0.9863
G2	0.9635	0.9475	0.9402	0.9348	0.9233
G3	0.9856	0.9319	0.9411	0.9499	0.9427
G4	0.8793	0.8153	0.8276	0.8213	0.8088
G5	0.9925	0.9112	0.9254	0.9421	0.9334
G6	0.8873	0.8494	0.8601	0.8715	0.8846
G7	0.9331	0.8840	0.8542	0.8927	0.9030
G8	0.9579	0.9311	0.9150	0.9348	0.9453
G9	0.9343	0.9301	0.9197	0.9300	0.9466
G10	1.0265	1.0289	0.9869	0.9628	0.9737
Total system mean	**0.8692**	**0.8035**	**0.8021**	**0.8119**	**0.8137**

Source: MCVL-2019

Table 26. Immigrant's Contribution Base / Native's Contribution Base Ratio (male, 2004-2019).

Group	2004	2008	2012	2016	2019
G1	1.0035	0.9804	0.9818	0.9941	1.0077
G2	0.9761	0.9561	0.9506	0.9399	0.9583
G3	0.9628	0.9235	0.9151	0.8901	0.8985
G4	0.8808	0.8156	0.7870	0.7610	0.7586
G5	0.9220	0.8712	0.8663	0.8735	0.8657
G6	0.8568	0.8113	0.8158	0.8276	0.8438
G7	0.8671	0.8168	0.6927	0.7908	0.8554
G8	0.8956	0.8810	0.8573	0.8468	0.8548
G9	0.8746	0.8552	0.8196	0.8274	0.8525
G10	0.9845	0.9600	0.8912	0.9025	0.9260
Total system mean	**0.8568**	**0.8150**	**0.7754**	**0.7775**	**0.7985**

Source: MCVL-2019

This wage gap widens when considering non-EU immigrants and narrows considerably for those from EU15 (see ratios in Appendix D). In fact, the latter seem to be fully integrated into the Spanish labour market. There are slight differences by country of origin and gender but, on average, their behaviour is similar to that of natives in terms of salary level. French and German show full integration, but the UK, Italy and Portugal are countries that send workers whose wages are slightly lower than those of natives.

More precise conclusions on immigrants' wage assimilation require the analysis of the evolution of the wage earned by the same cohort individuals throughout their time in the labour market. Thus, we focus on various entry cohorts (2004 cohort, 2008 cohort and 2012 cohort) and track their wages up to present day.[29]

[29] Subsequent cohorts have not been considered due to their low representativeness in the different contribution groups (many newcomers also entered the labour market as self-employed workers, not considered in this analysis).

Focusing on the 2004 cohort, the data reveal that immigrants' wage at entry into the host labour market is not only lower than that of natives, but also lower than that of other immigrants who arrived earlier. On average, immigrants earn around 32% less at arrival than native-born workers. Similar percentage is obtained by Izquierdo et al. (2009) with data up to 2005, but Adsera and Chiswick (2007) find a wage gap around 40% over some EU countries from 1994 to 2000, the differences being higher in Spain (up to 55% for women and 63% for men).

By origin, these differences are even greater if we focus on non-EU nationals. Furthermore, gender continues to be a source of inequality, as the gap appears from the moment women enter the labour market (Table 27).

Table 27. Contribution bases by Contribution Group in 2004

Group	Migrants (2004 cohort)	All migrants	Natives	TCN (2004 cohort)	TCN (all)
G1	1903.94	2243.42	2266.01	1767.74	2225.74
G2	1461.42	1966.36	2026.32	1367.50	1945.87
G3	1484.31	1912.03	1976.46	1240.72	1840.07
G4	1108.70	1568.19	1797.42	1004.38	1455.84
G5	1150.63	1457.51	1520.98	1077.53	1366.31
G6	884.25	1101.76	1263.74	873.90	1059.16
G7	937.59	1089.24	1190.49	908.02	1035.60
G8	1044.28	1173.47	1306.68	1028.78	1154.17
G9	963.69	1053.95	1183.12	970.49	1042.34
G10	799.08	933.16	916.50	832.42	941.31
Total system mean	**890.03**	**1104.11**	**1304.49**	**882.26**	**1051.64**

Source: MCVL-2019

Although the wage gap is notable when they enter the labour market (in 2004), it narrows over time. The justification lies in the growth rate of wages, which is higher for immigrants than for natives. Training processes, greater linguistic training, improvements in their human capital, recognition of immigrants' qualification by the employer and, in general, better understanding of the labour market as they perform their jobs are arguments that justify this higher wage growth. Given the difficulties in the transferability of the human capital acquired in origin, immigrants opt to invest in learning at the destination. This human capital acquired in Spain has a higher marginal return than that accumulated in the country of origin (San Romá et al. 2009). In addition, the entrepreneur, once discovered workers productivity, pays them accordingly. In short, in addition to the worker's own attributes, the structural characteristics of the job and the company influence the worker's occupational/wage assimilation.

Table 28. Immigrant's Contribution Base / Native's Contribution Base Ratio (2004 cohort), 2004-2019.

Group	2004	2008	2012	2016	2019
G1	0.8402	0.9305	0.9815	1.0152	1.0377
G2	0.7212	0.8276	0.8482	0.8724	0.9315
G3	0.7510	0.8498	0.8692	0.8202	0.8257
G4	0.6168	0.7457	0.8123	0.8041	0.8792
G5	0.7565	0.8180	0.8383	0.8919	0.9173
G6	0.6997	0.7720	0.7934	0.8294	0.8606
G7	0.7876	0.8436	0.8067	0.8507	0.8917
G8	0.7992	0.8669	0.8648	0.8644	0.8868
G9	0.8145	0.8714	0.8648	0.8839	0.9168
G10	0.8719	1.0168	0.9758	0.9707	0.9807
Total system mean	**0.6823**	**0.8016**	**0.7869**	**0.7938**	**0.8145**

Source: MCVL-2019

Additionally, the crisis does not affect this cohort to a large extent, which is explained by the fact that these are precisely the individuals who entered the labour market in 2004 and are still working today. It is true that there was a slight drop in the ratio of contribution bases in the lower groups, but this decline has been correcting itself during the period of economic growth (Table 28).

Fifteen years later, however, full assimilation of this group into all contribution groups is not yet apparent. Full integration is observed in the extreme groups, but there is still room for improvement, for example, in groups G3, G6 and G4, since this cohort earns a salary 17.4%, 13.9% and 12.9%, respectively, lower than native workers.

Table 29. Immigrant's Contribution Base / Native's Contribution Base Ratio (2004 cohort by gender), 2004 and 2019.

	2004			2019		
Group	**all**	**women**	**men**	**all**	**women**	**men**
G1	0.8402	0.7154	0.9345	1.0377	1.0341	1.0446
G2	0.7212	0.6321	0.8307	0.9315	0.8954	0.9840
G3	0.7510	0.6678	0.8395	0.8257	0.8639	0.8116
G4	0.6168	0.7281	0.5722	0.8792	0.9605	0.8467
G5	0.7565	0.7941	0.7095	0.9173	0.9480	0.8765
G6	0.6997	0.7469	0.6612	0.8606	0.9148	0.8157
G7	0.7876	0.8144	0.7259	0.8917	0.8924	0.8918
G8	0.7992	0.9036	0.7964	0.8868	0.9704	0.8773
G9	0.8145	0.8895	0.7861	0.9168	1.0048	0.8778
G10	0.8719	0.8978	0.8456	0.9807	0.9985	0.9645
Total system mean	**0.6823**	**0.6559**	**0.7046**	**0.8145**	**0.8169**	**0.8117**

Source: MCVL-2019

In addition, wage differences are greater among men (immigrants versus natives) than among women except for the first two groups, which require higher qualifications. In other words, while the gender pay gap (with lower wages for women) is present in practically all contribution groups, the gap by origin is smaller among these women than among men (Table 29).

Analysing the successive cohorts (Table 30), their entry ratios, on average are lower than those of the preceding cohorts: 0.6188 in the 2012 cohort compared to 0.6551 in the 2008 cohort and 0.6823 in the 2004 cohort. This leads us to believe that the economic crisis affected to a greater extent the immigrants who entered the labour market during this stage, although the least affected are the groups entering the highest groups (G3 does not seem to have been affected). It is clear that immigrants suffer a penalty when accessing the labour market.

Table 30. Immigrant's Contribution Base / Native's Contribution Base Ratio at entry into the host labour market.

Group	2004 cohort	2008 cohort	2012 cohort
G1	0.8402	0.9117	0.7942
G2	0.7212	0.8052	0.7244
G3	0.7510	0.8030	0.9087
G4	0.6168	0.6066	0.5648
G5	0.7565	0.7093	0.7195
G6	0.6997	0.7505	0.7052
G7	0.7876	0.7671	0.6600
G8	0.7992	0.7730	0.7194
G9	0.8145	0.7993	0.7715
G10	0.8719	0.8501	0.8383
Total system mean	**0.6823**	**0.6551**	**0.6188**

Source: MCVL-2019

Regardless of the cohort, wage gaps are more pronounced in the central groups. Thus, for instance, the 2004 cohort earns in that year 29% less than immigrants who were already in the G4 group and differences, in general, are greater when the comparison is established with native counterparts (38.62%). Moreover, this percentage increases to 43.52% for the 2012 cohort.

Evidently, later cohorts, with less experience in the labour market, have lower ratios than the previous cohorts (Table 31). The only exception is the group *G7-Administrative Assistants*: regardless of the number of years in the labour market, these individuals end up earning 86-89% of what natives earn. There appears to be a wage gap of 11-14% that is perpetuated over time, thus ruling out wage assimilation in this group (see more detailed tables in Appendix D).

Table 31. Immigrant's Contribution Base / Native's Contribution Base Ratio by cohort in 2019.

Group	2004 cohort	2008 cohort	2012 cohort
G1	1.0377	1.0273	0.9973
G2	0.9315	0.9216	0.8809
G3	0.8257	0.8841	0.8689
G4	0.8792	0.7015	0.6828
G5	0.9173	0.8964	0.8676
G6	0.8606	0.8366	0.7995
G7	0.8917	0.8626	0.8931
G8	0.8868	0.8504	0.8052
G9	0.9168	0.8728	0.8703
G10	0.9807	0.9470	0.9346
Total system mean	**0.8145**	**0.7801**	**0.7657**

Source: MCVL-2019

Our results are in line with the evidence obtained by Izquierdo et al. (2009) in Spain. With data up to 2005, they find that the wage gap between native and immigrant men decreases with time, but it does not vanish completely. This behaviour differs from that found by Chiswick (1978) for the USA, where a wage equalisation is detected 10-15 years after immigrants enter the labour market and even a positive wage gap for the immigrant after 20 years.

In summary, even though there is a convergence between the wages of natives and immigrants, full assimilation is not achieved even after 15 years in the labour market. The exceptions are the workers in the extreme groups (*G1-Engineers and University Graduates* and *G10-Unskilled Labourers*), but not in the intermediate groups. Thus, in the G7 group, in which *Administrative Assistants* contribute, immigrants end up earning 11-14% less than natives, regardless of their cohort of entry into the labour market. Consequently, there is still room for improvement if pay equity is to be achieved.

5. Conclusions

Origin and gender are sources of inequality in the EU labour market.

Foreign-born workers are not evenly distributed in the occupational ladder, they have their own labour niches. They face barriers that prevent them from accessing the labour market on equal terms with natives. Lack of verbal proficiency, mismatch of human capital to the production system, or insufficient understanding of labour market are, among others, the reasons why, regardless of their level of education, foreign-born workers are willing to supply labour at lower wages than natives upon arrival in the country. Thus, newcomers have a lower occupational attainment than their native counterparts and they also suffer from a significant initial earning gap. They fill the lower rungs of the occupational ladder, often entering occupations characterised by gender norms. However, some integration of foreign-born occurs over time and these differences progressively narrow. They adjust to labour market conditions and their skills and knowledge are recognised, increasing their ability to compete with local workers. Nevertheless, their career progression occurs within the same "labour segment" and, even though there is a convergence between the wages of natives and immigrants, full assimilation is not achieved.

In recent years, there has been a new trend in the insertion of foreign-born workers into the labour market, whereby upon arrival they enter occupations at higher rungs on the occupational ladder. Skills shortages in the EU may be behind this fact.

Nonetheless, foreign-born workers are not a uniform group, but the processes of integration and assimilation are conditioned by the country of origin. EU-born and TCN citizens behave differently in the labour market. EU-movers' behaviour is more similar to that of natives, while TCNs have poorer labour outcomes (Dustmann and Frattini, 2011; Platt et al., 2022). Only workers born in the former EU15 converge to natives.

Due to the double dimension of inequality, TCN women are the most disadvantaged and vulnerable group, since they have to meet the specific challenges of immigrants and women simultaneously (Hamedanian, 2022).

Moreover, TCN do not compete perfectly with native labour, but play a complementary role and stimulate supply of native labour. By accessing lower-skilled occupations, they induce occupational mobility of unskilled native workers. The decrease in the relative provision of manual tasks is larger among women than among men. This suggests a greater complementarity between native and immigrant women than among men. Nevertheless, the increase in the participation of native workers in non-manual occupations as a consequence of the entry of immigrants into the labour market is not conclusive for women. This may be due to the greater presence of women in non-manual tasks that require less physical effort. Furthermore, the greatest impact occurs during the first years of immigrants' entry into the labour market where all immigrants, non-university and college graduates compete with less skilled natives.

To conclude, heterogeneity emerges as a key feature of inequality within the EU. Unexpected segregation effects within the EU suggest a complex integration process for foreign-born workers. While western and northern countries have lower levels of segregation, eastern and especially southern countries stand out as having much more segmented labour markets. Gender differences are also more pronounced in the south of Europe. Spain is a clear example.

From a policy perspective, this evidence highlights the need for the EU to implement integration policies for foreign-born workers with special attention to TCN women, the most disadvantaged group.

A common policy framework that outlines further measures in order to integrate foreign-born workers into the labour market should include the establishment of anti-discrimination and equal rights policies in working places, the improvement of opportunities for immigrants' progression, setting policies that improve information related to immigrants' productivity, earlier provision of career advice or sharing information with different parties, among others.

Having said that, as long as the EU legislation does not provide for binding directives, and given the idiosyncrasy of each member state, each national government will have to prioritise the specific actions to be applied within its borders applying tailor-made policies.

References

Adsera, A., and Chiswick, B.R. (2007). Are there gender and country of origin differences in immigrant labor market outcomes across European destinations? *Journal of Population Economics, 20*, 495–526. https://doi.org/10.1007/s00148-006-0082-y

Aldaz, L., and Eguía, B. (2016). Immigration and Occupational Mobility of Native Workers in Spain. A Gender Perspective. *Int. Migration & Integration, 17*, 1181–1193. https://doi.org/10.1007/s12134-015-0459-4

Aleksynska, M., and Algan, Y. (2010). Assimilation and Integration of Immigrants in Europe. *Discussion Paper No. 5185.* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/5185/assimilation-and-integration-of-immigrants-in-europe

Alonso-Villar, O., and Del Río, C. (2010). Local versus overall segregation measures. *Mathematical Social Sciences, 60*(1), 30-38. https://doi.org/10.1016/j.mathsocsci.2010.03.002

Amuedo-Dorantes, C., and De la Rica, S. (2007). Labour Market Assimilation of Recent Immigrants in Spain. *British Journal of Industrial Relations, 45*(2), 257-284. https://doi.org/10.1111/j.1467-8543.2007.00614.x

Amuedo-Dorantes, C., and De la Rica, S. (2011). Complements or substitutes? Task specialization by gender and nativity in Spain. *Labour Economics, 18*(5), 697-707. https://doi.org/10.1016/j.labeco.2011.02.002

Arranz, J.M., Carrasco, C., and Massó M. (2017). La movilidad laboral de las mujeres inmigrantes en España (2007-2013) [The labour mobility of immigrant women in Spain (2007-2013)]. *Revista Española de Sociología*, *26*(3), 329-344.

Aysa-Lastra, M., and Cachón-Rodríguez, L. (2013). Determinantes de la movilidad ocupacional segmentada de los inmigrantes no comunitarios en España [Determinants of segmented occupational mobility of non-EU immigrants in Spain]. *Revista Internacional de Sociología*, *71*(2), 383-413. https://doi.org/10.3989/ris.2012.05.519

Benton, M., Sumption, M., Alsvik, K., Fratzke, S., Kuptsch, C., and Papademetriou, D.G. (2014). *Aiming Higher: Policies to Get Immigrants into Middle-Skilled Work in Europe.* Migration Policy Institute and International Labour Organization. https://www.migrationpolicy.org/research/aiming-higher-policies-get-immigrants-middle-skilled-work-europe

Bettio, F. (2002). The Pros and Cons of Occupational Gender Segregation in Europe. *Canadian Public Policy, 28*(1), 65-84. http://qed.econ.queensu.ca/pub/cpp/May2002/Bettio_Chap.pdf

Borjas, G.J. (1985). Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants. *Journal of Labor Economics, 3*(4), 463-489.

Borjas, G.J. (1994). The Economics of Immigration. *Journal of Economic, 32*(4), 1667-1717.

Borjas, G.J. (1995). Assimilation and Changes in Cohort Quality Revisited: What Happened to Immigrant Earnings in the 1980s? *Journal of Labor Economics, 13*(2), 201-245.

Borjas, G.J. (2003). The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on Labor Market. *Quarterly Journal of Economics, 118*(14), 1335-1374.

Borjas, G.J., and Katz, L. (2007). The Evolution of the Mexican-Born Workforce in the United States In G.J. Borjas (eds.), *Mexican Immigration to the United States* (pp.13-55). Chicago: University of Chicago Press.

Campaña, J. C., Gimenez-Nadal, J. I., and Velilla, J. (2023). Measuring Gender Gaps in Time Allocation in Europe. *Social Indicators Research, 165*(2), 519–553. https://doi.org/10.1007/s11205-022-03026-0

Cangiano, A. (2014). Migration Policies and Migrant Employment Outcomes. *Comparative Migration Studies, 2*(4), 417–443. https://doi.org/10.5117/CMS2014.4.CANG

Cantalini, S., Guetto, R., and Panichella, N. (2023). Ethnic Wage Penalty and Human Capital Transferability: A Comparative Study of Recent Migrants in 11 European Countries. *International Migration Review, 57*(1), 328–356. https://doi.org/10.1177/01979183221099481

Card, D. (2005). Is the New Immigration Really so Bad? *The Economic Journal, 115*(507), 300-323.

Card, D., and Di Nardo, J. (2000). Do Immigrant Inflows Lead to Native Outflows? *American Economic Review, 90*(2), 360-367.

Card, D., and Lewis, E. (2007). The Diffusion of Mexican Immigrants during the 1990s: Explanations and Impacts In Borjas, G.J. (eds.), *Mexican Immigration to the United States*. Chicago: University of Chicago Press.

Carrasco, R., Jimeno, J.F., and Ortega, C. (2008). The effect of immigration on the labor market performance of native-born workers: some evidence for Spain. *Journal of Population Economics, 21*(3), 627-648.

Casado, M., González, M., Molina, L., and Oyarzun, D. (2005). *Análisis Económico de la Inmigración en España: Una Propuesta de Regulación* [Economic Analysis of Immigration in Spain: A Proposal for Regulation]. Madrid: Ediciones UNED.

Cattaneo, C., Fiorio, C. V., and Peri, G. (2013). Immigration and careers of European workers: Effects and the role of policies. *IZA Journal of European Labor Studies 2, 17* https://doi.org/10.1186/2193-9012-2-17

Chiswick, B. (1978). The Effect of Americanization on the Earnings of Foreign-born Men. *Journal of Political Economy, 86*(5), 897-921.

Chiswick, B., Cohen, Y., and Zach, T. (1997). The Labor Market Status of Immigrants: Effects of the Unemployment Rate at Arrival and Duration of Residence. *ILR Review, 50*(2), 289-303.

Clark, K., and Lindley, J. (2005). *Immigrant Labour Market Assimilation and Arrival Effects: Evidence from the Labour Force Survey. Sheffield Economic Research Paper Series, No. 2005004.* University of Sheffield.

Constant, A., and Massey, D.G. (2003). Self-selection, earnings, and out-migration: A longitudinal study of immigrants to Germany. *Journal of Population Economics, 16,* 631-653. https://doi.org/10.1007/s00148-003-0168-8

D'Amuri, F., Ottaviano, G., and Peri, G. (2010). The Labor Market Impact of Immigration in Western Germany in the 1990s. *European Economic Review, 54*(4), 550-570.

D'Amuri, F., and Peri, G. (2010). *Immigration and Occupations in Europe. Discussion Paper Series CDP no 26/10.* Centre for Research and Analysis of Migration.

De Haas, H. (2018). *European Migrations: Dynamics, Drivers, and the Role of Policies.* Luxembourg: Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/handle/JRC109783

De la Rica, S., Glitz, A., and Ortega, F. (2013). *Immigration in Europe: Trends, Policies and Empirical Evidence. Discussion Paper No. 7778.* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/7778/immigration-in-europe-trends-policies-and-empirical-evidence

De la Rica, S., and Polonyankina, T. (2013). The impact of immigration on occupational specialisation among natives in Spain: Does the business cycle matter? *Revista de Economía Aplicada, XXI*(63), 51-74. https://www.redalyc.org/articulo.oa?id=96929566003

Del Río, C., and Alonso-Villar, O. (2022). On Measuring Segregation in a Multigroup Context: Standardized Versus Unstandardized Indices. *Social Indicators Research, 163*(2), 633–659. https://doi.org/10.1007/s11205-022-02911-y

Dorn, D., and Zweimüller, J. (2021). *Migration and Labor Market Integration in Europe. Discussion Paper No. 14538* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/14538/migration-and-labor-market-integration-in-europe

Dueñas-Fernández, D., and Llorente-Heras, R. (2021). La segregación laboral en tiempos de crisis: Diferencias europeas [Occupational segregation in times of crisis: European differences]. *Revista de Economía Mundial,* (57), 87-118. https://doi.org/10.33776/rem.v0i57.4804

Dustmann, C. (1993). Earnings adjustment of temporary migrants. *Journal of Population Economics, 6,* 153-168. https://doi.org/10.1007/BF00178559

Dustmann, C., and Frattini, T. (2011). *Immigration: The European Experience. Discussion Paper No. 6261.* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/6261/immigration-the-european-experience

Eurofound, and European Commission Joint Research Centre. (2021). *European Jobs Monitor 2021: Gender gaps and the employment structure.* Luxembourg: Publications Office of the European Union. https://www.eurofound.europa.eu/publications/report/2021/european-jobs-monitor-2021-gender-gaps-and-the-employment-structure

European Commission, Directorate-General for Employment, Social Affairs and Inclusion, Verashchagina, A., and Bettio, F. (2009). *Gender segregation in the labour market: Root causes, implications and policy responses in the EU.* Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2767/1063

European Institute for Gender Equality. (2020). *Sectoral Brief: Gender and Migration.* Luxembourg: Publications Office of the European Union. https://eige.europa.eu/publications/gender-and-migration

Falcon, J. (2015). Social Position: Social Position Indicators Construction Toolbox. R package version 1.1. https://cran.r-project.org/web/packages/SocialPosition/index.html

Fernández, C., and Ortega, C. (2008). Labor market assimilation of immigrants in Spain: employment at the expense of bad job-matches? *Spanish Economic Review, 10,* 83-107. https://doi.org/10.1007/s10108-007-9032-4

Foged, M., and Peri, G. (2016). Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data. *American Economic Journal: Applied Economics, 8* (2), 1-34.

Friedberg, R.M. (1992). *The Labor Market Assimilation of Immigrants in the United States: The Role of Age at Arrival*. Brown University.

Gang, I.N., Rivera-Batiz, F.L., and Yun, M. (1999*). Immigrants and Unemployment in the European Community: From the Eyes of Natives*. *Discussion Paper No. 70*. IZA- Institute of Labor Economics. https://www.econstor.eu/handle/10419/20905

Garcés-Mascareñas, B., and Penninx, R. (2016). *Integration Processes and Policies in Europe. Contexts, Levels and Actors.* IMISCOE.

González, L., and Ortega, F. (2008). *How Do Very Open Economies Absorb Large Immigration Flows? Recent Evidence from Spanish Regions. Discussion Paper No. 3311*. IZA- Institute of Labor Economics. https://www.iza.org/publications/dp/3311/how-do-very-open-economies-absorb-large-immigration-flows-recent-evidence-from-spanish-regions

Górka, S., Hardy, W., Keister, R., and Lewandowski, P. (2017). *Tasks and Skills in European Labour Markets*. *Background paper for the World Bank report "Growing United: Upgrading Europe's Convergence Machine"*. *IBS Research Report, 03/2017*. Institute for Structural Research.

Gorodzeisky, A., and Semyonov, M. (2017). Labor force participation, unemployment and occupational attainment among immigrants in West European countries. *PLoS ONE, 12*(5): e0176856. https://doi.org/10.1371/journal.pone.0176856

Hakim, C. (1993). Segregated and Integrated Occupations: A New Approach to Analysing Social Change. *European Sociological Review, 9*(3), 289-314.

Hamedanian, F. (2022). Access to the European Labor Market for Immigrant Women in the Wake of the COVID Pandemic. *World 2022, 3*(4), 957-978. https://doi.org/10.3390/world3040054

Iglesias, C., and Llorente-Heras, R. (2008). *The impact of economic immigration on labour opportunities of native-born workers: the Spanish case. Working Papers 05/2006*. Institute of Social and Economic Analysis.

IOM. (2020). *World Migration Report 2020*. International Organization for Migration.

Izquierdo, M., Lacuesta, A., and Vegas, R. (2009). Assimilation of immigrants in Spain: A longitudinal analysis. *Labour Economics*, 16 (6), 669-678.

Jiang, S. (2021). Task Specialization, Wage, and Immigration in Canada. *Annals of Economics and Finance, 22*(2), 389-420.

Larrañaga-Sarriegui, M.M., Jubeto-Ruiz, Y., and De la Cal-Barredo, M.L. (2012). La diversidad de los modelos de participación laboral de las mujeres en la UE-27 [The diversity of women's labor participation patterns in the EU-27]. *Lan Harremanak - Revista de Relaciones Laborales,* (25), 291-327. http://hdl.handle.net/10810/15424

Lee, T., Peri, G., and Viarengo, M. (2020). *The Gender Aspect of Immigrants' Assimilation in Europe. Discussion Paper No. 13922.* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/13922/the-gender-aspect-of-immigrants-assimilation-in-europe

Lewis, E. (2003). *Local Open Economies within the US: How do Industries Respond to Immigration?* Federal Reserve Bank of Philadelphia Working Paper No. 04-1.

Manacorda, M., Manning, A., and Wadsworth, J. (2012). The Impact of Immigration on the Structure of Male Wages: Theory and Evidence from Britain. *Journal of the European Economic Association, 10*(1), 120-151.

Moreno, A. (2008). El reducido empleo femenino en los estados del bienestar del sur de Europa. Un análisis comparado [The limited women's employment in the southern European welfare states. A comparative analysis]. *Revista Internacional de Sociología, 66*(50), 129-162. https://doi.org/10.3989/ris.2008.i50.99

Okoampah, S. (2016). *Estimating earnings assimilation of immigrants to Germany: Evidence from a double cohort model. Ruhr Economic Papers, No. 630*. Leibniz Information Centre for Economics. http://hdl.handle.net/10419/144839

Ortega, F., and Peri, G. (2009). *The Causes and Effects of International Mobility: Evidence from OECD Countries 1980-2005. Human Development Research Paper 2009/06*. New York: United Nations. https://hdr.undp.org/content/causes-and-effects-international-labor-mobility

Ortensi, L.E., and Tosi, F. (2021). *Gender and migration background at their intersection. An analysis of labour market data in Europe.* Milan: ISMU. https://www.ismu.org/gender-and-migration-background-at-their-intersection/

Palencia-Esteban, A. (2022). Occupational segregation of female and male immigrants in Europe: Accounting for cross-country differences. *International Labour Review, 161*(3), 341-373. https://doi.org/10.1111/ilr.12207

Palencia-Esteban, A., and Del Río, C. (2020). *The earnings effects of occupational segregation in Europe: The role of gender and migration status.* Working Papers 533, ECINEQ, Society for the Study of Economic Inequality. http://www.ecineq.org/2020/05/01/the-earnings-effects-of-occupational-segregation-in-europe/

Peri, G., and Rutledge, Z. (2020). *Revisiting Economic Assimilation of Mexican and Central Americans Immigrants in the United States*. *Discussion Paper No. 12976.* IZA - Institute of Labor Economics. https://www.iza.org/publications/dp/12976/revisiting-economic-assimilation-of-mexican-and-central-americans-immigrants-in-the-united-states

Peri, G., and Sparber, C. (2009). Task Specialization, Immigration, and Wages. *American Economic Journal, 1*(3), 135-169.

Pischke, J.S. (1993). *Assimilation and the Earnings of Guestworkers in Germany*. Boston: MIT.

Pischke, J.S., and Velling, J. (1994). *Wage and Employment Effects of Immigration to Germany: An Analysis Based on Local Labour Markets*. CEPR Discussion Paper, No. 935.

Platt, L., Polavieja, J., and Radl, J. (2022). Which Integration Policies Work? The Heterogeneous Impact of National Institutions on Immigrants' Labor Market Attainment in Europe. *International Migration Review, 56*(2), 344–375. https://doi.org/10.1177/01979183211032677

Price, S. (2001). The employment adjustment of male immigrants in England. *Journal of Population Economics, 14,* 193-220. https://doi.org/10.1007/s001480050165

Rodríguez-Planas, N. (2012). *Wage and Occupational Assimilation by Skill Level: Migration Policy Lessons from Spain*. *Policy Paper No. 53.* IZA - Institute of Labor Economics. https://www.iza.org/en/publications/pp/53/wage-and-occupational-assimilation-by-skill-level-migration-policy-lessons-from-spain

San Romá, E., Ramons, R., and Simón, H. J. (2009). Los salarios de los inmigrantes en el mercado de trabajo español: ¿importa el origen del capital humano? [Immigrants' wages in the Spanish labour market: Does the origin of human capital matter?]. Document de Treball XREAP2009-4

Schieckoff, B., and Sprengholz, M. (2021). The labor market integration of immigrant women in Europe: context, theory, and evidence. *SN Social Sciences, 1, 276.* https://doi.org/10.1007/s43545-021-00279-3

Seo, H. (2023). Gendered labour market patterns across Europe: Does family policy mitigate feminization of outsiders? *Journal of European Social Policy, 33*(1), 3–16. https://doi.org/10.1177/09589287221148916

Silber, J. (1992). Occupational Segregation Indices in the Multidimensional Case: A Note. *The Economic Record, 68*(3), 276-277.

Simón, H., Ramos, R. and Sanromá, E. (2014). Immigrant Occupational Mobility: Longitudinal Evidence from Spain, *European Journal of Population*, *30*(2), 223-255.

Stirling, A. (2015). *Migrant employment outcomes in European labour markets.* IPPR. https://www.ippr.org/publications/migrant-employment-outcomes-in-european-labour-markets

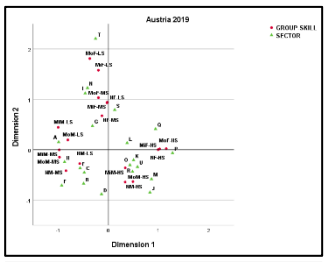
United Nations. (2020). *International Migrant Stock 2020*. Department of Economic and Social Affairs, Population Division, United Nations.

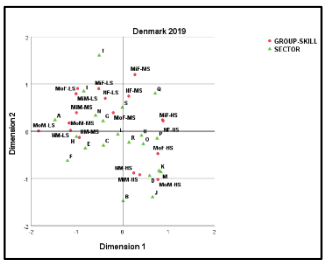
Vedder, R., Gallaway, L., and Moore, S. (2000). The Immigration Problem: Then and Now. *The Independent Review, 4*(3), 347-364.

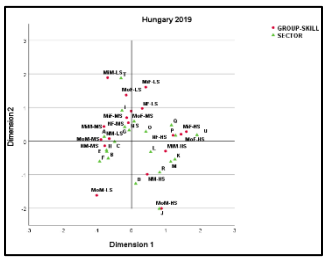
Vidal-Coso, E. (2019), Employment Trajectories of recent Immigrants in Switzerland, in Migrants and Expats: The Swiss Migration and Mobility Nexus, IMISCOE Research Series, I Steiner, P.Wanners (eds), SpringerOpen.

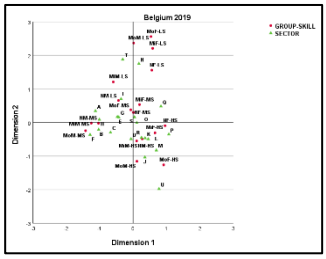
Appendix

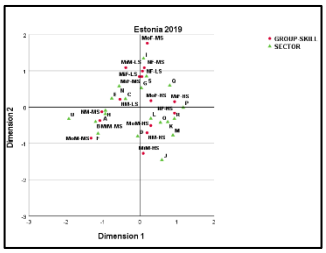
Appendix A. Labour market participation by origin and gender in the EU member states, 2019

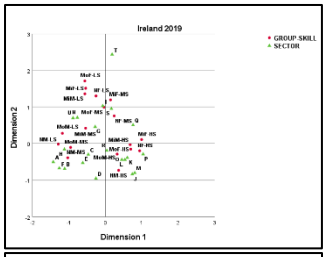


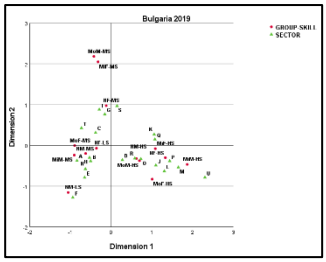


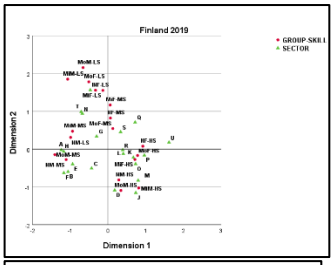


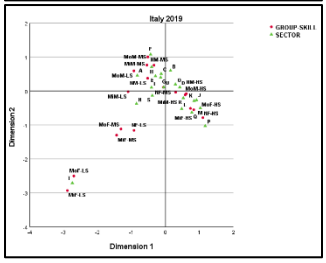


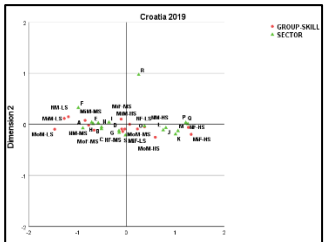


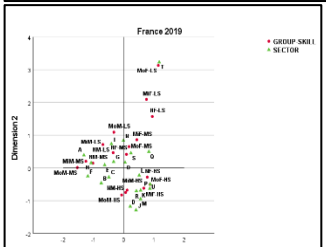


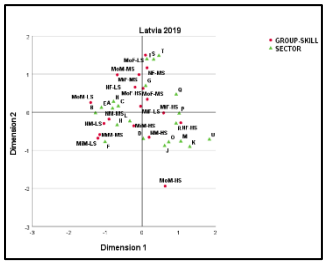


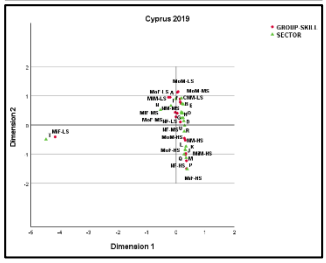


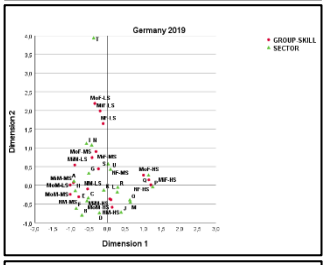


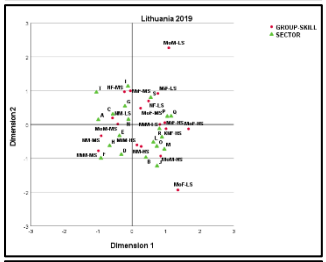


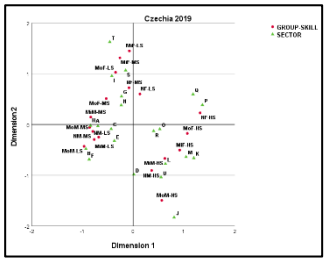


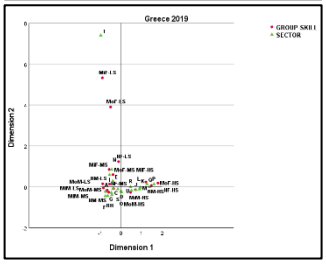


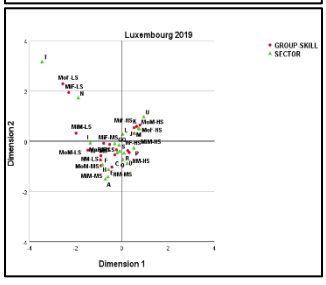


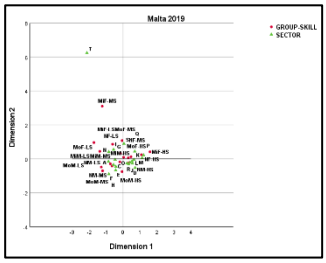


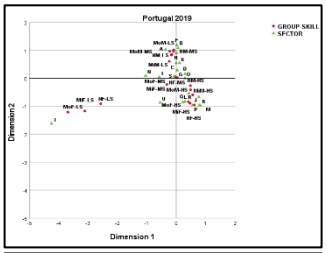


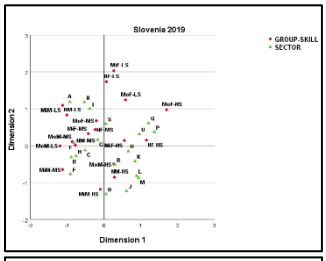


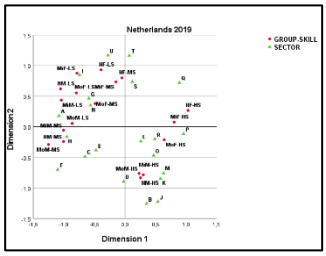


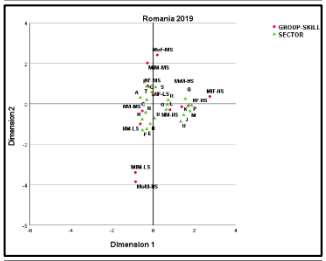


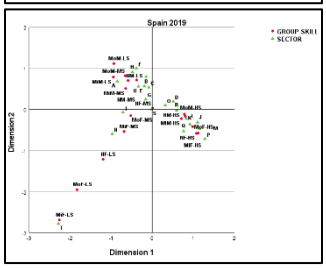


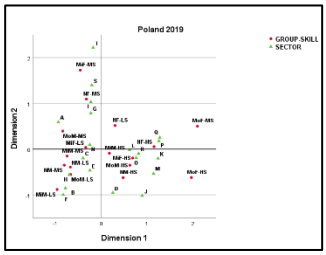


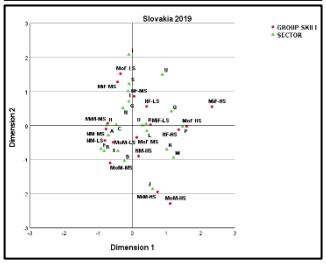


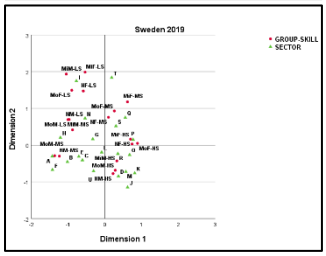


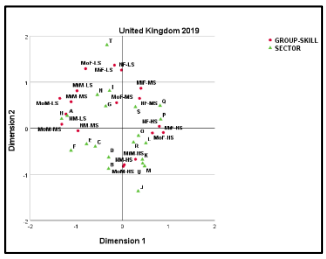












Source: EU-LFS microdata

Appendix B. Occupational segregation indices.

B.1. Description of local and overall segregation indices (Del Río and Alonso-Villar, 2022) applied for robustness check.

- **Local Gini index**: this is based on an adequate version of the classic Gini index and takes values between 0 and 1.

$$G^g = \frac{\sum_{ij} \frac{t_i}{T}\frac{t_j}{T}\left|\frac{c_i^g}{t_i} - \frac{c_j^g}{t_j}\right|}{2\frac{C^g}{T}}$$

We standardised the local Gini index as follows:

$$\tilde{G}^g = \frac{G^g}{G^{g*}} = \frac{\sum_{ij} \frac{t_i}{T}\frac{t_j}{T}\left|\frac{c_i^g}{t_i} - \frac{c_j^g}{t_j}\right|}{2\frac{C^g}{T}\left(1-\frac{C^g}{T}\right)}$$

- **Local generalised entropy family index:** this is a modification of the Theil index and is bounded between 0 and the maximum value of ln (T), being T the total number of jobs in the economy.

$$\text{[illegible]}_1^g = \sum_i \frac{c_i^g}{C^g} \ln\left(\frac{c_i^g/C^g}{t_i/T}\right)$$

We standardised the local generalised entropy family index as follows:

$$\widetilde{\text{[illegible]}_1^g} = \frac{\text{[illegible]}_1^g}{\text{[illegible]}_1^{g*}} = \frac{\sum_i \frac{c_i^g}{C^g} \ln\left(\frac{c_i^g/C^g}{t_i/T}\right)}{ln\left(\frac{T}{C^g}\right)}$$

- **Gini index:** it corresponds to the weighted average of the local Gini index. This index is calculated as follows:

$$G_u = \sum_g \frac{C^g}{T} G^g$$

We standardised the Gini index as follows:

$$G = \frac{G_u}{G^*} = \frac{G_u}{\sum_g \frac{C^g}{T}\left(1-\frac{C^g}{T}\right)}$$

- **Mutual information index:** it corresponds to the weighted average of the local generalised entropy family index. This index is calculated as follows:

$$\mathrm{M} = \sum_{g} \frac{C^{g}}{T} \square_{1}^{g}$$

We standardised the Mutual information index as follows:

$$H = \frac{M}{M^{*}} = \frac{M}{\sum_{g} \frac{C^{g}}{T} \left(ln \frac{T}{C^{g}} \right)}$$

B.2. Results

Local segregation in the EU by country, 2019. Local Gini index.

	Unstandardised, G^g						Standardised, $\tilde{G}^g$					
Country	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**
AT	0.3423	0.3871	0.4448	0.4362	0.5319	0.5677	0.5885	0.6128	0.4678	0.4593	0.5674	0.5983
BE	0.3244	0.3664	0.5256	0.4979	0.5092	0.6220	0.5725	0.6011	0.5490	0.5195	0.5376	0.6476
HR	0.3511	0.4154	0.7909	0.8621	0.6464	0.6899	0.6968	0.7063	0.7969	0.8688	0.6750	0.7144
CY	0.3680	0.4058	0.5649	0.5617	0.6709	0.7425	0.6015	0.6202	0.6031	0.6021	0.7150	0.8019
CZ	0.3329	0.4123	0.5612	0.6071	0.5870	0.6364	0.7103	0.7186	0.5685	0.6123	0.5938	0.6426
DK	0.3201	0.3361	0.5326	0.4885	0.5185	0.5686	0.5972	0.5924	0.5434	0.4967	0.5372	0.5876
EE	0.3675	0.4013	0.8851	0.9280	0.6224	0.6111	0.6879	0.6910	0.8888	0.9316	0.6549	0.6482
FI	0.3530	0.3640	0.5925	0.5989	0.5537	0.6211	0.6781	0.6715	0.6005	0.6056	0.5652	0.6323
FR	0.3187	0.3423	0.5528	0.4817	0.4661	0.5070	0.5738	0.6025	0.5621	0.4896	0.4907	0.5286
DE	0.3089	0.3560	0.4709	0.4376	0.4561	0.5039	0.5348	0.5821	0.4917	0.4533	0.4880	0.5289
EL	0.2351	0.3256	0.6691	0.7165	0.6796	0.6910	0.4927	0.5377	0.6735	0.7214	0.7090	0.7110
HU	0.3371	0.4034	0.6606	0.6704	0.7151	0.7314	0.7200	0.7214	0.6666	0.6758	0.7193	0.7348
IE	0.3462	0.3776	0.4318	0.4052	0.4844	0.5200	0.5706	0.5851	0.4751	0.4415	0.5057	0.5399
IT	0.2861	0.3803	0.6089	0.6093	0.5591	0.6781	0.5575	0.6010	0.6223	0.6239	0.5950	0.7068
LV	0.3963	0.3957	0.8933	0.8592	0.6945	0.6363	0.7322	0.7346	0.8958	0.8628	0.7167	0.6643
LT	0.3754	0.3700	0.9037	0.8860	0.6627	0.6268	0.7113	0.7086	0.9063	0.8876	0.6768	0.6426
LU	0.4242	0.5684	0.4336	0.4349	0.6184	0.6009	0.5442	0.7035	0.5866	0.5522	0.6571	0.6360
MT	0.1510	0.2412	0.3461	0.2386	0.2723	0.4304	0.2768	0.3370	0.3702	0.2549	0.2911	0.4614
NL	0.3094	0.3517	0.4980	0.3986	0.4284	0.4165	0.5764	0.6041	0.5063	0.4065	0.4483	0.4334
PT	0.3576	0.3466	0.5481	0.5214	0.4440	0.5302	0.6448	0.6244	0.5549	0.5286	0.4630	0.5539
SI	0.2572	0.3258	0.5602	0.5693	0.5891	0.5995	0.4911	0.5606	0.5643	0.5754	0.6239	0.6189
ES	0.3166	0.3700	0.4860	0.5063	0.4589	0.6211	0.5797	0.5845	0.5001	0.5193	0.4914	0.6606
SE	0.3332	0.3327	0.5275	0.4755	0.4088	0.5468	0.5634	0.5388	0.5429	0.4894	0.4462	0.5867
GB	0.3108	0.3415	0.4740	0.4112	0.3692	0.3959	0.5424	0.5626	0.4934	0.4272	0.3910	0.4157

Source: EU-LFS microdata

Local segregation in the EU by country, 2019. Local generalised entropy family index.

	Unstandardised, ϕ_1^g						Standardised, Φ_1^g					
Country	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**	**NM**	**NF**	**MoM**	**MoF**	**MiM**	**MiF**
AT	0.1972	0.2676	0.3294	0.3371	0.4879	0.5903	0.2263	0.2679	0.1094	0.1128	0.1762	0.1985
BE	0.1799	0.2466	0.4779	0.4499	0.4453	0.7090	0.2152	0.2622	0.1513	0.1414	0.1513	0.2195
HR	0.2220	0.3289	1.3501	1.8165	0.7834	0.9147	0.3168	0.3708	0.2759	0.3732	0.2480	0.2712
CY	0.2347	0.3032	0.5701	0.5723	0.8267	1.1598	0.2480	0.2854	0.2065	0.2118	0.2966	0.4457
CZ	0.1956	0.3108	0.5833	0.6801	0.6393	0.7470	0.3093	0.3645	0.1339	0.1425	0.1432	0.1607
DK	0.1659	0.2108	0.5031	0.4750	0.4806	0.6028	0.2161	0.2517	0.1282	0.1158	0.1430	0.1755
EE	0.2383	0.3145	1.9874	2.4084	0.7243	0.6811	0.3119	0.3618	0.3620	0.4339	0.2412	0.2381
FI	0.2075	0.2473	0.6406	0.6916	0.5549	0.7202	0.2822	0.3166	0.1486	0.1537	0.1424	0.1787
FR	0.1741	0.2060	0.5501	0.4156	0.3654	0.4547	0.2148	0.2454	0.1340	0.1007	0.1220	0.1421
DE	0.1576	0.2292	0.3698	0.3516	0.3420	0.4625	0.1829	0.2423	0.1169	0.1044	0.1254	0.1515
EL	0.0965	0.2093	0.8574	0.9966	0.8965	0.9848	0.1488	0.2249	0.1700	0.2000	0.2817	0.2757
HU	0.1933	0.3093	0.8699	0.8506	1.0498	1.0629	0.3061	0.3776	0.1848	0.1762	0.2041	0.1976
IE	0.1989	0.2644	0.3077	0.3159	0.4166	0.4958	0.2131	0.2550	0.1285	0.1264	0.1315	0.1501
IT	0.1386	0.2646	0.6637	0.6968	0.5344	0.9015	0.1925	0.2642	0.1729	0.1855	0.1904	0.2812
LV	0.2878	0.3066	2.0776	1.7627	0.9479	0.7667	0.3693	0.3962	0.3530	0.3207	0.2726	0.2422
LT	0.2389	0.2696	2.0556	1.9160	0.8197	0.7266	0.3184	0.3650	0.3504	0.3035	0.2116	0.1960
LU	0.3004	0.5640	0.3319	0.3535	0.7249	0.6956	0.1988	0.3417	0.2470	0.2282	0.2561	0.2400
MT	0.0391	0.1205	0.1965	0.1568	0.1304	0.3558	0.0496	0.0958	0.0719	0.0570	0.0476	0.1319
NL	0.1592	0.2183	0.4376	0.3069	0.3104	0.3236	0.2068	0.2501	0.1063	0.0779	0.0997	0.0996
PT	0.2145	0.2407	0.5679	0.5402	0.3421	0.5119	0.2652	0.2973	0.1290	0.1256	0.1071	0.1624
SI	0.1063	0.2030	0.5719	0.6110	0.6144	0.6970	0.1434	0.2333	0.1161	0.1342	0.2128	0.2014
ES	0.1695	0.2502	0.3994	0.4544	0.3536	0.6904	0.2145	0.2497	0.1119	0.1233	0.1302	0.2450
SE	0.1794	0.2015	0.4798	0.4132	0.2918	0.5282	0.2005	0.2098	0.1347	0.1161	0.1177	0.1966
GB	0.1550	0.2169	0.3714	0.3144	0.2454	0.2810	0.1822	0.2322	0.1147	0.0956	0.0851	0.0922

Source: EU-LFS microdata

Local segregation in the EU, 2019. Local Gini index.

	Unstandardised, G^g	Standardised, $\tilde{G}^g$	Group share
MiF	0.4994	0.5190	3.8%
MiM	0.3776	0.3965	4.8%
MoF	0.4186	0.4287	2.4%
MoM	0.4142	0.4251	2.6%
NF	0.3439	0.5766	40.4%
NM	0.3022	0.5616	46.2%

Source: EU-LFS microdata

Local segregation in the EU, 2019. Local generalised entropy family index.

	Unstandardised, $\square_1^g$	Standardised, $\square_1^g$	Group share
MiF	0.4602	0.1405	3.8%
MiM	0.2317	0.0761	4.8%
MoF	0.3098	0.0826	2.4%
MoM	0.2770	0.0756	2.6%
NF	0.2171	0.2393	40.4%
NM	0.1499	0.1940	46.2%

Source: EU-LFS microdata

Overall segregation in the EU, 2019. Gini index.

	Unstandardised, G_u	Standardised, G	Maximum value, G_u^*
MT	0.2216	0.3186	0.6954
EL	0.3081	0.5420	0.5686
SI	0.3207	0.5403	0.5935
EU28	0.3357	0.5424	0.6189
GB	0.3403	0.5197	0.6549
NL	0.3413	0.5625	0.6068
DK	0.3489	0.5868	0.5945
FR	0.3504	0.5735	0.6111
DE	0.3573	0.5403	0.6613
SE	0.3634	0.5398	0.6733
IT	0.3676	0.5912	0.6217
PT	0.3682	0.6139	0.5997
FI	0.3728	0.6665	0.5594
ES	0.3733	0.5744	0.6499
HU	0.3760	0.7192	0.5228
CZ	0.3778	0.7055	0.5355
BE	0.3781	0.5799	0.6519
IE	0.3822	0.5449	0.7014
LT	0.3874	0.7074	0.5477
AT	0.3920	0.5783	0.6778
HR	0.4090	0.7038	0.5811
EE	0.4126	0.6859	0.6015
LV	0.4187	0.7294	0.5740
CY	0.4529	0.6362	0.7120
LU	0.4778	0.6012	0.7948

Source: EU-LFS microdata

Overall segregation in the EU, 2019. Mutual information index.

	Unstandardised, M	Standardised, H	Maximum value, M*
MT	0.1072	0.0751	1.4283
EL	0.2102	0.2091	1.0050
SI	0.2024	0.1889	1.0711
GB	0.2048	0.1592	1.2862
EU28	0.1997	0.1701	1.1738
NL	0.2044	0.1810	1.1293
FR	0.2190	0.1925	1.1376
DK	0.2221	0.2035	1.0915
DE	0.2275	0.1745	1.3035
SE	0.2362	0.1781	1.3264
IT	0.2640	0.2222	1.1882
PT	0.2529	0.2302	1.0986
IE	0.2617	0.1852	1.4130
BE	0.2647	0.2070	1.2787
ES	0.2560	0.2020	1.2673
HU	0.2648	0.3180	0.8329
CZ	0.2641	0.2963	0.8915
FI	0.2531	0.2613	0.9687
AT	0.2750	0.2027	1.3567
LT	0.2858	0.3152	0.9068
HR	0.3344	0.3224	1.0370
EE	0.3354	0.3113	1.0774
LV	0.3481	0.3501	0.9943
CY	0.4072	0.2799	1.4549
LU	0.4174	0.2519	1.6566

Source: EU-LFS microdata

Appendix C. Mobility Tables

C.1. Mobility Tables by Entry Cohort

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table. Cohort 2004-2007

COHORT 2004-2007		LAST CONTRACT/CURRENT STATUS												
		G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**	**0.92**	0.07	0.05	0.02	0.05	0.01	0.03	0.02	0.01	0.02	0.01	0.26	**1.45**
	G2	0.13	**0.20**	0.03	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.00	0.08	**0.54**
	G3	0.12	0.03	**0.24**	0.02	0.06	0.01	0.05	0.04	0.02	0.04	0.01	0.15	**0.78**
	G4	0.06	0.03	0.03	**0.13**	0.07	0.02	0.07	0.11	0.12	0.13	0.01	0.22	**1.02**
	G5	0.23	0.10	0.12	0.06	**0.54**	0.08	0.31	0.29	0.20	0.21	0.02	0.47	**2.64**
	G6	0.05	0.06	0.02	0.05	0.10	**0.20**	0.18	0.21	0.24	0.27	0.03	0.22	**1.65**
	G7	0.34	0.17	0.24	0.17	0.83	0.21	**1.23**	0.62	0.56	0.64	0.13	1.11	**6.26**
	G8	0.15	0.08	0.19	0.15	0.40	0.31	0.56	**4.18**	1.43	1.47	0.15	2.11	**11.19**
	G9	0.15	0.11	0.24	0.27	0.58	0.50	0.88	2.90	**2.89**	2.25	0.26	2.28	**13.32**
	G10	0.24	0.16	0.27	0.49	0.86	0.89	3.62	7.20	5.28	**14.10**	0.86	4.11	**38.09**
	GD	0.10	0.15	0.09	0.29	0.65	0.88	1.75	1.69	2.11	4.17	**5.48**	1.41	**18.75**
	GSW	0.10	0.02	0.04	0.05	0.13	0.08	0.13	0.74	0.35	0.59	0.07	**2.02**	**4.31**
	Total	**2.59**	**1.20**	**1.57**	**1.70**	**4.29**	**3.20**	**8.82**	**18.01**	**13.23**	**23.90**	**7.04**	**14.45**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table. Cohort 2008-2013

COHORT 2008-2013		LAST CONTRACT/CURRENT STATUS												
		G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**	**2.24**	0.10	0.08	0.04	0.13	0.01	0.06	0.04	0.01	0.01	0.00	0.28	**3.00**
	G2	0.20	**0.36**	0.07	0.02	0.07	0.01	0.05	0.03	0.00	0.01	0.00	0.10	**0.92**
	G3	0.14	0.07	**0.28**	0.03	0.06	0.00	0.03	0.05	0.03	0.03	0.00	0.14	**0.86**
	G4	0.09	0.06	0.08	**0.19**	0.07	0.08	0.14	0.17	0.19	0.20	0.04	0.27	**1.57**
	G5	0.23	0.12	0.15	0.12	**0.80**	0.07	0.33	0.24	0.25	0.19	0.04	0.52	**3.07**
	G6	0.06	0.04	0.03	0.07	0.15	**0.40**	0.23	0.28	0.30	0.35	0.05	0.31	**2.25**
	G7	0.38	0.20	0.20	0.26	0.85	0.25	**1.65**	0.64	0.68	0.71	0.17	1.10	**7.10**
	G8	0.13	0.05	0.15	0.18	0.32	0.26	0.61	**2.46**	1.06	1.22	0.17	1.51	**8.11**
	G9	0.14	0.11	0.17	0.29	0.56	0.43	1.15	2.09	**3.33**	2.30	0.40	2.00	**12.97**
	G10	0.20	0.18	0.19	0.43	0.72	0.75	3.56	4.33	4.75	**15.12**	1.26	3.07	**34.57**
	GD	0.08	0.08	0.06	0.20	0.30	0.56	1.13	1.31	1.69	3.47	**9.25**	1.01	**19.16**
	GSW	0.13	0.07	0.06	0.07	0.14	0.12	0.32	0.80	0.52	0.78	0.06	**3.35**	**6.41**
	Total	**4.03**	**1.44**	**1.50**	**1.87**	**4.19**	**2.94**	**9.28**	**12.43**	**12.80**	**24.40**	**11.45**	**13.66**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table. Cohort 2014-2019

COHORT 2014-2019			LAST CONTRACT/CURRENT STATUS												
			G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**G8**	**G9**	**G10**	**GD**	**GSW**	**Total**
FIRST CONTRACT	**G1**		**3.38**	0.11	0.05	0.04	0.10	0.01	0.10	0.02	0.02	0.02	0.00	0.11	**3.94**
	G2		0.10	**0.91**	0.04	0.02	0.08	0.01	0.06	0.03	0.01	0.02	0.00	0.06	**1.34**
	G3		0.08	0.05	**0.94**	0.03	0.08	0.02	0.06	0.05	0.04	0.02	0.00	0.07	**1.43**
	G4		0.09	0.05	0.04	**1.00**	0.14	0.05	0.24	0.16	0.27	0.24	0.01	0.12	**2.43**
	G5		0.20	0.15	0.10	0.10	**2.36**	0.10	0.54	0.25	0.24	0.21	0.02	0.18	**4.45**
	G6		0.03	0.02	0.02	0.07	0.13	**1.18**	0.30	0.24	0.35	0.35	0.04	0.11	**2.84**
	G7		0.38	0.21	0.20	0.28	1.07	0.26	**6.15**	0.63	0.77	0.85	0.08	0.49	**11.37**
	G8		0.08	0.05	0.08	0.19	0.31	0.26	0.79	**5.05**	1.10	0.97	0.05	0.51	**9.43**
	G9		0.09	0.05	0.10	0.33	0.49	0.35	1.17	1.52	**7.23**	2.04	0.13	0.66	**14.16**
	G10		0.17	0.13	0.11	0.32	0.66	0.60	2.52	2.13	3.61	**19.68**	0.38	0.99	**31.31**
	GD		0.03	0.01	0.03	0.08	0.12	0.21	0.42	0.43	0.70	1.25	**5.33**	0.13	**8.75**
	GSW		0.12	0.06	0.05	0.07	0.17	0.12	0.30	0.44	0.43	0.64	0.04	**6.13**	**8.56**
	Total		**4.75**	**1.81**	**1.76**	**2.52**	**5.71**	**3.16**	**12.65**	**10.96**	**14.76**	**26.28**	**6.09**	**9.56**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

C.2. Mobility Tables by Origin

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table.
EU-15 Immigrants

EU-15		LAST CONTRACT/CURRENT STATUS												
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	GD	GSW	Total
FIRST CONTRACT	G1	**5.79**	0.32	0.25	0.07	0.36	0.03	0.10	0.05	0.02	0.02	0.00	0.92	**7.94**
	G2	0.69	**1.91**	0.14	0.03	0.21	0.01	0.12	0.04	0.02	0.02	0.00	0.50	**3.68**
	G3	0.41	0.14	**1.64**	0.09	0.24	0.02	0.12	0.07	0.05	0.04	0.00	0.59	**3.39**
	G4	0.23	0.14	0.13	**0.85**	0.17	0.04	0.25	0.16	0.16	0.08	0.01	0.36	**2.57**
	G5	0.91	0.44	0.45	0.18	**3.53**	0.13	0.78	0.30	0.18	0.17	0.01	1.36	**8.45**
	G6	0.10	0.09	0.09	0.08	0.24	**0.59**	0.25	0.18	0.17	0.14	0.01	0.32	**2.25**
	G7	1.05	0.60	0.66	0.46	2.50	0.25	**5.94**	0.83	0.48	0.53	0.06	2.32	**15.71**
	G8	0.30	0.20	0.29	0.25	0.67	0.26	0.84	**5.81**	1.05	0.71	0.04	1.97	**12.39**
	G9	0.28	0.24	0.37	0.29	1.08	0.39	1.16	2.24	**3.80**	0.99	0.14	1.92	**12.89**
	G10	0.37	0.35	0.35	0.32	1.03	0.38	1.36	2.38	1.46	**4.43**	0.22	2.40	**15.05**
	GD	0.01	0.02	0.00	0.03	0.03	0.04	0.07	0.06	0.10	0.25	**0.43**	0.10	**1.15**
	GSW	0.38	0.20	0.20	0.10	0.41	0.18	0.49	0.81	0.35	0.43	0.05	**10.95**	**14.54**
	Total	**10.54**	**4.64**	**4.57**	**2.76**	**10.46**	**2.31**	**11.48**	**12.92**	**7.83**	**7.81**	**0.95**	**23.73**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table.
Immigrants from Enlargement Countries

Enlargement countries		LAST CONTRACT/CURRENT STATUS												
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	GD	GSW	Total
FIRST CONTRACT	G1	**0.57**	0.04	0.02	0.01	0.01	0.00	0.02	0.02	0.01	0.00	0.00	0.06	**0.78**
	G2	0.04	**0.21**	0.01	0.00	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.02	**0.35**
	G3	0.02	0.01	**0.21**	0.02	0.01	0.00	0.01	0.03	0.02	0.02	0.00	0.04	**0.38**
	G4	0.02	0.03	0.02	**0.21**	0.05	0.01	0.06	0.11	0.12	0.14	0.02	0.09	**0.87**
	G5	0.10	0.05	0.05	0.04	**0.57**	0.04	0.20	0.15	0.11	0.09	0.03	0.11	**1.54**
	G6	0.02	0.01	0.02	0.01	0.09	**0.44**	0.14	0.21	0.16	0.24	0.05	0.16	**1.55**
	G7	0.17	0.08	0.08	0.08	0.41	0.14	**1.48**	0.40	0.34	0.43	0.11	0.40	**4.12**
	G8	0.05	0.02	0.11	0.12	0.22	0.21	0.39	**5.34**	1.12	1.11	0.10	1.38	**10.17**
	G9	0.08	0.07	0.17	0.25	0.40	0.41	0.83	2.64	**3.98**	2.06	0.33	1.24	**12.47**
	G10	0.09	0.09	0.16	0.25	0.50	0.73	4.47	6.57	4.95	**26.75**	1.20	3.09	**48.85**
	GD	0.03	0.08	0.04	0.15	0.32	0.33	0.58	0.66	0.92	1.82	**5.26**	0.59	**10.79**
	GSW	0.04	0.03	0.03	0.07	0.12	0.16	0.27	1.86	0.96	1.52	0.11	**2.97**	**8.15**
	Total	**1.21**	**0.72**	**0.92**	**1.21**	**2.73**	**2.51**	**8.46**	**17.99**	**12.68**	**34.20**	**7.22**	**10.15**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table.
Immigrants from Africa

AFRICA		LAST CONTRACT/CURRENT STATUS												
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	GD	GSW	Total
FIRST CONTRACT	G1	**0.39**	0.01	0.02	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.08	**0.59**
	G2	0.06	**0.17**	0.00	0.00	0.02	0.01	0.01	0.02	0.00	0.01	0.00	0.04	**0.34**
	G3	0.01	0.01	**0.15**	0.00	0.05	0.00	0.01	0.02	0.02	0.05	0.00	0.05	**0.37**
	G4	0.02	0.02	0.01	**0.18**	0.03	0.02	0.07	0.09	0.09	0.19	0.01	0.10	**0.82**
	G5	0.02	0.03	0.03	0.04	**0.31**	0.04	0.17	0.12	0.14	0.17	0.02	0.18	**1.27**
	G6	0.01	0.02	0.04	0.02	0.05	**0.29**	0.10	0.22	0.18	0.31	0.01	0.06	**1.32**
	G7	0.12	0.07	0.10	0.07	0.34	0.13	**1.06**	0.37	0.41	0.70	0.03	0.33	**3.73**
	G8	0.04	0.03	0.05	0.07	0.11	0.13	0.33	**2.32**	0.86	1.51	0.06	0.68	**6.19**
	G9	0.07	0.07	0.10	0.22	0.22	0.27	0.64	1.68	**3.42**	3.01	0.17	0.90	**10.77**
	G10	0.12	0.08	0.22	0.48	0.51	0.70	5.62	7.45	7.53	**35.11**	0.61	3.51	**61.92**
	GD	0.02	0.02	0.03	0.10	0.14	0.20	0.55	0.83	1.03	2.88	**2.51**	0.44	**8.76**
	GSW	0.02	0.04	0.02	0.01	0.03	0.04	0.15	0.34	0.35	0.91	0.04	**1.98**	**3.93**
	Total	**0.90**	**0.58**	**0.76**	**1.20**	**1.83**	**1.84**	**8.73**	**13.46**	**14.05**	**44.85**	**3.47**	**8.33**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Percentage of Immigrant workers by Initial and Current Contribution Group. Mobility Table.
Immigrants from Latin America

LATIN AMERICA		LAST CONTRACT/CURRENT STATUS												
		G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	GD	GSW	Total
FIRST CONTRACT	G1	**2.14**	0.08	0.06	0.02	0.07	0.01	0.07	0.02	0.01	0.02	0.00	0.26	**2.76**
	G2	0.13	**0.44**	0.04	0.01	0.04	0.01	0.03	0.02	0.00	0.02	0.00	0.08	**0.85**
	G3	0.12	0.08	**0.36**	0.02	0.06	0.02	0.05	0.06	0.03	0.04	0.00	0.16	**0.99**
	G4	0.09	0.04	0.05	**0.43**	0.12	0.07	0.18	0.16	0.21	0.18	0.03	0.17	**1.72**
	G5	0.24	0.11	0.15	0.13	**1.24**	0.10	0.47	0.34	0.27	0.24	0.03	0.42	**3.76**
	G6	0.06	0.06	0.02	0.07	0.16	**0.75**	0.30	0.28	0.35	0.37	0.07	0.21	**2.71**
	G7	0.45	0.25	0.27	0.29	1.11	0.36	**3.55**	0.72	0.82	0.85	0.18	0.99	**9.85**
	G8	0.13	0.09	0.19	0.21	0.43	0.38	0.75	**3.73**	1.21	1.22	0.17	1.26	**9.77**
	G9	0.16	0.13	0.20	0.32	0.70	0.57	1.26	2.45	**4.84**	2.18	0.34	1.41	**14.57**
	G10	0.32	0.24	0.22	0.47	1.04	1.00	2.49	4.46	3.99	**9.56**	0.92	2.24	**26.96**
	GD	0.10	0.13	0.10	0.26	0.57	0.98	2.01	1.63	2.02	4.13	**8.89**	1.14	**21.96**
	GSW	0.14	0.06	0.04	0.06	0.14	0.08	0.23	0.29	0.25	0.32	0.07	**2.41**	**4.10**
	Total	**4.08**	**1.71**	**1.72**	**2.29**	**5.69**	**4.31**	**11.40**	**14.17**	**14.02**	**19.13**	**10.72**	**10.76**	**100**

Upward occupational mobility

Downward occupational mobility

Source: MCVL-2019

Note: The table shows the percentage of immigrant workers whose first contract was registered in the Contribution Group given in each row and who currently belong to the contribution group listed in each column.

Appendix D. Immigrant's Contribution Base / Native's Contribution Base Ratio

D.1. TCN: Immigrant's Contribution Base / Native's Contribution Base Ratio

Immigrant's Contribution Base / Native's Contribution Base Ratio (TCN, 2004-2019)

Group	2004	2008	2012	2016	2019
G1	0.9822	0.9756	0.9713	0.9866	0.9950
G2	0.9603	0.9593	0.9545	0.9260	0.9294
G3	0.9310	0.8779	0.8763	0.8467	0.8534
G4	0.8100	0.7479	0.7395	0.7154	0.7130
G5	0.8983	0.8380	0.8434	0.8596	0.8572
G6	0.8381	0.8005	0.8225	0.8292	0.8456
G7	0.8699	0.8365	0.7528	0.8247	0.8629
G8	0.8833	0.8713	0.8477	0.8439	0.8545
G9	0.8810	0.8745	0.8462	0.8538	0.8759
G10	1.0271	1.0146	0.9402	0.9348	0.9530
Total system mean	**0.8062**	**0.7798**	**0.7409**	**0.7471**	**0.7785**

Source: MCVL-2019

D.2. EU15-Born Immigrants: Immigrant's Contribution Base/Native's Contribution Base Ratio

Immigrant's Contribution Base / Native's Contribution Base Ratio (EU15, 2004-2019).

Group	2004	2008	2012	2016	2019
G1	1.0102	0.9963	1.0019	1.0195	1.0238
G2	0.9681	0.9468	0.9411	0.9536	0.9601
G3	1.0196	1.0047	1.0185	1.0370	1.0420
G4	0.9948	0.9546	0.9683	0.9895	0.9571
G5	1.0480	1.0201	1.0361	1.0314	1.0086
G6	0.9604	0.9818	0.9549	0.9895	0.9921
G7	1.0158	0.9808	1.0597	1.0670	1.0482
G8	0.9584	0.9420	0.9343	0.9185	0.9160
G9	0.9347	0.9130	0.9133	0.9138	0.9252
G10	1.0301	1.0178	1.0058	1.0025	0.9935
Total system mean	**0.9914**	**0.9612**	**0.9643**	**0.9654**	**0.9604**

Source: MCVL-2019

D.3. 2008 Cohort. Immigrant's Contribution Base / Native's Contribution Base Ratio

Immigrant's Contribution Base / Native's Contribution Base Ratio (2008 cohort, 2008-2019).

Group	2004	2008	2012	2016
G1	0.9117	0.9410	1.0012	1.0273
G2	0.8052	0.8684	0.8687	0.9216
G3	0.8030	0.8374	0.8649	0.8841
G4	0.6066	0.6606	0.6621	0.7015
G5	0.7093	0.7791	0.8451	0.8964
G6	0.7505	0.7985	0.8196	0.8366
G7	0.7671	0.7177	0.8070	0.8626
G8	0.7730	0.7819	0.8182	0.8504
G9	0.7993	0.7979	0.8432	0.8728
G10	0.8501	0.8945	0.9119	0.9470
Total system mean	**0.6551**	**0.7026**	**0.7371**	**0.7801**

Source: MCVL-2019

D.4. 2012 Cohort. Immigrant's Contribution Base / Native's Contribution Base Ratio

Immigrant's Contribution Base / Native's Contribution Base Ratio (2012 cohort, 2012-2019)

Group	2012	2016	2019
G1	0.7942	0.9146	0.9973
G2	0.7244	0.8120	0.8809
G3	0.9087	0.8315	0.8689
G4	0.5648	0.5842	0.6828
G5	0.7195	0.8123	0.8676
G6	0.7052	0.7520	0.7995
G7	0.6600	0.8246	0.8931
G8	0.7194	0.7505	0.8052
G9	0.7715	0.8185	0.8703
G10	0.8383	0.8752	0.9346
Total system mean	**0.6188**	**0.7011**	**0.7657**

Source: MCVL-2019

Wage bargaining, relative prices and capital: the impact of immigration on wages and wage ineqauality*

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Abstract

This paper develops a model of immigration that encompasses different channels through which immigration impacts native wages. The framework incorporates a frictional labor market with different outside options for immigrants and natives, local demand conditions captured by relative prices, and capital-labor substitution. The model is calibrated on labor date for the four largest European Union economies, France, Germany, Italy and Spain. Three counterfactual scenarios are explored, where the adjustment speed of the capital stock and the sensitivity of domestic relative prices to immigration differ. Results shows that the impact of immigration on wages and wages inequality depends crucially on the latter factor, i.e. whether relative prices are determined by local vs. global conditions. In the former case, the migration pattern observed in the data has led to a non-negligible increase in native wage inequality. In the latter case, migration skewed towards the low-skilled has led to a (quantitatively small) decrease in native wage inequality, due to the lower wage bargaining power of immigrants who compete with native workers.

Keywords: immigration, search and matching, bargaining power, capital-labor ratio, relative prices

JEL codes: E24, J21, J31, J61, J64

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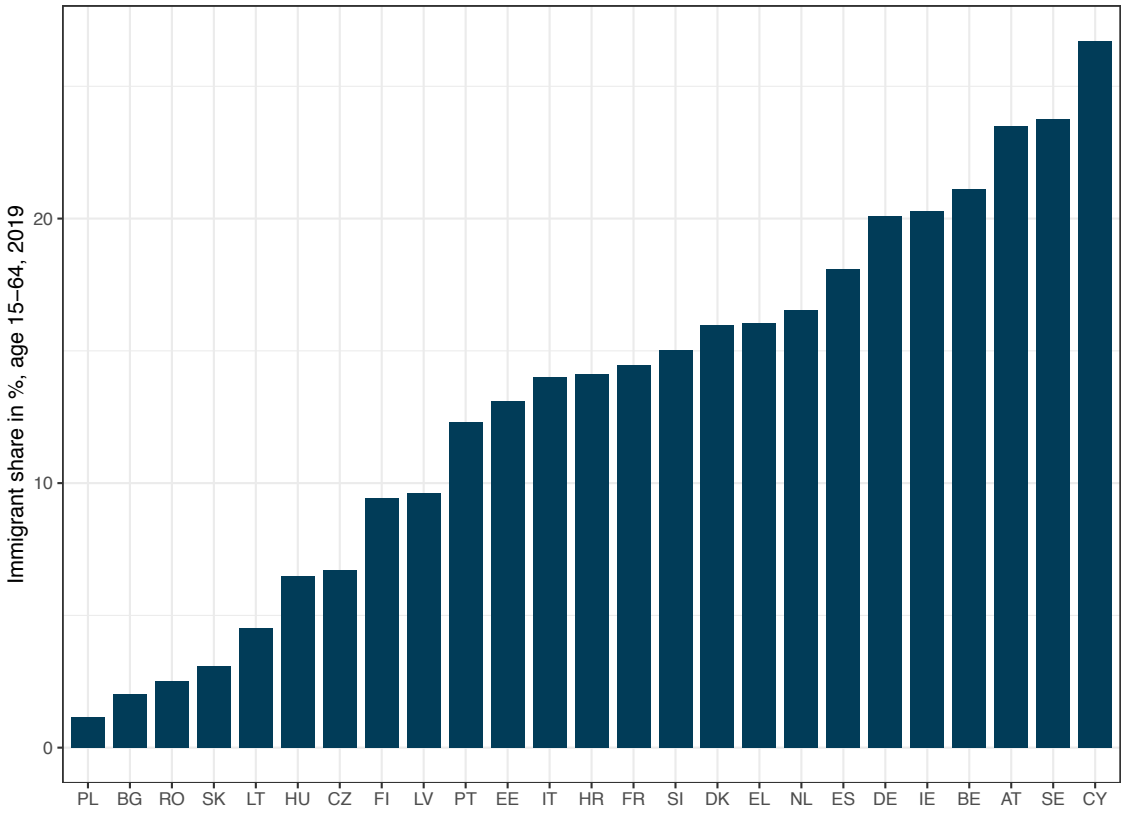
1 Introduction

Large-scale immigration has a potentially significant impact on the labor markets of host countries. Immigrant workers compete with some native employees, and complement others, creating heterogenous effects that may increase or decrease native wages and native wage inequality. Finding out the exact impact is an empirical question, and different available methodologies have different strengths and weaknesses.

Fig. 1.1: The share of immigrants in the working age population



European countries have been subject to significant immigration in the past decades, although to varying degrees. Figure 1.1 plots the share of immigrants in the working age (15-64) population across the European Union.[1] In the majority of the EU countries this share is above 10%, and in six countries it is above 20%. The four largest EU economies (France, Germany, Italy and Spain), on which the quantitative analysis of this paper will focus on, have immigrant shares in the 14%-20% range. This magnitude is large enough to ask whether immigration has had a sizable impact on European wages and on wage inequality. The main goal of this paper is to provide

[1] The figure omits Luxembourg, which is an outlier with an immigrant share of more than 50%.

a framework that can be used to analyze this question, using a tractable, quantitative general equilibrium approach.

There is a very large literature that analyses the impact of immigration on host country labor markets, focusing on many countries. Broadly speaking, there are two main strands in the literature to understand labor market changes caused by migration. Area studies utilize variation across geographical regions (cities, metropolitan areas, or larger units within countries) in their exposure to immigration. Examples of such papers are Card (1990) Altonji and Card (1991), Card (2001) in the United States; Dustmann et al. (2013) and Nickell and Saleheen (2015) in the UK; Pischke and Velling (1997) and D'Amuri et al. (2010) in Germany. The general consensus among these papers is that immigration has at most a very small negative impact on native wages.

There are various reasons why these conclusions need to be refined. First, native workers may respond to an immigration shock by moving to other parts of a country, diluting the regional differences on which local area studies are based (see for example Borjas, 1994). To mitigate this effect, a second strand of the literature focuses at large enough geographical units (typically countries) that can be considered having closed labor markets (apart from the immigration inflow). Given the lack of degrees of freedom for country level econometric estimation, such studies have utilized simple neoclassical production theory to quantify the impact of migration on wages ("the factor proportions approach"). Articles in this tradition include Borjas et al. (1997); Borjas (2003); Ben-Gad (2008) or Busch et al. (2020). Using an aggregate production function, on the other hand, necessarily ignores much of the fine-grained information available at the local level, and may lead to simplistic conclusions.

In more recent work, the fact that immigrant and native workers are heterogenous along many dimensions plays center stage. In particular, heterogeneity along skill levels is very important to understand the differential impact of immigration on native wages. A long tradition in the macroeconomic analysis of wages and inequality distinguishes skilled and unskilled workers, along with capital as factors of production (a seminal treatment is given in Hamermesh, 1993; another important study is Krusell et al., 2000). Other work has looked at a somewhat higher level of disaggregation, such as effects along the native wage distribution (Dustmann et al., 2013), or across occupation categories (Burstein et al., 2020; Nickell and Saleheen, 2015). Of course the different approaches are not mutually exclusive, and many papers – including the last two –

combine worker heterogeneity, a production function approach, and identification based on local labor market differences.

A different tradition in the study of labor markets focuses on search-and-matching frictions in employment and wage determination (Mortensen and Pissarides, 1994; Pissarides, 2000). This approach has recently made inroads into the migration literature (Ortega, 2000; Liu, 2010; Chassamboulli and Palivos, 2014; Chassamboulli and Peri, 2015; Moreno-Galbis and Tritah, 2016). An attractive feature of allowing for labor market frictions is that ex-ante identical workers become less than perfect substitutes ex-post. Once a job is filled, firms and workers share a surplus that makes job changes costly for both sides. If the relative bargaining position of immigrants and natives differ, an *immigrant wage gap* opens up between them. Taking this into account is potentially important to understand native wage changes due to immigration.

Based on these ideas, this paper builds a model of frictional labor markets with immigrants and natives. The labor markets are embedded in a macroeconomic environment where goods and services produced by different occupations are imperfect substitutes, and capital is a factor of production at the aggregate level. The model is calibrated to labor market data in the four largest EU economies, France, Germany, Italy and Spain, using observed employment numbers in occupation categories for immigrants and natives. Additional data on aggregate labor market tightness, job finding and job separation rates, along with data on average wages for each occupation, and estimates of the immigrant wage gap, allows for the quantification of the key labor market parameters.

Given the observed and calibrated *migration equilibrium*, I calculate counterfactual scenarios without any immigrants in the labor force. Broadly speaking, there are two extreme assumptions about the macroeconomic environment in which wage determination takes place. In highly open economies, relative prices of goods and services associated with different occupations are determined in global markets, and do not respond to labor supply changes. Similarly, the capital-output ratio adjusts quickly to an immigration shock. Under these circumstances, the main effect of immigration on wages is via the bargaining process, which leads to an *increase* in native wages and a *decline* in native wage inequality, at least for the pattern of migration observed in Europe.

In the second case, when the economy in question is closed, both relative prices and the capital-output ratio change, at least in the short-run. If, as in the data, the occupation composition

of immigrants is different from natives, relative price movements lead to changes in relative wages. Given migration patterns, this leads to a significant decline in low-skilled wages, and to an increase in wage inequality. A lower capital-output ratio further decreases native real wages, since the real rental rate of capital rises. One of the main conclusions of this paper, therefore, is that the extent of openness is the key determinant of how native wages and wage inequality are impacted by large-scale immigration.

My approach combines key ingredients from three closely related papers. Chassamboulli and Palivos, 2014 work in a very similar framework, embedding frictional labor markets into a macroeconomic environment with capital. They rely on the same key mechanisms: bargaining power, relative prices, and capital-labor substitution. In contrast to the present paper, however, they work with only two labor types, skilled and unskilled workers, whereas I include 8 occupation categories in the analysis. This allows me to use occupation-level wage data in the calibration, also estimating productivity differentials across occupations.[2]

Chassamboulli and Palivos, 2014 calibrate their model to the United States, assuming a closed economy, whereas I allow for the possibility that relative prices are determined globally. Not necessarily consistent with the closed economy setup, they assume that the capital stock is always in steady state, while in my case the capital-labor ratio may change with the immigration shock. This allows me to explore a key determinant of how immigrants impact native wages, i.e. the extent of openness in goods and capital markets.

An advantage of the setup in Chassamboulli and Palivos, 2014 from a theoretical perspective is that they allow for different substitution elasticities between capital on the one hand, and skilled and unskilled labor on the other hand. With 8 occupation categories picking the right elasticities would be very difficult, so I focus on the Cobb-Douglas case. The upside of my choice is that the calibration and the calculation of the various counterfactuals in particularly simple.

The second closely related paper is Moreno-Galbis and Tritah, 2016. They use the same framework on the labor market, with a slight difference in the wage bargaining assumption.[3] The key common assumption in their paper and the current one is the lower outside option of immigrants, which leads to different wages even for workers that have the same productivity. Moreno-Galbis

[2] Chassamboulli and Palivos, 2014 generate a skilled-unskilled wage gap by assuming differential search costs, a much less realistic assumption than differences in productivity (human capital).

[3] These differences are not important for the main results.

and Tritah, 2016 use the matching model to motivate a reduced-form econometric exercise, testing the qualitative implications of the wage setting process. In the current paper, however, the labor market is embedded in a macroeconomic environment, and the full model is calibrated to labor market data. This allows me to run counterfactual exercises about the impact of immigration on wages and wage inequality.

Finally, Burstein et al., 2020 emphasizes the different levels of tradability for occupations, at least across regions in the United States. As I also show, the extent of tradability is crucial to understand how immigration affects wages. There are two important differences in the modeling approach of Burstein et al., 2020 and the current paper. First, they do not consider capital as a factor of production, thus omitting the effect of the capital-labor ratio on real wages. Second, they work in a neoclassical setting, and do not consider matching frictions. They allow native and immigrant workers to differ exogenously within the same occupation, while here ex-post heterogeneity arises endogenously due to the different outside options.

Overall, to the best of my knowledge, this is the first paper to incorporate matching frictions in a broader macroeconomic framework in the European context. The combination of detailed occupations, relative price effects, and the role of the capital-labor ratio is a unique feature of the model. Also, I provide a detailed analysis of both (real and nominal) wages by occupation, and wage inequality overall. The focus on wage inequality is important from a policy perspective, since it drives much of the discussion about the desirability of future immigration. While I look at only at the four largest EU economies, but the approach can be applied to any country that reports the necessary data for the calibration.[4]

The rest of the paper is organized as follows. Section 2 describes the search-and-matching framework of the labor market, while Section 3 details how this is embedded into a macroeconomic environment. Section 4 presents a detailed description of the data and the calibration process. Section 5 contains the results on nominal and real wages, and on wage inequality. Finally, Section 6 concludes.

[4] I report numbers for the four countries mostly for expositional purposes. Similar results are available for most EU economies from the author upon request.

2 A model of segmented search

This section describes the search model, which forms the basis in the quantification of the impact of immigration on wage inequality. The model is an extended version of Moreno-Galbis and Tritah (2016), who introduced differential outside options into evaluating the effect of immigration on native wages. The main assumptions are as follows.

Jobs are created by competitive, single-employee firms, as in the standard approach (Pissarides, 2000). The labor market is segmented by occupations, and workers can only search in one chosen occupation. In case of immigrants, and in line with the empirical evidence, this may involve occupational downgrading once in the host country. To keep the model simple, separation rates are exogenous and constant (Merz, 1995; Andolfatto, 1996).

In each occupation, immigrants and natives are searching together. In terms of productivity, they are perfect substitutes for firms once hired. They differ, however, in their outside option. This is both because of immigrants' more limited eligibility for unemployment benefits, and also because of their weaker support networks in the host country. This difference introduces an important channel through which immigration impacts wage setting and wage inequality.

2.1 Unemployment and matching

The model is set in discrete time, with a quarterly frequency. Potential workers (the unemployed) search for jobs and meet vacancies opened by firms randomly. This process is captured by the aggregate matching function for each occupation:

$$m_{j,t} = \mu v_{j,t}^{1-\sigma} u_{j,t}^{\sigma},$$

where m denotes new matches (job interviews), v is open vacancies, and u is the number of unemployed looking for jobs in occupation j. The unemployed are composed by natives and immigrants:

$$u_{j,t} = u_{j,t}^{n} + u_{j,t}^{m},$$

where m, n denote immigrants and natives, respectively. For future reference, we can define the share of immigrants among the unemployed as

$$v_{j,t} = \frac{u^m_{j,t}}{u_{j,t}}.$$

Employment n_t evolves through separations and new matches. As in much of the literature (Merz, 1995; Andolfatto, 1996), I assume that a new match becomes productive in the following period. In equilibrium, all matches are successful, so the flow equation of employment is given by

$$n_t = (1 - s)\, n_{t-1} + m_{t-1}, \tag{2.1}$$

where s is the exogenous separation rate.

I assume that the labor force is fixed at the occupation level, and regular movements into and out of the labor force are not important to understand the impact of immigration on labor market equilibrium. The labor force is composed of the employed and the unemployed:

$$n_{j,t} + u_{j,t} = l_{j,t}, \tag{2.2}$$

where $l_{j,t}$ is exogenously given (but not necessarily constant). The labor force is composed of immigrants ($l^m_{j,t}$) and natives ($l^n_{j,t}$), whose numbers are also fixed.

Using the matching function, we can define the job finding (f_t) and job filling (q_t) rates as follows:

$$f_{j,t} = \frac{m_{j,t}}{u_{j,t}} = \mu \left(\frac{v_{j,t}}{u_{j,t}} \right)^{1-\sigma} \tag{2.3}$$

$$q_{j,t} = \frac{m_{j,t}}{v_{j,t}} = \mu \left(\frac{v_{j,t}}{u_{j,t}} \right)^{-\sigma}. \tag{2.4}$$

Given the assumption of constant returns to scale in matching, f_t and q_t are only functions of labor market tightness, $\theta_{j,t} = v_{j,t}/u_{j,t}$. Note that since immigrant and native job searchers are not distinguishable ex ante by firms, the job finding rate is the same for the two sub-groups within an occupation.

2.2 Job creation

Firms create jobs via posting vacancies. Opening and maintaining a vacancy is subject to a period cost of κ. The value of a filled job depends on the (occupation specific) productivity $\zeta_{j,t}$ and on the wage rate $w_{j,t}$. More specifically, the value functions for a filled position and an open vacancy are as follows:

$$J^i_{j,t} = p_{j,t}a_{j,t} - w^i_{j,t} - r_t k_{j,t} + \beta \mathbb{E}_t \left[(1-s) J^i_{j,t+1} + s V_{j,t+1} \right]$$
$$V_{j,t} = -\kappa + \beta \mathbb{E}_t \left[q_{j,t} \bar{J}_{j,t+1} + (1 - q_{j,t}) V_{j,t+1} \right].$$

Note that once a job interview is in place, firms learn the identity of the applicant. Given the different outside options of natives and immigrants, their negotiated wages in general will also differ. This means that the value of a filled position has to be conditioned on the worker type i. Since the type is not known when a vacancy is posted, advertising firms calculate with the average job value, $\bar{J}_{j,t} = \upsilon_{j,t} J^m_{j,t} + (1 - \upsilon_{j,t}) J^n_{j,t}$.

Introducing the notation $\zeta_{j,t} = p_{j,t}a_{j,t}$, the value of a filled job can be written as

$$J^i_{j,t} = \zeta_{j,t} + \beta \mathbb{E}_t \left[(1-s) J^i_{j,t+1} + s V_{j,t+1} \right].$$

As standard in the literature, we assume free entry into vacancy creation. The free entry condition implies that the value of vacancies is identically zero, $V_{j,t} \equiv 0$. Substituting this into the three value functions ($V_{j,t}$, $J^n_{j,t}$ and $J^m_{j,t}$) and rearranging yields the well-know job creation condition:

$$\frac{\kappa}{q_{j,t}} = \beta \mathbb{E}_t \left[\zeta_{j,t+1} - \bar{w}_{j,t} + \frac{(1-s)\kappa}{q_{j,t+1}} \right], \tag{2.5}$$

where $\bar{w}_{j,t} = \upsilon_{j,t} w^m_{j,t} + (1 - \upsilon_{j,t}) w^n_{j,t}$. This is the standard formula, where the cost of creating and maintaining a vacancy equals to the expected flow profit of a filled job and the option value of not having to post a vacancy again in the future.

2.3 Wage setting

To describe wage setting, we first define the value functions of workers and the unemployed for natives and immigrants in occupation j:

$$W^i_{j,t} = w^i_{j,t} + \beta \mathbb{E}_t \left[(1-s) W^i_{j,t+1} + s U^i_{j,t+1} \right]$$
$$U^i_{j,t} = b^i_{j,t} + \beta \mathbb{E}_t \left[f_{j,t} W^i_{j,t+1} + (1 - f_{j,t}) U^i_{j,t+1} \right],$$

where b^i_t is the outside option for a worker when unemployed. Notice that b is different for natives and immigrants, and possibly also depends on the occupation type. The latter is allowed because typically unemployment replacement rates are lower at higher wage levels (see the calibration section below). We can define the net value of a job as the difference between the two value functions:

$$W^i_{j,t} - U^i_{j,t} = w^i_{j,t} - b^i_{j,t} + \beta \mathbb{E}_t \left[(1 - s - f_{j,t}) \left(W^i_{j,t} - U^i_{j,t} \right) \right].$$

Wage setting follows the Nash-barganing solution (Mortensen and Pissarides, 1994), which implies a constant sharing rule each period:

$$W^i_{j,t} - U^i_{j,t} = \eta \left(J^i_{j,t} + W^i_{j,t} - U^i_{j,t} \right),$$

where η measures the exogenous bargaining power of workers, assumed to be the same for each agent. Using the value function definitions in this equation, one can derive the wage equation. Since the derivation is well-known, I omit the details here:

$$w^i_{j,t} = \eta \left(\zeta_{j,t} + \kappa \theta_{j,t} \right) + (1 - \eta) \, b^i_{j,t}. \tag{2.6}$$

The equation clearly shows that due to the different outside option assumption, immigrants and native will generally receive different wages in the same occupation type.

2.4 Labor market steady state

Since I am interested in the systematic impact of immigration, I will concentrate on the steady state. This is not the same concept as a long-run equilibrium, as changes in various model param-

eters will also change the steady state. Focusing on the steady state simply means that I abstract away from the dynamic adjustment unrelated to the systematic impact of immigration.

The steady state can be summarized by the following conditions, using equations (2.1), (2.2), (2.3), (2.4), (2.5) and (2.6):

$$
\begin{aligned}
u_j^i &= \frac{s l_j^i}{s + f_j} \\
q_j &= \mu \theta_j^{-\sigma} \\
f_j &= \mu \theta_j^{1-\sigma} \\
\frac{\kappa}{q_j} &= \frac{\zeta_j - \upsilon_j w_j^m - (1 - \upsilon_j) w_j^n}{1 - \beta (1 - s)} \\
w_j^i &= \eta (\zeta_j + \kappa \theta_j) + (1 - \eta) b_j^i.
\end{aligned}
$$

Notice that the unemployment rate u_j^i / l_j^i is the same for natives and immigrants, as it only depends on the inflow and outflow rates determined by aggregate tightness.

3 The macroeconomic environment

Having described the labor market, we now embed it into a general macroeconomic environment, which allows us to add two short-run factors to quantify the effect of migration on wages and wage inequality. First, we allow for demand-side effects that lead to relative price – and hence wage – changes across occupations (Cortes, 2008; Burstein et al., 2020). This effect captures the impact of increased competition within occupation categories due to the uneven immigration patterns presented earlier. Second, the capital stock may not adjust immediately as the labor force increases with immigration, leading to a general decline in the price of labor relative to the price of capital (Borjas et al., 1996; Borjas et al., 1997). While this does not necessarily influence *wage* inequality, it does contribute to overall inequality once capital income is taken into account.

3.1 Final goods

To keep the model tractable, I use a simple specification to embed the labor market into the broader environment. I assume that consumption and investment require a homogenous final

good, which is assembled from individual varieties produced at the different labor market segments described in the previous section, and physical capital. The aggregate production function is given as

$$Y = K^{\alpha} Z^{1-\alpha},$$
$$Z = \prod_{j} z_{j,t}^{\chi_j}$$

where K is the economy-wide capital stock, z_j is total production in occupation j, and $\sum_j \chi_j = 1$ (constant returns to scale). Recall that $z_j = a_j n_j$, where a_j is labor productivity and n_j is the number of workers engaged in occupation j. The Cobb-Douglas specification is somewhat restrictive, but leads to a particularly tractable framework.[5] Moreover, it would be difficult to calibrate a more general production function, where the elasticity of substitution between occupations is different from unity. Finally, the unit elasticity leads to a particularly simple and tractable model, which is very easy to calibrate from labor market data.

The final good is produced by competitive firms. The representative firm solves the following problem:

$$\max \Pi = PK^{\alpha} \left(\prod_{j} z_{j,t}^{\chi_j} \right)^{1-\alpha} - rPK - \sum_{j} p_j z_j,$$

where p_j is the price of an individual variety (as introduced earlier), P is the price of the final good, and r is the real rental rate of capital.

The derivation of the first-order conditions is standard, and leads to the following equations:

$$r = \alpha K^{\alpha-1} Z^{1-\alpha} \tag{3.1}$$
$$z_j = \frac{\chi_j (1-\alpha) PY}{p_j}. \tag{3.2}$$

[5] The same assumption about the substitutability of occupations was made in the context of economic growth by Dvorkin and Monge-Naranjo, 2019

The aggregate price index follows from the first-order conditions, and it is defined as

$$P = \underbrace{\alpha^{-\alpha}\left(1-\alpha\right)^{-(1-\alpha)}}_{\vartheta} r^{\alpha} P_z^{1-\alpha} \tag{3.3}$$

$$P_z = \prod_j \left(\frac{p_j}{\chi_j}\right)^{\chi_j}. \tag{3.4}$$

3.2 Aggregate equilibrium

The macroeconomic equilibrium is defined by a set of prices, $\{p_j\}$ and r, and the associated quantities $\{z_j\}$ and K. The determination of these prices depends on whether the economy is closed, or integrated in the international economic environment (small open economy). Alternatively, even for open economies, one can think about the closed economy setup as a short-run step along the adjustment path when a migration shock hits. In the following I define the two alternative sets of assumptions and state the respective conditions for price determination.

Open economy Prices and the rental rate of capital are determined on international markets. In this case, migration has no impact on the prices of individual varieties. The rental rate of capital is also given by the international capital market, which I assume is in steady state. I omit the formal derivation of the determination of the real interest rate, assuming that it is the same as in standard neoclassical growth models. The steady state real rental rate of capital is given by

$$r^* = \frac{1}{\beta} - 1 + \delta, \tag{3.5}$$

where β is the subjective discount factor and δ is the depreciation rate of the capital. With open capital markets the capital stock always adjusts so that the rental rates are equalized across countries at the steady state level.

Closed economy In this case the individual prices are determined by demand conditions, as captured by eq. [3.2]. Using this condition for two different varieties, relative prices are given by

$$\frac{p_j a_j n_j}{p_1 a_1 n_1} = \frac{\chi_j}{\chi_1}. \tag{3.6}$$

Without loss of generality, I use good 1 as the numeraire, i.e. $p_1 = 1$. The rental rate of capital is determined by the supply and demand of capital, linked by eq. [3.1]. For a given capital stock, the condition determines the real rental rate endogenously.

The model is solved by selecting the appropriate equilibrium concept and by calibrating the necessary parameter values. I describe the calibration and data in the next section, and present results afterwards.

4 Calibration and data

4.1 Data

The main goal of the paper is to evaluate counterfactual scenarios about the extent and consequences of immigration into European countries. I calibrate the steady state equilibrium to recent labor market data when available. In principle, most European Union countries could be included in the analysis, but for presentation purposes I restrict the country sample to the four biggest EU countries: France, Germany, Italy and Spain. In addition to being the largest economies in the EU, they also had significant immigrant shares in employment (see Table 1 below).

Since search is occupation specific, ideally calibration should also be done at this level. Unfortunately even when data exists in principle, there are often too many missing observations. In these cases I use aggregate statistics, and indicate when data constraints are present. The main data source is Eurostat, but I also use auxiliary data from the OECD and from an ILO article (Amo-Agyei, 2020). Detailed data sources are listed in Appendix A.

First, I fix some parameters that are either not very important for the results, or have standard values in the literature. For the discount factor, I use $\beta = 0.99$, which is usual for quarterly frequency. I set the elasticity of the matching function to $\sigma = 0.5$ and the exogenous bargaining power of workers to $\eta = 0.5$. The first value is in the range of admissible values as estimated by Petrongolo and Pissarides (2001). The assumption that $\eta = \sigma$ is equivalent to the Hosios condition (Hosios, 1990), and it is commonly assumed in the literature. Note that overall bargaining power is determined not only by this parameter, but also by the outside option of workers, a parameter we calibrate separately.

The three key labor market indicators I use are the separation rate s, the job finding rate f and labor market tightness θ. Tightness can be directly calculated from observations on vacancies and unemployment. These data in principle exist at the occupation level, but for most EU countries vacancy observations are missing. I therefore rely on aggregate tightness and assume it is the same - at the chosen time period of 2019 - across the occupations.

To calculate the job finding and separation rates, I use an extended version of Shimer's method (Shimer, 2005). The original approach assumes two relevant labor market states - employment and unemployment - and uses data on the duration of unemployment to identify the unemployment outflow rate (interpreted as the job finding rate). The two-state assumption, along with the flow equation of employment (eq. [2.1]), defines the job separation rate. Shimer (2005) shows that in the context of the United States this approach yields a very good approximation of the underlying flow rates, and is much less data intensive than a direct flow-based method.

Tab. 1: Descriptive statistics, aggregate

Country	Sep. rate	Job find. rate	Tightness	Wage gap	Immig. share
Germany	0.03	0.52	1.17	0.20	0.20
Spain	0.06	0.32	0.04	0.28	0.18
France	0.04	0.34	0.15	0.09	0.14
Italy	0.03	0.24	0.14	0.30	0.14

Source: Eurostat, own calculations

An alternative to using unemployment duration is to utilize data on job tenure. Job tenure information can be used to directly calculate the job separation rate. Maintaining the two-state assumption, eq. [2.1] can than be used to calculate the job finding rate. In general, the two procedures yield different results when (i) movements into and out of inactivity, and (ii) job-to-job transitions are present. Therefore I take simple averages of the rates based on unemployment duration and job tenure. A final issue is the time aggregation bias discussed in Shimer (2005), which I correct for by relying on an underlying continuous time process. Appendix B contains the details.

I rely on Amo-Agyei (2020) for the immigrant wage gap in each country. In addition to the aggregate numbers, the paper also (graphically) reports wage differences by occupation categories, but not for all countries in the sample. I therefore use the country level averages and assume it to be the same for each occupation.

Tab. 2: Descriptive statistics, occupations

	OC1	OC2	OC3	OC4	OC5	OC7	OC8	OC9
Immigrant share								
Germany	0.14	0.15	0.14	0.13	0.23	0.24	0.35	0.49
Spain	0.14	0.09	0.12	0.12	0.24	0.23	0.19	0.41
France	0.11	0.12	0.09	0.10	0.17	0.17	0.15	0.24
Italy	0.08	0.05	0.06	0.06	0.20	0.20	0.20	0.35
Relative wage								
Germany	2.33	1.40	1.06	0.84	0.64	0.82	0.77	0.57
Spain	1.99	1.37	1.15	0.88	0.70	0.85	0.89	0.67
France	1.88	1.29	0.96	0.72	0.68	0.73	0.77	0.60
Italy	3.37	1.18	1.14	0.93	0.76	0.81	0.84	0.68
Replacement rate								
Germany	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Spain	0.56	0.56	0.56	0.54	0.54	0.54	0.54	0.54
France	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67
Italy	0.53	0.53	0.53	0.62	0.62	0.62	0.62	0.62

Source: Eurostat, own calculations

Table 1 shows the country-specific values used for the calibration. The job separation rates vary between 0.03-0.06, while job finding rates vary between 0.24-0.57. Labor market tightness, the ratio of vacancies to unemployment, is also highly different across countries, with a range of 0.04-1.17. The immigrant wage gap is universally positive, with the highest difference of 0.3 in Italy, and the lowest difference of 0.09 in France. The country with the highest immigrant share Germany (0.20), while France and Italy have somewhat lower values (0.14).

The last part of the calibration uses occupation specific indicators. I collect data on employment by occupation and country of birth, which is used to calculate the share of immigrants among workers in an occupation. To calibrate the outside option parameters for native and immigrant workers, I use the following procedure. First, data on wages by occupation is available from Eurostat. I work under the natural assumption that these are averages based on the actual observed native-immigrant composition in employment. Due to the lack of reliable data, I work with 8 out of the 9 main occupation categories, omitting category 6 ("Skilled Agricultural, Forestry and Fishery Workers"). Since there are only a few worker in this occupation, the quantitative conclusions are not sensitive to the inclusion or omission of this category.

Third, I use OECD data on unemployment benefit replacement rates for various worker categories. I take values for singles, at the level of the average wage and at the level of 67% of the average wage. Using data on unemployment duration, I calculate average durations for each

country, and match the benefit replacement rate schedule to that average duration. Finally, for occupations where the wage is above the average, I use the average wage replacement rate. For occupations whose wage is below average, I use the 67% value for the replacement rate. This makes the replacement rate occupation specific, although only distinguishing two broad categories of occupations.

Table 4.1 presents the occupation-specific indicators that are used in the calibration. The share of immigrant workers varies by occupation, but it is typically higher in less skilled jobs. The relative wage - defined as the ratio relative to the economy-wide relative wage - also declines by skill requirements. As discussed above, the unemployment replacement rate is distinguished between occupation that have above and below average wages.

4.2 Calibration

Note that we observe a migration equilibrium, but we do not know if it is a closed, or open economy one, as defined earlier. Luckily, the structure of the model allows me to base the calibration of the parameter values on labor market data, and postpone the question of the equilibrium type to the derivation of counterfactuals.

First, without loss of generality I can choose units such that in the observed migration equilibrium $\forall j : p_j = 1$. This choice implies that $\zeta_j = a_j$, i.e. I can calibrate the productivity parameters directly from the labor market equilibrium conditions below. To conserve notation, I will omit the time and occupation indices when no confusion arises. I work with quarterly data, which is appropriate for labor market parameterization in the European context (monthly data is mostly unavailable).

Using data on the job finding rate and tightness, the matching efficiency parameter can be calculated as

$$\mu = \frac{f}{\theta^{1-\sigma}}.$$

This, substituted into eq. [2.4] yields the job filling rate q.

Next, let $\bar{b}_u = \bar{b}/\bar{w}$ be the observed replacement rate. Substituting this into the wage equation [2.6] and rearranging leads to

$$\bar{w} = \frac{\eta\left(a + \kappa\theta\right)}{1 - \left(1 - \eta\right)\bar{b}_u}.$$

Plugging this into the job creation condition [2.5] and rearranging yields the calibrated value of the vacancy cost:

$$\kappa = \frac{q\left(1-\eta\right)\left(1-\bar{b}_u\right)\bar{w}}{\eta\left[1-\beta\left(1-s\right)+f\right]}.$$

Putting κ back into the wage equation, one can rearrange for the occupation specific productivity parameter a.

To calibrate the separate outside options for immigrants and natives, we first express the native wage as a function of the average wage:

$$w^n = \frac{\bar{w}}{1-\omega+\omega\lambda},$$

where $\lambda = w^m/w^n$ is the immigrant wage gap and ω is the share of immigrants among the employed (in a particular occupation).[6] Given the value of λ, this equation also defines the immigrant wage w^m. Using these wages in the wage equation [2.6], we can solve for the unknown parameters b^m and b^n. Finally, for future usage we can also calculate the differential replacement rates as $b_u^i = b^i/w^i$.

Turning to parameters outside the labor market, I use standard values from the literature to set $\beta = 0.99$ (the discount factor), $\delta = 0.015$ (depreciation rate) and $\alpha = 0.33$ (capital share in GDP). This yields the steady state real rental rate of capital r^* as defined by eq. [3.5]. To select the variety share parameters χ_j, I utilize eq. [3.2] and the choice of unitary prices in the benchmark equilibrium. Rearranging the relative demand condition for varieties, the shares are given as

$$\frac{\chi_j}{\chi_1} = \frac{a_j n_j}{a_1 n_1} \quad j > 1,$$

where n_j are simply the observed employment levels in each occupation and a_j was already calibrated from the labor market. We need an extra condition to pin down the value of χ_1: this is given by the assumption of constant returns-to-scale, i.e. that $\sum_j \chi_j = 1$.

Since the calibrated parameters are either difficult to interpret (μ, κ) or fairly closely related to data observations (a, b_u^i) I do not present them here to conserve space. All values are reasonable given the observed data moments. Details are available from the authors upon request.

[6] Note that in the steady state equilibrium, the unemployment rate is the same for immigrants and native. This implies that the share of immigrants among the employed is the same as the share of immigrants among the unemployed.

5 The impact of migration

The calibrated migration equilibrium serves as the benchmark against we can evaluate counterfactuals. The most important questions concern the impact of immigration on aggregate and occupation-level wages, and on wage inequality. Unfortunately, it is not possible to give an unequivocal answer to this question given the available data. The reason is that we do not observe whether the migration shock led to changes in relative prices and the capital-output ratio. In other words, we do not know whether, and to what extent, the observed economy is in an open or closed equilibrium, as defined in section 2.

To circumvent this problem, I examine one intermediate and two extreme scenarios. In one extreme, I calculate the non-migration equilibrium under the assumption that neither relative prices nor the rental rate of capital changes, i.e. the capital stock adjusts to the increased population (the open economy setting). In the other extreme, I assume a closed economy in the short-run. In this case, relative prices are determined by the relative demand conditions [3.2]. These are different in a closed economy without migrants, since their occupational distribution differs from natives (see Table [4.1]). I also assume that the capital stock is in steady state before migration occurs, but there is no additional capital accumulation once immigrants arrive. Note the inverted logic in this exercise: since we observe the equilibrium with immigration, we essentially "reverse engineer" the no-migration past by making assumptions about the nature of the unobserved adjustment process.

As an intermediate step, I also calculate a counterfactual case without immigrants when prices do not change (free trade), but capital takes longer to adjust. This way I can separate the impact of price changes (the demand side) from the impact of factor prices. It is important to emphasize that the second effect will have no impact on wage inequality, since capital has a symmetric effect on all occupations. If, as often discussed in the literature (Borjas, 1995; Ben-Gad, 2008; Krusell et al., 2000), skilled and unskilled labor have different elasticities of substitution with capital, there would also be distributional effects when the capital-labor ratio changes. Introducing this channel, however, would substantially complicate the model, and I leave it for further research.

To summarize, I study three possible scenarios to quantify the impact of immigration on wages, working backwards from the migration equilibrium.

1. **Scenario 1** ("Open"): migration does not change relative prices or the capital-labor ratio.

2. **Scenario 2** ("Capital"): migration does not change relative prices, but the capital stock remains constant at its pre-migration level.

3. **Scenario 3** ("Closed"): migration leads to changes in relative prices, and the capital stock remains constant at its pre-migration level.

5.1 Nominal and real wages

I start the analysis with presenting nominal and real wages under the three alternative scenarios. Recall that the capital stock does not have a direct impact on nominal wages, because it only enters the aggregate production function. It does, however, influence real wages through the rental rate of capital and the overall price index (equations [3.1] and [3.3]). Changes in relative prices impact both nominal wages (through the marginal value product of labor, $\zeta = pa$) and real wages (through the price index P). Ultimately it is real wages that are linked to welfare, but looking at nominal wages separately helps identify the role of prices in real wage changes.

Table 3 present results for the three scenarios, as discussed in the previous section. The table cells contain changes (in percentages) between the hypothetical no-migration equilibrium and the observed migration equilibrium. As discussed earlier, I calculate wages for 8 out of 9 occupation categories. Wage changes vary by occupation because the composition of immigrants is different from natives. Note that the table contains *native* wages, which are the appropriate indicators to understand the changes relative to the no-migration equilibrium.

The impact of immigration on real wages is highly heterogenous both across occupations and across countries. As shown in Table 4.1, the share of immigrants is much higher in low-skilled occupations, as much as 49% in Germany in unskilled jobs (OCC9). If local demand constrains output increases, an increased labor supply leads to lower relative prices for goods and services intensive in low-skilled workers. One the other hand, high-skilled workers benefit (except in France), since relative prices in their sectors rise. These results are in line with findings of Borjas (2003), who also estimates a large short-run negative impact of immigration among the low-skilled.

Also note that real wage changes are lower (or more negative) than nominal wage changes. This

Tab. 3: Nominal and real wage changes

		Nominal wage change			Real wage change		
Country	Occupation	Closed	Capital	Open	Closed	Capital	Open
France	OC1	0.91	0.91	0.91	-1.97	-3.61	0.91
France	OC2	0.35	0.95	0.95	-2.53	-3.56	0.95
France	OC3	3.81	0.69	0.69	0.93	-3.83	0.69
France	OC4	2.48	0.79	0.79	-0.41	-3.73	0.79
France	OC5	-4.90	1.34	1.34	-7.79	-3.18	1.34
France	OC7	-5.10	1.35	1.35	-7.99	-3.17	1.35
France	OC8	-2.73	1.18	1.18	-5.62	-3.34	1.18
France	OC9	-13.94	1.95	1.95	-16.83	-2.57	1.95
Germany	OC1	2.79	2.79	2.79	1.50	-4.25	2.79
Germany	OC2	1.84	2.98	2.98	0.55	-4.06	2.98
Germany	OC3	2.91	2.77	2.77	1.62	-4.27	2.77
Germany	OC4	3.71	2.61	2.61	2.42	-4.43	2.61
Germany	OC5	-6.11	4.48	4.48	-7.40	-2.56	4.48
Germany	OC7	-7.32	4.69	4.69	-8.61	-2.35	4.69
Germany	OC8	-20.99	6.94	6.94	-22.28	-0.10	6.94
Germany	OC9	-42.42	9.84	9.84	-43.71	2.80	9.84
Italy	OC1	2.19	2.19	2.19	2.99	-2.37	2.19
Italy	OC2	4.82	1.32	1.32	5.62	-3.24	1.32
Italy	OC3	4.34	1.48	1.48	5.14	-3.08	1.48
Italy	OC4	4.21	1.54	1.54	5.01	-3.03	1.54
Italy	OC5	-8.85	5.61	5.61	-8.05	1.05	5.61
Italy	OC7	-8.96	5.65	5.65	-8.16	1.08	5.65
Italy	OC8	-8.80	5.60	5.60	-8.00	1.03	5.60
Italy	OC9	-25.50	9.98	9.98	-24.70	5.42	9.98
Spain	OC1	3.37	3.37	3.37	1.76	-3.02	3.37
Spain	OC2	7.33	2.28	2.28	5.72	-4.11	2.28
Spain	OC3	5.18	2.88	2.88	3.57	-3.51	2.88
Spain	OC4	5.11	2.89	2.89	3.50	-3.50	2.89
Spain	OC5	-7.46	6.11	6.11	-9.07	-0.28	6.11
Spain	OC7	-5.99	5.76	5.76	-7.59	-0.63	5.76
Spain	OC8	-2.11	4.80	4.80	-3.72	-1.59	4.80
Spain	OC9	-28.13	10.53	10.53	-29.74	4.14	10.53

is because with the capital stock fixed, the capital-labor ratio falls, and rental rate of capital rises. This leads to an increase in the overall price index P, which hurts real wages uniformly. Since migration shocks in the four countries are large (14%-20% of employment), a constant capital stock leads to a significant increase in the real rental rate of capital. In France, for example, the higher price level adds almost 3% to the nominal wage decline of 14% in unskilled occupations.

The third main effect – specific to the frictional nature of the labor market – is a differential increase in the nominal wages of all native workers. Lower outside options of immigrants lead to a worse wage bargaining position for them, which increases firm profits. Higher profits increase the expected surplus of job creation, leading both to more jobs and higher wage offers to natives, whose outside options are better. The impact is not uniform across occupations: lower skilled workers benefit more, since a higher share of immigrant workers allows firms to increase native wages more than in occupations with lower immigrant shares. In most cases, this effect is not strong enough to overcome the other two, especially for low-skilled occupations.

In the second scenario ("Capital"), when relative prices do not change but the capital stock has not adjusted yet, nominal wages changes are driven by the increased relative bargaining position of native workers only. This means that nominal wages rise across all occupations, but the increase is highest among the low-skilled (as the share of immigrants is highest among them). Real wages, however, still fall in most cases, since the increased real rental rate of capital drives up the price index. Although not a subject of the quantitative exercise, capital owners benefit and labor is worse off via this channel. Overall, as Table 3 demonstrates, the majority of native workers are hurt by immigration. But in Italy, for example, the impact on the real wages on low-skilled natives is positive, as the bargaining effect on nominal wages is higher than the price level increase due to the lower capital-labor ratio.

Immigration has a uniformly positive impact on native real wages in the "Open" case. Neither the demand, nor the capital effect is in operation, and wage changes driven solely by the bargaining channel. This is the point made by Moreno-Galbis and Tritah (2016), and relies crucially on the lower outside option of immigrant workers. This is supported empirically by the existence of an immigrant wage gap. As Table 3 shows, the effect is sizable, especially for low-skilled workers (up to 10% in Germany, Italy and Spain). The effect of immigration, therefore, is not uniformly negative for low wage workers. The net impact depends on the strength of the relative price

(demand) channel, the capital channel, and the bargaining channel.

Tab. 4: Over-qualification rates

	Immigrants	Natives
Germany	31.2	15.6
Spain	53.5	34.3
France	30.4	20.6
Italy	51.4	17.1

Source: Eurostat

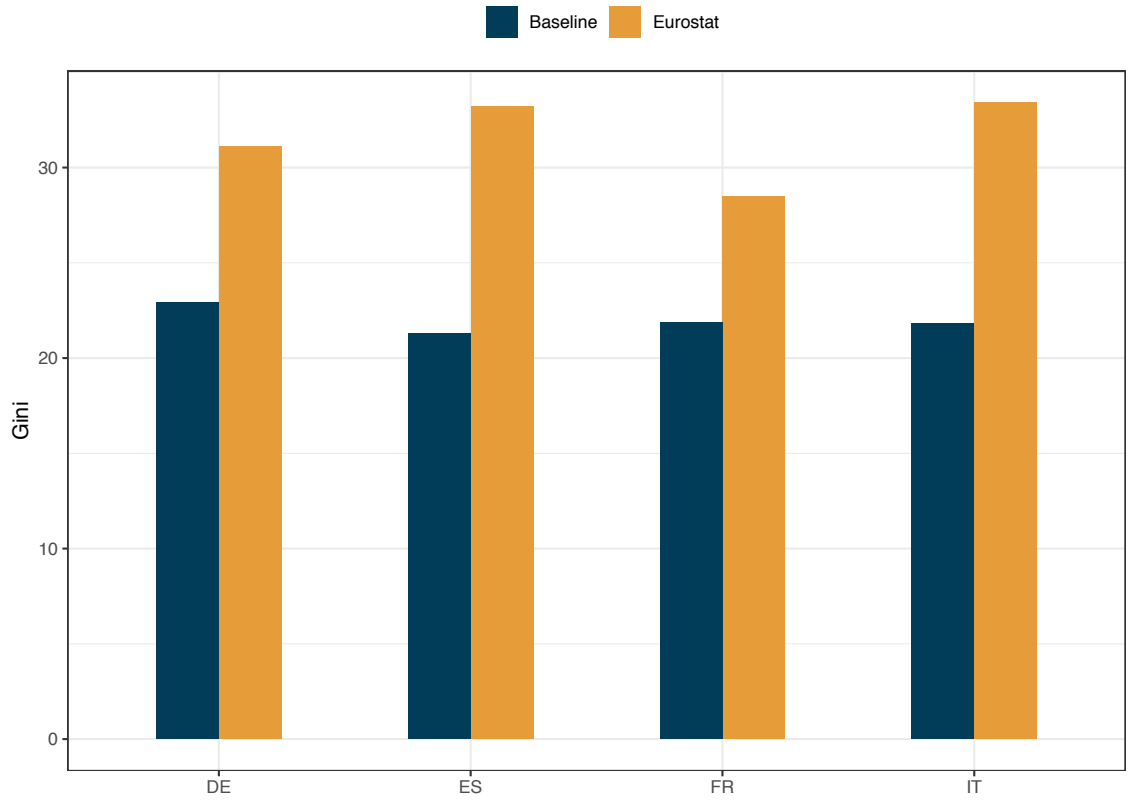
The three channels discussed so far operate in the short- and medium-run. There are two additional changes in the long-run that accompany immigrants' assimilation into the host country labor market. First, the bargaining disadvantage of immigrants eventually disappears, both because they acquire the same entitlements and natives, and also because they establish local networks and connections. Second, some (or all) of the occupational downgrading observed when arriving in the host country is reversed. Table 4 lists over-qualification rates for immigrants in the four countries, which are uniformly higher for immigrants. Without additional information on the home-country occupational distribution of immigrants, it is not possible to predict the precise effects of the gradual reversal of occupational downgrading. We do expect, however, that as immigrants are becoming more similar to natives (both in bargaining positions and in occupational structure), the short- and medium-run wage effects eventually disappear.

5.2 Wage inequality

The previous section discussed the effect of immigration on nominal and real wages in different scenarios. Now we turn to a more systematic analysis of wage inequality by looking at standard measure of inequality, the Lorenz curve and the summary statistics derived from it, the Gini coefficient. As before, we focus on native wages, since the policy debate is mostly about the impact of immigration on the native wage distribution. The calculations are based on wages by occupation category, using the native distribution of workers across occupations as weights.

Given the aggregate nature of the data used, and the macroeconomic model based on occupations, the calculations by definition miss wage inequality within occupations. Figure 5.1 shows the actual Ginis from Eurostat for the four analyzed countries, compared to the occupation-based Ginis calculated in the baseline migration equilibrium. As expected, the empirical measures are

Fig. 5.1: Empirical and calculated Gini coefficients in the observed equilibrium

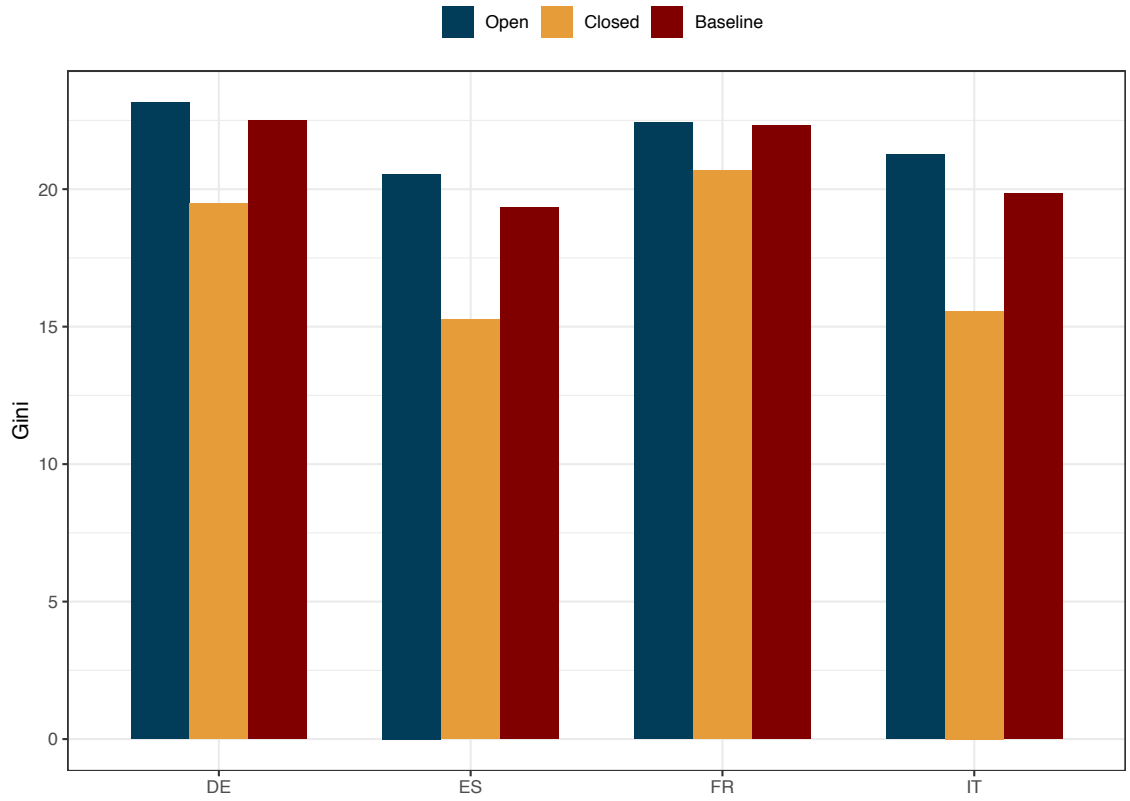


higher, since they include more information about the actual wage distributions. That said, occupational differences are highly important to understand wage inequality, and the model-based Ginis capture about two-thirds of overall wage differences. As long as *within-occupation* wage distributions are not highly systematically different between immigrants and natives, focusing on inequality *across occupations* gives us an accurate picture of the impact of migration on *changes* in inequality.

Figure 5.2 shows Gini coefficients from the baseline and two of the three scenarios discussed before. I omit the "Capital" scenario because in terms of wage distributions it is equivalent to the baseline, since the impact of the capital stock (through the price level P) is uniform across occupations. Wage inequality changes due to immigration operate via the other two main channels, the demand and bargaining channels.

As can be seen on the Figure, the bargaining channel alone (the change from the "Open" to the "Baseline" scenario) leads to reduction in wage inequality as measured by the Gini coefficient. The reason is that immigrants are overrepresented among low-skilled occupations. Recall that

Fig. 5.2: Gini coefficients in the three migration scenarios



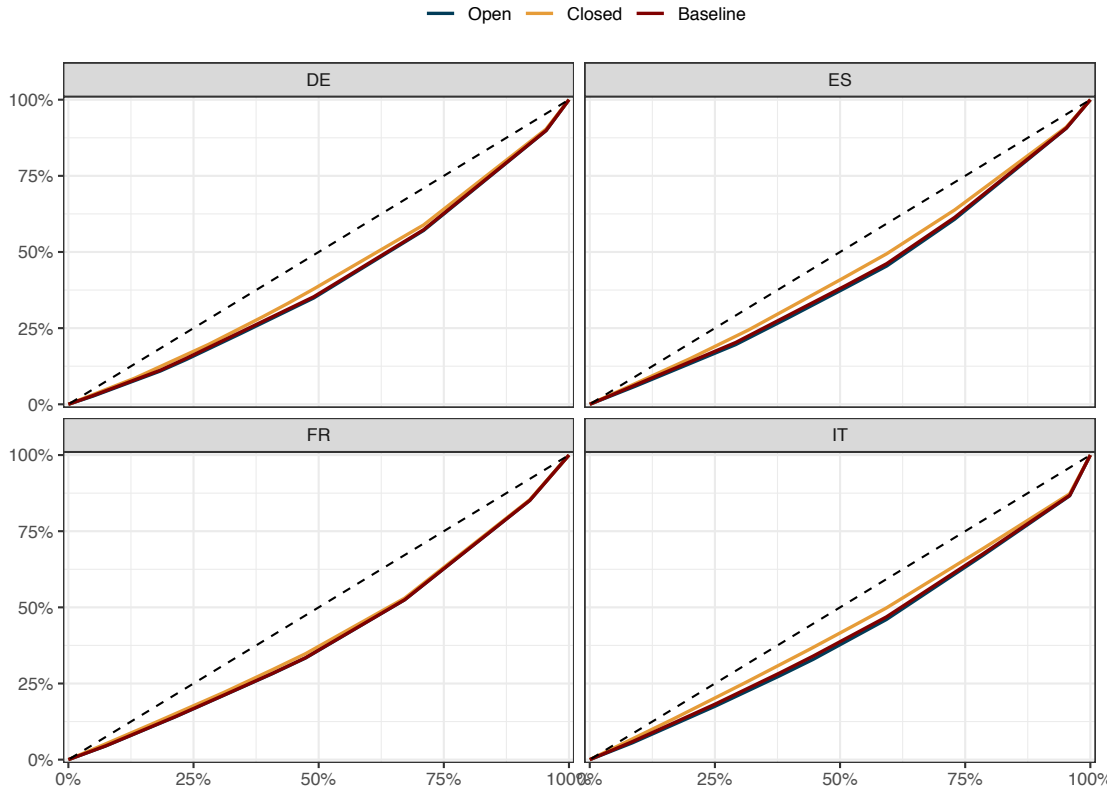
the lower bargaining position of immigrants allows firms to pay higher wages to natives, and this effect is bigger for the low-skilled. It can be shown that - due to the labor market setup - average wages are the same between the two scenarios. Natives simply benefit at the expense of lower paid immigrant workers.

When we compare the baseline migration equilibrium with the "Closed" no-migration scenario (the change from the "Closed" to the "Baseline" scenario), the result is very different. Due to the strong demand effects, the immigration shock, which is skewed towards the low-skilled, depresses the relative price of goods produced in the low-skill intensive sectors. In our calibrated model, this effect is stronger than the bargaining channel. With significant demand effects, native wage inequality increases.

Gini coefficients are useful because they condense information about income distribution into a single number. This also means, however, that much information about the underlying distribution is lost. For completeness, I also present Lorenz curves that show the cumulative wage distributions in the various scenarios. In particular, for the reasons outlined above, I retain the

"Closed", "Open", and "Baseline" scenarios. The results are shown on Figure 5.3.

Fig. 5.3: Lorenz curves

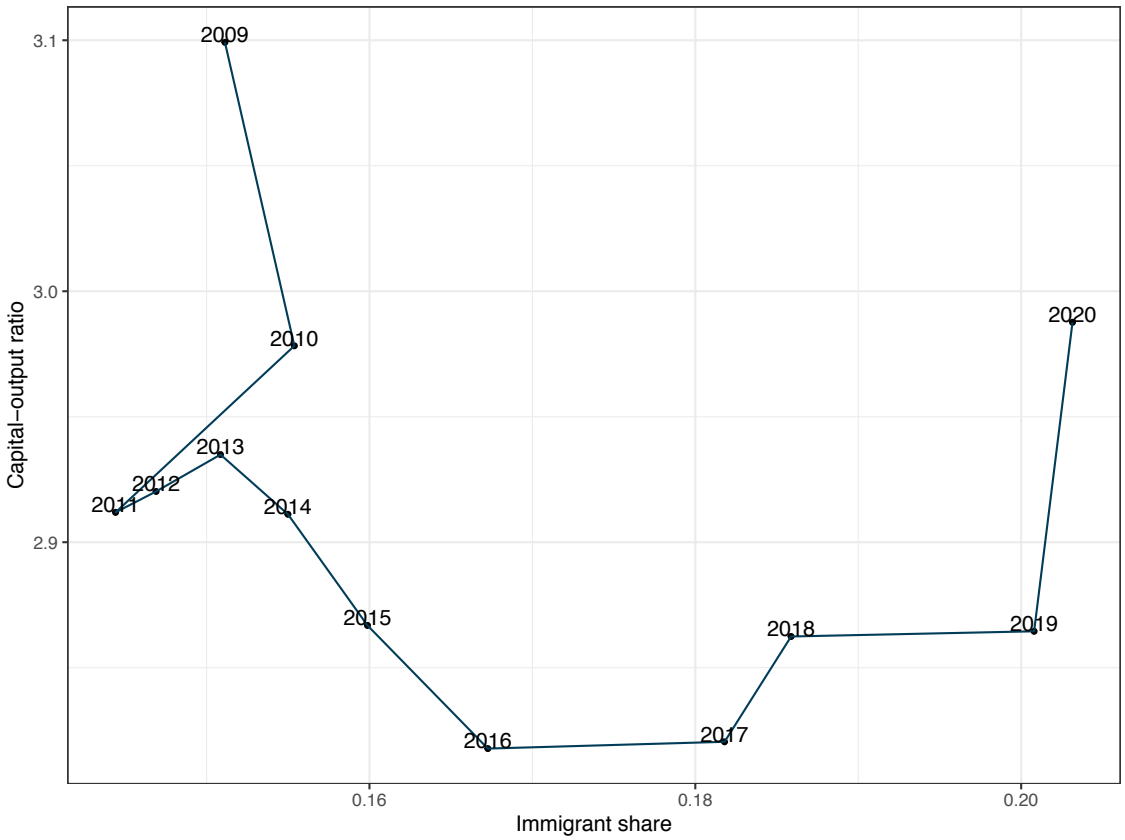


Overall, the figures support the conclusions drawn from the Gini comparisons. The impact of immigration on inequality crucially depends on the strength of the demand channel. When relative prices respond strongly, leading to an equally strong realignment of relative wages, native wage inequality rises significantly. On the other hand, the bargaining channel decreases native wage inequality, but the quantitative impact is moderate. Looking at the different countries, immigration has had a potentially bigger impact in Spain and Italy, compared to Germany and (specially) France.

5.3 Discussion

To summarize, the quantitative results for the four countries analyzed paint an ambiguous picture about the effects of immigration on wages and on wage inequality. The conclusions strongly depend on the strength of the demand channel, i.e. how much local demand conditions influence the relative wages of different occupations. When this channel is weak, immigration may even

Fig. 5.4: Capital-output ratios and immigration in Germany



mitigate wage inequality among natives. Alternatively, with strong demand effects, native wage inequality rises significantly.

The capital channel has a sizable impact on wages, but not on the wage distribution, at least in our framework where the elasticity of substitution between capital and labor is uniform across occupations. In any case, the capital-labor (or capital-output) ratio can be expected to adjust to the increased supply of labor, driven by the temporarily higher rental rate of capital. This may happen very quickly under open capital markets, which is the more likely case in the European Union. But even in a closed economy, the capital-output ratio is expected to return its steady state value over time.

Unfortunately, it is extremely hard to empirically distinguish between the various scenarios. In case of capital, Figure 5.4 illustrates this point by showing the evolution of the capital-output ratio and the share of immigrant workers between 2009-2019 (data for the latter starts in 2009). We see that the share of immigrants rose since 2011, by a total of 5 percentage points by 2009. The capital-output ratio fluctuated, but overall fell between 2011 and 2019. This seems to support

the existence of a capital channel in the short-run. However, the period coincides with the global financial crisis and its aftermath. We know that investment activity was depressed for many years, caused by the crisis and leading to an overhang until the mid 2010s. It is impossible to disentangle the effect of migration from the effect of the financial crisis. Looking at the other countries (not shown) is even muddier.

It would be equally difficult to isolate the demand cannel.[7] One potential avenue of investigation would be to distinguish goods and services in terms of their tradability, and quantify their occupation content to see how much particular occupations are subject to local demand conditions. This is possibly feasible, with data on the occupational composition of production sectors. Note, however, that there are two practical issues the limit the usefulness of such an exercise. First, employment data in industry-occupation cells are likely to be incomplete (a casual check on Eurostat confirms this). Second and more importantly, putting one digit sectors (at which level such data is available) into tradable and non-tradable categories is highly imprecise and in the end subjective. That said, extending the current framework would be an interesting and perhaps an informative exercise.

6 Conclusion

This paper investigated the impact of immigration on wages and wage inequality using a macroeconomic framework. The model incorporates three main channels via which immigration impacts native wages: bargaining power in wage negotiations, local demand conditions for goods and services produced by workers in different occupations, and possible changes in the capital-labor ratio. I calibrated the model to European labor market data for the for largest economies in the European Union: France, Germany, Italy and Spain. Depending on the operation of the various channels, I calculated three counterfactuals and compared them with the observed migration equilibrium.

The main results are as follows. First, the given that immigrants tend to cluster in low-skilled occupations, the bargaining channel increases native wages and reduces native wage inequality. This channel is empirically supported by the immigrant wage gap. Due to the lower bargaining

[7] A similar exercise was done in a local labor market context in the United States by Burstein et al. (2020).

power of immigrants, firm profitability rises and they are able to pay higher wages to natives. This is strongest among the low-skilled, pushing up native wages there the most.

Second, the capital channel lowers the real wage of natives because it increases the rental rate on capital. In the current specification, however, it does not affect wage inequality, since the price level impact different occupations uniformly. Third, the extent to which occupations are affected by local demand conditions - as opposed to global demand - is crucial to understand how native wages change due to immigration. Strong demand effects increase native wage inequality, because (negative) wage changes are the strongest among the low-skilled.

The missing step in the current exercise is to pin down the relative importance of the three channels. In the long-run, when immigrants becomes more-and-more similar to natives, and the capital stock adjusts, the wage distribution is expected to return to its pre-migration pattern (absent other shocks). In the short-run, not only the strength, but the timing of the identified effects determine the overall evolution of native wage inequality. Disentangling these should be the goal of potentially very fruitful, but highly difficult future research.

References

Altonji, J. and Card, D. (1991). he effects of immigration on the labor market outcomes of less-skilled natives.". In Abowd, J. and Freeman, R., editors, *Immigration, Trade and the Labor Market*. The University of Chicago Press.

Amo-Agyei, S. (2020). The migrant pay gap: Understanding wage differences between migrants and nationals. Report, International Labour Organization.

Andolfatto, D. (1996). Business cycles and labor-market search. *The American Economic Review*, 86:112–132.

Ben-Gad, M. (2008). Capital–skill complementarity and the immigration surplus. *Review of Economic Dynamics*, 11:335–365.

Borjas, G. (1994). The economics of immigration. *Journal of Economic Literature*, 32(1667-1717).

Borjas, G. (1995). The economic benefits from immigration. *Journal of Economic Perspectives*, 9:3–22.

Borjas, G. (2003). The labor demand curve is downward sloping: Reexamining the impact of immigration on the labor market. *The Quarterly Journal of Economics*, 118:1335–1374.

Borjas, G., Freeman, R., and Katz, L. (1996). Searching for the effect of immigration on the labor market searching for the effect of immigration on the labor market searching for the effect of immigration on the labor market. *The American Economic Review*, 86:246–251.

Borjas, G., Freeman, R., Katz, L., DiNardo, J., and Abowd, J. (1997). How much do immigration and trade affect labor market outcomes? *Brookings Papers on Economic Activity*, 1997:1–90.

Burstein, A., Hanson, G., Tian, L., and Vogel, J. (2020). Tradability and the labor-market impact of immigration: Theory and evidence from the united states. *Econometrica*, 88:1071–1112.

Busch, C., Krueger, D., Ludwig, A., Popova, I., and Iftikhar, Z. (2020). Should germany have built a new wall? macroeconomic lessons from the 2015-18 refugee wave. *Journal of Monetary Economics*, 113:28–55.

Card, D. (1990). The impact of the mariel boatlift on the miami labor market. *Industrial and Labor Relations Review*, 65:467–479.

Card, D. (2001). Immigrant inflows, native outflows, and the local labor market impacts of higher immigration. *Journal of Labor Economics*, 19:22–64.

Chassamboulli, A. and Palivos, T. (2014). A search-equilibrium approach to the effects of immigration on labor market outcomes. *International Economic Review International Economic Review*, 55:111–129.

Chassamboulli, A. and Peri, G. (2015). The labor market effects of reducing the number of illegal immigrants. *Review of Economic Dynamics*, 18:792–821.

Cortes, P. (2008). The effect of low-skilled immigration on u.s. prices: Evidence from cpi data. *Journal of Political Economy*, 116:381–422.

D'Amuri, F., Ottaviano, G. I., and Peri, G. (2010). The labor market impact of immigration in western germany in the 1990s. *European Economic Review*, 54:550–570.

Dustmann, C., Frattini, T., and Preston, I. P. (2013). The effect of immigration along the distribution of wages. *Review of Economic Studies*, 80:145–173.

Dvorkin, M. and Monge-Naranjo, A. (2019). Occupation mobility, human capital and the aggregate consequences of task-biased innovations. Working Paper 2019-13, Federal Reserve Bank of St. Louis.

Hamermesh, D. S. (1993). *Labor Demand*. Princeton University Press.

Hosios, A. (1990). On the efficiency of matching and related models of search and unemployment. *The Review of Economic Studies*, 57:279–298.

Krusell, P., Ohanian, L., Rios-Rull, J.-V., and Violante, G. (2000). Capital-skill complementarity and inequality: A macroeconomic analysis. *Econometrica*, 68:1029–1054.

Liu, X. (2010). On the macroeconomic and welfare effects of illegal immigration. *Journal of Economic Dynamics and Control*, 34:2547–2567.

Merz, M. (1995). Search in the labor market and the real business cycle. *Journal of Monetary Economics*, 36:269–300.

Moreno-Galbis, E. and Tritah, A. (2016). The effects of immigration in frictional labor markets: Theory and empirical evidence from eu countries. *European Economic Review*, 84:76–98.

Mortensen, D. and Pissarides, C. (1994). Job creation and job destruction in the theory of unemployment. *The Review of Economic Studies*, 61:397–415.

Nickell, S. and Saleheen, J. (2015). The impact of immigration on occupational wages: evidence from britain. Working Paper 574, Bank of England.

Ortega, J. (2000). Pareto-improving immigration in an economy with equilibrium unemployment. *Economic Journal*, 110:92–112.

Petrongolo, B. and Pissarides, B. P. C. (2001). Looking into the black box: A survey of the matching function. *Journal of Economic Literature*, 39:390–431.

Pischke, J.-S. and Velling, J. (1997). Employment effects of immigration to germany: An analysis based on local labor markets. *The Review of Economics and Statistics*, 79:594–604.

Pissarides, C. (2000). *Equilibrium Unemployment Theory, second edition*. MIT Press.

Shimer, R. (2005). The cyclical behavior of equilibrium unemployment and vacancies. *American Economic Review*, 95:25–49.

A Data sources

Eurostat

- Employment by sex, age, migration status, occupation and educational attainment level: LFSA_EGAISEDM (2021, 2022)
- Over-qualification rates by country of birth: LFSA_EOQGAC
- Employment by sex, age, occupation and educational attainment level: LFSA_EGISED
- Employed foreign-born by change in skill level from last job before migrating to current job, sex, age, country of birth and educational attainment level: LFSO_21EDUC05
- Foreign-born population by main obstacle to get a suitable job, sex, age, country of birth and educational attainment level: LFSO_21OBST01
- Mean annual earnings by sex, economic activity and occupation: EARN_SES18_49
- Job vacancy statistics by NACE Rev. 2 activity, occupation and NUTS 2 regions - quarterly data: JVS_Q_ISCO_R2
- Previous occupations of the unemployed, by sex (1 000): LFSQ_UGPIS
- Employment by sex, age, time since job started and economic activity (from 2008 onwards, NACE Rev. 2) - 1 000: LFSQ_EGDN2

OECD

- Net replacement rate in unemployment: NRR
- Unemployment by duration: DUR_D

International Labor Organization

- Migrant pay gaps using hourly wages, latest years: Amo-Agyei (2020), Figure 17

B Job finding and job separation rates

- Continuous time

$$
\begin{aligned}
\dot{n}_\tau &= f_t\left(1-n_\tau\right)-s_t n_\tau \\
\dot{n}_\tau+\left(f_t+s_t\right)n_\tau &= f_t \\
e^{(f_t+s_t)\tau}n_\tau &= f_t\int_0^\tau e^{(f_t+s_t)\nu}d\nu+c \\
e^{(f_t+s_t)\tau}n_\tau &= f_t\left[\frac{e^{(f_t+s_t)\nu}}{f_t+s_t}\right]_0^\tau+c \\
e^{(f_t+s_t)\tau}n_\tau &= \frac{f_t}{f_t+s_t}\left[e^{(f_t+s_t)\tau}-1\right]+c \\
n_\tau &= \frac{f_t}{f_t+s_t}\left[1-e^{-(f_t+s_t)\tau}\right]+e^{-(f_t+s_t)\tau}n_t \\
n_{t+1} &= \frac{f_t}{f_t+s_t}\left[1-e^{-f_t-s_t}\right]+e^{-f_t-s_t}n_t \\
S_t &= \frac{n_{t+1}-n_{t+1}^s}{n_t} \\
s_t &= -\log(1-S_t) \\
F_t &= 1-e^{-f_t}
\end{aligned}
$$

- Unemployment duration and job finding rate

$$
\begin{aligned}
f_t &= 1-\frac{u_t-u_t^s}{u_{t-1}} \\
1-u_t &= \left(1-s_t\right)\left(1-u_{t-1}\right)+f_t u_{t-1} \\
u_t &= u_{t-1}+s_t\left(1-u_{t-1}\right)-f_t u_{t-1} \\
s_t &= \frac{u_t-\left(1-f_t\right)u_{t-1}}{1-u_{t-1}} \\
u_{t+1} &= \frac{s_t}{f_t+s_t}\left[1-e^{-(f_t+s_t)}\right]+u_t \\
1-e^{f_t} &= \frac{u_{t+1}-u_{t+1}^s}{u_t}
\end{aligned}
$$

– Continuous time

$$u_{t+1} = \frac{s_t}{f_t + s_t}\left[1 - e^{-f_t - s_t}\right] + e^{-f_t - s_t} u_t$$
$$1 - e^{f_t} = \frac{u_{t+1} - e^s_{t+1}}{e_t}$$

Exploring the Effect of Immigration on Consumer Prices in Spain*

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Abstract

We investigate the effect of immigration on consumer prices in Spain between 1997 and 2013. Using variation across provinces, we first document a positive correlation between consumer prices and the share of migrants in the population. However, controlling for regional supply and demand shocks, and addressing endogeneity through an instrumental variables approach, we show that immigration has actually *reduced* consumer prices in Spain. An increase in the share of migrants by 10 percentage points reduces (CPI-weighted) consumer prices by approx. 1.25 percent. We show that the effect materializes around the years of the 2008 financial crisis, and that it is concentrated among non-tradable goods and services. Focusing on individual products, we find that some of those products that rely most heavily on migrant labor have been subject to considerable price reductions, while we find no such effects for those products that make intensive use of native labor. Finally, we find that it is immigration from outside Western Europe that led to a reduction in consumer prices, while the effect of immigration from Western Europe is zero. Overall, our results paint a complex picture of the effects of immigration on consumer prices. They support the idea that immigration can reduce consumer prices through both supply-side and demand-side channels.

JEL codes: F22; J61.
Keywords: Immigration; Consumer Prices; Spain.

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1 Introduction

Immigration is a topic of considerable public concern. Much research has been devoted to analyzing the impact of immigration on labor market outcomes such as wages and employment.[1] Less research, on the other hand, has been carried out on the impact of immigration on consumer prices, although empirical evidence into this relationship is clearly desirable, as it carries first-order welfare implications for the native population through changes in real incomes and wealth.

The purpose of this paper is to provide new evidence on the effect of immigration on consumer prices by looking into the remarkable case of Spain. In particular, we analyze the relationship between immigration and prices for a variety of consumer goods and services and focusing on the time period between 1997 and 2013. This period includes a full-blown immigration boom in Spain and the ensuing global financial crisis and economic recession. The Spanish case is quite unique in terms of the magnitude and pace of migration: within just 10 years the share of migrants increased from 2 to 12 percent. We believe, therefore, that it can serve as an interesting opportunity to generate valuable empirical evidence into the relationship between immigration and consumer prices.

To identify the effect of immigration on consumer prices, we exploit variation in the share of migrants across provinces. Specifically, we relate changes in consumer prices over time to changes in the share of migrants at the province level. Our analysis is challenged by a formidable endogeneity problem in the relationship between prices and immigration, which implies that simple OLS estimates are biased and inconsistent. To overcome this problem, we combine a stringent fixed effects estimation (to control for regional supply and demand shocks) with an instrumental variables approach familiar from the literature.

We first estimate the relationship using OLS, and document a strong positive correlation between consumer prices and the share of migrants in the population. However, this correlation could be the result of migrants targeting locations subject to strong economic growth and, thus, rising prices. Addressing this endogeneity problem, we show that immigration has actually *reduced* consumer prices in Spain. Our estimates imply that an increase in the share of migrants by 10 percentage points reduces (CPI-weighted) average consumer prices by approx. 1.25 percent. We show that the effect materializes in the wake of the 2008 financial crisis, and that it is concentrated among non-tradable goods and services, while the average effect among tradable goods is zero (in a statistical sense).

Focusing on individual products, we find that some of those products whose production relies most heavily on migrant labor (food; household maintenance; restaurant & hotel services) have been subject to considerable price reductions, while we find no such effects for those products that

[1] See Dustmann et al. (2008) and Edo (2019) for reviews of this important and extensive literature.

make intensive use of native labor. This suggests that some of the observed price effects are driven by downward pressure on wages and a corresponding reduction in the unit cost of production. In 2002, by far the largest share of migrants in a given sector—35%—can be found in household-related activities.[2] This is also where we find the largest price effect with a semi-elasticity exceeding -1.0. This implies that an increase in the share of migrants by 10 percentage points reduces prices for household services by more than 10 percent.

We also reveal a sharp difference in the price effects between migrants from Western Europe and those from other countries. In particular, we find that it is immigration from other countries that reduces consumer prices, while the effect of immigration from Western Europe is essentially zero. This finding supports the idea that the effect of migration on prices operates through different channels, and that the type of migration matters greatly for the relevance of specific channels. Migration from high-income countries in Western Europe is a mix of retirement-related migration and labor migration. Both supply-side and demand-side effects are plausibly small. Migration from low-income countries outside of Western Europe, on the other hand, is mostly labor migration. Under the assumption that these migrants are more price-sensitive than natives, we can expect both supply-side and demand-side explanations to be relevant for the price reductions that we find.

Our paper is most closely related to Frattini (2008, 2014) who investigates the impact of migration on consumer prices for a similar period as we do (1997-2012), but who focuses on the case of the UK. Like ours, his empirical strategy exploits the fact that, relative to the overall population, immigrants are not uniformly distributed across locations, but instead cluster in some places. The results indicate that immigration helped in slowing down price inflation of non-tradable goods and services in the pre-recession period (1997-2007), albeit modestly, while having no effect in the post-crisis period (2008-2012). The results also suggest that immigration had the strongest effect on the prices of those goods and services that rely intensively on low-wage labor. This supports a supply-side explanation of the effect operating through a reduction in wages at the bottom of the wage distribution, a channel supported through evidence by Dustmann et al. (2013).[3]

A paper emphasizing, and credibly identifying, demand-side effects as opposed to supply-side effects is Lach (2007). He studies the response of detailed consumer prices to the sudden and unexpected arrival of a large number of immigrants from the former Soviet Union in Israel in 1990. He finds that migration had a negative effect on prices through its effect on goods demand. The underlying idea, supported by the data, is that migrants and natives differ in terms of their price

[2] Source: EU Labor Force Survey from 2002.

[3] Another important paper supporting the hypothesis of supply-driven effects of immigration on prices is Cortes (2008). She analyzes the effect of low-skilled immigration on US prices of non-traded goods and services, and finds that this type of immigration benefits the native population by decreasing the prices of services that rely intensively on immigrant labor. More recently, Balkan and Tumen (2016) use the inflow of Syrian refugees in Turkey after 2011 as a natural experiment, and find that Syrian immigration reduced consumer prices through labor cost reductions in the informal labor market.

elasticities of demand, and that the influx of migrants took away some of firms' market power resulting in lower prices.[4]

Another strand of the literature related to what we do investigates the relationship between immigration and housing prices. González and Ortega (2013) look into the case of Spain focusing on the effect of immigration on both housing prices and housing supply. They use some of the same data as we do, and also employ an instrumental variables strategy in order to isolate the causal effects of immigration on the housing market from other confounding factors. They find that immigration accounted for one quarter of the rise in housing prices over the period 2000 to 2010, but also one half of the construction activity observed over the same period.[5]

The rest of the paper is organized as follows. In the next section, we introduce the data we use in our empirical analysis, and we provide a few facts on the evolution of immigration and consumer prices between 1997 and 2013. In Section 3, we first describe the empirical methodology we employ to identify the effects of immigration on consumer prices, and then present and discuss the estimation results we obtain across a variety of empirical specifications. Section 4 closes with a brief summary.

2 Main data sources

Migration data. The migration data we use come from the Spanish Municipal Register (*Padrón Municipal*) and are given at the province level in Spain. Spain is divided into 52 different provinces. We exclude the two enclaves Ceuta and Melilla from our analysis due to their special geographical location in North Africa. The 50 provinces (*províncias*) we consider belong to 17 regions (*comunidades autónomas*); see Table A.1. This will become important later in the context of our identification strategy.[6] All residents in Spain are obliged to confidentially register in the local Municipal Register with their name, surname, sex, usual domicile, nationality, passport number, as well as their place and date of birth.

A major advantage of the data is that they are likely to include both documented and undocumented immigrants. This is so because all immigrants were strongly incentivized to register at the time of arrival, as the *Law on the Rights and Freedoms of Aliens in Spain and their Social In-*

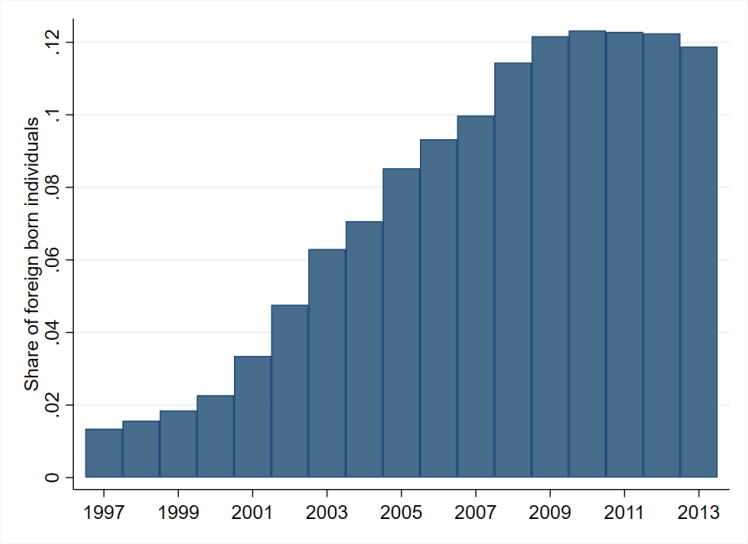
[4] Zachariadis (2012) finds international migration to be a vehicle for international price convergence in cross-country data for the period 1996-2006. Price convergence occurs because of both supply-side effects along the lines of Cortes (2008), and demand-side effects along the lines of Lach (2007).

[5] Sá (2015) investigates the effect of immigration on the housing market in the UK. Earlier papers studying the link between immigration and housing prices are Saiz (2003, 2007) and Ottaviano and Peri (2012), among others.

[6] In principle, the data are also available at the municipality level (*municipios*), but since no price data are available at such a high level of disaggregation, we conduct the analysis at the province level. The migration data can be accessed through the website of the Instituto Nacional de Estadística (INE) at https://www.ine.es/dyngs/INEbase/es/categoria.htm?c=Estadistica_P&cid=1254734710984.

tegration in 2000 (Ley Orgánica 4/2000, artículo 12) entitled all foreigners (with or without legal residence permits) to free medical care under the same conditions as Spanish nationals provided they were registered in the Municipal Register.

Figure 1: Share of migrants in Spain (1997-2013).†

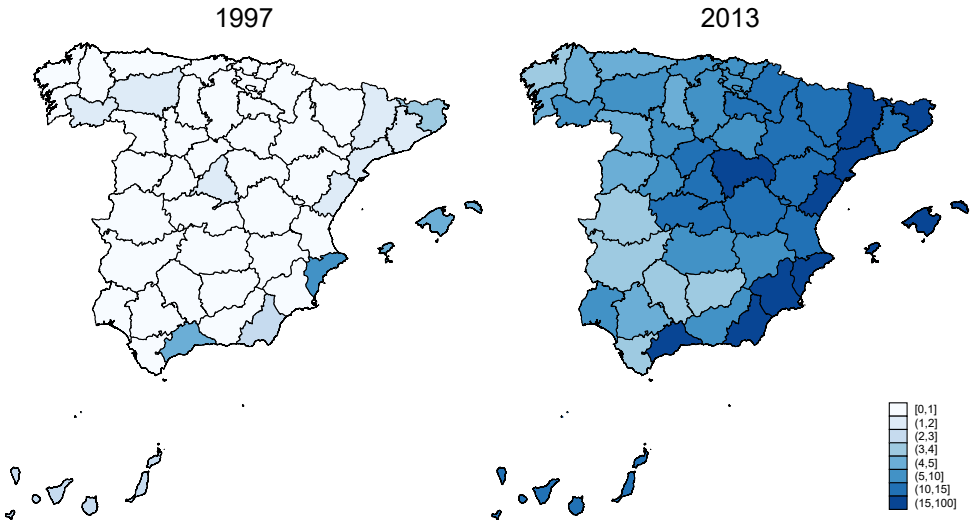


†*Source:* Author's illustration using data from INE.

Figure 1 illustrates the considerable increase in the number of immigrants in Spain between 1997 and 2013. The share of foreign-born individuals started out from a low level—less than 2 percent—and settled at more than 12 percent after the financial crisis.[7] Figure 2 visualizes differences in the share of immigrants by province and makes a comparison between 1997 and 2013. We see sizable differences in the share of migrants across provinces, not just in terms of the level in 2013, but also in terms of the changes relative to 1997. This is the variation in the data that we will exploit for identification purposes in the econometric analysis. Figure 3 shows stocks and flows of immigrants from the six most important countries of origin. These are Romania, Morocco, Ecuador, Colombia, the UK, and Bolivia. The pattern of migration differs a bit between countries, but overall the yearly inflow of migrants accelerated initially, around the year 2000, and declined in the years of the financial crisis (while fluctuating in between in some countries).

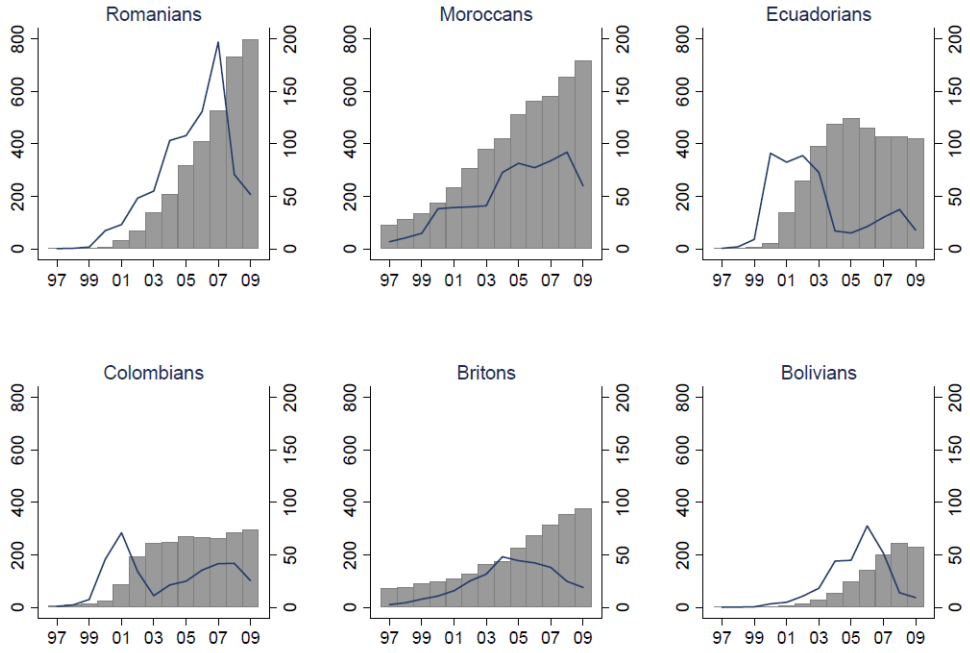
[7]The share of foreign-born individuals among the working-age population was even larger and exceeded 16 percent.

Figure 2: Share of migrants by province in Spain.†



†*Note:* This figure illustrates the distribution of migrants across provinces in Spain in 1997 and 2013, respectively. The numbers are defined as the share of migrants in the total population multiplied by 100. Darker colors indicate larger migrant shares. The provinces Las Palmas and Santa Cruz de Tenerife are grouped together as Islas Canarias. *Source:* Author's illustration using data from INE.

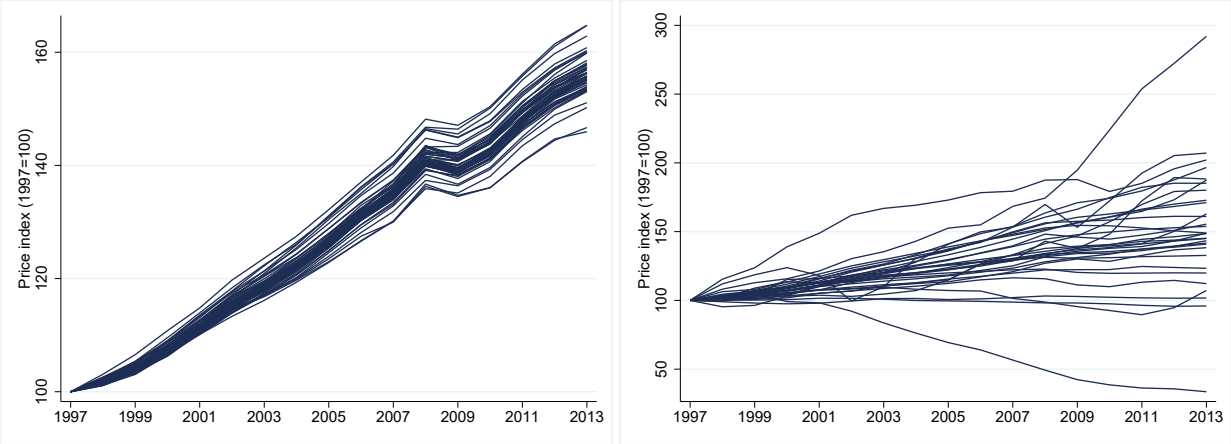
Figure 3: Migrants by country of origin (1997-2009).†



†*Note:* This figure shows migrant stocks in Spain (bars; left ordinate) and gross inflows to Spain (lines; right ordinate) by nationality for the six major origin countries over the period 1997-2009. Numbers are in thousands ('000s). *Source:* Author's illustration using data from INE.

Price data. The price data are also from INE and they are disaggregated by different product subgroups. By matching two series with slightly different subgroup classifications, we construct a consistent series with annual price data from 1997 to 2013 for 31 products at the province level; see Table A.4 in the Appendix for how we match the data.[8]

Figure 4: Evolution of consumer prices (1997-2013).†



(a) By province. (b) By product.

†*Note:* This figure shows the evolution of consumer prices by province (a) and by product (b) between 1997 and 2013. Prices are normalized to 100 in 1997. In (a), products are weighted by national CPI weights from 2002; see Table A.4. Ceuta and Melilla are excluded. *Source:* Author's illustration using data from INE.

Figure 4a shows the evolution of consumer prices by province over our period of analysis. Prices are normalized to 100 in the year 1997.[9] We see a monotonic increase in prices in all provinces, interrupted only by the 2008 financial crisis. Importantly, we observe significant differences in the price evolution across provinces. In 2013, the maximum difference in the price index was 18.7 index points. The three provinces with the highest compound annual inflation rate are Lleida (3.12%), Barcelona (3.11%), and Girona (3.04%), while the ones with the lowest compound annual inflation rate are Santa Cruz de Tenerife (2.34%), Las Palmas (2.34%), and Badajoz (2.49%). Figure 4b illustrates the same data, but slices them by product rather than province. Prices for different products have evolved very differently. The products with the strongest price increase over the whole period are tobacco (+292%), use of vehicles (+207%), and tourist services

[8]The series follow slightly different versions of the Classification of Individual Consumption by Purpose (COICOP), which is the international reference classification of household expenditure. The data are accessible through the INE website at https://www.ine.es/dyngs/INEbase/es/categoria.htm?c=Estadistica_P&cid=1254735976607.

[9]In this figure and the empirical analysis that follows, we use common national and time-constant CPI weights from 2002 to construct the price data series, in order to evaluate all consumer price differences on an equal footing; see Table A.4 in the Appendix for the product-specific weights we employ. The weights can be accessed through the INE website at https://www.ine.es/dynt3/inebase/index.htm?padre=649&capsel=649.

(+202%). The most moderate price development is seen for postage and communication (−66%), heating and household appliances (−4%), and recreational goods and accessories (+2%).

3 Empirical analysis

3.1 Methodology

The starting point of our analysis is the observation that immigrants have targeted some provinces in Spain much more than others. This allows us to exploit variation in the share of migrants across provinces for identification purposes. We index provinces by j, regions by ℓ (with $j \in \ell$), and years by t. Then the basic equation we bring to the data reads as follows:

$$\ln p_{jt} = \beta \mu_{jt} + \gamma_j + \gamma_{\ell t} + \boldsymbol{X}_{jt}^{\mathsf{T}} \boldsymbol{\gamma} + \varepsilon_{jt}, \quad j \in \ell, \tag{1}$$

where $\ln p_{jt}$ is the log price, μ_{jt} is the share of migrants, γ_j is a province fixed effect, $\gamma_{\ell t}$ is a region×year fixed effect, $\boldsymbol{X}^{\mathsf{T}}$ is a row vector of control variables, $\boldsymbol{\gamma}$ is the corresponding column vector of parameters to be estimated, and ε_{jt} is the error term. The central parameter of interest is β, which captures the relationship between immigration and prices.

We estimate Equation (1) in first differences, which eliminates the province fixed effect γ_j. Differences in price *levels* across provinces are, therefore, immaterial for our analysis. To control for demand- and supply-side factors that could influence prices differentially over time, we do two things. First, we include as province-specific control variables the unemployment rate as well as the size of the native population (in logs).[10] Secondly, and more importantly, we include region×year dummy variables to capture $\gamma_{\ell t}$. This controls for all supply and demand shocks that affect a certain region in the same way, and it means that we identify β from differential changes in migration and prices across provinces *within regions*. Hence, the fact that immigration to certain boom regions in Spain is endogenous is not a problem, per se, for our analysis.[11]

However, it is still possible that even within regions immigrants in Spain targeted specific provinces characterized by above-average GDP growth rates and lots of job opportunities and, thus, potentially higher growth in consumer prices. To address this endogeneity issue, we follow Dustmann et al. (2013) and Frattini (2014) and implement an instrumental variables strategy. Specifically, we use as an instrumental variable the fourth lag of the share of migrants in levels in the first-differenced equation of (1), that is, we instrument the change in the migrant share, $\Delta \mu_{jt}$,

[10] These data are also available freely from the INE website.

[11] Regions in our analysis are autonomous communities (*comunidades autónomas*); see Table A.1 in the Appendix.

by the (fourth lag of the) level of the migrant share, μ_{jt-4}.[12]

3.2 Estimation and results

All goods and services. We start by estimating Eq. (1) in first differences on all goods and services (whether tradable or not). The dependent variable is the log average price of all goods and services.[13] In Table 1, columns (1)-(3) report the OLS estimates; columns (4)-(6) report the IV results based on the fourth lag of the migrant share as an instrument. For either estimation approach, we first run the regression with the migrant share as the only explanatory variable (apart from simple year dummy variables); we then augment the regression by including the unemployment rate as well as the size of the native population as additional explanatory variables at the province-level; and in the last specification we augment the model by region×year dummy variables. This is clearly our preferred specification, as it controls for all region-specific demand and supply shocks which move consumer prices in one or the other direction. In all specifications, we estimate robust standard errors clustered at the province level.

The OLS estimates indicate a positive correlation between prices and the migrant share over the period considered. In columns (1) and (2), we find highly significant estimates of β close to $+0.09$. An increase in the migrant share by 10 percentage points is thus associated with an increase in consumer prices by almost 1 percent. However, this estimate is likely to be biased upwards, as migrants can be expected to move to boom locations that experience above-average price growth (Frattini, 2014). Allowing for region-specific shocks, whether permanent or transitory, by augmenting the estimation with region×year fixed effects supports this possibility, as the estimated coefficient becomes considerably smaller and turns insignificant. Turning to our IV estimates, we find a *negative* estimate of β throughout. The first stage F-statistic of a test whether the excluded instrument is significantly different from zero suggests that the instrument is sufficiently strong. The point estimates range from -0.158 to -0.125, and the coefficient is significantly different from zero (at the 10 percent level) in our preferred specification with region×year fixed effects. Hence, our IV estimates demonstrate that the OLS estimates are highly misleading, and that immigration has, if anything, led to a reduction in the CPI in Spain. In the following we cut the data in different ways to shed further light on the possibility of a negative causal effect running from immigration to prices.

[12] We have also experimented with a shift-share type of instrument based on the past sorting of immigrants across provinces; see Frattini (2014). However, this alternative approach suffered from a notorious weak-identification problem.

[13] Since we use the fourth lag to instrument the migrant share, and since the relevant data we use go back until 1995, we can only base our estimates on the period from 1999 to 2013. To make our OLS and our IV estimates comparable, we use the same sample for both estimators.

Table 1: All goods and services

	Dep. var.: Log average price of all goods and services					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	0.084***	0.090***	0.024	-0.158	-0.134	-0.125*
	(0.031)	(0.031)	(0.024)	(0.154)	(0.128)	(0.073)
Unemployment rate		-0.011*	-0.002		0.000	0.003
		(0.006)	(0.007)		(0.009)	(0.007)
Native population (in logs)		-0.018	0.002		-0.013	-0.004
		(0.027)	(0.029)		(0.031)	(0.026)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
First stage F-test of excl. inst.				76.10	55.53	121.10
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all goods and services. The equation is estimated in first differences. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

Tradables vs. non-tradables. We first make a broad distinction between tradable goods on the one hand and non-tradable goods and services on the other hand. From a theoretical point of view, there are reasons to believe that tradable goods are affected differently by migration than non-tradable goods and services.

Table 2: Tradable goods

	Dep. var.: Log average price of tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	0.073**	0.079**	0.014	-0.237	-0.189	-0.069
	(0.031)	(0.031)	(0.040)	(0.176)	(0.140)	(0.077)
Unemployment rate		-0.009	0.001		0.004	0.003
		(0.007)	(0.009)		(0.011)	(0.009)
Native population (in logs)		-0.033	0.027		-0.028	0.024
		(0.034)	(0.039)		(0.037)	(0.030)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
First stage F-test of excl. inst.				76.10	55.53	121.10
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all tradable goods. The equation is estimated in first differences. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

For non-tradable goods and services, both demand- and supply-side effects might be important. On the demand side, if migration raises local demand, and local supply adjusts sluggishly, then we would expect migration to raise prices in the short run (temporarily). But migrants could also have different price elasticities of demand than natives, which could raise or reduce the market power of firms (and thus the markups over marginal costs) even in the medium and long run. Evidence in favor of this basic mechanism is documented by Lach (2007) in the case of Israel, even though he focuses on short-run effects. On the supply side, migrants could reduce wages and, thus, the unit cost of production in those industries that rely heavily on "migrant-intensive" occupations subject to poor wage growth. For perfectly tradable goods, we expect no supply-side effects on prices, unless trade costs that depend on local labor supply make up a significant portion of the total costs. Demand-side effects might, however, play a role also for perfectly tradable goods. For these reasons, we run the same set of regressions as before, but we now distinguish between

tradable goods (Table 2) and non-tradable goods and services (Table 3).[14]

Table 3: Non-tradable goods and services

	Dep. var.: Log average price of non-tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	0.094**	0.099**	0.032	-0.090	-0.088	-0.173*
	(0.038)	(0.038)	(0.035)	(0.166)	(0.150)	(0.091)
Unemployment rate		-0.011	-0.004		-0.002	0.002
		(0.009)	(0.011)		(0.011)	(0.010)
Native population (in logs)		-0.004	-0.021		-0.000	-0.029
		(0.029)	(0.034)		(0.031)	(0.034)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
First stage F-test of excl. inst.				76.10	55.53	121.10
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all non-tradable goods and services. The equation is estimated in first differences. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

We obtain somewhat lower point estimates for β for tradable goods than for non-tradable goods and services when using OLS. These point estimates are positive throughout, but as before insignificant when controlling for regional supply and demand shocks; see column (3) in either table. More importantly, while we find again negative IV estimates of β throughout all specifications and across both types of goods (tradables and non-tradables), these estimates are only different from zero (in a statistical sense) for non-tradable goods and services and once we include region$\times$year fixed effects. Specifically, in this last regression we obtain an estimated coefficient of the migrant share equal to -0.173 with an estimated standard error of 0.091. We interpret this as evidence in favor of the idea that the room for price changes following migration is somewhat bigger for non-tradable goods and services than for tradable goods, as we would expect and as was also found by Frattini (2014).

Boom vs. crisis period. We next make a distinction between the earlier years in our sample and the later years. We do this because the later years are arguably characterized by a strikingly different

[14] In our list of products, the distinction between tradables and non-tradables is unfortunately somewhat blurry; see Table A.4.

environment in the labor and product markets than the earlier years due to the 2008 financial crisis and subsequent recession. The strong (and accelerating) inflow of migrants seen in the years preceding the crisis also slowed down considerably in the wake of the crisis; see Figure 1.

Table 4: Boom vs. crisis: Tradable goods

	Dep. var.: Log average price of tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	0.091**	0.103***	0.024	0.015	0.135*	0.012
	(0.038)	(0.036)	(0.048)	(0.097)	(0.070)	(0.078)
Migrant share × Crisis	-0.077	-0.109**	-0.039	-1.200*	-0.908**	-0.187
	(0.051)	(0.046)	(0.074)	(0.721)	(0.403)	(0.185)
Unemployment rate		-0.009	0.001		0.002	0.002
		(0.007)	(0.009)		(0.012)	(0.008)
Native population (in logs)		-0.042	0.025		-0.105*	0.013
		(0.034)	(0.040)		(0.054)	(0.031)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all tradable goods. The equation is estimated in first differences. Crisis is a dummy variable equal to one for the years 2008 to 2013, and zero otherwise. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). We use this variable interacted with the Crisis dummy as a second excluded instrument. All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

To investigate differences in the effect of immigration on consumer prices across the boom period (1997-2007) and the crisis period (2008-2013), we run the same set of regressions as before, but we now interact the migrant share with a crisis dummy variable which is equal to one in the years 2008 to 2013, and zero otherwise. We show the results separately for tradable goods (Table 4) and for non-tradable goods and services (Table 5). Focusing on our preferred specification based on our IV approach in column (6) of either table, we gain two important insights from these regressions. First, there is no significant effect of immigration on the average price of tradable goods, irrespective of the period of analysis (boom or crisis years). Secondly, and more importantly, the negative effect on non-tradable goods and services materializes fully in the crisis period, and is non-existent in the boom period. Indeed, the coefficient estimates of the migrant share and its interaction with the crisis dummy variable in column (6) of Table 5 suggest a quantitatively im-

portant and statistically significant effect of immigration, but only in the period from 2008 to 2013. One possible explanation for this is that the labor market effects of immigration also materialized in the crisis, much more than in the boom years, with corresponding implications for changes in production costs and prices. In line with this possibility, Carrasco et al. (2008) find no wage effects of immigration in the earlier years of Spain's immigration boom. An alternative explanation is that differences in the price elasticity of demand between migrants and natives became more evident in the crisis. It is possible, for example, that migrants suffered more severe income losses than natives during the crisis, which might have raised their price elasticity of demand beyond the one for natives. Investigating this possibility is, however, beyond the scope of this paper.

Table 5: Boom vs. crisis: Non-tradable goods and services

	Dep. var.: Log average price of non-tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	0.129***	0.137***	0.079*	0.053	0.109	0.134
	(0.046)	(0.046)	(0.041)	(0.103)	(0.088)	(0.089)
Migrant share × Crisis	-0.156***	-0.167***	-0.168**	-0.679	-0.550	-0.709**
	(0.056)	(0.061)	(0.077)	(0.512)	(0.389)	(0.331)
Unemployment rate		-0.011	-0.004		-0.003	-0.003
		(0.009)	(0.010)		(0.012)	(0.008)
Native population (in logs)		-0.018	-0.032		-0.047	-0.070
		(0.030)	(0.037)		(0.046)	(0.046)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all non-tradable goods and services. The equation is estimated in first differences. Crisis is a dummy variable equal to one for the years 2008 to 2013, and zero otherwise. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). We use this variable interacted with the Crisis dummy as a second excluded instrument. All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

Intensity of migrant labor at the product level. We have so far lumped all products together or we have drawn a (somewhat blurry) line between tradable and non-tradable goods and services. Table A.2, using 2002 data from the European Labor Force Survey (EU-LFS), demonstrates that migrants are not equally represented across sectors of employment (NACE rev. 1.1). Specifically,

the top five sectors in terms of migrant employment shares are domestic households (33.65%); hotels and restaurants (18.89%); mining and quarrying (15.50%); construction (9.88%); and agriculture (9.72%).[15] We also know from the EU-LFS data that migrants are highly overrepresented in service-related occupations as well as elementary occupations with just basic educational requirements; see Table A.3.

Table 6: Products intensive in migrant labor

	Dep. var.: Log average price of a specific good or service					
	Food		Household maintenance		Rest. & hotel services	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Migrant share	0.007	-0.282**	-0.222	-1.117***	0.041	-0.085
	(0.067)	(0.115)	(0.160)	(0.328)	(0.105)	(0.148)
Unemployment rate	0.013	0.021	-0.032	-0.004	0.008	0.012
	(0.018)	(0.016)	(0.040)	(0.035)	(0.020)	(0.017)
Native population (in logs)	0.111**	0.100***	-0.068	-0.102	0.009	0.004
	(0.042)	(0.036)	(0.155)	(0.154)	(0.046)	(0.036)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-test of excl. inst.		121.10		121.10		121.10
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of a specific product. The equation is estimated in first differences. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

We use this information to investigate potential supply-side effects on consumer prices in "migrant-intensive" sectors, and we expect to find a more moderate price development in these sectors, through the potential effect migration has on wages and, thus, the unit cost of production. To do so, we match NACE rev. 1.1 industries to products in our INE data; see Table A.5. The three products included in the CPI and most intensive in migrant labor are thus food; household maintenance (including domestic service); and restaurants, bars, coffee bars and hotels along with tourist services. Table 6 reports our estimation results, separately for the three product groups, and always for the most comprehensive specification with the full set of control variables. Our IV

[15]This abstracts from extra-territorial organizations and bodies (NACE code Q), which is irrelevant in our context.

estimates of the coefficient of the migrant share are always negative. They are significant for food and for households maintenance, respectively, and insignificant otherwise. As it turns out, we find the largest negative (and highly significant) coefficient (-1.12) for household maintenance, which corresponds to the sector with the highest share of migrants in Spain. Table 7 reports the results for the three products in the CPI with the least intensive use of migrant labor. These are electricity, gas, and other fuels; education; and financial services. Interestingly, we find no significant price effects there. Hence, our product-specific estimates are in line with a supply-side explanation of the effect of immigration on consumer prices.

Table 7: Products intensive in native labor

	Dep. var.: Log average price of a specific good or service					
	El., gas, fuels		Education		Fin. services	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Migrant share	0.160	0.250	0.058	-0.289	-0.002	-0.041
	(0.166)	(0.222)	(0.078)	(0.204)	(0.105)	(0.132)
Unemployment rate	0.034	0.031	-0.059**	-0.049**	-0.064*	-0.063**
	(0.044)	(0.036)	(0.026)	(0.022)	(0.034)	(0.027)
Native population (in logs)	-0.311**	-0.307***	0.145**	0.132**	-0.035	-0.037
	(0.123)	(0.098)	(0.065)	(0.065)	(0.082)	(0.063)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-test of excl. inst.		121.10		121.10		121.10
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of a specific product. The equation is estimated in first differences. 2SLS refers to our instrumental variable based on the fourth lag of the migrant share (this variable is *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

Different countries of origin. In a final step of our analysis we consider different countries of origin. It is well-known that for many people from Western Europe Spain serves as a country to spend their retirement. It is obvious that the implications for wages and consumer prices can be radically different depending on whether migrants integrate into the labour market or not, what their incomes and wealth are, and how much time per year they actually spend in the country. To capture these differences in a very simple fashion, we distinguish between migrants from Western European countries and migrants from all other countries in the world. In terms of the regression

equation, we include now the share of migrants from Western Europe and the share of migrants from other countries simultaneously, so that we need to instrument two endogenous variables. We do this with the four-year lags of the two respective level variables in the first-differenced estimation equation.

Table 8: Migrants from Western Europe vs. other countries: Tradable goods

	Dep. var.: Log average price of tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	-0.116	-0.105	-0.014	-0.701*	-0.634*	-0.082
(Western Europe)	(0.121)	(0.114)	(0.061)	(0.415)	(0.381)	(0.083)
Migrant share	0.115***	0.119***	0.021	0.186	0.217	-0.057
(Other countries)	(0.037)	(0.037)	(0.046)	(0.187)	(0.189)	(0.126)
Unemployment rate		-0.008	0.001		-0.005	0.003
		(0.008)	(0.009)		(0.009)	(0.009)
Native population (in logs)		-0.032	0.027		-0.026	0.024
		(0.033)	(0.039)		(0.036)	(0.030)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
First stage F-test of excl. inst. (Western Europe)				54.96	100.33	72.68
First stage F-test of excl. inst. (Other countries)				17.26	16.78	70.12
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all tradable goods. The equation is estimated in first differences. 2SLS refers to our instrumental variables based on the fourth lag of the two different migrant shares (these variable are *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

For tradable goods, we find no significant effect of immigration on consumer prices, regardless of the country of origin. This can be seen in column (6) of Table 8, where the coefficients of both migrant shares are insignificant. For non-tradable goods and services, we find that the effect of migrants from Western Europe is insignificant, while the effect of migrants from other countries is negative and highly significant; see column (6) of Table 8. The estimated coefficient of -0.273 implies that an increase in the share of migrants from other countries (i.e., non-Western European countries) by 10 percentage points reduces average consumer prices of non-tradable goods and

Table 9: Migrants from Western Europe vs. other countries: Non-tradable goods and services

	Dep. var.: Log average price of non-tradable goods					
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Migrant share	-0.238**	-0.229**	-0.091	-0.326*	-0.322**	-0.078
(Western Europe)	(0.098)	(0.096)	(0.067)	(0.173)	(0.144)	(0.130)
Migrant share	0.167***	0.171***	0.065	0.126	0.126	-0.273***
(Other countries)	(0.042)	(0.042)	(0.041)	(0.207)	(0.203)	(0.103)
Unemployment rate		-0.010	-0.004		-0.007	0.004
		(0.009)	(0.011)		(0.011)	(0.011)
Native population (in logs)		-0.001	-0.022		0.000	-0.029
		(0.026)	(0.034)		(0.025)	(0.037)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Year fixed effects	No	No	Yes	No	No	Yes
First stage F-test of excl. inst. (Western Europe)				54.96	100.33	72.68
First stage F-test of excl. inst. (Other countries)				17.26	16.78	70.12
N	750	750	750	750	750	750

Note: The dependent variable in all regressions is the log average price of all non-tradable goods and services. The equation is estimated in first differences. 2SLS refers to our instrumental variables based on the fourth lag of the two different migrant shares (these variable are *not* given in first differences in the estimation). All variables are given at the province level (*provincias*). Full first stage results are available from the author upon request. Robust standard errors are clustered at the level of 50 different provinces and are given in parentheses. *,**,*** denote significance at the 10%, 5%, 1% levels, respectively.

services by more than 2.5 percent. This is a sizable effect, and it squares well with the idea that immigrants can help in reducing domestic consumer prices by raising domestic labor supply. The effect is also consistent, however, with different price elasticities of demand depending on immigrants' countries of origin (low-income versus high-income).

4 Conclusion

We have conducted an investigation into the effect of immigration on consumer prices in Spain focusing on a major migration episode from the recent past: the immigration boom to Spain triggered by strong economic growth before the 2008 financial crisis. Overall, we find plausible and negative effects on consumer prices concentrated among non-tradable goods and services, as well as among goods intensive in migrant labor. Interestingly, these effects materialize exclusively in the wake of the 2008 financial crisis and subsequent economic recession, a period of extraordinary economic distress.

We should like to close by emphasizing the significant negative effect that we found immigration to have on food prices. Food products have the largest weight in the national CPI index that we use in our analysis (more than 20%). The benefits of these price reductions caused by immigration accrue to all households. However, they favor low-income households more than high-income households, because food accounts for a larger share of expenditure among low-income households. According to data from Eurostat, households in Spain from the bottom income quintile allocated 23.8% of their total consumption expenditure to food in 2005.[16] The same number for households from the top income quintile was a mere 11.8%. This is a sizable difference that needs to be taken into account when evaluating effects of immigration on real wages and inequality.

[16]The data are available at https://ec.europa.eu/eurostat/databrowser/product/page/hbs_str_t223.

References

Balkan, B. and S. Tumen, "Immigration and Prices: Quasi-Experimental Evidence from Syrian Refugees in Turkey," *Journal of Population Economics*, 2016, *29* (3), 657–686.

Carrasco, R., J. F. Jimeno, and A. C. Ortega, "The Effect of Immigration on the Labor Market Performance of Native-born Workers: Some Evidence for Spain," *Journal of Population Economics*, 2008, *21* (3), 627–648.

Cortes, P., "The Effect of Low-Skilled Immigration on U.S. Prices: Evidence from CPI Data," *Journal of Political Economy*, 2008, *116* (3), 381–422.

Dustmann, C., A. Glitz, and T. Frattini, "The Labor Market Impact of Immigration," *Oxford Review of Economic Policy*, 2008, *24* (3), 922–948.

Dustmann, C., T. Frattini, and I. P. Preston, "The Effect of Immigration along the Distribution of Wages," *Review of Economic Studies*, 04 2013, *80* (1), 145–173.

Edo, A., "The Impact of Immigration on the Labor Market," *Journal of Economic Surveys*, 2019, *33* (3), 922–948.

Frattini, T., "Immigration and Prices in the UK," Working Papear, UCL Department of Economics 2008.

_ , "Impact of Migration on UK Consumer Prices," Report for the Migration Advisory Committee (MAC) 2014.

González, L. and F. Ortega, "Immigration and Housing Booms: Evidence from Spain," *Journal of Regional Science*, 2013, *53* (1), 37–59.

Lach, S., "Immigration and Prices," *Journal of Political Economy*, 2007, *115* (4), 548–587.

Ottaviano, G. I. P. and G. Peri, "The Effects of Immigration on US Wages and Rents: A General Equilibrium Approach.," in P. Nijkamp, J. Poot, and M. Sahin, eds., *Migration Impact Assessment: New Horizons.*, Elgar, Cheltenham, 2012, pp. 107–146.

Sá, F., "Immigration and House Prices in the UK," *Economic Journal*, 2015, *125* (587), 1393–1424.

Saiz, A., "Room in the Kitchen for the Melting Pot: Immigration and Rental Prices," *Review of Economics and Statistics*, 2003, *85* (3), 502–521.

_ , "Immigration and Housing Rents in American Cities," *Journal of Urban Economics*, 2007, *61* (2), 345–371.

Zachariadis, M., "Immigration and International Prices," *Journal of International Economics*, 2012, *87* (2), 298–311.

A Appendix

Table A.1: Regions and provinces in Spain

ANDALUCÍA	CASTILLA Y LEÓN	CATALUÑA	GALICIA
Almería	Ávila	Barcelona	La Coruña
Cádiz	Burgos	Girona	Lugo
Córdoba	León	Lleida	Orense
Granada	Palencia	Tarragona	Pontevedra
Huelva	Salamanca		
Jaén	Segovia	COMUNITAT VALENCIANA	PAÍS VASCO
Málaga	Soria	Alicante	Álava
Sevilla	Valladolid	Castellón	Guipúzcoa
	Zamora	Valencia	Vizcaya
ARAGÓN			
Huesca	CASTILLA-LA MANCHA	EXTREMADURA	OTHER PROVINCES/REGIONS
Teruel	Albacete	Badajoz	Principado de Asturias
Zaragoza	Ciudad Real	Cáceres	Illes Balears
	Cuenca		Cantabria
CANARIAS	Guadalajara		Comunidad de Madrid
Las Palmas	Toledo		Región de Murcia
Santa Cruz de Tenerife			Comunidad Foral de Navarra
			La Rioja

Note: The table shows autonomous communities and provinces in Spain. Ceuta and Melilla are excluded.

Table A.2: Migrants by industry in 2002 (NACE rev. 1.1)

NACE code	Industry	Migrant share (in %)
A	Agriculture, hunting and forestry	9.72
B	Fishing	5.60
C	Mining and quarrying	15.59
D	Manufacturing	5.40
E	Electricity, gas and water supply	2.60
F	Construction	9.88
G	Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods	6.19
H	Hotels and restaurants	18.89
I	Transport, storage and communication	6.96
J	Financial intermediation	3.32
K	Real estate, renting and business activities	8.86
L	Public administration and defence, compulsory social security	2.20
M	Education	4.57
N	Health and social work	5.19
O	Other community, social and personal service activities	5.75
P	Activities of households	33.65
Q	Extra-territorial organizations and bodies	70.15

Note: The data come from the EU Labor Force Survey (EU-LFS).

Table A.3: Migrants by occupation in 2002 (ISCO 88)

ISCO 88 code	Occupation name	Migrant share (in %)
11	Legislators and senior officials	4.01
12	Corporate managers	8.15
13	Managers of small enterprises	5.83
21	Physical, mathematical and engineering science professionals	7.82
22	Life science and health professionals	6.15
23	Teaching professionals	4.42
24	Other professionals	6.72
31	Physical and engineering science associate professionals	5.16
32	Life science and health associate professionals	6.08
33	Teaching associate professionals	3.01
34	Other associate professionals	5.83
41	Office clerks	4.38
42	Customer services clerks	8.41
51	Personal and protective services workers	13.34
52	Models, salespersons and -demonstrators	5.10
61	Market-oriented skilled agricultural and fishery workers	4.54
71	Extraction and building trades workers	8.24
72	Metal machinery and related trades workers	5.79
73	Precision handicraft, craft printing and related trades workers	3.60
74	Other craft and related trades workers	5.05
81	Stationary plant and related operators	4.85
82	Machine operators and assemblers	4.51
83	Drivers and mobile plant operators	5.44
91	Sales and services elementary occupations	17.90
92	Agricultural, fishery and related labourers	24.00
93	Labourers in mining, construction, manufacturing and transport	13.44

Note: The data come from the EU Labor Force Survey (EU-LFS). Armed forces are excluded.

Table A.4: Product correspondence COICOP subgroups (before/after 2002)

COICOP (from 2002 on)	COICOP (before 2002)	CPI weight 2002 (in ‰)
011 Food*	Food	206.452
012 Non-alcoholic beverages*	Non-alcoholic beverages	12.178
021 Alcoholic beverages*	Alcoholic beverages	8.999
022 Tobacco*	Tobacco	23.171
031 Clothing*	Clothing, including repairs	79.258
032 Footwear*	Footwear, including repairs	20.023
041 Actual rentals for housing 043 Maintenance and repair of the dwelling 044 Water supply and miscellaneous services relating to the dwelling	Housing and water supply	69.21
045 Electricity, gas and other fuels	Heating and lighting	41.049
051 Furniture and furnishings, carpets and other floor coverings*	Furniture, accessories, floor coverings and repairs	19.547
052 Household textiles*	Articles, other furniture and repairs	5.626
053 Household appliances*	Heating apparatus, electrical appliances and repairs	10.795
054 Glassware, tableware and household utensils*	Glassware, crockery, household furnishings and ut.and repairs	1.972
055 Tools and equipment for house and garden* 056 Goods and services for routine household maintenance	Goods and services for household maintenance, except domestic service Domestic service	25.63
061 Medical products, appliances and equipment*	Medicines and other pharmaceutical products Apparatus, therapeutic material and repairs	16.203
062 Out-patient services	Out-of-hospital services of doctors, nurses and others	10.841
063 Hospital services	Hospital care and similar services	1.018
071 Purchase of vehicles*	Purchase of vehicles for personal transport	71.769
072 Operation of personal transport equipment	Use of vehicles	72.912
073 Transport services	Transport services	11.079
082 Telephone and telefax equipment* 083 Telephone and telefax services 091 Audio-visual, photographic and information processing equipment*	Communication	39.38
093 Other recreational items and equipment, gardens and pets*	Recreational articles, accessories and repairs	10.379
094 Recreational and cultural services	Leisure, entertainment and cultural services	14.526
095 Newspapers, books and stationery	Books, newspapers and magazines	17.2
096 Package holidays	Tourist services	11.507
101 Pre-primary and primary education 102 Secondary education 104 Tertiary education 105 Education not definable by level	Education	17.444
111 Catering services 112 Accommodation services	Restaurants, bars, coffee bars and hotels	112.707
121 Personal care	Goods and services for personal care	22.531
123 Personal effects n.e.c.*	Other personal articles	5.173
124 Social protection		2.314
125 Insurance	Medical insurance	34.693
126 Financial services n.e.c.	Financial services	0.278
127 Other services n.e.c.	Other services	4.135

Note: Product subgroups marked with an asterisk (*) are classified as tradable goods. The CPI weight is the national CPI weight from 2002.

Table A.5: Industry-product correspondence (NACE rev. 1.1/COICOP)

Industry NACE rev. 1.1	COICOP (from 2002 on)
A Agriculture, hunting and forestry	011 Food
B Fishing	
C Mining and quarrying	
D Manufacturing	012 Non-alcoholic beverages 021 Alcoholic beverages 022 Tobacco 031 Clothing 032 Footwear 051 Furniture and furnishings, carpets and other floor coverings 052 Household textiles 053 Household appliances 054 Glassware, tableware and household utensils 055 Tools and equipment for house and garden 061 Medical products, appliances and equipment 082 Telephone and telefax equipment 091 Audio-visual, photographic and information processing equipment 071 Purchase of vehicles 123 Personal effects n.e.c.
E Electricity, gas and water supply	044 Water supply and miscellaneous services relating to the dwelling 045 Electricity, gas and other fuels
F Construction	
G Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods	072 Operation of personal transport equipment 093 Other recreational items and equipment, gardens and pets
H Hotels and restaurants	096 Package holidays 111 Catering services 112 Accommodation services
I Transport, storage and communication	073 Transport services 081 Postal services 083 Telephone and telefax services 095 Newspapers, books and stationery
J Financial intermediation	125 Insurance 126 Financial services n.e.c.
K Real estate, renting and business activities	041 Actual rentals for housing 043 Maintenance and repair of the dwelling 127 Other services n.e.c.
L Public administration and defence, compulsory social security	124 Social protection
M Education	101 Pre-primary and primary education 102 Secondary education 104 Tertiary education 105 Education not definable by level
N Health and social work	062 Out-patient services 063 Hospital services
O Other community, social and personal service activities	094 Recreational and cultural services 121 Personal care
P Activities of households	056 Goods and services for routine household maintenance
Q Extra-territorial organizations and bodies	

Immigration and Occupational Shortage in Western European Countries

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Abstract

In Western European countries where immigration rates are rising and labour shortages persist, the former could potentially serve as a solution to the latter. We examine the impact of an exogenous increase in migrant workers on occupational shortages in 14 Western European countries over the period 2006-2018. We construct an occupational shortage indicator that includes five components representing supply and demand for each country and occupation at the 2-digit level each year. In our model, which assesses the influence of the migrant share on the occupational shortage index and identifies occupations facing shortages, we show that immigration flows reduce occupational shortages, with a more pronounced effect observed for migrants from non-EU countries. By recognising the contribution of migrants to addressing occupational shortages, policymakers can implement more effective strategies for managing migration flows and harnessing the potential of migrant workers not only in the EU but globally.

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1 Introduction

Western Europe accommodates a diverse migrant population, with Austria (16%), Ireland (13%), Belgium (12%), and Germany (12%)[1] hosting the highest proportions of foreign-born residents. Notably, between 2001 and 2018, amid two EU enlargements, Western European nations experienced the most substantial increases in immigrants both from EU-countries (Romania, Poland, Bulgaria) and from non-EU countries (Morocco, Syria, China, and Ukraine).

Much of the ongoing debate on the labour market issues is centred around concerns regarding the labour supply, with a particular emphasis not only on the general labour force but also on specific skills that are necessary for particular occupations. Education and migration policies are intricately related to these discussions. Namely, following the arguments of Cappelli (2015), inadequacies in the fundamental skills of prospective employees, often attributed to shortcomings in the education system, result in a skills gap. This gap is exemplified by shortages in certain professions, such as engineers. When the balance between the supply and demand of skills is disrupted, whether due to oversupply or undersupply, it gives rise to a broader issue known as skills mismatch, a specific instance of the latter is skills shortage. Failure to solve issued caused by skills shortages adequately can adversely impact company performance, widen wage gaps across skill groups, and exacerbate overall economic inequalities, consequently diminishing overall economic competitiveness (Strietska-Ilina, 2007).

Skill shortage may thereby be addressed as a situation of "a market disequilibrium between supply and demand in which the quantity of workers demanded exceeds the supply of workers available and willing to work at a particular wage and working conditions at a particular place and point of time" (Barnow et al., 1998). On the flip side, skill shortages may arise when there is a challenge in filling specific job vacancies, for example those requiring skilled workers. In such instances, the goal is not to achieve an equilibrium state, but rather to navigate a situation where the firm encounters prolonged wait times or engages in more active search for employees. The duration of job vacancies, and consequently skill shortages, hinges on various factors including the number of open positions for skilled workers, the number of job-seekers, and the effectiveness of the hiring process. Skill shortages may be indicative of challenges in hiring new employees or perceived skill deficiencies in the existing workforce. Respectively, skill shortages are closely associated with hiring difficulties and hard-to-fill vacancies (Haskel & Martin, 1993; Haskel & Martin, 2001).

The EU is committed to attracting migrants with the skills, talents, and contributions needed to support economic growth, address demographic challenges, and foster social cohesion within the EU. Among some of such policies is the revised Blue Card Directive that introduces regulations aimed at

[1] Source : Authors' calculations based on the European Labour Force Survey.

attracting highly skilled workers to the EU. It provides flexible admission criteria, rights, and ease of mobility and employment across EU Member States. The EU expands employment opportunities for students, researchers, seasonal workers, start-up entrepreneurs, enables reunification of families and facilitates integration programs.

Creating suitable conditions to address labour market shortages by migration policies is crucial for several reasons. Primarily, migrants play a vital role in filling in workforce gaps, especially in professions and sectors experiencing shortages. Their presence augments the labour force, thereby enhancing overall productivity and boosting the economy's competitiveness. Additionally, migrants frequently bring diverse skill sets and backgrounds that complement the existing workforce, fostering innovation, creativity, and knowledge exchange across industries. This diversity increases efficiency and competitiveness on the global stage. Furthermore, attracting migrants serves as a strategic response to demographic challenges, such as ageing populations and declining birth rates.

In this paper, we set as an objective to conduct an empirical investigation of the impact of immigration on labour shortages in Western European countries from 2006 to 2018 through addressing specifically occupational labour shortages. Occupational shortage refers to a deficit in labour availability characterized by specific levels of qualification required for particular occupations. Regrettably, a standardized methodology for measuring occupational shortage at the European level is still lacking, hindering the ability to make accurate labour market forecasts (Strietska-Ilina, 2007).

To this end, our aim is to examine whether a correlation exists between migration and labour market shortage, and if the latter can be confronted by the former. Previous research indicates that migration patterns display variations based on the educational attainment of migrants. A prominent trend in contemporary international migration is the increasing prevalence of high-skill migration (Docquier & Rapoport, 2012). In particular, Germany, France, and Italy host larger proportions of low-skilled immigrant populations, while Spain and the United Kingdom have relatively higher numbers of well-educated foreign residents. However, despite advancements in the educational attainment of immigrants, they generally remain less educated than the local populations in most European countries. Correspondingly, as migration flows from economically less prosperous to more affluent nations, the latter are more likely to attract immigrants with higher skill levels (Dorn & Zweimüller, 2021).

Migration itself exhibits a significant skill bias, as individuals with tertiary degrees are four times more likely to migrate than those with lower education levels (Biavaschi et al., 2020). However, upon entering the new labour market, immigrants often find themselves overqualified for the positions they secure, leading to a pronounced downgrading of their skills (Dustmann et al., 2010). In terms of employment rates and incomes, immigrants tend to experience outcomes that are less favourable compared to natives (Dorn & Zweimüller, 2021).

Another perspective postulates that migration may potentially threaten native workers by reducing their wages and exerting additional pressure on their employment opportunities (this viewpoint is elaborated upon in the literature review section). In our paper, we present evidence that migrants are in fact a valuable asset in the fight against labour market shortage. In particular, we demonstrate a distinct pattern indicating that migration diminishes occupational shortage, with a more noticeable impact observed among migrants originating from non-EU countries.

2 Literature review

2.1 Labour market shortage and the role of migration

The phenomenon referred to as a "labour shortage" transpires when the demand for labour surpasses the available supply. Operationally, it denotes a contraction in the workforce within a specific occupation relative to the societal ideal. The reluctance of individuals to transition across economic sectors, locations, and occupations can precipitate labour shortage. Moreover, labour shortages may arise when sectors and firms experience expansion, necessitating a greater demand for qualified workforce in specific fields (Groiss & Sondermann, 2023). Dustmann et al. (2010) postulate that immigration emerges as a viable remedy in order to addressing it, yielding a consequential welfare gain.

National shortages cannot be mitigated solely through internal migration. Instead, addressing this excess demand at the national level requires a significant increase in wages. In the event that the native population displays a limited propensity for mobility, both across regions and sectors, immigration serves to facilitate labour market dynamics, particularly when migration is unregulated by stringent visa conditions and is not mandatorily tied to employment within specific occupations (Dustmann et al., 2010).

Migration can impact the economic development of countries through various channels. In the next two subsections, we examine the effects of migration in general on the labour market and on skills on the population of the receiving country.

2.2 Effects of migration on the labour market

There are varied findings concerning labour market outcomes on wages and employment in the receiving countries. A group of researchers (Card (2009), Dustmann et al. (2013), Docquier et al. (2014), Foged & Peri (2015), Moreno-Galbis & Tritah (2016)) find positive or neutral effects of migration on the local labour market. On the contrary, another other researchers (Angrist & Kugler (2003), Borjas et al. (2008)) report diagonal findings of negative effects of migration on the labour market of the accepting country.

To illustrate positive and weak positive or neutral effects, we further present certain findings. Card (2009) claims that immigration has a subtle influence on the mean wage variations across various skill groups within the native population. Additionally, the presence of immigrants has not led to a widening of

the residual wage gap among native workers. Similarly, according to Edo (2019), immigration may have no or little effect on native workers' average wage and employment.

Dustmann et al. (2013) argues that immigration in the UK has, on average, somewhat raised local workers' average wages. According to Docquier et al. (2014), immigration in OECD countries has been associated with favourable effects on both the wages and employment levels of the native population. This positive impact is attributed to the presence of well-educated immigrants, who act as catalysts in stimulating the labour market, thereby fostering the creation of additional opportunities within the receiving economy. Foged & Peri (2015) show that the surge in immigration from refugee-producing countries compelled less educated native workers to transition to different careers, and more specifically, non-manual. Individuals with lower levels of education among the native population experienced either positive or neutral effects on both wages and employment.

More specifically to EU region, Kahanec & Pytliková (2017) illustrate that, concerning the EU enlargement before 2010, migratory flows from the newly joined EU Member States following the enlargement have positively influenced the GDP, GDP per capita, and employment rate of destination countries. Guzi et al. (2021) demonstrate that from 2003 to 2017, immigration played a role in decreasing inequality within the 25 EU Member States. Finally, Moreno-Galbis & Tritah (2016) demonstrate a positive effect of immigration on the native employment of Western European countries. Specifically, a 10% increase in the number of non-EU15 immigrants in a given occupation is correlated with a corresponding rise in the natives' employment rate within that occupation by approximately 0.5%. In a recent paper Signorelli (2023) demonstrates that while external migration does indeed augment the labour supply within local markets, it typically does not adversely affect employment prospects for the resident population. Moreover, migration appears to exert weak influence on the incomes of the local population, primarily because migrants often possess limited bargaining power and production does not readily allow for perfect substitution.

On the contrary, Angrist & Kugler (2003) suggest that migration deteriorates the labour market of the receiving country, yielding contrasting results. The authors indicate that a 10% increase in the employment of migrants from former Yugoslavia is associated with a reduction in native employment rates of European countries by 0.2-0.7 of a percentage point. Borjas et al. (2008) assume that in the United States, immigration is expected to result in lower wages for those native workers who are most impacted by labour supply changes brought about by immigration. In a particular natural experiment, Dustmann et al. (2017) finds that a substantial rise in labour supply, triggered by the sudden influx of Czech workers in regions along the German-Czech border following the fall of the Berlin Wall, led to a modest reduction in local wages and a significant decline in local employment.

2.3 Effects of migration on skills

Consensus among most researchers suggests that the impacts of immigration vary across different segments of the local population, particularly in terms of skill groups. Edo & Özgüzel (2023) prove that, in the short run, employment responses for low-educated natives are either negative or neutral, while the expected impacts on the employment rate of highly educated natives are neutral in the short run and positive in the long run. Biavaschi et al. (2020) assert that while migration with a skill bias is advantageous for the majority of receiving countries, it can yield both positive and negative outcomes for sending countries, ultimately contributing to a minor yet positive effect on global welfare.

The inquiry into the substitutability or complementarity dynamics between the native and migrant populations is crucial in understanding the impact of immigration on wages. Illustrated by the case of learning English during compulsory education, Fenoll & Kuehn (2019) demonstrate complementarity between the two. They reveal that individuals acquiring proficiency in English during their school years are more inclined to migrate to countries where English is less prevalent, potentially augmenting the value of their English language skills and complementing the local labour market. Aligned with these findings, D'Amuri & Peri (2014) reveal the complementarity between immigrants and natives through the reallocation of workers to tasks where they possess a comparative advantage. Conversely, Ottaviano & Peri (2012) demonstrate a scenario of imperfect substitution between current migrants and the native population, coupled with perfect substitution with older immigrants.

It is worth noting that we are well aware of the approach that the market could exhibit monopsonistic features or that employers might exploit monopsony power. In such instances, wages, deviating from corresponding marginal products, are often subject to discrimination to capitalize on varied supply responses. Overall, for the society, elevated levels of monopsony power can result in substantial welfare losses, stemming from the misallocation of labour and the redistribution of income away from workers (Ashenfelter et al., 2010). In the context of the labour market, immigration impacts native workers through markdowns enforced by firms possessing monopsony power. Employers with considerable market power primarily over migrants (though to a lesser extent over natives) and unable to directly discriminate wages, exploit the larger pool of migrant workers, simultaneously applying higher markdowns to both migrants and natives (Amior & Manning, 2021).

To gain a holistic understanding of migration as a complex phenomenon, it is essential to incorporate additional insights and findings into the analysis, namely though the role of institutions and the effect migration has on the population of sending countries.

Institutions exert a significant influence in shaping the immigration outcomes within the labour markets of local countries. Edo (2019) proposes that labour market rigidities, encompassing elements such as employment protection, high minimum wage, and welfare benefits, often hinder wage adjustments for

specific native worker cohorts. This, in turn, can lead to unfavourable native employment outcomes and increased unemployment. In terms of minimum wage policy, a lower minimum wage exacerbates the adverse effects of immigration on the employment trends and wages of local workers Edo & Rapoport (2019). Building upon this, Edo & Özgüzel (2023) provide evidence that heightened collective bargaining coverage and robust employment protections act as safeguards, shielding native workers from both short- and long-term employment effects associated with immigration.

So far, we described the effect of migration on welcoming countries, but it has an influence on home countries of migrants too. Dustmann et al (2015) discovers that the external migration from Poland spanning the period between 1998 and 2007 exerted an upward influence on the wages of individuals who remained in the country, particularly among those categorized within the intermediate-skill segment. In fact, individuals who have never migrated to receiving countries reap benefits from migrant self-selection. Conversely, this phenomenon exerts a detrimental impact on the welfare of many sending countries (Biavaschi et al., 2020). Another characteristic of migration lies in the fact that newly arrived immigrants in a destination country are more responsive to regional wage differentials compared to those who arrived earlier (Dustmann et al., 2010).

This paper contributes to existing literature by identifying occupations facing shortages in the host country and evaluating the impact of immigration within this specific context. Moreover, we decompose the effect of migration into two groups of population: migrants born in the EU and migrants born outside of the EU. We also discuss the impact of migration on different occupational categories.

3 Data and empirical strategy

3.1 Data

We employ data from the *European Union Labour Force Survey (EU-LFS)* and the *European Union Survey of Income and Living Conditions (EU-SILC)* encompassing fourteen Western countries (Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom) over the period from 2006 to 2018. To clarify, our focus is specifically on the sample of Western EU economies, including the United Kingdom, which exited the EU in 2020. Wage data is derived from the EU-SILC, while all other variables are generated utilizing the EU-LFS.

The primary unit for our analysis is the International Standard Classification of Occupations (ISCO) cell. Due to the ISCO classification change in 2011 from ISCO-88 to ISCO-08[2], we employ our own approach to reach harmonization between ISCO-88 and ISCO-08.

[2] ISCO-08 is a four-level hierarchically structured classification that allows all jobs in the world to be classified into 436 unit groups.

The EU-LFS is one of the main national household surveys that countries carry out. The EU-LFS collects data on individual and household characteristics, labour market participation, educational attainment and background, job characteristics, working conditions including working hours, participation in education and training, income, etc. (Eurostat, 2024a). Survey's objective is to generate official national data on employment, unemployment, and the labour force for planning and monitoring reasons. For these reasons, the EU-LFS is the primary source of labour market indicators for short-term monitoring, as well as for more structural data on the number of the employed, jobs and working conditions, the job search activities of the unemployed, etc. With add-on modules, the EU-LFS may provide statistics on unpaid work and other relevant areas (Eurostat, 2024b; ILOSTAT, 2024). In the EU-LFS, we use ISCO data at a 2-digit level, although the survey provides more detailed ISCO classification. We define a person as a migrant if he/she was born outside of the country of residence.

Introduced in 2003, the EU-SILC gathers standardized cross-sectional and longitudinal microdata focusing on income distribution, poverty, and social exclusion across 27 countries as of 2022. The EU-SILC encompasses a range of interconnected aspects of living conditions and poverty policies within the EU framework, including child poverty, healthcare accessibility, housing, over-indebtedness, and overall quality of life. The survey acts as a primary data source for microsimulation modelling and swift estimates of income distribution and poverty rates within the EU (European Commission, 2022). In the EU-SILC, we use the variable "Occupation in main job" that provides ISCO 2-digits code. Similarly to the EU-LFS, those who reside outside of their country of birth are defined as migrants.

Migration data is sourced from the OECD database. The *Database on Immigrants in OECD Countries (DIOC)* includes statistics on the labour market and demographic characteristics of the population in OECD countries around the year 2000, broken down by place of birth. Therefore, we are able to compute the proportion of migrants born in the EU and migrants born outside of the EU[3] in receiving countries, which forms the basis for our estimation of the impact of the migration of both groups. By utilizing the *OECD International Migration Database and labour market outcomes of immigrants*, we can effectively distinguish between inflows of foreign population and stocks of foreign-born population. This differentiation is essential for conducting instrumental analysis.

For our analysis, we specifically target the working-age population, ranging from 15 to 64 years old, with a focus on both employed and unemployed individuals within these demographics.

[3] Migrants are categorized as born in the EU if their birth country is within one of the 27 EU member states (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden) or EFTA (Iceland, Liechtenstein, Norway, Switzerland) countries. Otherwise, migrants are defined as born outside of the EU.

3.2 Empirical strategy

To identify occupations with shortages, we first derive the occupational shortage index based on the native sample of workers and relying on the OECD measurement framework (OECD, 2017). Accordingly, the indicator consists of five variables: hourly wage growth, employment rate growth, hours worked growth, unemployment rate, and underqualification growth:

$$OS_{oct} = (\Delta W_{oct} - \Delta \overline{W}_{ct}) + (\Delta E_{oct} - \Delta \overline{E}_{ct}) + (\Delta H_{oct} - \Delta \overline{H}_{ct}) + (U_{oct} - \overline{U}_{ct}) + (\Delta UQ_{oct} - \Delta \overline{UQ}_{ct})$$

Where OS_{oct} denotes occupational shortage in occupation o, in country c at time t. ΔW is hourly wage growth, ΔE – total employment growth, ΔH – growth in hours worked, U – inverse of unemployment rate, ΔUQ – underqualification[4] growth; and $\Delta \overline{W}$, $\Delta \overline{E}$, $\Delta \overline{H}$, $\Delta \overline{U}$, $\Delta \overline{UQ}$ represent respective country averages.

In this equation, the dynamics of wage growth or decline serve as the initial indicator, revealing the areas of heightened demand within occupations. An increase in wages for a particular occupation highlights a potential labour shortage there. Secondly, the growth rate of total employment delineates the shifts in demand for workers across specific occupations. Thirdly, the variation in working hours reflects the evolving demand for labour: an increase in working hours indicates a rising demand for specific workers and, consequently, an occupational shortage. Fourthly, the unemployment rate serves as an informative metric, signalling occupations in demand within the labour market. A low unemployment rate for a specific occupation suggests a growing demand, indicative of an occupational shortage. Lastly, a rising trend of underqualification within a particular occupation may signify a shortage, as employers might seek less qualified individuals to fill workforce gaps.

Examined separately, each of the explained five components of the occupational shortage index may present a potentially misleading perspective. For instance, one might contend that fluctuations in the employment rate of specific workers, influenced by factors such as demographic shifts or technological advancements, may not unequivocally signify a labour shortage. However, when collectively considered, these components synergistically contribute to a more coherent and meaningful quantification of occupational shortage.

Our baseline estimation equation is:

$$OS\ dummy_{cot}^{n} = \beta_0 + \beta_1 SI_{cot} + \alpha_c + \alpha_O + \alpha_t + \varepsilon_{cot}\ ,$$

[4] Underqualified workers are defined as those whose educational attainment is below the modal educational attainment of their occupation.The mode is country and year specific.

Where $OS\ dummy_{cot}^{n}$ is 1 if $OS\ _{cot}^{n}$ is positive (meaning that there is a shortage for a specific occupation o in a particular country c and year t) and 0 is the value of OS_{cot}^{n} is 0 or less; SI_{cot} is the share of immigrants in the labour market country c, occupation o in time t.

3.3 Endogeneity bias correction

As new individuals enter the labour market, it is natural for them to gravitate towards occupations and sectors that could affect the existing population. This self-selection in employment could arise from various factors, such as increased demand in particular sectors and professions, personal connections facilitating job opportunities, or the presence of diaspora communities.[5] We adopt an instrumental variable strategy, which aims to deal with endogeneity bias. By using the Bartik instrument (Bartik, 1991; Goldsmith-Pinkham et al., 2020), we calculate the expected inflow of immigrants across occupations, countries and years:

$$\widehat{M}_{cot} = \sum_s \frac{Stock_{so,2000}}{Stock_{s,2000}} \frac{Flow_{s,t}}{L_{o,2005}},$$

Where $\frac{Stock_{so,2000}}{Stock_{s,2000}}$ represents a fraction or earlier immigrants from country of origin s working in occupation o in 2000; $Flow_{s,t}$ is the number of new immigrants from country of origin s to destination country c; $L_{o,2005}$ is the total labour force within occupation o at reference year $t-1$. All data used for the instrument is derived from the OECD data sources mentioned earlier.

By introducing $\widehat{M}_{cot}$,, representing the expected influx of immigrants across occupations, countries, and years, we anticipate that our instrumental variable is correlated with migrant inflows, while remaining uncorrelated with the underlying causes of employment fluctuations among the local population. An analogous instrument, as elucidated Jaeger et al. (2018), has been demonstrated to be a robust determinant of concurrent migrant inflows. Its' application is also evidenced by Card (2009), Moreno-Galbis & Tritah (2016) and others.

4 Empirical results

4.1 Descriptive statistics

We begin our analysis by examining the dynamics of migration and the shares of immigrants by occupations and by countries. For this, we differentiate between EU-born and non-EU born migrants.

[5] For example, Dorn & Zweimüller (2021) show that immigrants tend to settle in countries with a pre-existing substantial diaspora of their nationality.

Figure 1. Shares of migrants during 2006-2018

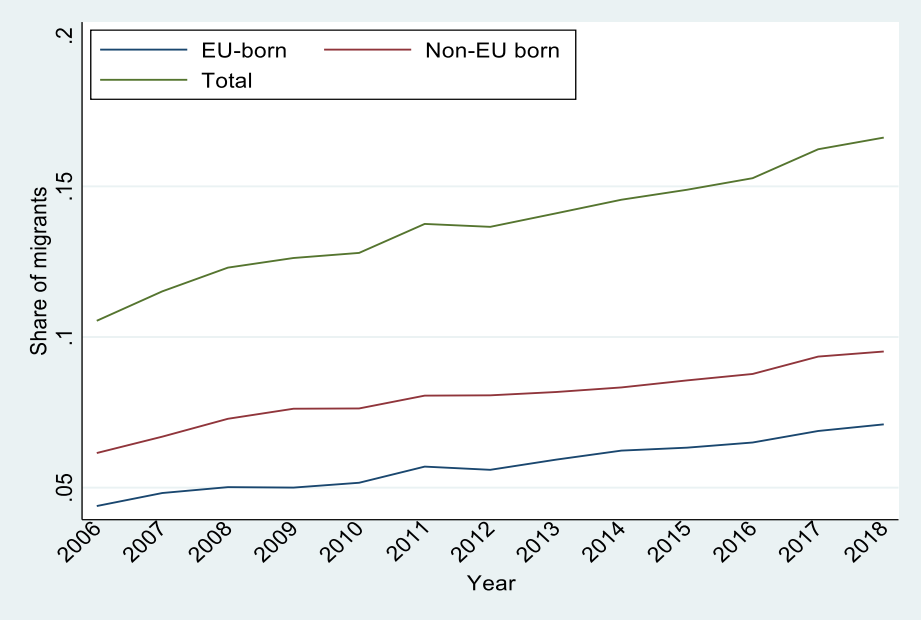
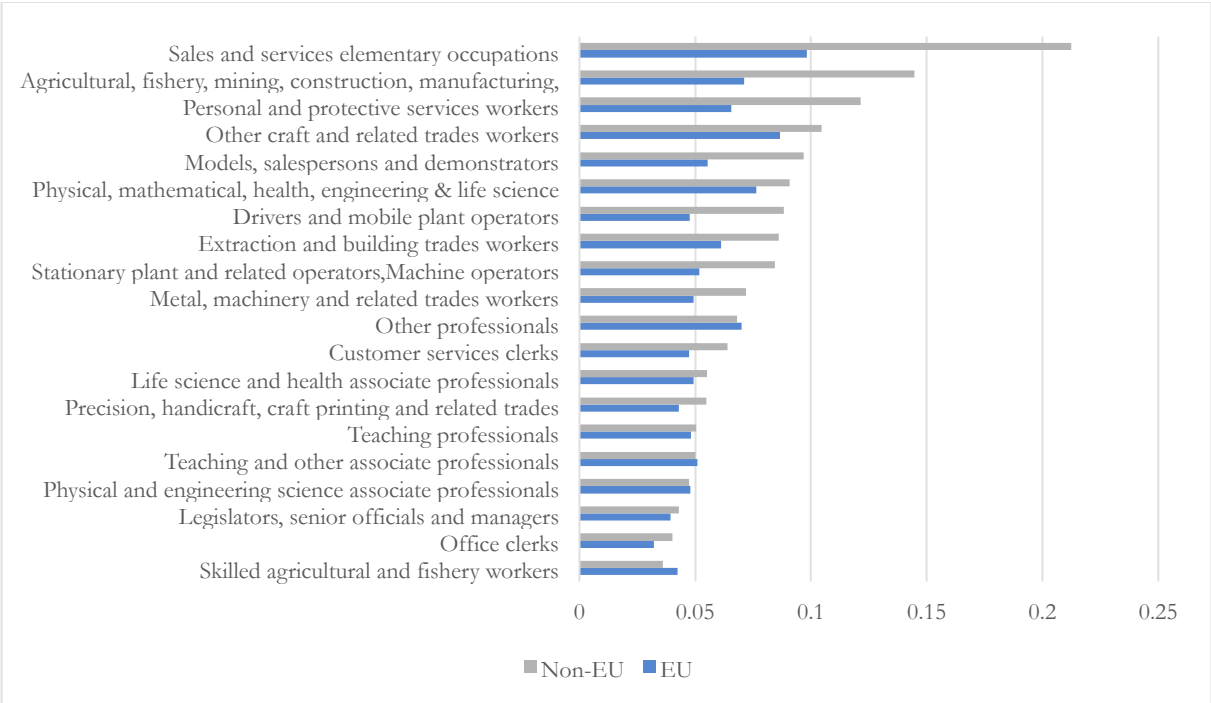


Figure 1 illustrates the increasing shares of migrants within the total sample of countries from 2006 to 2018. During the period from 2007 to 2010, the growth in non-EU born migration surpassed the influx of EU-born migrants. However, the trend stabilized thereafter, and since 2012, both types of migration have exhibited relatively similar tendencies.

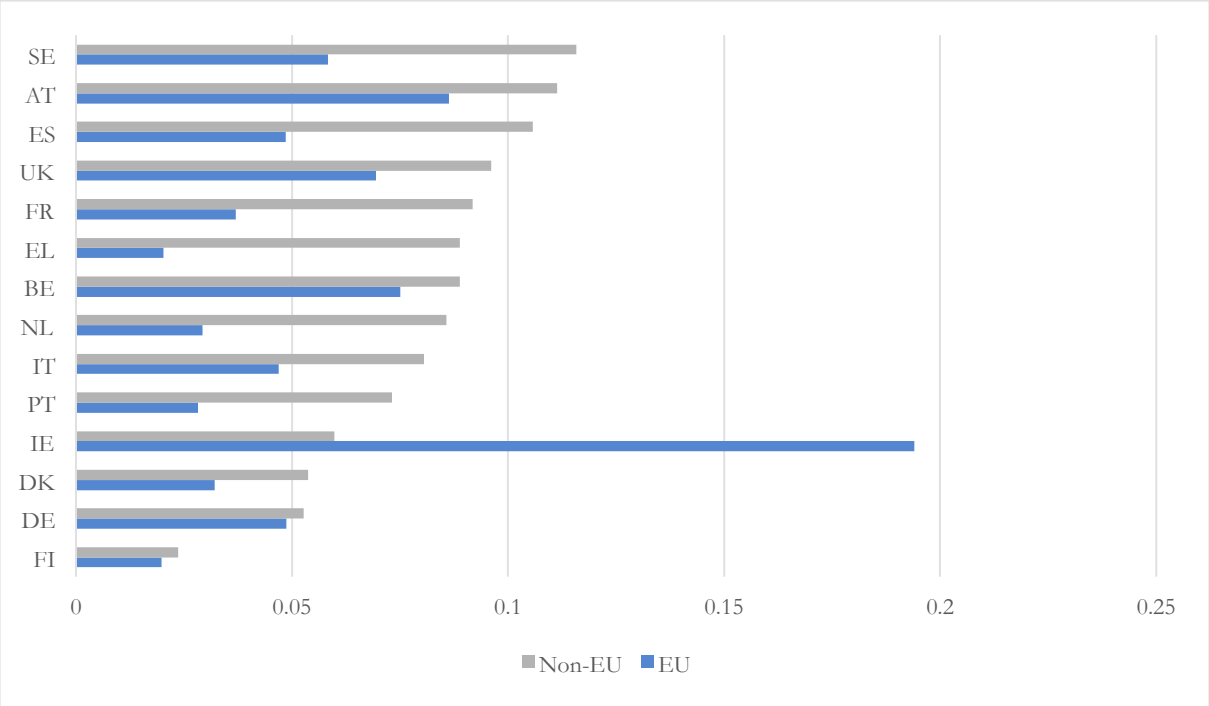
Figure 2. Share of immigrants by occupations



According to Figure 2, the majority of EU-born immigrants are concentrated in occupations such as "Sales and services elementary occupations", "Other craft and related trades workers", "Physical,

mathematical, health, engineering and life science professionals", and "Agricultural, fishery, mining, construction, manufacturing, transport related labourers". Conversely, non-EU born immigrants are predominantly found in occupations such as "Sales and services elementary occupations", "Agricultural, fishery, mining, construction, manufacturing, transport related labourers", "Personal and protective services workers", and "Other craft and related trades workers". See Table 5 in Annex with ISCO classification used in the paper.

Figure 3. Share of immigrants by country



In terms of the distribution of migrants across European countries (refer to Figure 3), Ireland, Austria, Belgium, and the UK stand out with the highest proportions of EU-born migrants. Conversely, non-EU born migrants predominantly reside in Sweden, Austria, Spain, and the UK.

In order to understand the scale and the prevalence of occupational shortage in each country and each occupation over the period of 2006-2018, we calculate the percentage share of the number of instances of occupational shortage during this period for each country. According to Table 1, occupation "Physical, mathematical, health, engineering & life science professionals" displays high labour shortage in all countries analysed, followed by "Other professionals", "Life science and health associate professionals" and "Teaching professionals" in the whole sample of European countries. Occupational categories of "Physical and engineering science associate professionals" and "Legislators, senior officials and managers" are also in strong labour shortage, as well as "Teaching and other associate professionals". On the contrary, occupations with the lowest number of labour shortage instances are "Extraction and building trades workers", "Agricultural, fishery, mining, construction, manufacturing, transport related labourers",

“Stationary plant and related operators, machine operators and assemblers”, “Sales and services elementary occupations”, and “Office clerks”.

Table 1. Prevalence of OS by countries and occupations over the period of 2006-2018

ISCO	AT	BE	DE	DK	EL	ES	FI	FR	IE	IT	NL	PT	SE	UK
Legislators, senior officials and managers	54%	69%	77%	62%	62%	54%	54%	57%	77%	46%	36%	31%	92%	92%
Physical, mathematical, health, engineering & life science professionals	85%	100%	92%	85%	62%	92%	92%	86%	92%	85%	100%	85%	92%	77%
Teaching professionals	92%	69%	85%	69%	46%	54%	54%	57%	77%	69%	91%	73%	77%	85%
Other professionals	77%	85%	100%	85%	69%	77%	85%	86%	77%	92%	91%	77%	92%	77%
Physical and engineering science associate professionals	77%	46%	62%	85%	62%	77%	54%	43%	62%	69%	64%	54%	69%	62%
Life science and health associate professionals	77%	54%	92%	62%	62%	54%	85%	86%	69%	85%	91%	67%	69%	85%
Teaching and other associate professionals	46%	62%	77%	69%	54%	46%	62%	57%	46%	46%	55%	69%	92%	62%
Office clerks	46%	23%	38%	38%	46%	46%	38%	29%	31%	46%	9%	46%	38%	23%
Customer services clerks	38%	23%	54%	38%	62%	46%	62%	57%	62%	46%	27%	58%	15%	31%
Personal and protective services workers	46%	38%	38%	69%	69%	69%	54%	43%	62%	54%	64%	75%	23%	46%
Models, salespersons and demonstrators	46%	38%	54%	54%	38%	38%	46%	29%	46%	38%	27%	54%	31%	31%
Skilled agricultural and fishery workers	69%	38%	46%	54%	69%	31%	38%	57%	69%	54%	55%	31%	38%	54%
Extraction and building trades workers	23%	38%	8%	31%	23%	15%	31%	43%	46%	0%	27%	38%	23%	54%
Metal, machinery and related trades workers	77%	54%	46%	62%	31%	46%	62%	57%	38%	54%	55%	62%	38%	62%
Precision, handicraft, craft printing and related trades workers	38%	38%	31%	38%	23%	38%	46%	43%	23%	31%	36%	54%	38%	38%
Other craft and related trades workers	46%	31%	46%	54%	46%	38%	46%	43%	46%	31%	55%	31%	62%	54%
Stationary plant and related operators,Machine operators and assembler	23%	38%	31%	15%	46%	23%	15%	71%	46%	31%	45%	42%	8%	31%
Drivers and mobile plant operators	15%	62%	23%	31%	54%	38%	62%	57%	31%	31%	45%	38%	23%	46%
Sales and services elementary occupations	23%	38%	8%	38%	46%	38%	38%	43%	46%	38%	55%	36%	15%	31%
Agricultural, fishery, mining, construction, manufacturing, transport related labourers	15%	38%	31%	31%	69%	38%	38%	14%	23%	31%	36%	25%	23%	15%

4.2 Estimation results

In this section, we present the results of our estimation of the effect of migration on the occupational shortage index. First, we employ an OLS model, consistently using the proportion of the migrant population as our independent variable. In Table 2, the independent variable is the share of all migrants in the labour market country, occupation and time, including migrants both from EU and non-EU countries. In Table 3, we consider separately migrants originating from the EU and non-EU countries.

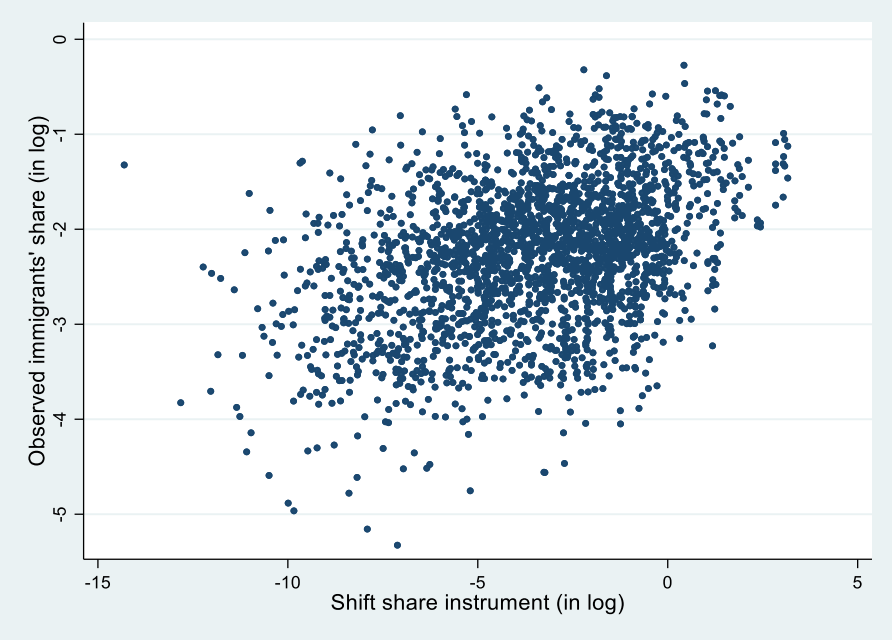
Table 2. Immigration impact on occupational shortage, OLS

	(1)	(2)	(3)
Migrants all	-0.045**		
	(0.019)		
EU migrants		0.018	
		(0.023)	
Non-EU migrants			-0.053***
			(0.016)
Observations	3,471	3,463	3,467
Year fixed effects	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Country by year fixed effects	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: calculation of authors
Note: Dependent variable is a dummy of occupational shortage (OS) index, representing a shortage for a specific occupation o *in a particular country* c *and year* t*. Standard errors clustered at the country-occupation level are reported in parentheses. Regressions are weighted by the total number of natives in a country-occupation cell in 2006.*

According to Table 2, we observe that migrants contribute to a reduction in occupational shortage, with this effect being notably significant in two of the three models examined. Specifically, OLS regression indicates that the total number of migrants reduces occupational shortage. When analysed separately, the role of non-EU born migrants seems to be more deciding in decreasing occupational shortage, compared to EU-born migrants.

Figure 4. Scatterplot of instrumental variable over the share of migrants



Source: calculation of authors

The scatterplot (Figure 4) analysis reveals a clear positive relationship between the instrumental variable and the share of migrants in our dataset. As the values of the instrumental variable increase, there is a corresponding increase in the proportion of migrants observed. This positive correlation suggests that the instrumental variable may indeed be associated with higher levels of migration in the studied context. This suggests that the instrumental variable constructed serves as a valid instrument for estimating the causal effect of migration on occupational shortage index.

Table 3. Immigration impact on occupational shortage, IV, all migrants

	(1)	(2)	(3)	(4)
All migrants	-0.105**	-0.104**	-0.182***	-0.156**
	(0.049)	(0.049)	(0.065)	(0.064)
Observations	2,439	2,439	2,439	2,439
First stage F-test	37.70	37.92	23.53	22.37
Year fixed effects	No	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes
Country by year fixed effects	No	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: calculation of authors
Note: Dependent variable is a dummy of occupational shortage (OS) index, representing a shortage for a specific occupation o *in a particular country* c *and year* t*. Standard errors clustered at the country-occupation level are reported in parentheses. Regressions are weighted by the total number of natives in a country-occupation cell in 2006.*

Now we incorporate instrumental variable approach, correcting endogenous self-selection into employment in particular occupations. In Table 3, using the share of total migrant population in the labour market, we demonstrate that there is a negative relationship between migrants and occupational shortage, suggesting that migration contributes to a reduction in occupational shortage. This negative effect persists and gets stronger across various configurations of fixed effects – namely, year fixed effects, country fixed effects, and country-by-year fixed effects.

Table 4. Immigration impact on occupational shortage, IV, EU and non-EU migrants

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU-born migrants	-0.074	-0.076	-0.212	-0.230				
	(0.073)	(0.074)	(0.166)	(0.160)				
Non-EU born migrants					-0.085*	-0.084*	-0.133**	-0.109**
					(0.045)	(0.045)	(0.052)	(0.049)
Observations	1,701	1,701	1,701	1,701	2,191	2,191	2,191	2,191
First stage F-test	37.50	36.98	8.273	8.568	32.28	32.26	24.73	23.64
Year fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Country by year fixed effects	No	No	No	Yes	No	No	No	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: calculation of authors
Note: Dependent variable is a dummy of occupational shortage (OS) index, representing a shortage for a specific occupation o *in a particular country* c *and year* t*. Standard errors clustered at the country-occupation level are reported in parentheses. Regressions are weighted by the total number of natives in a country-occupation cell in 2006.*

In Table 4, we separate the effect of migration on occupational shortage into the share of EU-born migrants and the share of non-EU born migrants. The negative effect persists across various configurations of fixed effects. Interestingly, the sample of EU-born migrants appears to have no discernible effect on decreasing occupational shortage, possibly due to their proportion being only half that of non-EU born migrants. Conversely, when adding year fixed effects along with country fixed effects, as well as when including year fixed effects, country fixed effects, and country-by-year fixed effects in the model focusing solely on non-EU born immigrants, we observe a significant negative effect of such migrant population on occupational shortage. In summary, our estimation results indicate that immigrants contribute to a decrease in occupational shortage in receiving countries, with the impact of non-EU immigration being more pronounced.

It is worth noting that although we used the dummy of occupational shortage, representing the presence of occupational shortage (if equal to 1, and 0 otherwise), we also perform similar regression analysis by using the continuous variable of occupational shortage (see Tables 6 and 7 in Annex) which shows the impact of migration rather on the extent of occupational shortage, not on its likelihood. Both results are convergent.

Inverse relationship between immigration and occupational shortage suggests that immigration may be utilized as a tool to address occupational shortage. Such policy would necessitate not only the establishment of an efficient system capable of promptly identifying these shortages but also the implementation of a flexible migration policy. This assertion is supported by numerous studies (here we refer to Table 2 from Edo (2019) where he collects data on predominantly positive effects of immigration on the labour markets of France, Germany, Switzerland, the United States, and Canada) that have demonstrated the positive impact of targeted immigration policies on alleviating labour market imbalances and meeting the demands of specific industries. In line with findings mentioned, Kahanec & Guzi (2016) suggest that migrants can assist the labour market in adapting to economic disparities, particularly when supported by a well-structured migration policy.

4 Conclusions

This paper presents empirical investigation of the impact of immigration on occupational labour shortages in Western European countries in the period between 2006 and 2018. First, we identify occupations facing shortages in receiving countries and later, we evaluate the impact of immigration on these particular labour shortages. Moreover, we decompose the effect of migration into two groups of population: migrants born in the EU and migrants born outside of the EU.

Our findings provide compelling evidence that migrants play a significant role in alleviating occupational shortage in receiving countries. This is supported by statistical evidence, which highlights the negative correlation between migrant influx and occupational shortage.

Occupations that are perceived to be in shortage are “Physical, mathematical, health, engineering & life science professionals”, “Other professionals”, “Life science and health associate professionals”, “Teaching professionals”, “Physical and engineering science associate professionals”, “Legislators, senior officials and managers”, and “Teaching and other associate professionals”. Occupations with the lowest number of labour shortage instances are “Extraction and building trades workers”, “Agricultural, fishery, mining, construction, manufacturing, transport related labourers”, “Stationary plant and related operators, machine operators and assemblers”, “Sales and services elementary occupations”, and “Office clerks”.

We prove that immigration flows reduce the occupational shortage in the fourteen selected receiving Western European countries (Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom), with a more pronounced effect observed for migrants from non-EU countries.

Demonstration of an inverse relationship between migrant share and occupational shortage in recipient countries suggests a positive impact of migration (through, for example, targeted immigration policies) on receiving labour markets by alleviating labour market imbalances and meeting the demands of specific industries. Respectively, using immigration as a tool to address occupational shortage implies an efficient system to identify shortages and implement an flexible migration policy.

The implications of these findings are far-reaching. By recognising the contribution of migrants to addressing occupational shortage, policymakers can devise more effective strategies for managing migration flows and targeting the potential of migrant workers. Implementing targeted immigration policies, investing in skills development programs, and fostering inclusive labour market practices are some of the ways in which governments and businesses can capitalise on the benefits of migrant labour.

References

Amior, M., & Manning, A. (2021). *Monopsony and the Wage Effects of Migration*.

Angrist, J. D., & Kugler, A. D. (2003). Protective or Counter-Productive? Labour Market Institutions and the Effect of Immigration on EU Natives. *The Economic Journal*, *113*, F302–F331.

Ashenfelter, O. C., Farber, H., & Ransom, M. R. (2010). Labor market monopsony. *Journal of Labor Economics*, *28*(2), 203–210. https://doi.org/10.1086/653654

Barnow, B., Trutko, J., & Lerman, R. (1998). *Skill mismatches and worker shortages: The problem and appropriate responses*.

Bartik, T. (1991). *Who benefits from state and local economic development policies?* (M. Kalamazoo, Ed.).

Biavaschi, C., Burzyński, M., Elsner, B., & Machado, J. (2020). Taking the skill bias out of global migration. *Journal of Development Economics*, *142*. https://doi.org/10.1016/j.jdeveco.2018.12.006

Borjas, G. J., Grogger, J., Hanson, G. H., Harris, I. B., & Policy, U. (2008). *Imperfect Substitution between Immigrants and Natives: A Reappraisal*. http://www.nber.org/papers/w13887

Cappelli, P. H. (2015). Skill gaps, skill shortages, and skill mismatches: Evidence and arguments for the United States. *Industrial and Labor Relations Review*, *68*(2), 251–290. https://doi.org/10.1177/0019793914564961

Card, D. (2009). Immigration and inequality. *American Economic Review*, *99*(2), 1–21. https://doi.org/10.1257/aer.99.2.1

D'Amuri, F., & Peri, G. (2014). Immigration, jobs, and employment protection: Evidence from europe before and during the great recession. *Journal of the European Economic Association*, *12*(2), 432–464. https://doi.org/10.1111/jeea.12040

Docquier, F., Ozden, Ç., & Peri, G. (2014). The labour market effects of immigration and emigration in OECD countries. *Economic Journal*, *124*(579), 1106–1145. https://doi.org/10.1111/ecoj.12077

Docquier, F., & Rapoport, H. (2012). Globalization, brain drain, and development. In *Journal of Economic Literature* (Vol. 50, Issue 3, pp. 681–730). American Economic Association. https://doi.org/10.1257/jel.50.3.681

Dorn, D., & Zweimüller, J. (2021). Migration and labor market integration in Europe. In *Journal of Economic Perspectives* (Vol. 35, Issue 2, pp. 49–76). American Economic Association. https://doi.org/10.1257/JEP.35.2.49

Dustmann, C., Frattini, T., & Preston, I. (2010). *Can immigration constitute a sensible solution to sub-national and regional labour shortages? Report for the Migration Advisory Committee (MAC) Final Report*.

Dustmann, C., Frattini, T., & Preston, I. P. (2013). The effect of immigration along the distribution of wages. *Review of Economic Studies*, *80*(1), 145–173. https://doi.org/10.1093/restud/rds019

Dustmann, C., Frattini, T., & Rosso, A. (2015). The effect of emigration from Poland on Polish wages. *Scandinavian Journal of Economics*, *117*(2), 522–564. https://doi.org/10.1111/sjoe.12102

Dustmann, C., Schönberg, U., & Stuhler, J. (2017). Labor supply shocks, native wages, and the adjustment of local employment. *Quarterly Journal of Economics*, *132*(1), 435–483. https://doi.org/10.1093/qje/qjw032

Edo, A. (2019). The Impact of Immigration on the Labor Market. *Journal of Economic Surveys*, *33*(3), 922–948. https://doi.org/10.1111/joes.12300

Edo, A., & Özgüzel, C. (2023). *The Impact of Immigration on the Employment Dynamics of European Regions* (2023–20; CEPII Working Paper).

Edo, A., & Rapoport, H. (2019). Minimum wages and the labor market effects of immigration. *Labour Economics*, *61*(July), 101753. https://doi.org/10.1016/j.labeco.2019.101753

European Commission. (2022). *Methodological guidelines and description of EU-SILC target variables*.

Eurostat. (2024a). *EU Labour Force Survey – main features and legal basis*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_labour_force_survey_%E2%80%93_main_features_and_legal_basis#Main_features_of_the_EU-LFS

Eurostat. (2024b). *EU Labour Force Survey Database User Guide*. https://ec.europa.eu/eurostat/statistics-

Fenoll, A. A., & Kuehn, Z. (2019). Immigrants move where their skills are scarce: Evidence from English proficiency. *Labour Economics*, *61*. https://doi.org/10.1016/j.labeco.2019.101748

Foged, M., & Peri, G. (2015). *Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data*.

Goldsmith-Pinkham, P., Sorkin, I., & Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review*, *110*(8), 2586–2624. https://doi.org/10.1257/AER.20181047

Groiss, M., & Sondermann, D. (2023). *Help wanted: the drivers and implications of labour shortages* (2863; Working Paper Series). https://doi.org/10.2866/227914

Guzi, M., Kahanec, M., & Ulceluse, M. M. (2021). *Europe's Migration Experience and its Effects on Economic Inequality*. www.iza.org

Haskel, J., & Martin, C. (1993). Do Skill Shortages Reduce Productivity? Theory and Evidence from the United Kingdom. In *Source: The Economic Journal* (Vol. 103, Issue 417).

Haskel, J., & Martin, C. (2001). Technology, wages, and skill shortages: evidence from UK micro data. *Oxford Economic Papers*, *53*, 642–658.

ILOSTAT. (2024). *ILO Survey catalogue. Collections. LFS*. https://www.ilo.org/surveyLib/index.php/collections/LFS

Jaeger, D. A., Ruist, J., & Stuhler, J. (2018). *Shift-share instruments and the impact of immigration* (NBER Working Paper Series). http://www.nber.org/papers/w24285

Kahanec, M., & Guzi, M. (2016). How immigrants helped EU labor markets to adjust during the Great Recession. *IZA Discussion paper series*, No. 10443.

Kahanec, M., & Pytliková, M. (2017). The economic impact of east–west migration on the European Union. *Empirica*, *44*(3), 407–434. https://doi.org/10.1007/s10663-017-9370-x

Moreno-Galbis, E., & Tritah, A. (2016). The effects of immigration in frictional labor markets: Theory and empirical evidence from EU countries. *European Economic Review*, *84*, 76–98. https://doi.org/10.1016/j.euroecorev.2015.10.001

OECD. (2017). *Getting Skills Right: Skills for Jobs Indicators*. OECD. https://doi.org/10.1787/9789264277878-en

Ottaviano, G. I. P., & Peri, G. (2012). Rethinking the effect of immigration on wages. *Journal of the European Economic Association*, *10*(1), 152–197. https://doi.org/10.1111/j.1542-4774.2011.01052.x

Signorelli, S. (2023). *Do Skilled Migrants Compete with Native Workers? Analysis of a Selective Immigration Policy*.

Strietska-Ilina, O. (2007, April 26). Skills shortages. *Contribution to the Agora Conference "Building a European VET Area."*

Annex

Table 5. ISCO classification used

ISCO code	ISCO category
10	Legislators, senior officials and managers
21, 22	Physical, mathematical, health, engineering and life science professionals
23	Teaching professionals
24	Other professionals
31	Physical and engineering science associate professionals
32	Life science and health associate professionals
33, 34	Teaching and other associate professionals
41	Office clerks
42	Customer services clerks
51	Personal and protective services workers
52	Models, salespersons and demonstrators
60	Skilled agricultural and fishery workers
71	Extraction and building trades workers
72	Metal, machinery and related trades workers
73	Precision, handicraft, craft printing and related trades workers
74	Other craft and related trades workers
83	Drivers and mobile plant operators
81, 82	Stationary plant and related operators, machine operators and assemblers
91	Sales and services elementary occupations
92, 93	Agricultural, fishery, mining, construction, manufacturing, transport related labourers

Table 6. Immigration impact on occupational shortage, IV, all migrants

	(1)	(2)	(3)	(4)
All migrants	-0.105**	-0.104**	-0.182***	-0.156**
	(0.049)	(0.049)	(0.065)	(0.064)
Observations	2,439	2,439	2,439	2,439
First stage F-test	37.70	37.92	23.53	22.37
Year fixed effects	No	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes
Country by year fixed effects	No	No	No	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: calculation of authors

Note: Dependent variable is the occupational shortage (OS) index, representing a shortage for a specific occupation o *in a particular country* c *and year* t*. Standard errors clustered at the country-occupation level are reported in parentheses. Regressions are weighted by the total number of natives in a country-occupation cell in 2006.*

Table 7. Immigration impact on occupational shortage, IV, EU and non-EU migrants

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EU-born migrants	-0.074	-0.076	-0.212	-0.230				
	(0.073)	(0.074)	(0.166)	(0.160)				
Non-EU born migrants					-0.085*	-0.084*	-0.133**	-0.109**
					(0.045)	(0.045)	(0.052)	(0.049)
Observations	1,701	1,701	1,701	1,701	2,191	2,191	2,191	2,191
First stage F-test	37.50	36.98	8.273	8.568	32.28	32.26	24.73	23.64
Year fixed effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Country by year fixed effects	No	No	No	Yes	No	No	No	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: calculation of authors

Note: Dependent variable is the occupational shortage (OS) index, representing a shortage for a specific occupation o *in a particular country* c *and year* t*. Standard errors clustered at the country-occupation level are reported in parentheses. Regressions are weighted by the total number of natives in a country-occupation cell in 2006.*

GI-NI PROJECT IDENTITY

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Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek TNO, Netherlands

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