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IMMIGRANTS-NATIVES COMPLEMENTARITIES IN PRODUCTION: EVIDENCE FROM ITALY

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Immigrants-Natives Complementarities in Production: Evidence from Italy

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Abstract

This paper studies the impact of immigration on the Italian labour market using administrative data on Italian private-sector employees during the period 1995-2004. The analysis adopts a structural model based on a two levels CES production function extending the model in Card (2001) in order to allow for imperfect substitution between immigrants and natives within the same area-skill cell, other than between high and low skilled labour inputs. The endogeneity of labour supply is controlled for by using an instrument based on the (1985) historical immigrants' settlement as in Card (2001). The results, robust to the offsetting role of other factors' movements, provide evidence of a small but detectable degree of imperfect substitution between immigrants and natives. Despite immigrants not having any effect on natives' employment, the simulation based on the estimated parameters suggests that the actual flow of low-skilled immigrants over the period of analysis has reduced the wages only of similarly skilled immigrants (1%), with no impact on natives. At the same time the inflow of immigration has increased the return to skill for natives.

Keywords: Wages, international migration, skill complementarities, labour supply.
JEL codes: J61, J23, F22.

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1 Introduction and literature review

A great body of literature has been focused on estimating whether and to what extent immigrants might have an impact on the labour force of natives[1]. The issue is controversial, as the complementarity or substitutability between the different labour types can generate opposite outcomes. If natives and immigrants are perfect substitutes, a boom in immigration would generate a supply increase and, as a consequence, a contraction in wages as follows from the standard economic theory. However, if the two groups are imperfect substitutes, complementarities between them are at work, thus an increase in immigrants' supply generates an increase in the productivity of the native group, enhancing the latter's wage. Thus, immigration could also bring about a positive effect on the labour market outcomes of natives.

Most of the empirical results on the impact of immigration on the host country's labour market comes from the US, where this strand of literature has been particularly fertile and where scholars have obtained mixed findings. The large majority of the results finds that immigrants have either a non-significant or a positive effect on the salary of natives: Card (1990, 2001, 2007), Friedberg and Hunt (1995), LaLonde and Topel (1991), Ottaviano and Peri (2008, 2011), and Peri (2007), to mention only some of those belonging to this broad category. In contrast, fewer studies conclude that immigration has a detrimental effect on the wage structure of natives (Borjas, 2003; Borjas et al., 2008). Some of these studies adopt a spatial correlation approach (Card, 1990; Friedberg and Hunt, 1995; LaLonde and Topel, 1991) which consists in a reduced form aiming at comparing labour outcomes in different local markets (i.e. cities or regions) affected by different concentration of immigrants. An alternative method has developed in the last decade and rests on a structural approach, whose distinctive feature is to set first a theoretical model, by defining a CES type production function and disaggregating the labour inputs according to different dimensions, such as education or skill, experience or age. The production function allows to define the labour demand functions and to estimate the impact of flows of immigration on natives' wages using the actual flow or simulating different policy scenarios of immigration. In this structural setting the unit of analysis is mostly defined at the national level with few exceptions adopting a production function locally defined (Card, 2001, 2009).

In the last decade this issue has been investigated also for European countries, a few studies are represented by Manacorda et al. (2011), and Dustmann et al. (2005) for the UK, and by D'Amuri et al. (2010) for Western Germany, all of them sharing the same result in favour of a non-significant or negligible effect of immigrant labour supply on natives' wages. As for Italy, to my knowledge, there is only one study focusing on the potential displacement of natives due to the immigrants' flow and is represented by Venturini and Villosio (2004), who find that immigrants do not displace natives. In turn Gavosto et al. (1999) is the only study investigating the wage impact of immigrants on

[1]For a recent review of the relevant literature see Okkerse (2008).

natives. The authors adopt a spatial correlation approach in order to detect a complementary effect between immigrants and natives. Nonetheless, their estimates can be severely affected by potential bias since they do not account for the endogeneity of immigrants, thus underestimating the potential harmful effect of immigration on wages.

This paper contributes to the existing literature on the impact of immigration on the host country and aims to expand the evidence for Italy where very little is known about the impact of the recent immigration on wage structure and employment of natives since the few studies exploring this issue date back to at least a decade ago[2], despite immigrants have increased their weight by more than ten times in the current decade (Figure 1) by generating a pronounced change in the structure of the Italian labour force.

Immigration is quite a recent phenomenon in Italy where immigrants were barely represented among the resident population at the beginning of the 1990s (0.9%) but their presence has steadily risen up to reaching the 7% of the resident population in 2010. Recent Italian studies account for other aspects of the impact of immigration on the host country: the impact on natives' labour supply and on natives' internal mobility. Barone and Mocetti (2011) find that immigrants specialized in household production increase the labour supply of Italian highly skilled women at the intensive margin, whereas Mocetti and Porello (2010) provide evidence that immigrant concentration in the northern regions has partially replaced the South-North mobility of less skilled-natives.

This study draws from the existing literature on immigration and uses a simple structural approach extending the model in Card (2001). The CES production function adopted in Card (2001) is extended by allowing immigrants and natives to be imperfect substitutes within the same skill-area cell and estimating their degree of substitution through the data. The endogeneity of the labour aggregates is accounted for by using the well-known *supply push component* developed by Card (2001), which is based on the past immigrants' settlement, as an instrument for the current stock of immigrants and for the current skill-specific aggregate labour input as detailed below.

Then a simulation analysis, based on the results of the estimation, provides additional evidence on the impact of immigration on the changes in wages and in return to skill, considering the actual flow of immigration and simulating other scenarios with skill-specific inflow of immigrants. There is evidence (Card, 2009) that the estimates of the elasticity of substitution between natives and immigrants obtained by defining the labour market at the country level are consistent with those obtained by adopting a local definition. Nevertheless previous studies (Borjas, 2003; D'Amuri et al., 2010; Manacorda et al., 2011; Ottaviano and Peri, 2008, 2011; Peri, 2007) justify the adoption of a national approach following the main critique to the spatial correlation approach (Borjas et al., 1997), which was motivated by the fact that factors movements re-equilibrate the market: natives may move away from areas where immigrants concentrate, capital move into cities with labour

[2]Gavosto et al. (1999) analyse the labour market impact for the period 1986-1995 whereas Venturini and Villosio (2004) study the period 1993-1997.

supply shocks, and, as a consequence, the offsetting role of these movements may reduce the adverse impact of immigration, producing biased results. By adopting as geographical unit of analysis the nation as a whole all these flows are taken into account. However the evidence that natives "vote with their feet" is not as clear-cut: Borjas et al. (1997) document the reduction of natives' inflow to the main immigrant-receiving states, and Borjas (2005) shows that outflows of natives is in place as a reaction to the immigrants' inflow. On the other hand Card and DiNardo (2000) and Card (2001) find that there is no outflow of natives as a consequence of immigrants' arrival. However, given that the evidence for Italy shows that immigrants reduce the traditional native internal mobility between Southern and Northern regions (Mocetti and Porello, 2010), and since this study adopts a structural approach where each labour market is defined in terms of local areas, I try to deal with the previous issue by carrying out different robustness checks, such as comparing the results obtained by alternative definitions of the local labour market. I start with the benchmark case where the labour market is defined at the regional level, then all regions are aggregated into five macro-areas, and I compare the estimates obtained according to these two definitions. Finally all the analysis is replicated on a sub-sample of workers who never change their region of work ("non movers").

The rest of the paper is organised as follows: Section 2 presents the data and the descriptives statistics, Section 3 describes the theoretical model, Section 4 derives the structural equations, Section 5 describes the empirical strategy adopted, Section 6 provides the results of the estimation, Section 7 presents the simulation, and Section 8 concludes.

2 Data

This paper uses Italian administrative data for a representative sub-sample of all private-sector employees collected by the Social Insurance Institute (*INPS-Istituto Nazionale per la Previdenza Sociale*) and covers the period 1995-2004. Information on demographic factors (such as age, gender and country of birth) is provided, along with the information on occupation, type of contract, sector, gross wages, working days, and region of work. Immigrants are defined as those who were born outside Italy. The selected sample consists of workers in the age range between 15 and 65 year old who report a positive wage[3]. Each worker can have more than one job spell per year, therefore the measure of daily wage is computed by summing up total monthly wages and dividing them by the total number of working days reported[4]. Only full-time workers are chosen since unfortunately the dataset does not provide information about the number of hours worked, thus the distinction between part-time and full-time is crucial in order to gain more homogeneity in the computation of the daily wage rate. Workers differ according to country of birth,

[3]I exclude those whose reported number of working days per each job spell is higher than 312.

[4]My measure of daily wage is then trimmed in order to exclude the bottom and top percentile of the distribution.

type of occupation, and the occupation is used as a proxy for the skill, as the education level is not known. Skill categories are defined as white collars or managers[5] and blue collars, since for the other categories available in the dataset (executives and apprentices) the distinction between part time and full time contract is not available. The labour supply is measured in terms of employment, and wage represents daily wage, gross of income taxes and social security contribution paid by employees and net of social security contribution paid by employers. Earnings are expressed in Euro and converted to a common scale using the ISTAT (*Istituto Nazionale di Statistica*) consumer price index for families containing a dependent employee with base 2000=100[6]. The final sample consist in 800 cell-observations, where each cell is identified by region, skill, immigration status, and time[7]. I consider the period 1995-2004 excluding the timespan between 1985-1994 due to the strategy adopted in order to implement the instrument, since I need to use the past local distribution of immigrants as in 1985 to build the instrument. This allows a time lag of at least 10 years between the past distribution and the timespan of the analysis.

Table 1 reports the main descriptive statistics of the variables included in the analysis and disaggregated by immigration status: the average daily wage is higher for natives than for immigrant workers. Immigrant workers are on average younger, work mainly in the North, and most of them is employed in blue collar occupations (84%) compared to a much lower share of natives (60%). Men form the large majority of immigrant workers, higher with respect to the native counterpart (77% vs 67%) and this feature can be easily explained by the fact that a large share of immigrants work in the household services sector, which is almost entirely represented by women and this sector is not contained in the archive.

From Figure 1 it is clear how the upward trend in the immigrants' flow is shared by all countries, but in particular the group coming from the Eastern European countries experiences the biggest increase. The share of immigrants ranges from 4.6% in 1995 to reach 11.4% of the sample in ten years time. These features are higher if compared to the share of resident immigrants out of the total resident population as reported in Figure 1 because the latter only accounts for resident immigrants discarding the non resident ones. However the pattern over time of the sample distribution of immigrants by country resembles the one reported by registry data: the countries increasing most their weight are Eastern European countries, Africa and Asia. At the beginning of the empirical analysis the average share of immigrants is almost 6% per each cell containing low-skilled workers at regional level and this share rises up to over 16% (Table 2). Immigrants are less represented in white collar occupations, their average share by cell is less than 3% in 1995 and it only rises up to the 3.5% in 2004. As for the average daily wage (Table

[5]White collars cannot be separated from managers because it is not possible to identify the former separately from the latter before 1997.

[6]The implementation of the instrument is provided in Section 5 in details.

[7]The final number of cells is obtained by multiplying 20 regions, 2 occupations, 2 immigration status and 10 years

3), blue collar immigrants seem to suffer a loss relatively to natives, since the average daily wage is almost constant over the timespan of the analysis (45.50 - 45.44), whereas the corresponding values for natives are 49.94 and 51.37 respectively. On the other hand both immigrants and natives experience quite a similar gain in average wage if they are employed in white collar occupations (62.83 - 66.42 are the mean wages for immigrants, and 65.54 - 69.54 the corresponding values for natives computed at the beginning an at the end of the reference period).

As a robustness check, in order to control for the potential offsetting effect of other inputs' outflows, the geographic variability is defined also according to 5 macro-areas (North East, North West, Centre, South, and Islands) and all the analysis is replicated using this alternative definition, thus the resulting sample decreases to 200 cell-observations.

3 Theoretical set-up

Extending the theoretical framework adopted by Card (2001), consider an aggregate production function F of a competitive firm as follows:

$$Y_{rt} = F(K_{rt}, L_{rt}) \tag{1}$$

Where subscript r and t stand for area and time, K for capital and non-labour inputs and L is the CES type aggregate of skilled and unskilled labour input as follows

$$L_{rt} = \left[\sum_{k=s,u} \theta_{rkt} L_{rkt}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} = \left[\theta_{rst} L_{rst}^{\frac{\sigma-1}{\sigma}} + \theta_{rut} L_{rut}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{2}$$

with elasticity of substitution equal to σ and where θ_{rkt} denotes the skill-specific productivity term. Subscript s stands for skilled and u for unskilled respectively.

In turn, immigrants and natives sharing the same skill are allowed to be imperfect substitutes. This is justified because of language difficulties for immigrants and because of discrimination motives on behalf of employers[8]. Immigrants and natives likely do not perform the same tasks despite having similar skills, because language difficulties and scarce understanding of local rules and costumes make easier for immigrants to be hired to perform more manual tasks with respect to natives. In addition to that discrimination motives may make firms prefer natives. Due to these factors immigrants and natives are

[8]This follows quite a standard assumption adopted by other studies where immigrants and natives within experience-education cells are considered as imperfect substitutes (D'Amuri et al., 2010; Manacorda et al., 2011; Ottaviano and Peri, 2008, 2011; Peri, 2007).

allowed to be imperfect substitutes within the same skill-area-cell by defining each skill-area-specific labour input, L_{rkt} as a CES type aggregate of natives and immigrants with elasticity of substitution equal to δ. The prior is that $\delta > \sigma$ since it is likely that a firm finds easier to substitute immigrants with natives with the same skill than a low-skilled with a high-skilled worker, regardless of its immigration status.

$$L_{rkt} = \left[\theta^I_{rkt} I_{rkt}^{\frac{\delta-1}{\delta}} + \theta^N_{rkt} N_{rkt}^{\frac{\delta-1}{\delta}}\right]^{\frac{\delta}{\delta-1}} \tag{3}$$

Without loss of generality the relative productivity terms between natives and immigrants are normalized as follows $\theta^I_{rkt} + \theta^N_{rkt} = 1$. This type of production function has the drawback that the estimated elasticity of substitutions are constant: between low-skilled and high-skilled workers σ does not vary regardless of immigration status, at the same time the elasticity of substitution between immigrants and natives, δ is constant across skills (i.e. low- and high-skilled pairs of immigrants-natives are characterized by the same value of δ.)

4 Optimality conditions

Imposing the equality between the marginal productivity and the relevant price, I derive the labour demand functions for each labour input. Therefore the optimal labour demand for input of skill k in area r is obtained by differentiating the profit function with respect to the labour aggregate L_{rkt} as in (2). Normalizing to one the price of the output and taking logs I obtain:

$$\ln w_{rkt} = \ln F_{L_{rt}} + \ln \theta_{rkt} - \frac{1}{\sigma} \ln L_{rkt} + \frac{1}{\sigma} \ln L_{rt} \tag{4}$$

The demand for labour input specific to skill k, immigration status S, and area r is derived differentiating the profit function with respect to the labour aggregate S_{rkt} (with S=N,I) as in (3). By taking logs it follows:

$$\ln w_{rkSt} = \ln F_{L_{rt}} + \ln \theta_{rkt} + \ln \theta^S_{rkt} - \left(\frac{1}{\sigma} - \frac{1}{\delta}\right) \ln L_{rkt} + \frac{1}{\sigma} \ln L_{rt} - \frac{1}{\delta} \ln S_{rkt} \tag{5}$$

5 Empirical strategy

In order to estimate the elasticity of substitution between immigrants and natives within the same skill-area cell, subtract equation (5) for immigrants by equation (5) for natives and obtain the following relative demand function:

$$\ln\left(\frac{w_{rkIt}}{w_{rkNt}}\right) = \ln\left(\frac{\theta^I_{rkt}}{\theta^N_{rkt}}\right) - \frac{1}{\delta}\ln\left(\frac{I_{rkt}}{N_{rkt}}\right) \tag{6}$$

Following a similar approach found in Manacorda et al. (2011), I assume the unobserved relative productivity term to vary additively by area r, skill k, and time t and I obtain the following specification in order to estimate (6)

$$\ln\left(\frac{w_{rkIt}}{w_{rkNt}}\right) = D_r + D_k + D_t - \frac{1}{\delta}\ln\left(\frac{I_{rkt}}{N_{rkt}}\right) + \xi_{rkt} \tag{7}$$

where the unobservable relative productivity is controlled for by three additive fixed effects: D_t represents time fixed effects, D_r is area fixed effects, D_k denotes skill fixed effects, and ξ_{rkt} is a zero mean cell-specific error term.

Lastly in order to estimate the elasticity of substitution between high and low skilled workers, note that σ cannot be identified if the regression included interactions of area-skill-time effects to capture the term θ_{rkt}. Therefore I follow a similar strategy also adopted by Borjas (2003) and I adopt the following specification for equation (4):

$$\ln w_{rkt} = D_{rt} + (\text{linear trend})_{kr} - \frac{1}{\sigma}\ln L_{rkt} + \nu_{rkt} \tag{8}$$

where the linear trend interacted with skill-area fixed effects controls for the terms $\ln L_{rkt}$, and $\ln\theta_{rkt}$ whereas D_{rt} are area-time fixed effects, which control for the terms $\ln F_{L_{rt}}$, and ν_{rkt} is a zero mean cell-specific error term. I prefer to adopt such estimation strategy instead of a relative specification as in (7) which regresses relative skill specific wages on relative skill-specific labour inputs in order to gain efficiency: I would have ended up with half of the observations if I have adopted a relative specification.

An OLS estimation strategy does not allow us to correctly identify the inverse elasticities of substitution in equations (7), and (8) since the labour input terms do not represent an exogenous shift in the relevant supply functions but are likely correlated to unobserved demand shocks which enter the error term, as a consequence the estimated parameters would turn out to be a mixture of demand and supply elasticities. Immigrants can be thought as an exogenous supply shock, since they move to the nation as a whole driven by source country factors, however the local distribution of immigration is probably less

supply-driven, immigrants are not randomly allocated to local areas, but it is likely that they cluster into regions with thriving economies which in turn push up wages. In order to deal with this bias I need to isolate the supply component of immigration which is not driven by demand factors; for this purpose an instrumental variable approach is adopted, following the popular supply-push component initiated in Card (2001). Empirical findings largely report the tendency of newly arriving immigrants to move to enclaves established by earlier immigrants from the same source country in order to take advantage of network effects (Cutler et al., 2008; Damm, 2009). Exploiting this phenomenon the current total inflow of immigrants arriving to Italy from a given country is allocated to regions according to the past regional country-specific distribution. In addition to that the regional stock of immigrants is allocated to different occupations according to the current country specific distribution, this is justified on the ground that the allocation of immigrants to a given occupation is hardly endogenous, but it is rather driven by the pre-existing skills immigrants are endowed with. Therefore the instrument for each skill-area labour input has been computed according to the following formula

$$IV_{rkt} = \Sigma_g \tau_{gkt} \lambda_{gr,t_0} M_{gt} \tag{9}$$

where τ_{gkt} is the proportion of immigrants from country g at time t falling in skill group k, λ_{gr,t_0} is the proportion of immigrants at time $t_0 = 1985$ from country g working in region r, and M_{gt} is the total flow of immigrants from country g at time t. In order to implement the instrument I aggregate immigrants into 7 groups of countries of origin: Western Europe, Eastern Europe, Asia, Africa, North America, Central and South America, and Oceania. The formula (9) is used as an instrument for L_{rkt} in equation (8), and as an instrument for the skill specific immigrants to natives ratio in equation (7). The validity of this approach rests on the fact that the endogeneity of the labour supply consists only in selecting the regions where working, whereas the selection into a given occupation is exogenously predetermined. As a results both the total inflow of country specific immigrants, M_{gt} and their current distribution into occupations, τ_{gkt} are exogenously determined, since completely unrelated to any local demand factors, whereas the past regional distribution is also not driven by current local demand factors under the assumption of the absence of their time persistence. However I am also controlling for regional fixed effects which should take this potential persistence in local demand factors into account. The standard implementation of this instrument typically uses Census data in order to compute the past local country-specific distribution of immigrants, because this measure is less affected by measurement errors with respect to the case of using survey or administrative data where the number of immigrants is less representative of the actual distribution. Unfortunately I do not have access to the decennial Census which would fit the purpose of my analysis, the 1981 Census data. In addition to that I would

expect the number of immigrants residing in Italy in 1981 to be extremely low, at least lower than the one I obtain by using the 1985 as a reference year.

The good predictive power of the instrument is clear from Figure 2 which reports the actual and predicted flow of immigrants.

6 Estimation results

I proceed first by running the regressions on cells defined at regional level and then I try to enlarge the local unit by grouping regions into 5 macro-areas, this will allow me to check whether my results are driven by movements of other input factors, such as other labour inputs or capital, which would hide the actual impact of immigration. Unfortunately I cannot replicate the analysis at national level as Borjas (2003), Borjas et al. (2008), Ottaviano and Peri (2008, 2011), and Manacorda et al. (2011) due to the few observations I have[9]. As an additional robustness check I also replicate the analysis by only considering workers who never change the region where they work in order to take into account the potential out-flow of natives as a consequence of the inflow of immigrants. Both the OLS and the IV estimates of the inverse elasticity of substitution between natives and immigrants (equation (7), Table 4) are in favour of a small but detectable degree of imperfect substitution, with a value of $-1/\delta$ around -0.06. The log of the supply push component of immigrants by cells, $\ln IV_{rkt}$ as described in (9) is used as an instrument for the log of the relative immigrants-natives supply by cell, $\ln\left(\frac{I_{rkt}}{N_{rkt}}\right)$. Since each cell represents averages I control for heteroskedasticity, by weighting each cell with the number of workers per cell; I also account for serial correlation by using a cluster correction of the standard error, with clusters defined at skill-area cell. The estimates of $-1/\delta$ are robust to the different definitions of local labour market adopted thus providing further evidence that the outflow of natives or movement of other inputs as a consequence of immigrants do not play any role.

I proceed by estimating the inverse elasticity of substitution between high and low skilled workers. The term L_{rkt} needs to be computed according to the estimated value of δ and the two estimated productivity terms. Exploiting the normalization previously imposed $\theta^I_{rkt} + \theta^N_{rkt} = 1$, I need to compute:

$$\hat{L}_{rkt} = \left[\hat{\theta}^I_{rkt} I_{rkt}^{\frac{\hat{\delta}-1}{\hat{\delta}}} + \hat{\theta}^N_{rkt} N_{rkt}^{\frac{\hat{\delta}-1}{\hat{\delta}}}\right]^{\frac{\hat{\delta}}{\hat{\delta}-1}}$$

The results in Table 5 provide evidence of a strong complementarity between high and low skilled workers, with an estimates of $-1/\sigma$ around -0.6 obtained by using as instrument for $\hat{L}_{rkt}$ the term IV_{rkt} and this holds true throughout all specifications.

[9]By adopting a national approach I would have only 20 observations for running regression (7).

The evidence found in a recent study (Mocetti and Porello, 2010) that the immigration flow to Italy has brought about a reduction in the inflow of similarly skilled natives to the regions where immigrants concentrate would suggest that the outflow of natives might reduce the true impact of immigration on natives, and thus could potentially affect the estimation of the structural parameters. However, this study provides substantive evidence that this phenomenon does not affect my estimation, in fact, in addition to the results found on macro-areas, replicating all the analysis on the sub-sample of those who never change the region of work the results previously obtained by using the entire sample are confirmed (Tables 8 and 9).

These results are higher than those found by Manacorda et al. (2011), who report estimates for natives and immigrants within the same education and age category around 0.12 as for the UK; on the other hand my estimates are consistent with results found in other studies: Ottaviano and Peri (2011) present estimates that range from 0.02 to 0.06, and estimates provided by Card (2009) for immigrants and natives within the same education category center at around 0.04. Also D'Amuri et al. (2010) report a value around 0.03 for their study on German data where they compare immigrants and natives within the same education and experience cell.

7 Simulation

In order to implement the simulation exercise I consider the following simplified functional form for the aggregate production function (1):

$$Y_{rt} = A_{rt} L_{rt} \tag{10}$$

which can be interpreted as a short run production function where capital is considered as fixed given the quite limited timespan of my analysis (1995-2004) or endogeneized in the technology parameter A_{rt}[10], L_{rt} is defined as in (2), accordingly also L_{rkt} is defined as in (3).

Applying the first order condition to (10) I obtain the following demand function for each immigration-skill-area specific labour aggregate:

[10] Ottaviano and Peri (2008) estimate the impact of immigration on wages assuming both partial adjustment of capital to its long run level and full adjustment. Their findings show that the impact of immigration on both native and immigrant wages is more negative in case of partial adjustment compared to the case of full adjustment (long-run) and that assuming fixed capital corresponds to the most negative impact of immigration, which is the assumption we made in line also with Borjas (2003) and Manacorda et al. (2011). Moreover Ortega and Peri (2009) provide evidence that capital adjusts to keep its price constant as a consequence of the yearly inflow of immigrants to OECD countries. Therefore my estimates can be thought as a lower bound of the impact found by assuming that capital adjusts to immigration.

$$\ln w_{rkSt} = \ln A_{rt} + \ln \theta_{rkt} + \ln \theta_{rkSt} + \frac{1}{\sigma} \ln L_{rt} - \left(\frac{1}{\sigma} - \frac{1}{\delta} \right) \ln L_{rkt} - \frac{1}{\delta} \ln S_{rkt} \qquad (11)$$

In order to simulate the labour market impact of immigration on native and immigrant workers I follow a similar approach also found in Manacorda et al. (2011). I evaluate the impact of immigrants on natives' wage growth by totally differentiating equation (11) and I obtain

$$d \ln w^N_{rkt} = \frac{1}{\sigma} \left[\Sigma_k s_{rkt} \left(S^I_{rkt} \frac{dI_{rkt}}{I_{rkt}} + S^N_{rkt} \frac{dN_{rkt}}{N_{rkt}} \right) \right] + \left(\frac{1}{\delta} - \frac{1}{\sigma} \right) \left[S^I_{rkt} \frac{dI_{rkt}}{I_{rkt}} + S^N_{rkt} \frac{dN_{rkt}}{N_{rkt}} \right] - \frac{1}{\delta} \frac{dN_{rkt}}{N_{rkt}} \qquad (12)$$

similarly I obtain the expression of the impact of immigrants on immigrants' wage growth

$$d \ln w^I_{rkt} = \frac{1}{\sigma} \left[\Sigma_k s_{rkt} \left(S^I_{rkt} \frac{dI_{rkt}}{I_{rkt}} + S^N_{rkt} \frac{dN_{rkt}}{N_{rkt}} \right) \right] + \left(\frac{1}{\delta} - \frac{1}{\sigma} \right) \left[S^I_{rkt} \frac{dI_{rkt}}{I_{rkt}} + S^N_{rkt} \frac{dN_{rkt}}{N_{rkt}} \right] - \frac{1}{\delta} \frac{dI_{rkt}}{I_{rkt}} \qquad (13)$$

where

$$S^S_{rkt} = \frac{w^S_{rkt} S_{rkt}}{\Sigma_s w^S_{rkt} S_{rkt}}$$

represents the wage bill share of the labour aggregate specific to each immigration status among the relevant skill-area and time cell, and

$$s_{rkt} = \frac{w_{rkt} L_{rkt}}{\Sigma_k w_{rkt} L_{rkt}}$$

is the wage bill share of the labour aggregate specific to each skill among the relevant area and time cell. Before estimating equations (12) and (13) using the previously estimated parameters and the observed wage bill I need to recover the term $\frac{dN_{rkt}}{N_{rkt}}$ representing the potential employment effect of immigrants' flow on natives. A shock in the supply of immigrants brings about a reduction in their wages, and, due to the complementarity between natives and immigrants, this shock triggers also a shift in the natives'

labour demand curve, which is defined at the new equilibrium point for immigrants (set at an higher value of their employment). Since, as opposed to the case for immigrants, the labour supply function is assumed to be highly elastic for natives, there might be an employment effect for natives as a consequence of a shock in the supply of immigrants. I adopt the following reduced form approach in order to verify whether this employment effect is ultimately in place:

$$\frac{dN_{rkt}}{N_{rkt}} = \beta \frac{dI_{rkt}}{I_{rkt}} + D_t + D_r + D_k + \mu_{rkt} \tag{14}$$

where β is the parameter of interest, D_t are time fixed effects, D_r are area fixed effects, D_k are skill fixed effects and μ_{rkt} is a zero mean cell-specific random shock. Equation (14) represents the benchmark specification, whereas additional set of regressors, represented by mortality rate and its interaction with skill fixed effects, are included in order to control for any systematic change in employment due to demographic factors and their change across different occupations[11]. Additional controls include the interaction between region and time fixed effects controlling for change in regional demand factors. The IV strategy adopted in order to identify the parameter β uses the growth rate of the instrument previously described as an instrument for the growth rate of immigrants by cell. In order to account for the serial correlation among units belonging to the same area-skill cell, the standard error are clustered at area-skill level. Table 6 provides evidence that immigrants do not displace natives with the same skill and geographic location, nor have such a complementary effect to enhance their employment level, since the coefficient β is almost zero and never significant at any conventional levels. Table 7 confirms that the results are robust to the definition of the local unit. Moreover these results are consistent with those found by Venturini and Villosio (2004) who analyse the Italian labour market on a different timespan and also to D'Amuri et al. (2010) who do not find any employment effect on natives for the case of Western Germany. One might argue that this result is driven by the endogenous change of occupation by natives as a consequence of immigration, if the inflow of one immigrant fully displaces the incumbent native worker who switches to a different occupation. However, by looking at the empirical evidence provided by the sample, it is clear how this phenomenon is negligible since only 2% of native workers change their occupation over the timespan of the analysis. This result is consistent with the low but detectable degree of imperfect substitution found between immigrants and natives within the same skill-area-time cell, since the complementarity found between the two labour inputs is too low to be able to drive a significant enhancing effect on natives' employment and at the same time the two inputs are not perfect substitutes so as to motivate a crowding out effect on natives. As a result, having ruled out any employment effect, equations (12) and (13) simplify as follows

[11] Mortality rate is computed from registry data.

$$d\ln w^N_{rkt} = \frac{1}{\sigma}\left[\Sigma_k s_{rkt} S^I_{rkt}\frac{dI_{rkt}}{I_{rkt}}\right] + \left(\frac{1}{\delta}-\frac{1}{\sigma}\right)\left[S^I_{rkt}\frac{dI_{rkt}}{I_{rkt}}\right] \tag{15}$$

$$d\ln w^I_{rkt} = \frac{1}{\sigma}\left[\Sigma_k s_{rkt} S^I_{rkt}\frac{dI_{rkt}}{I_{rkt}}\right] + \left(\frac{1}{\delta}-\frac{1}{\sigma}\right)\left[S^I_{rkt}\frac{dI_{rkt}}{I_{rkt}}\right] - \frac{1}{\delta}\frac{dI_{rkt}}{I_{rkt}} \tag{16}$$

Finally, in order to run the simulation, I consider four different hypothetical scenarios of the immigration's flow. First, I consider an increase in both high and low skilled immigrants of the same amount equal to 10% (hereafter denoted as "skilled neutral" immigration shock), an inflow of only high skilled immigrants equal to 20% (hereafter denoted as "high skilled" immigration shock), an inflow of only low skilled immigrants equal to 20% (hereafter denoted as "low skilled" immigration shock), and the actual flow of immigration as provided by the data (hereafter denoted as "actual" immigration shock). Table 10 reports the results of these simulations computed by using the estimated parameters and the actual wage bill share as observed in the data. The actual flow of immigrants occurring over the timespan of the analysis exerts a negative impact only on low-skilled immigrants since it reduces their wages by 1%, on the other hand the simulated "high skilled" scenario decreases wages of high-skilled immigrants by 1.5%, and the simulated "low-skilled scenario" reduces wages of low-skilled immigrants by 1.8%. On the contrary natives result completely unaffected under all scenarios.

Figure 3 plots the results of the simulation under the "actual" scenario. The left panel describes the impact of the actual flow of immigrants on the wage change of low-skilled natives and immigrants, whereas the right panel plots the impact of the actual immigration shock on high-skilled natives and immigrants. Clearly the group suffering most from immigration are immigrants themselves, especially their low-skilled component which experiences a steady decrease in wages throughout the period of analysis. Despite being low, the degree of complementarity between natives and immigrants is clear from the right panel where high skilled natives slightly gain from immigration whereas the impact on immigrants themselves is rather volatile, varying between being slightly positive and slightly negative.

I also try to simulate the impact of immigration on the return to skill for natives, as measured by the (log) skilled-unskilled wage differential. By subtracting equation (15) for low skilled workers from equation (15) for high skilled ones, I obtain the following expression for natives:

$$d\ln\frac{w^N_{rst}}{w^N_{rut}} = \left(\frac{1}{\delta}-\frac{1}{\sigma}\right)\left[S^I_{rst}\frac{dI_{rst}}{I_{rst}} - S^I_{rut}\frac{dI_{rut}}{I_{rut}}\right] \tag{17}$$

Table 11 reports the simulated impact of immigration on the log skilled-unskilled wage

differential for natives. The actual immigration flow increases the return to skill for natives, since their impact is higher (0.005) with respect to the corresponding lower level as observed in the data (.003). The biggest increase in the return to skill is brought about by the "low-skilled scenario" whose associated change in the log skilled-unskilled wage differential is of the order of 0.009, whereas the "high-skilled scenario" brings about a reduction in the return to skill for natives (-0.004).

8 Conclusions

This study contributes to the existing literature on the impact of immigration on the labour market of the host country by adopting a structural approach and extending the model as developed by Card (2001) in order to allow for imperfect substitution between immigrants and natives with similar skill-area. I estimate the labour market impact of immigration to Italy defining first the local labour market in terms of regions. Immigrants and natives within the same skill-region cell are allowed to be imperfect substitutes and their elasticity of substitution is estimated through the data. My findings provide evidence that natives and immigrants within the same skill-region cell are less than perfect substitutes with an estimated inverse elasticity of substitution of 0.06. These results are in line with most previous findings for other countries (Card, 2009; D'Amuri et al., 2010; Ottaviano and Peri, 2008, 2011). Strong complementarity has been found between high- and low-skilled workers and the estimate of its elasticity is around 2, a lower value with respect to a range of 5-10 reported by Card (2001) using US census data. These results, despite being based on a local definition of labour market, are consistent with other time-series estimates which explicitly account for the offsetting role of other inputs in detecting the real impact of immigration on the wage structure. Moreover the estimates turn out to be robust to different definitions of the local labour market, confirming that the potential outflow of natives or capital's movement play a minor role in offsetting the actual impact of immigration.

The simulation obtained by using the estimated parameters suggests that the group suffering most from immigration are immigrants themselves, particularly low-skilled immigrants, who experiment a reduction in their wages equal to (1%) as a consequence of the actual rise in immigration occurring over the period of my analysis (1995-2004), whereas no impact has been detected on natives. On the other hand I confirm previous findings (Venturini and Villosio, 2004) that immigrants do not displace natives, since natives' employment results to be unaffected by the immigration flow and these results are in line with the estimated low but detectable degree of imperfect substitution between the two groups, which is too low in order to enhance employment for natives. In addition my simulation shows that inflow of immigrants which occurred over the period 1995-2004 in Italy increased the return to skill for natives.

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Table 1: Descriptive statistics.

	Total		Immigrants		Natives	
Variable	**Mean**	**Sd**	**Mean**	**Sd**	**Mean**	**Sd**
Daily wage	56.74	22.84	48.32	17.92	57.44	23.07
Female	0.33	0.47	0.23	0.42	0.33	0.47
Age	36.95	10.21	34.39	8.16	37.16	10.33
Blue collar	0.62	0.49	0.84	0.37	0.60	0.49
North West	0.34	0.47	0.34	0.47	0.34	0.47
North East	0.25	0.43	0.34	0.48	0.24	0.43
Center	0.19	0.39	0.19	0.39	0.19	0.39
South	0.16	0.36	0.09	0.29	0.16	0.37
Islands	0.07	0.25	0.03	0.17	0.07	0.26
Asia	0.12	0.32	0.12	0.32		
Africa	0.34	0.47	0.34	0.47		
North America	0.03	0.16	0.03	0.16		
South America	0.06	0.24	0.06	0.24		
Wester EU	0.19	0.39	0.19	0.39		
Easter EU	0.26	0.44	0.26	0.44		
Oceania	0.01	0.09	0.01	0.09		
Industry	0.49	0.50	0.45	0.50	0.50	0.50
PA	0.05	0.23	0.02	0.14	0.06	0.23
Artisans	0.12	0.32	0.21	0.41	0.11	0.31
Insurance	0.04	0.20	0.01	0.09	0.04	0.20
Commerce	0.29	0.45	0.31	0.46	0.29	0.45

Source: INPS (1995-2004)

Table 2: Immigrants.

	1995	**2004**
	4.61%	11.40%
Low skilled cell		
	5.70%	16.46%
Cell size	3271.25	3358.75
High skilled cell		
	2.93%	3.52%
Cell size	2123.5	2143.95

Source: INPS (1995-2004)

Table 3: Average wage by cell.

	1995	**2004**
Low skilled cell		
Immigrants	45.50	45.44
Natives	49.94	51.37
High skilled cell		
Immigrants	62.83	66.42
Natives	65.54	69.54

Source: INPS (1995-2004)

Table 4: Inverse elasticity of substitution between natives and immigrants.

	OLS Region	OLS Region	IV Region	IV Region	OLS Macro-area	OLS Macro-area	IV Macro-area	IV Macro-area
$-1/\delta$	-0.0569***	-0.0502**	-0.0718**	-0.0690**	-0.0649**	-0.0565**	-0.0595**	-0.0568***
	(0.014)	(0.018)	(0.030)	(0.021)	(0.019)	(0.021)	(0.025)	(0.014)
First stage			0.597**	0.636**			0.920**	0.930**
			(0.168)	(0.230)			(0.207)	(0.235)
Kleibergen-Paap rk Wald F statistic			12.56	7.646			19.67	15.64
Time*area		Yes		Yes		Yes		Yes
N	400	400	400	400	100	100	100	100

Note: additional regressors: time, area, and skill fixed effects.
Regressions weighted by the number of observations by cell.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 5: Inverse elasticity of substitution between high and low-skilled.

	OLS Region	IV Region	OLS Macro-area	IV Macro-area
$-1/\sigma$	-0.427***	-0.646***	-0.517***	-0.632***
	(0.062)	(0.097)	(0.105)	(0.088)
First stage		0.385***		0.412**
		(0.094)		(0.104)
Kleibergen-Paap rk Wald F statistic		16.79		15.71
N	400	400	100	100

Note: additional regressors: time, area, and skill fixed effects.
Regressions weighted by the number of observations by cell.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 6: Impact of immigration on natives' employment. Regions.

	OLS	OLS	OLS	IV	IV	IV
β	-0.00338	0.00408	-0.00453	0.0110	0.0475	0.0109
	(0.029)	(0.026)	(0.029)	(0.069)	(0.058)	(0.070)
First Stage				0.381***	0.505***	0.379***
				(0.056)	(0.050)	(0.057)
Kleibergen-Paap rk Wald F statistic				46.13	101.4	44.94
Time*area		Yes			Yes	
Mortality rate			Yes			Yes
Mortality rate*skill			Yes			Yes
N	400	400	400	400	400	400

Note: additional regressors: time, area, and skill fixed effects.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 7: Impact of immigration on natives' employment. Macro areas.

	OLS	OLS	OLS	IV	IV	IV
β	-0.00828	-0.0365	-0.00137	-0.00648	0.0211	0.00668
	(0.046)	(0.037)	(0.050)	(0.125)	(0.032)	(0.129)
First Stage				0.870***	0.921**	0.847**
				(0.180)	(0.215)	(0.185)
Kleibergen-Paap rk						
Wald F statistic				23.28	18.40	20.92
Time*area		Yes			Yes	
Mortality rate			Yes			Yes
Mortality rate*skill			Yes			Yes
N	100	100	100	100	100	100

Note: additional regressors: time, area, and skill fixed effects.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 8: Inverse elasticity of substitution between natives and immigrants. Non movers.

	OLS Region	OLS Region	IV Region	IV Region	OLS Macro-area	OLS Macro-area	IV Macro-area	IV Macro-area
$-1/\delta$	-0.0679***	-0.0644**	-0.0583**	-0.0614**	-0.0816**	-0.0750**	-0.0672**	-0.0643***
	(0.016)	(0.022)	(0.027)	(0.019)	(0.024)	(0.028)	(0.028)	(0.018)
First Stage			0.662***	0.709**			0.946***	0.949**
			(0.168)	(0.237)			(0.178)	(0.207)
Kleibergen-Paap rk Wald F statistic			15.53	8.968			28.29	21.06
Time*area		Yes		Yes		Yes		Yes
N	393	393	393	393	100	100	100	100

Note: additional regressors: time, area, and skill fixed effects.
Regressions weighted by the number of observations by cell.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 9: Inverse elasticity of substitution between high and low-skilled. Non movers.

	OLS Region	IV Region	OLS Macro-area	IV Macro-area
$-1/\sigma$	-0.408***	-0.646***	-0.503**	-0.621***
	(0.069)	(0.100)	(0.106)	(0.086)
First stage		0.390***		0.436**
		(0.098)		(0.113)
Kleibergen-Paap rk Wald F statistic		15.87		15.00
N	393	393	100	100

Note: additional regressors: time, area, and skill fixed effects.
Regressions weighted by the number of observations by cell.
Standard errors in parenthesis clustered by area-skill, significance: (*) if p<.1, (**) if p<.05, (***) if p<.01.

Table 10: Simulations of impact of immigration on the wage change by skill and immigration status.

	Actual flow	Skill neutral 10% rise	Low skilled 20% rise	High skilled 20% rise
$d\ln w^I_{Lt}$	-0.011	-0.009	-0.018	0.000
$d\ln w^N_{Lt}$	-0.003	-0.002	-0.006	0.000
$d\ln w^I_{Ht}$	-0.000	-0.006	0.003	-0.015
$d\ln w^N_{Ht}$	0.001	0.000	0.003	-0.003

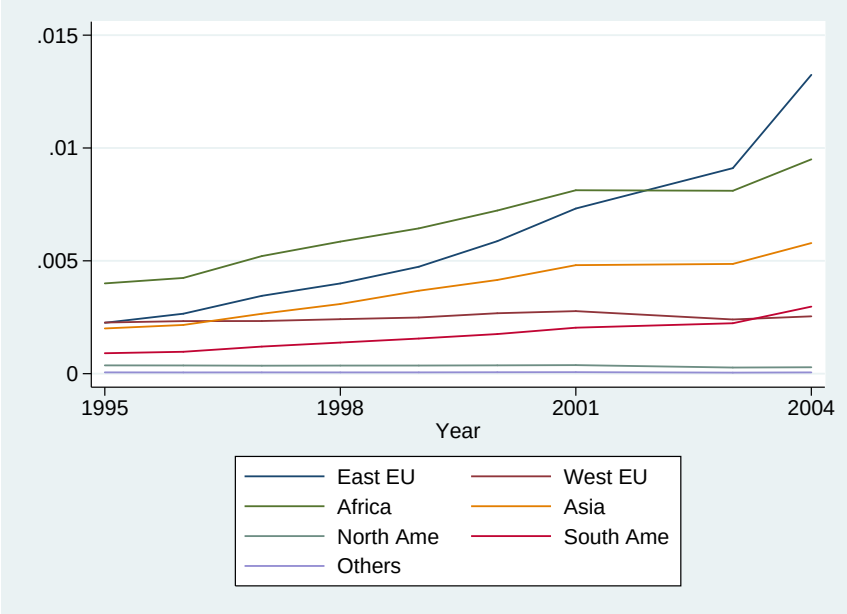
Note: simulations based on actual wage bill shares.
Parameters setting: $1/\delta$=0.06, $1/\sigma$=0.6.

Table 11: Simulations of impact of immigration on the (log) skilled-unskilled wage differential for natives.

Actual flow	Skill neutral 10% rise	Low skilled 20% rise	High skilled 20% rise
0.005	0.003	0.009	-0.004

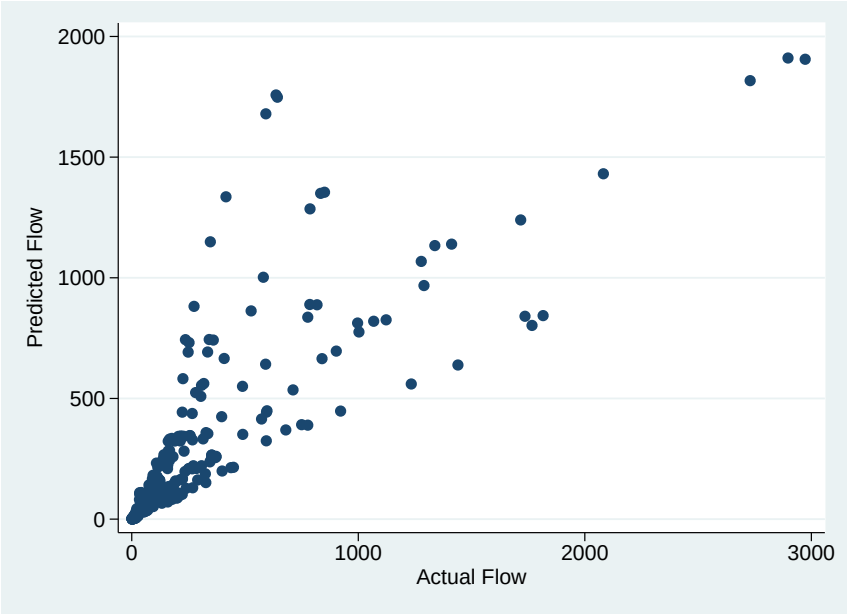
Note: simulations based on actual wage bill shares.
Parameters setting: $1/\delta$=0.06, $1/\sigma$=0.6.

Figure 1: Immigrants (share of total resident population) by country.



Note: author's calculation from registry data.

Figure 2: Predicted (IV) and actual flow of immigrants.



Source: INPS (1995-2004).

Figure 3: Simulation. Impact of actual flow of immigration on real daily wages.

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N° 2/00	Pier Marco Ferraresi Elsa Fornero	Social Security Transition in Italy: Costs, Distorsions and (some) Possible Correction
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