

Do Immigrants Displace Native Workers? Evidence from Matched Panel Data

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Do Immigrants Displace Native Workers? Evidence from Matched Panel Data^{*}

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Abstract

Using matched employer-employee data, we analyse the impact of immigrants on natives' employment in Portugal. Using different model specifications, we show that the natives and immigrants are 'complements' at most occupation levels, in the sense that both types are hired when the number of immigrants is increasing. Controlling for different skill-level groups as well as for temporary and permanent jobs, the estimates show that, contrary to the evidence from some existing literature, the natives at the lower end of the skills spectrum are not affected by the presence of immigrants as well. There is, however, some evidence that when the number of immigrants in the firm is decreasing, natives tend to replace immigrants.

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1. Introduction

The impact of immigration on a receiving country's economy, particularly its labour market, is a hotly debated topic. Although there is no consensus in the existing literature about the overall effect on natives' employment, there is still plenty of empirical evidence that shows that immigrants have a modest effect on employment (and wages) of natives. Notwithstanding this evidence, the popular perception, including among some policymakers, is that immigrants 'steal' natives' jobs. One reason why the difference between empirical evidence and people's perception might persist, as pointed out by Malchow-Moller *et al* (2009), is that most of the empirical literature uses relatively aggregate data to analyse the role of migrants on host country's labour markets. However, 'folklore' about immigrants taking natives' jobs is probably based more at the firm level, which is why it is important to analyse the overall impact using disaggregated data to properly address the question posed in the title of this paper: do immigrants displace native workers?

Most of the previous literature on this topic uses either the regional or national level data. Within this general structure, two opposing results have been obtained depending on the stated assumptions. For instance for the US, Borjas (2003) uses census data to analyse the labour market effects of large immigration flows in the 1980s and 1990s, assuming that similarly educated immigrants and natives have different work experiences and therefore are not perfect substitutes. In contrast to some previous literature (e.g. Card 1990; Altonji and Card, 1991), he finds a negative impact of immigration on the labour supply (and wages) of competing native workers. Card (2001) also uses 1990 US census data to study the impact of immigrant flows on natives' occupation-specific labour market outcomes in selected US cities. He treats natives and immigrants as a heterogeneous group as well, though similarly educated immigrants and natives are assumed perfect substitutes, and finds only a small negative effect on the employment prospects (and wages) of low-skilled workers in certain US gateway cities like Miami and Los Angeles.

Similar modest effects of immigration have also been obtained for a number of European countries. Pischke and Velling (1997) use German county level data to analyse the employment effects of immigration based on local labour markets. They study two measures of immigration: the change in the share of foreigners between 1985 and 1989 and one year gross and net flows of immigrants to an area. They use different model specifications and show that there is little evidence for displacement effects of natives in the counties' labour markets due to immigration. Carrington and De Lima (1996) analyse the labour market

impacts of *retornados*, refugees from Mozambique and Angola to Portugal from 1974 to 1976, many of which were natives to Portugal. They compared the Portuguese case with the influx of immigrants in France and Spain, also sparked by political changes. In addition, they also made comparisons at the county level within Portugal. Their cross-country comparison results suggest that immigration has a “very modest” effect on the labour market in Portugal though the within-country comparison shows that immigrants diminish natives’ labour market opportunities. However, the authors state that they “find the international comparisons more persuasive” and that their “overall results are consistent with the earlier literature: immigration does not have a large adverse effect on natives’ labour market outcomes”. Similar results are obtained by Winter-Ebmer and Zimmerman (1999) for Germany, Winter-Ebmer and Zweimuller (1999) for Austria, Villosio and Venturini (2002) for Italy, Carrasco *et al* (2004) for Spain and Dustmann *et al* (2005) for the UK.

Borjas (2006), however, argues that a number of these papers assume away the standard “closed” economy setup within which a large immigrant flow in one region might mean an outflow of natives from that region to another. His results show that once this native outflow is taken into account from one US state to another, then this closed economy structure could reveal more clearly the real impact of immigration as in this setup the natives move out of the region where immigration rates are higher, hence creating a possible negative effects on natives. While his main focus is on the wages of natives, his overall results could be used to show that there is a clear implication for natives when their response to immigration supply shock is taken into account. One clear aspect of his paper, as well as a few others (e.g., Borjas *et al*, 2008), is the diverging results obtained once assumptions of a model are changed, even when using the same type of data.

A recent paper by Ottaviano *et al* (2013) argues that not only immigrants but also offshoring tasks are available to the host country employers as potential competitors to native workers. Using US manufacturing data they show that there are potential efficiency gains that could offset the native displacement effects, if immigrants, offshoring and native tasks are assigned to each group according to their comparative advantage in performing tasks of different complexity.

Notwithstanding the extensive literature on the topic, it is clear that there is still no consensus on how immigrants affect the labour market for natives. This is partly because all of the papers discussed above use net migration implications based on immigration flows at a regional level, primarily because of a lack of consistent disaggregated data, which means that

the existing results possibly underestimate the impact of migration as they are not able to capture the true incidence either at the firm level or at each skill/occupation level. Borjas (2003; p.1370) acknowledges this inadequacy in the existing literature by stating: “I suspect that we can learn a great deal more about the labour market impact of immigration by documenting the many adjustments that take place, by workers and firms, both inside and outside the labour market, as immigration alters economic opportunities in many sectors of the economy”.

Our main objective in this paper, therefore, is to contribute to the existing literature by using firm-level data as that has more potential to capture certain aspects better than census or other regional data. To our knowledge the only other paper that addresses this issue at a disaggregated level is Malchow-Moller *et. al.* (2009). They use firm-level matched employer-employee data from Denmark and employ a competing risk duration model to analyse the impact of immigration on native employment. They find no evidence of immigrants displacing or “taking the jobs” of natives in Denmark. While our focus is similar to theirs, we use a different empirical approach and a different matched data set.

In order to carry out the analysis we use the *Quadros de Pessoal*, which is a matched panel data set collected annually by the Portuguese Ministry of Economy and Employment for all employees in all (private) enterprises. The data set contains company-based information, socio-demographic characteristics of the employees, employment conditions and other relevant information about workers and private firms. Using different model specifications, we show that the natives and immigrants are ‘complements’ at most occupation levels, in the sense that they are jointly hired and fired. More precisely, we find that in the expansionary phase of the firm, the hiring strategy is not one of displacing natives with immigrants (for cost or other purposes) but rather the two groups are complementary in terms of new hiring by firms. Controlling for different skill-level groups as well as for temporary and permanent jobs, the estimates show that, contrary to evidence from some existing literature the natives at the lower end of the skills spectrum are not affected by migration as well.¹

¹Using the same data as we use in this paper, Carneiro et al (2012) show how immigrants fare in the labour market by looking at the possible wage gap with the natives. They find that immigrants are assigned to lower levels of occupation than similar natives working for similar employers. Economic assimilation of immigrants occurs due to both within-job and between-jobs mobility. A significant portion of the immigrants' wage penalty is explained by non-random sorting across workplaces, with immigrants selecting themselves into low pay establishments.

The rest of the paper is organised as follows. The next section presents a brief description of Portugal's immigration record. Section 3 presents the estimation strategy used in this paper. Data and descriptive statistics are presented in Section 4 while Section 5 discusses the results. Concluding remarks appear in the last section.

2. Immigration to Portugal

Until relatively recently, Portugal had been a country of emigration (except for a short period of time during 1975/76 when there was a huge inflow of immigrants from its former colonies in Africa). However, the trend started to change around 1993 when outflows started to decrease and return migration from the rest of Europe accelerated, with the inflows further increasing in 2000 and especially after 2005 following EU expansion (Figure 1). Part of the growth of the stock of foreign citizens residing in the country between years 2001 and 2003 is due to a legislative change after which immigrants who had entered the country irregularly became eligible to temporary residential visas. In this process, the importance of Eastern European immigrant communities, especially from the Ukraine, first became apparent.

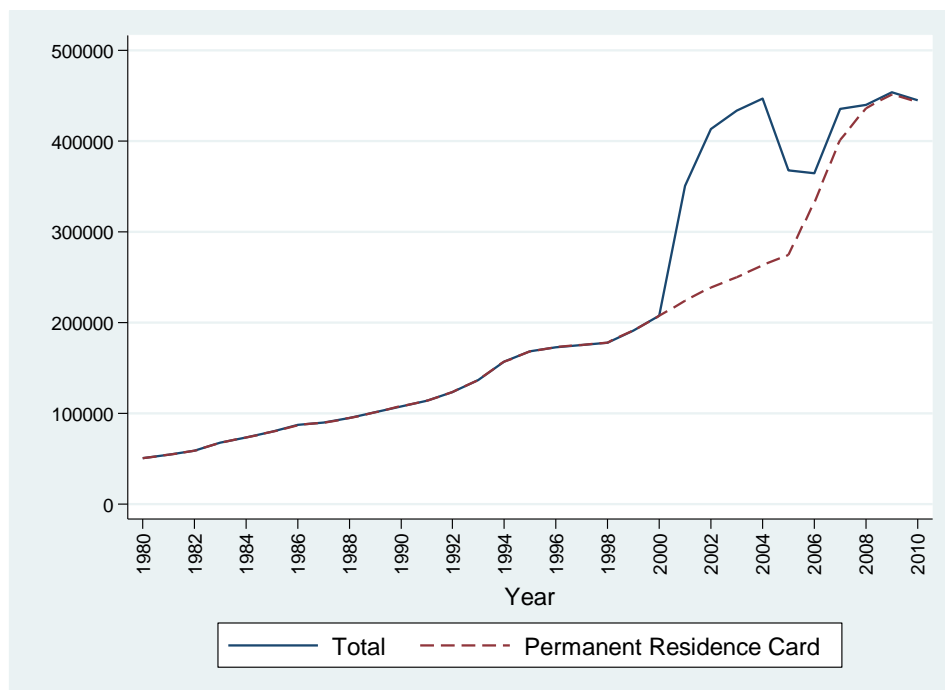


Figure 1. Stock of Immigrants, 1980-2010

Source: SEF-Serviço de Estrangeiros e Fronteiras - Annual Report 2010

The rapid increase of the number of foreign citizens residing in Portugal since the turn of the century is for the most part accounted for immigrants admitted on temporary permits, which were later converted to permanent status, though a fraction of the permits were cancelled as well. Due to a combination of visa conversions and return flows, the stock of immigrants on temporary permits declined significantly between 2005 and 2007. However, it was not until 2010, perhaps partly due to a significant increase in unemployment, that the number of non-national citizens in Portugal declined for the first time.

The immigration record to Portugal over the last 30 years also implied major changes in the composition of the stock of non-natives residing in the country, especially in terms of their national origins (Eastern Europe, but also Asia), that are not confined any longer to individuals originating in the Portuguese former colonies in Africa. Immigrants from Brazil and the Ukraine are now amongst the largest foreign communities in the country, and Romanians are the largest group originating within the European Union. Still, immigrants to Portugal remain younger and, on average, less educated than natives (see below, Section 4). Their wages are about 20 percent below those of natives, the wage differential being attributed to occupational downgrading, absence of match-specific human capital and selection into low-pay sector of the economy (Carneiro *et al*, 2012).

3. Analytical/Empirical Framework

A standard approach to analyse the labour market effects of immigration is to use the competitive labour demand/supply model and determine the impact on equilibrium of a change in labour supply, with either treating natives and immigrants as homogenous in terms of their skill levels or treating them as having distinct skill levels. This strand of literature uses the so called “spatial correlations” model (see Borjas, 1991) which primarily uses the flow of immigrants within a geographic location and estimates the effect on wages and employment from the resulting rightward shift of the labour supply curve.

These types of models could be represented by the following equation:

$$\Delta \log z_{it} = \frac{\alpha \Delta F_{it}}{WP_{it-1}} \quad (1)$$

where z is the variable of interest (native wages or employment rate), α is a function of demand and supply elasticities, F is the number of immigrants (foreigners) in the population which is divided by the total working population (WP). Eq (1) is then estimated by taking into account the immigrant flow into a geographical region, instrumenting for this flow by either the lagged unemployment rate or the stock of immigrants in the region (to capture immigrant network effects which might be the driving force behind the “current” flow).

Since the above type of models consider the net employment implication at either the regional or industry level, they are unlikely to properly capture the impact of immigrants on native employment levels. An advantage we have over the existing literature is the availability of detailed disaggregated employer-employee matching data, which enables us to estimate a model that can take into account the changes at the worker- and firm-level. Hence the key element of the analysis in this paper is that, rather than looking at the aggregate migration stock or flow at the regional or national level, the decision process at micro i.e, firm and job levels, is the key determinant in terms of exploring the real impact of immigration on native employment levels. This, in essence, enables us to consider the new hiring (and ‘firing’) decisions of the firm and determine the level of displacement, if any, of the native workers. This could be estimated using the following equation:

$$n_{it} - n_{it-1} = \alpha (f_{it} - f_{it-1}) + \beta x_{it} + \varepsilon_{it} \quad (2)$$

where left hand side determines the change in employment of natives (as a result of firm’s hiring or firing) and the first expression on the right hand side is the analogous change for immigrants (or non-natives); x denotes other characteristics that influence the employment of natives, excluding wages. Note that no distinction is made regarding the skill level of natives and immigrants here. Therefore, if the change in the employment in natives is positively dependent on change in immigrants’ employment, then we can conclude that natives and foreigners are hired and fired jointly. If, however, the impact is negative, even after controlling for business cycle effects, then we can conclude that natives and immigrants are substitutes in the sense that when the firm-level count of immigrant workers increases, the natives count decreases (immigrants displace natives), and vice-versa.

The above model assumes that natives and immigrants are homogeneous in terms of their skill level with the underlying assumption that all labour enters the firm’s production function as a single input. However, as pointed out by some of the existing literature, labour

should be split into at least two components, skilled and unskilled. Since there is some evidence that immigrants tend to be low skilled, the argument is that an increase in the supply of low skilled labour will decrease the relative supply of skilled labour thus pushing up their wages. This causes relative wages for the low skilled to fall resulting, at least in the short-run, in a disequilibrium in the labour market due to voluntary unemployment of natives. The result can then be interpreted as a negative effect of immigration on a particular native labour group. We can capture this more directly within our model. This is done by estimating eq (2) again but now at different job levels.

Finally, one feature of Portuguese labour market in the last few years is an increase in the level of temporary employment compared to permanent employment. It is argued in the literature and Table 1 seems to confirm that immigrants may have a bigger impact on jobs that are temporary in nature. In order to capture this aspect we also estimate the impact on temporary and permanent employment.² We again estimate eq (2) but this time distinguishing between the two types of contracts.

All versions of equation 2 were estimated by pooled OLS, and due to endogeneity concerns, also by IV methods and (firm) fixed-effects. Following Card (2001) we instrument the firm-level net immigrant employment variation with the predicted immigrant inflow into the region where the firm is located. The instrumental variable is computed by multiplying the total annual inflow of migrants from a given origin to each 'distrito' in Portugal by the fraction of migrants from the same origin that lived in the region in 2001.³ Hence, the predicted annual inflow of migrants into a given region is the inflow that would have been observed in the absence of a departure from past trends, i.e., if it were determined only by the actual inflow of immigrants to the country and historical settlement patterns. Arguably, such an instrument is appropriate because there is vast evidence of new arrivals to choose the same locations at destination as past cohorts from the same origin (Bartel, 1989).

² Table 1 shows that 20.7 percent of all native employed workers are on fixed-term contracts. For immigrants, the corresponding percentage is 49.2.

³ For this purpose we considered five origin groups (Africa, Asia, South America, Eastern Europe, and a residual group, and 20 destination regions (the 18 'distritos' in Portugal mainland, plus the Madeira and Azores islands).

4. Data Description

We use the *Quadros de Pessoal* (QP) panel data set which is collected annually by the Ministry of the Economy and Employment and covers all private firms that employ people in Portugal. As it is required by law for all firms to provide relevant information about their employees and is also available to all workers, it is a very reliable source that provides matched employer-employee information. This includes information about the employer -- type of business, number of employees and industry; as well as about the employees including gender, age, education and country of origin; and the match type of employment, type of contracts (permanent or temporary), tenure, the job title the worker is assigned to, wage and hours of work.

The first wave of the data set was collected in 1982 though the information on workers' nationality was not included until 2000. However, because the 2001 worker file is not available, the data used in this paper covers the time period 2002 to 2008 (last available wave). The analysis starts at the worker level but, for the sake of comparison with previous studies, it also considers data at different levels of aggregation. For each level of analysis, one data set was constructed. All data sets are derived from the original worker files.

Tracking workers across data waves is essential for our purpose as separations can only be identified comparing the situation of the same worker in two adjacent waves. This is possible because each worker is assigned a unique time-invariant identification number the first time he or she enters employment in the private sector. Hence, all cases of workers with invalid identification numbers (about 40 thousand per year) were deleted. Newly-admitted workers are all workers that are employed by firm j in year t but were not employed by the same firm in year $t-1$. Because this condition cannot be implemented in the first data wave, admissions in 2002 were identified on the basis of the self-reported date of admission. Separations were identified using a similar procedure: we consider that one separation occurs in year t if the worker is employed by firm j in year t but not in year $t+1$. Separations cannot be identified in the last data wave (2008).

All waves from 2002 to 2008 were pooled together without any further modification of the data. Because lagged values of some variables are used in regression analysis and the 2008 wave cannot be used due to the absence of data on separations for this year, worker-level results were derived from data for the period 2003-2007. The final dataset has 11.2 million observations, an average of 1.9 million observations (workers) per year.

Over this period, in the final sample, the share of non-native workers in total employment increased from 4.5 percent in 2003 to 5.0 percent in 2007, which is in line with the growth trend also observed in the official statistics of the stock of non-native population residing in the country. In total, the data includes 10.7 million observations on natives and 0.5 million observations on non-natives. The corresponding descriptive statistics are reported in Table 1.

Because the data we use were obtained from an annual census of employers and employees in the private sector of the economy, the descriptive statistics mirror very closely the characteristics of employment in the Portuguese labour market, except in terms of age and schooling.⁴ Workers are predominantly male (56.4 percent), and they have low levels of education (67.4 percent with 9 years of schooling or less). On average, 19.1 percent of all workers are in an employment spell with a total elapsed duration of 12 months or less; 22.1 percent of all workers are on a fixed-term contract.

As compared to natives, non-native workers display specific characteristics: the share of men is significantly larger (64.4 percent versus 56.0 percent in the case of natives) and they are younger (the average age is 35.3 years and 36.4 for natives). Despite similar levels of schooling, non-natives are more frequently assigned to lower-rank jobs: 26.9 and 6.2 percent of all non-natives (10.7 and 4.8 percent of all natives) are hired as non-skilled professionals, or apprentices/interns, respectively. More significantly, 49.2 percent of all non-native (20.7 percent of all native) workers are hired on a temporary (fixed-term) contract. Tenure profiles are also biased towards shorter durations in the case of non-native workers - for 73.3 percent of them (38.1 percent of natives), tenure on the job is shorter than three years.

Data at the worker level was also used to produce four additional data sets, each corresponding to a different level of aggregation. Aggregation was implemented at the industry/region level (7,000 observations), firm level (1.7 million observations), job title/firm level (3.5 million observations and 444,669 observations), and firm/type-of-contract level (444,300 observations). At the two latter levels, in order to guarantee that each unit considered has sufficient room to substitute workers across narrowly defined cells, two

⁴In the empirical part of the paper, all the estimations based on worker-level data were obtained considering only workers below the age of 55. Given the correlation between age and schooling, the latter variable is also biased upwards. The descriptive statistics reported in Table 1 correspond to the exact same data used in the empirical work, *i.e.*, after excluding observations on workers aged 55 or more and observations corresponding to workers employed by firms that shutdown in the corresponding year.

additional restrictions were imposed on the data: firms are required to be present in at least four waves of the data and to have a minimum number of 10 employees at least in one wave.

5. Empirical Results

We run a number of estimations with different specifications, as a robustness check for all estimates, though only a few of these are presented in the paper. In all the estimations (Tables 2-7) we use year dummies to capture the business cycle effect on employment decisions. In addition, all estimations (except in Table 7) include industry and region dummies as well as unit of observation fixed effects.

To fix ideas, we first run a probit model on the admissions and separations, capturing the native workers flow at the firm level. Table 2 thus shows the estimated probability that a native joined (admission) or left (separation) the firm conditional on employees' and firms' characteristics, with the latter including firm-level flows of immigrant workers in the previous year. Looking at separations it is clear that immigrants do not displace natives: the more immigrants left in the past the more natives will leave now; the more immigrants were hired in the past, the less likely it is that a native will leave now. In other words, natives do not lose their jobs because of immigrants. However, on the hiring side, the story seems to be different: the more immigrants left in the past the more likely it is that one native is hired while if more immigrants were hired in the past then it is less likely that one native is hired. In other words, natives' employment opportunities are worsen when immigrants are around. This could possibly be due to the employee network effects or what Dustmann *et al* (2011) refer to as "referral-based networks" where more immigrants a firm has results in a higher flow of immigrants over time. However, note that the type of analysis we are conducting here does not allow us to say that natives are looking for jobs and they are less likely to find them because of immigrants, though that could be a possibility. Another explanation of this result may be that immigrants were hired because natives were simply not available (between 2003 and 2007, the quarterly unemployment rate varied in Portugal between 6.1 and 8.4 percent, increasing towards the end of this period).

The probit model only gives us a net change of the odds of separation/admission of native workers due to changing of immigrant workers in the same firm. We now discuss several estimates at the worker-firm level, running estimates based on eq. (2) to help us determine the impact of immigrants on natives' employment, which is the main contribution of this paper. Table 3 presents the results of the impact of immigrants, within a firm, on

natives.⁵ The effect is positive for the sub-group of employers with increasing number of foreign workers. The result indicates that more employment opportunities become available for natives when the number of non-natives increases, proving complementarity between the two groups.

Equation (2) was initially estimated on the same data by pooled OLS and IV (cf. section 2). Results obtained with these methods are consistent with those presented in Table 3, obtained with firm fixed-effects: the signs of the estimates of the coefficients of the variable of interest do not vary with the estimation method. Some estimates that were positive but not significant with OLS become positive and significant with both IV and fixed-effects. Because the results are robust to the choice of the estimation method, throughout the article we report only the results corresponding to fixed-effects estimation.⁶

As mentioned in section 2, and consistent with the literature, it could be argued that immigrants tend to be generally low skilled and thus have a bigger impact on the new employment of lower skilled native labour force, therefore it is likely to be more informative to analyse the effect at a more disaggregated level. We capture these aspects in Tables 4 and 5. In order to address the possible displacement issue of natives by immigrants at different skill levels, we also control for industry effects and use year dummies to capture the business cycle effects. The results for all specifications in Table 4, except those with decreasing number of foreign workers, show that even after controlling for different skill levels there are no overall adverse native employment effects

We further disaggregate to analyse the possible displacement effects at each native job level as well (see Table 5). Looking at the diagonal values, starting with column 2 and row 1, it is clear that there is complementarity between immigrants and natives at all job levels. Therefore, contrary to the evidence in the existing literature of some small negative impact on lower skilled native labour, our results show that when using matched employer-employee

⁵We also ran the estimations on a sub-sample of firms that employed at least one non-native worker between 2002 and 2008. The results don't change from those obtained with the full sample.

⁶We also estimate the model with instrumental variables in the panel setting using the same instrument described before that proved valid when implemented on pooled data. However, with panel data the instrument is no longer valid, and more importantly, we do not reject the hypothesis that the change in immigrants' employment level is exogenous. This is an indication that the unobserved confounder causing endogeneity in the non-panel setting is effectively removed when we control for unobserved time-invariant characteristics of the employer.

data, there is actually a strong positive impact of immigrants on native hiring when matching the two groups at each skill level.

It has been argued in the literature that immigrants, compared to natives, might be more willing to take the jobs in which there is no prospect of upward mobility or perhaps they entered the country on short-term visa, i.e., they are more likely to take temporary jobs and thus compete with the natives in those specific type of contracts (see Somerville and Sumption, 2009). Therefore, we also estimate eq. (2) separately for temporary and permanent employment. Even with some evidence that a large number of “new” immigrants from Eastern Europe are likely to be in Portugal temporarily (possibly because of temporary work permits), the above result of “joint placement” of natives and immigrants still holds.

Finally, to capture results within the context of existing literature, in Table 7 we present the effect of a change in the stock of immigrants working in the same industry within a region on the employment of natives in firms in the same industry and region. First column in Table 7 shows a significant positive effect (with a coefficient value of 2.072) of an increase in immigration stock on native employment, which shows complementarity between natives and immigrants in the labour market. Since native employment is likely to be affected by the level of immigrant hiring (or laying off), we run further estimations to account for those effects. Columns 2 show that firms hire both immigrants and natives (joint-placement) when the number of immigrants is increasing (coefficient value 2.077). The results clearly show that there is a strong complementarity between native and immigrant new hiring at the firm level when the number of immigrants is increasing, and hence their employment level. The results show no detrimental effect on natives’ employment levels for a given change in firm’s hiring decision of an increase in immigrant stock in a region.

6. Conclusion

There is a vast literature that has studied the impact of immigration on natives’ employment in the host country. All of the existing studies, with one exception, use a rather aggregate, mostly census, data. Primarily because of the limitations in census-type data, the results obtained are not consistent across the existing literature. We contribute to the debate by using a matched employer-employee data from Portugal. The key aspect of the data is that it is possible in this setup to analyse the impact at the level where it is most pronounced, i.e., at the firm level.

We estimated whether two types of workers, immigrants and natives, are hired and laid-off jointly or whether one group of workers replaces the other. We found that natives replace immigrants when the number of latter type of workers is decreasing in a firm. However, for all other specifications, our results show no evidence of natives and immigrants substitutability in the Portuguese labour market. The overall strong complementarity result, i.e., that immigrants do not displace natives, is consistent across all specifications, starting from the results obtained at firm level, job level within firms as well as contract type (temporary or permanent employment) in all firms. In addition, in order to put our results in the context of most of the existing literature, we also ran estimations at an aggregate level considering the immigration stock at the regional level (at a region-industry pair, to be more precise) and found the results to be consistent with those obtained in most of the existing literature as well as with our own results under different specifications.

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Table 1. Descriptive statistics: worker-level data (2003-2007)

	All	Natives	Non-natives
Native	0.953		
Non-native	0.047		
Separation rate		0.179	0.389
Male	0.564	0.560	0.644
Worker age	36.348	36.398	35.335
Tenure			
≤12 months	0.191	0.179	0.416
12-36 months	0.207	0.202	0.317
>36 months	0.602	0.619	0.267
Skill-level			
Top manager	0.094	0.097	0.043
Intermediary/middle manager	0.045	0.047	0.020
Supervisors/Team leaders	0.036	0.037	0.014
Higher-skilled professionals	0.068	0.070	0.025
Skilled professionals	0.393	0.396	0.344
Semi-skilled professionals	0.156	0.156	0.151
Non-skilled professionals	0.115	0.107	0.269
Apprentices/Interns	0.049	0.048	0.062
Schooling			
≤4 years	0.013	0.011	0.052
4-9 years	0.661	0.665	0.576
12 years	0.207	0.207	0.188
College	0.112	0.114	0.069
Fixed-term contract	0.221	0.207	0.492
Temporary Help Agency	0.021	0.018	0.085
Part-time	0.030	0.029	0.051
State-owned firm	0.032	0.033	0.007
Multinational Firm	0.099	0.099	0.084
Multiplant firm	0.346	0.348	0.300
Firm age (years)	20.795	21.063	15.375
N	11,213,763	10,684,884	528,884

Table 2: Probit models for the probability of a native worker leaving or joining a firm (2003-2007)

	Separations	Admissions
No. of non-natives separations at $t-1$	0.001*** (0.00004)	0.001*** (0.0004)
No. of non-natives hired at $t-1$	-0.0004*** (0.00003)	-0.004*** (0.00004)
Gender (Male=1)	0.007*** (0.001)	0.048*** (0.001)
Tenure		
≤ 12 months	0.677*** (0.001)	
]12-36 months]	0.284*** (0.001)	
Skill-level		
Intermediary/Middle managers	0.053*** (0.003)	0.075*** (0.003)
Supervisors/Team leaders	0.112*** (0.003)	0.100*** (0.004)
Higher-skilled professionals	0.118*** (0.003)	0.180*** (0.003)
Skilled professionals	0.177*** (0.002)	0.299* (0.002)
Semi-skilled professionals	0.189*** (0.002)	0.364*** (0.003)
Non-skilled professionals	0.221*** (0.002)	0.621*** (0.003)
Apprentices/Interns	0.211*** (0.003)	0.596*** (0.003)
Schooling		
]4-9 years]	0.112*** (0.004)	0.005 (0.005)
12 years	0.057*** (0.004)	-0.025*** (0.005)
College	0.179*** (0.005)	0.288*** (0.005)
Job type		
Fixed-term contract	0.191*** (0.001)	1.160*** (0.001)
Temporary Help Agency	0.742*** (0.004)	1.704*** (0.005)
Part-time	0.285***	0.374***

	(0.003)	(0.003)
Age	-0.055***	-0.110***
	(0.0004)	(0.0001)
Age squared	0.006***	0.001***
	(0.00001)	(0.00001)
Firm type		
State-owned	-0.148***	-0.272***
	(0.003)	(0.004)
Foreign-owned	-0.009***	-0.103
	(0.002)	(0.002)
Multi-plant	0.041***	0.037***
	(0.001)	(0.001)
Firm age	-0.001***	0.004***
	(0.00002)	(0.00004)
Firm size (no. of employees)		
10-49	0.007***	0.053***
	(0.001)	(0.002)
50-249	-0.020	-0.008***
	(0.002)	(0.002)
≥ 250	-0.067	-0.083
	(0.002)	(0.002)
Constant	-0.920***	0.530***
	(0.012)	(0.011)
Industry dummies	Yes	Yes
Region dummies	Yes	Yes
Year dummies	Yes	Yes

N	11,213,763	11,213,763
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Notes: Unit of observation: worker.

Dependent variables: Separations coded 1 if in year t the worker exited the firm where he/she was employed in $t-1$; Admissions coded 1 if in year t the worker is employed in one specific firm and he was not employed in the same firm in $t-1$.

All variables denoting worker characteristics (except age that is measured in years) are dummy variables equal to 1 when the worker has the corresponding characteristic. Firm type, firm age, and firm size refer to the characteristic of the firm the worker is/was employed in. These are all dummy variables equal to 1 if the firm has the corresponding characteristic. The number of non-natives hired/separations are computed at the level of the firm the working is joining or leaving.

Cluster robust standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Effect of immigrant employment on native employment(firm level analysis) - Firm FE Estimates (2003-08)

Dependent variable: Change in natives' employment level

		Firms employing immigrants	Firms with <i>increasing</i> number of foreign workers	Firms with <i>decreasing</i> number of foreign workers	Firms with increasing number of foreign workers and mean employment >100 and net job creation <0.5
Change in immigrants' employment level	0.354 (0.388)	0.355 (0.389)	1.356* (0.596)	-0.139 (0.339)	1.382 (0.798)
Year dummies					
2004	0.128** (0.046)	0.546** (0.203)	1.038 (1.548)	1.651* (0.665)	9.801 (8.628)
2005	0.087 (0.053)	0.525** (0.230)	1.914 (1.473)	0.871 (0.800)	17.702* (7.758)
2006	0.069 (0.053)	0.472** (0.230)	1.607 (1.523)	0.159 (0.920)	22.605* (9.098)
2007	0.120* (0.056)	0.634** (0.238)	3.042 (1.642)	0.416 (0.881)	36.858*** (10.070)
2008	-0.060 (0.055)	0.215 (0.235)	0.932 (1.373)	1.603 (0.990)	24.616* (9.908)
R-squared	0.017	0.018	0.072	0.069	0.094
N	1,695,795	368,324	84,508	79,064	4,320

Notes: All results were obtained from fixed-effects (FE) estimation on firm-level data. Firm-cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001

Table 4: Effect of immigrant employment on native employment (firm-job title level analysis) - Pooled OLS with Firm*Job Title Effects
Estimates (2003-08)

Dependent variable: Change in natives' employment level

	All	Firms employing Immigrants*	Skill levels with <i>increasing</i> number of foreign workers	Skill levels with <i>decreasing</i> number of foreign workers
Change in immigrants' employment level	1.353*** (0.363)	1.353*** (0.363)	1.831** (0.647)	0.528 (0.668)
2004	-0.044 (0.029)	-0.053 (0.060)	-0.931 (2.379)	0.374 (1.764)
2005	-0.086*** (0.024)	-0.106* (0.050)	-1.620 (1.939)	1.711 (1.771)
2006	-0.249*** (0.027)	-0.283*** (0.057)	-4.446* (2.251)	1.420 (1.995)
2007	-0.242*** (0.026)	-0.268*** (0.053)	-4.356* (2.001)	1.010 (1.834)
2008	-0.311*** (0.027)	-0.362*** (0.056)	-5.303** (2.053)	0.730 (2.175)
Constant	-0.112 (0.413)	-0.513 (0.829)	-19.198 (20.561)	-6.447 (22.285)
R-squared	0.217	0.222	0.594	0.654
N	3,482,811	1,619,739	87,677	77,849

Notes: All results were obtained from pooled OLS regression on firm-job title pairs data, with unit of observation level fixed effects. The unit of observation in this data set is the job title within the firm. Industry and region dummies are included in the regressor set.

"Firms employing immigrant" are firms that employed at least one non-native worker between 2002 and 2008.

Job type-Firm cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001

Table 5: Effect of immigrant employment on native employment, by job title(firm level analysis) - Pooled OLS with Firm Effects Estimates (2003-08)

Dependent variable: Change in natives' employment level, total and by job title

	Change in native employment									
	All natives in a firm	CEO/High Manager	Middle manager	Supervisor/team leader	Higher-skilled Profess.	Skilled	Semi-skilled	Non-skilled	Apprentice/Trainee	
Change in Immigrant's Employment by job type										
CEO/High	4.979* (2.552)	3.376*** (0.929)	0.564 (0.639)	0.221 (0.239)	-0.993 (1.043)	-0.647 (0.875)	1.274 (0.883)	0.243 (0.221)	0.020 (0.046)	
Middle manager	3.746 (2.795)	0.542 (0.588)	1.400* (0.687)	-0.024 (0.073)	-0.899 (1.056)	0.596 (1.374)	1.105 (0.566)	0.707* (0.293)	0.061 (0.036)	
Supervisor/team leader	1.912** (0.640)	-0.028 (0.027)	0.056 (0.068)	1.143* (0.502)	-0.086 (0.186)	0.660 (0.798)	-0.066 (0.258)	0.125 (0.127)	0.016 (0.061)	
Higher-skilled Professionals	0.916 (2.560)	-0.425 (0.378)	-0.307 (0.392)	0.090 (0.195)	5.514* (2.283)	-0.338 (1.682)	-0.751 (1.267)	-0.779 (0.559)	0.099 (0.184)	
Skilled professionals	1.096 (0.581)	-0.053* (0.023)	0.126 (0.105)	0.040 (0.039)	0.142 (0.096)	2.065*** (0.609)	-0.215 (0.125)	-0.394* (0.180)	-0.043* (0.020)	
Semi-skilled	-0.473 (1.285)	0.008 (0.021)	0.017 (0.041)	-0.019 (0.040)	-0.0003 (0.049)	-0.149 (0.307)	1.538 (0.895)	-0.094 (0.126)	0.007 (0.023)	
Non-skilled Professional	1.595** (0.512)	0.018* (0.008)	-0.033 (0.029)	0.028 (0.023)	-0.069 (0.062)	-0.278 (0.253)	0.093 (0.112)	1.699*** (0.326)	0.033 (0.020)	
Apprentice/Trainee	0.193 (0.788)	-0.003 (0.036)	-0.045 (0.046)	-0.015 (0.046)	-0.250 (0.071)	-0.912 (0.259)	0.701 (0.892)	0.120 (0.678)	1.704*** (0.296)	(0.472)
2004	0.522** (0.165)	-0.032 (0.038)	0.066** (0.026)	0.045 (0.030)	-0.023 (0.061)	-0.026 (0.108)	0.081 (0.092)	0.150** (0.056)	-0.023 (0.029)	

2005	0.193 (0.183)	-0.106** (0.034)		0.088*** (0.027)	0.030 (0.016)	0.176*** (0.052)	-0.218* (0.078)	-0.087 (0.057)	0.092 (0.062)	-0.002 (0.031)
2006	-1.347*** (0.170)	-0.008 (0.035)		-0.083** (0.030)	-0.082*** (0.015)	-0.148* (0.069)	-0.731*** (0.101)	-0.212** (0.081)	-0.081 (0.069)	-0.050 (0.025)
2007	-1.247*** (0.174)	0.082* (0.033)		-0.169*** (0.028)	-0.069*** (0.020)	-0.051 (0.057)	-0.422*** (0.087)	-0.186** (0.065)	-0.159* (0.066)	-0.034 (0.026)
2008	-1.801*** (0.173)	-0.064* (0.028)		-0.054* (0.026)	-0.088*** (0.021)	0.031 (0.058)	-0.654*** (0.114)	-0.407*** (0.063)	-0.323*** (0.061)	-0.098*** (0.027)
Constant	-3.189 (3.345)	0.052 (0.340)	-0.351 (0.340)	-0.273 (0.243)	-0.272 (0.219)	0.831 (0.303)	-0.499 (1.209)	-0.876 (0.670)	0.001 (0.633)	(0.310)
R-squared	0.291	0.179	0.176	0.176	0.160	0.226	0.177	0.294	0.146	
N	444,669	444,669	444,669	444,669	444,669	444,669	444,669	444,669	444,669	

Notes: All results were obtained from pooled OLS regression on firm-level data, with firm effects. The unit of observation in this data set is the firm. Firm effects as well as industry and region dummies are included in the regressor set.

The sample covers all firms present in at least four waves of the data and employing a minimum number of 10 employees at least in one wave.

Firm cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001

Table 6: Effect of immigrant employment on native employment, by job-contract - Pooled OLS Estimates with Firm Effects (2003-08)

Dependent variable: Change in natives' permanent employment level (column 1) and Change in native's temporary employment level (column 2)

	Permanent Employment	Temporary Employment
Change in Immigrant's Permanent Employment	1.939*** (0.504)	0.050 (0.134)
Change in Immigrant's Temporary Employment	0.155 (0.100)	2.910*** (0.735)
2004	0.196 (0.127)	0.235** (0.082)
2005	-0.120 (0.167)	0.217 (0.121)
2006	-1.281*** (0.137)	-0.089 (0.108)
2007	-1.322*** (0.136)	0.376** (0.123)
2008	-1.501*** (0.128)	-0.256* (0.091)
Constant	0.745 (2.165)	-1.890 (1.875)
R-squared	0.233	0.327
N	444,291	444,291

Notes: All results were obtained from pooled OLS regression on firm-level data, with firm effects. The unit of observation in this data set is the firm. Firm effects as well as industry and region dummies are included in the regressor set.

Sample used here covers all firms present in at least four waves of the data and employing a minimum number of 10 employees at least in one wave.

Firm - cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001

Table 7: Effect of *aggregate* immigrant employment on native employment(industry-region level analysis) - Industry-region FE estimates (2003-2008)

Dependent variable: Change in natives' employment level

	All	Industries with <i>increasing</i> number of foreign workers	Industries with <i>decreasing</i> number of foreign workers
Change in immigrants' employment level	2.072*** (0.245)	2.077*** (0.591)	1.057 (1.141)
Year dummies			
2004	55.742.** (21.045)	56.073 (31.679)	179.767* (81.769)
2005	142.936*** (20.809)	252.986*** (44.309)	192.694** (63.515)
2006	53.274** (17.758)	68.310 (36.587)	97.163** (59.366)
2007	90.782*** (18.247)	151.957*** (37.279)	162.613** (61.981)
2008	29.345 (15.283)	1.273 (29.180)	108.480 (68.992)
R-squared	0.425	0.570	0.003
N	6,987	2,590	1,949

Notes: All results were obtained from FE regression on industry*region level data, with fixed effects defined at the same level as the unit of observation (industry*region fixed-effects).

Industry-region cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001