Complementarities between native and immigrant workers in Italy by sector.

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(Draft version: June 2018)

Abstract

This paper investigates the existence of complementarities between immigrant and native workers across sectors in Italy during the period 2011-2016. The analysis is based on a production function framework where the aggregate labor is the result of a nested-CES which, in turn, it allows us to estimate the elasticity of substitution between immigrants and native workers with same education-experience level by sector. The main contribution of the paper is to provide an estimate of the substitutability between natives and immigrants of similar education and experience level by sector. The aggregate estimate is equal to 20, thus in line with the aggregate value estimated for US by Ottaviano and Peri (2012) using a similar approach. Interestingly, once the estimates are carried out at sectoral level the main results suggest the existence of strong differences across the 12 sectors considered in our analysis. Nine sectors show imperfect substitutability between native and immigrant workers: Manufacturing, mining and quarrying, Electricity, Gas and water supply; Wholesale and retail trade; Hotel and Restaurants; Transportation and storage, Financial services and insurance; Real estate, administrative and support service activities; Public Administration; Education, human health and social work activities; Other community, social and personal services activities. These results are important because they imply that an increase in the foreign labor supply is likely to have different impact on wages depending on the distribution of immigrant workers across sectors.

***Keywords**: immigration, labor supply, skill groups, sectors, elasticity of substitution.*
***JEL**: E24, F22, J61, J31*

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1. Introduction

The effects of immigration on labor markets outcomes of native workers (essentially wages and employment) have been a hotly debated topic during the last decades (see the recent paper of Dustmann et al. 2016). From the theoretical point of view, the traditional way in which economists use to investigate these issues is the so called "canonical model" (Peri, 2016) in which immigrants are perfectly homogeneous with respect to natives and increased migration flows are considered as a change in total labor supply. Such an approach, on the one hand is theoretical very binding and, on the other hand, has found little support in the empirical investigations.

More recently, building on the labor market theories advanced, among others, by Katz and Murphy (1992) and Card and Lemieux (2001) to introduce imperfect substitutability between worker groups, the literature on migration has proposed new and more general theoretical frameworks. In particular, imperfect substitutability between native and foreign workers has become the standard way to analyze the role of immigrants in the labor market. The works of Ottaviano and Peri (2012) and Manacorda et al. (2012) are two recent examples of this new theoretical approach. In both studies perfect substitutability between natives and immigrants is not aprioristically assumed, not even when they hold the same educational/skill and experience levels. As it is well known, crucial in this new strand of research is the estimate of the elasticity of substitution between natives and immigrants.

From this viewpoint it is worth pointing out that, while the migration literature has already embraced the aggregate perspective suggested by the new labor market theories, the same has not yet happened at a more disaggregated industry/sector level. This paper aims at contributing to this field of research by applying the theory developed by Ottaviano and Peri (2012) to the approach suggested by Blankenau and Cassou (2011) in their industry/sector level analysis of the labor market dynamics and wage determination mechanisms. In particular, our investigation deals with the reaction of one type of worker within an industry in front of an increase of other types within the same industry. In doing that, we estimate the elasticity of substitution taking into account workers' education and experience.

2. Literature review

As briefly discussed in the Introduction, the investigation proposed by this paper brings together two fields of research. The first regards the macroeconomic analysis of labor market dynamics and the mechanisms of wage determination under the assumption of imperfect substitutability between workers. A branch of this field turns its attention to the industry level perspective, which, however, has received little attention until now. The second field of studies concerns researches on the effects of immigration on the labor market outcomes for natives and immigrant workers. In this section, we synthesize the main theoretical and empirical results already found in the literatures.

At the beginning of the nineties, the traditional neoclassical labor market approach has been extended assuming worker heterogeneity. In particular, given the pronounced upward trend of the share of the skilled population and of the wage premium for skilled workers, the focus has shifted to differences among workers in terms of experience and education/skill levels in order to analyze if supply changes of one category of worker affects wages of other categories. Welch (1979), Katz and Murphy (1992) and Card and Lemieux (2001) are notable examples in this new field of investigation. Katz and Murphy (1992) consider a simple structure with the two categories of young and old, while Card and Lemieux (2001) and Welch (1979) use a symmetric CES structure with several age categories. As for the substitutability across alternative experience categories, Katz and Murphy (1992) estimate an elasticity of substitution between young and old around 3.3, while elasticities between 5 and 10 are found in the works of Welch (1979) and Card and Lemieux (2001). As for the substitutability across

alternative education groups, estimates range between 1.1 and 1.6 (Cf. Katz and Murphy, 1992; Card and Lemieux, 2001).

In developing their empirical analysis, many of these works share the same theoretical framework (they derive relationships implied by profit maximizing behavior) and the aggregate perspective. An interesting extension of this literature has applied the aggregate approach at industry/sector level. Besides the aforementioned trends in the aggregate economy, the main challenge faced by the industry/sector modelling of labor substitutability is to accommodate sectoral output trends (Kongsamut at al. 2001; Ngai and Pissarides 2007; Blankenau and Cassou 2009). Building on this literature, Blankenau and Cassou (2011) focus on the issue of estimating the elasticity of substitution between skilled and unskilled workers at industry/sector level. They assume that each industry/sector, made by many identical firms, combine capital, skilled labor and unskilled labor along a labor augmenting Cobb-Douglas production function, but parameters may differ by industry and can change over time. Skilled and unskilled workers are aggregated through a constant elasticity of substitution function.

Following the new labor market theories based on the assumption of imperfect substitutability across workers, for the literature on migration it has been natural to introduce imperfect substitutability between foreign and native workers (Borjas 2003, Borjas and Katz 2007, Card 2007, Raphael and Smolensky 2008, D'Amuri et al. 2010, Borjas et al. 2008, Ottaviano and Peri 2012, Manacorda et al. 2012). In some of these papers, such as Borjas (2003), Borjas and Katz (2007), immigrants and natives belonging to the same educational and/or experience level are considered homogeneous inputs. Conversely, other papers such as Ottaviano-Peri 2012 and Manacorda et al. (2012) allow heterogeneity within groups and, consequently estimate the elasticity of substitution between immigrants and natives within the same education and experience groups. The two works of Ottaviano and Peri (2012) and Manacorda et al. (2012) propose a very similar approach: they match the labor markets literature with the migration literature represented by the work of Borjas (2003). One difference is that Ottaviano and Peri (2012) adopt a more flexible nested-CES production function that allows them to compare different nesting models already present in the literature.

As for the empirical evidence, while the general overview delivered by this literature goes in favor of imperfect substitutability between immigrant and native workers, the work of Ottaviano and Peri (2012) adds to the general picture several interesting insights. Using a nested-CES framework, the two authors estimate the elasticity of substitution between natives and immigrants within education and experience groups, also allowing this elasticity to vary across education groups, Moreover, to compare their results with those of the previous literature, they also reconsider the substitutability between workers of different schooling and experience level. In line with other literature (Cf., inter al. Card, 2007), Ottaviano and Peri (2012) estimate an elasticity of substitution between native and immigrant workers of about 20.

3. Theoretical framework

We adopt a structural approach similar to Ottaviano and Peri (2012), duly modified in order to account for sectoral differences. Our theoretical framework can also be viewed as an extension of the model estimated by Blankenau and Cassou (2011), with labor additionally disaggregated by experience and nationality. Accordingly, we assume that the production function of the representative firm in sector *s* at time *t* is the following Cobb-Douglas with constant returns to scale:

(1) $$Y_{t,s} = A_{t,s} L_{t,s}^{\alpha} K_{t,s}^{1-\alpha}$$

where, *Y* is the aggregate output level in sector *s* and year *t*, *A* is total factor productivity (TFP), *K* is physical capital and *L* is a constant elasticity of substitution (CES) type labor aggregate which allows us to model different types of workers heterogeneities. The parameter $0 < \alpha < 1$ measures the labor income share. We define three workers' characteristics according to their education level, years of experience and nationality. The first level of the nested CES is assumed to be the education level, which is grouped into three classes as follows:

$$(2) \qquad L_{t,s} = \left[\sum_{j=1}^{3} \theta_{j,s} L_{j,s,t}^{\frac{\sigma_{ED}-1}{\sigma_{ED}}}\right]^{\frac{\sigma_{ED}}{\sigma_{ED}-1}}$$

where *j* indicates three levels of education, namely 1=*high*, 2=*medium* and 3=*low*. Workers holding at least a university degree are included in the group *high*. The group with a *medium* education level corresponds to workers holding a high school diploma (but not a university degree) and workers with at most the compulsory years of schooling are considered as holding a low education level (i.e. *low*). The parameter $\theta_{j,s}$ measures the productivity levels specific to each of the three types of workers, it is standardized so that $\theta_H + \theta_M + \theta_L = 1$ and it is assumed to be constant over time. The parameter σ_{ED} measures the elasticity of substitution between workers with different education levels.
Workers with the same education level are assumed to be not homogenous with respect to the work experience. In other words, we assume that a low skilled worker with some work experience (measured in terms of number of years since the first job) is not perfectly substitutable with a worker without experience. Accordingly, the second CES level is:

$$(3) \qquad L_{E,t,s} = \left[\sum_{m=1}^{4} \theta_{j,m,s} L_{j,m,s,t}^{\frac{\sigma_{EX}-1}{\sigma_{EX}}}\right]^{\frac{\sigma_{EX}}{\sigma_{EX}-1}}$$

where *m* indicates four classes of work experience, with each class increasing by ten years so that *m* = 1 if workers have between zero and 10 years of experience, *m* = 2 for 11-20 years of experience, *m* = 3 for 21-30 years of experience, *m* = 4 for 31-40 years of experience, *m* = 5 if workers have more than 40 years of experience. The parameters $\theta_{j,m,s}$ are education-experience specific productivity levels $\left(\sum_{m=1}^{4} \theta_{j,m,s} = 1 \ for\ each\ j\right)$ assumed to be constant over time. The parameter σ_{EX} measures the elasticity of substitution between workers with the same education level *j* but pertaining to different experience groups. We next assume that each education-experience specific labor group is a CES combination of native (N) and immigrant (I) workers, as follows:

$$(4) \qquad L_{EX,t,s} = \left[\theta_{N,j,m,s} L_{N,j,m,s,t}^{\frac{\sigma_{IM}-1}{\sigma_{IM}}} + \theta_{I,j,m,s} L_{I,j,m,s,t}^{\frac{\sigma_{IM}-1}{\sigma_{IM}}}\right]^{\frac{\sigma_{IM}}{\sigma_{IM}-1}}$$

where σ_{IM} is the elasticity of substitution between native and immigrant workers with the same education level *j*, the same experience *m* and working in the same sector *s*. The parameters $\theta_{N,j,m,s}$ and $\theta_{I,j,m,s}$ measure the specific productivity level of native and immigrant workers, respectively and are normalized such that $\theta_{N,j,m,s} + \theta_{I,j,m,s} = 1$.

3.1 Estimating the elasticity of substitution between native and immigrant workers

In a competitive equilibrium profit maximizing firms use the amount of labor which equalize the value of marginal productivity to the wage. Accordingly, we compute the marginal product of a native worker for the specific education-experience group from equation (1), then take the natural logarithm in order to obtain their wage.

(5) $$ln\left(w^{N}_{j,m,s,t}\right) = ln(\alpha A k^{1-\alpha}) + \frac{1}{\sigma_{ED}} lnL_{t,s} + lnL\theta_{ED,s} - \left(\frac{1}{\sigma_{ED}} - \frac{1}{\sigma_{EX}}\right) lnL_{ED,t,s} + lnL\theta_{EX,s} - \left(\frac{1}{\sigma_{EX}} + \frac{1}{\sigma_{IM}}\right) lnL_{EX,t,s} + ln\theta_{N,j,m,s} - \frac{1}{\sigma_{IM}} lnL_{N,j,m,s,t}$$

Similarly, for immigrant workers we obtain:

(6) $$ln\left(w^{I}_{j,m,s,t}\right) = ln(\alpha A k^{1-\alpha}) + \frac{1}{\sigma_{ED}} lnL_{t,s} + lnL\theta_{ED,s} - \left(\frac{1}{\sigma_{ED}} - \frac{1}{\sigma_{EX}}\right) lnL_{ED,t,s} + lnL\theta_{EX,s} - \left(\frac{1}{\sigma_{EX}} + \frac{1}{\sigma_{IM}}\right) lnL_{EX,t,s} + ln\theta_{I,j,m,s} - \frac{1}{\sigma_{IM}} lnL_{I,j,m,s,t}$$

Subtracting equation (6) from equation (5) brings to the following equation:

(7) $$ln\left(\frac{w^{I}_{j,m,s,t}}{w^{N}_{j,m,s,t}}\right) = ln\left(\frac{\theta_{I,j,m,s}}{\theta_{N,j,m,s}}\right) - \frac{1}{\sigma_{IM}} ln\left(\frac{L_{I,j,m,s,t}}{L_{N,j,m,s,t}}\right)$$

Therefore, we can estimate σ_{IMM} from the following regression model:

(8) $$ln\left(\frac{w^{I}_{j,m,s,t}}{w^{N}_{j,m,s,t}}\right) = \mu_{j,m,s} - \frac{1}{\sigma_{IM}} ln\left(\frac{L_{I,j,m,s,t}}{L_{N,j,m,s,t}}\right) + \varepsilon_{j,m,s}$$

where $\mu_{j,m,s}$ captures the productivity changes across all worker types by means of 144 education-experience by sector fixed effects and $\varepsilon_{j,m,s}$ is the error term. Equation (8) is the main equation of the paper in that it allows us to estimate σ_{IM} at sectoral level by interacting $ln\left(\frac{L_{I,j,m,s,t}}{L_{N,j,m,s,t}}\right)$ with the sector dummies.

4. Data and variable construction

The analysis is based on information on the wages and employment of natives and immigrants (defined hereafter as individuals born abroad) contained in the Italian Labor Force Survey (LFS) and covering the period from 2011 to 2016. The time period is constrained by the availability of data on wages, which are available since 2008 only. Another limitation of the data regards the classification of the economic activity which is based on NACE rev.1 until 2010 and on NACE rev.2 from 2011 onward. The latter limitation affects the time span of our analysis because the aggregation of economic activities between the two NACE classification is quite different. We measure the labor supply of native and immigrant workers in each sector and for each education-experience group in terms of total hours worked in a year. The variable has been computed using the variable ORELAV, which measures the hours worked in a week, and multiplying it by 13 (i.e. the average number of weeks in a quarter) and by the personal weight (COEF) to obtain the total number of hours worked in each quarter by each worker. Then we computed the sum by sector and education-experience group to obtain the total number of hours worked in year *t*. Immigrants are defined according to the country of birth. We had to make the following adjustments to the original dataset in order to create a dataset ready for the analysis. We have kept only the employed people older than 15 years of age and we have dropped the self-employed workers. Education groups have been constructed as explained in section 2. With regards to experience, we have used the information on the first job together with that on the year when the worker first entered the labor market (when available) and completed the missing data by computing the potential experience as in both Borjas (2003) and Ottaviano and Peri (2012). We dropped workers with more than 45 years of experience and then grouped them in four experience classes as explained in Section 2. Wages are expressed in terms of hourly wages and have been

computed using the data on monthly gross wage to compute the total income in a year and then divided it by total hours worked. What we get is the average hourly wage of native and immigrant workers in each education-experience group by sector and year. Our final sample comprises 12 sectors, three education groups, four experience classes and six years (864 observations). Table 1 and Tables report some descriptive statistics regarding employment shares by sector, education and nationality. The first column of Table 1 reports the (percentage) distribution of total employees in 2016. The largest sector is the so called "Industry in a strict sense" (i.e. Manufacturing, mining and quarrying, Electricity, Gas and water supply) which absorbs the 23.3% of total employment, followed by Education, human health and social work activities (16.7%) and Wholesale and retail trade (11.7%). These three sector all together sum up to more than the 51% of total employees. The second column shows the percentage of immigrant workers employed in each sector. More than half of total employees in the sector Other community, social and personal services activities are immigrant workers (51.7%)[1]. Other sectors where the percentage of immigrant workers is noticeable are Agriculture, forestry and fishing (35.4%), Hotel & Restaurants (27.4%) and Construction (25%). The third column shows the (percentage) distribution of immigrant workers across sectors. The large majority of immigrant workers (57.7%) cluster in three sectors, namely Other community, social and personal services activities (25.6%), Manufacturing, mining and quarrying, Electricity, Gas and water supply (21.6%) and Hotel & Restaurants (10%).

Table 1. Employment by sector and share of immigrant workers (year: 2016)

Sector	***Share***	***Immig.***	***Immig. rel***
Agriculture, forestry and fishing	2.7%	35.4%	5.9%
Manufacturing, mining and quarrying, Electricity, Gas and water supply	23.3%	14.7%	21.6%
Construction	4.9%	25.0%	7.7%
Wholesale and retail trade	11.7%	9.5%	7.0%
Hotel and Restaurants	5.8%	27.4%	10.0%
Transportation and storage	5.5%	14.4%	5.0%
Information and communication	2.6%	5.1%	0.8%
Financial services and insurance	3.1%	2.8%	0.5%
Real estate, administrative and support service activities	8.6%	14.3%	7.7%
Public Administration	7.2%	2.3%	1.0%
Education, human health and social work activities	16.7%	6.9%	7.2%
Other community, social and personal services activities	7.9%	51.7%	25.6%
	100.0%		100.0%

Source: own computation based on Istat labor force survey data (LFS)

Table 2 describe the educational attainment characteristics of workers by sector and nationality. The first column shows the composition of each sector with respect to the percentage of high skill workers. It clearly emerges the well known concentration of high skill workers in the service sectors such as Financial services and insurance (49.5%), Education, human health and social work activities (48.6%) and Information and communication (44.2%). On the contrary large percentage of medium and low skilled workers characterize Agriculture, forestry and fishing (3.6% of high skilled workers), Construction (5.5% of high skilled workers) and Hotel & Restaurant (7.3% of high skilled workers). The second and the third columns show the distribution of high skilled workers across sectors by nationality. A comparison between high skilled Italians and immigrants high skilled shares by sector indicate that high skilled immigrant shares are higher in Manufacturing, mining and quarrying, electricity, gas and water supply, Hotel & Restaurants, Transport and storage and Other community, social and personal services activities. The last two columns show the composition of high skilled workers (fourth column) and medium-low skilled workers (fifth column) in each sector with respect

[1] This sector comprises the housekeeping and elderly care services.

to nationality of workers. Overall the ratios for high skilled workers are always higher than 1 and the size reflects the shares of immigrant workers showed in Table 1 (second column). The picture is similar for the medium-low skilled workers but for the sector Other community, social and personal services activities (0.9) where immigrant workers with medium-low skill education level are more than native workers. Moreover, comparing the ratio between the two brad skill groups it emerges that the distance between the size of native and immigrant workers is shorter for lower education level groups.

Table 2. Shares of employees by education and nationality (year: 2016)

Sector	*High skilled*	*High skilled Italians*	*High skilled Immig.*	*High-Skilled Ita/Imm*	*ML skilled Ita/Imm*
Agriculture, forestry and fishing	3.6%	0.4%	1.1%	3.4	1.8
Manufacturing, mining and quarrying, Electricity, Gas and water supply	13.0%	13.6%	15.4%	9.1	5.5
Construction	5.5%	1.1%	2.3%	4.9	2.9
Wholesale and retail trade	12.2%	6.5%	6.5%	10.3	9.4
Hotel and Restaurants	7.3%	1.4%	7.1%	2.1	2.7
Transportation and storage	11.2%	2.8%	3.3%	8.7	5.7
Information and communication	44.2%	5.4%	3.0%	18.7	18.3
Financial services and insurance	49.5%	7.4%	1.9%	39.6	31.0
Real estate, administrative and support service activities	22.7%	8.9%	8.2%	11.1	5.2
Public Administration	31.6%	11.2%	2.2%	52.6	40.0
Education, human health and social work activities	48.6%	38.0%	23.9%	16.4	11.6
Other community, social and personal services activities	14.9%	3.4%	25.1%	1.4	0.9
		100%	100%		

Source: own computation based on Istat labor force survey data (LFS)

Overall, from the Table 1 and Table2 it emerges a high degree of heterogeneity across sectors, both between and within native and immigrant workers with respect to the distribution across sector and with respect the skill level. This heterogeneity is likely to affect the substitutability degree between native and immigrant workers which might differ noticeably across sectors.

5. Results of the estimates for σ_{IM}

We start by showing the results for the estimates of σ_{IM} at aggregate level, that is without sectors. In this way we can use all the available years since the data on wages are available, thus from 2008 to 2016. We estimate equation (8) in three different specifications which differ from each other in the way the fixed effects are modelled. For the overall period the inverse of σ_{IM} ranges between -0.047 and -0.067, these values are in line with the value estimated by Ottaviano and Peri (2012) which is around -0.05 (Table 3). After restricting the sample period to 2011-2016 the estimates cluster around -0.07. We then estimate the elasticity of substitution between immigrant and native workers for each of the 12 sectors by interacting the relative labor supply of immigrant workers with the sector dummies and then testing the statistical significance of the linear combination between the coefficient of the interaction term and the labor supply variable.

Table 3. Estimate of the coefficient – ($1/\sigma_{IM}$), aggregate sample (no sectors).

	2011-2016			*2008-2016*		
	I	II	III	I	II	III

$1/\sigma_{IM}$	-0.071	***	-0.073	***	-0.069	***	-0.063	***	-0.047	***	-0.067	***
se	(0.011)		(0.020)		(0.015)		(0.010)		(0.015)		(0.014)	
Year effects	*yes*		*yes*		*yes*		*yes*		*yes*		*yes*	
Education effects	*yes*						*yes*					
Experience effects	*yes*						*yes*					
Education by experience effects			*yes*						*yes*			
Year by education effects					*yes*						*yes*	
Year by experience effects					*yes*						*yes*	
Adjusted R-squared	0.96		0.97		0.96		0.95		0.96		0.93	
Observations	108		108		108		72		72		72	

*Note: The dependent variable is the logarithm of the relative immigrant-Italians average wage in each education-experience cell. The method is least square, with each observation weighted by its employment. Heteroskedasticity robust standard errors, clustered over 12 education-experience groups are in brackets. Constant term included but not reported. *** significant 1%, ** significant 5%, * significant 10%.*

The first row of Table 4 shows the estimate of $1/\sigma_{IM}$ for the overall sample, whilst the other rows shows the estimates of $1/\sigma_{IM}$ for each sector. Firstly, the elasticity of substitution (i.e. σ_{IM}) is higher than the one estimated without controlling for sector fixed effects. This is not surprising in that it implies that immigrant and native workers with the same education and experience levels are more substitutable with each other if they work in the same sector. Moreover, as it emerges from the outcomes, the estimated coefficients, which corresponds to $1/\sigma_{IM}$, are not statistically different from zero for four sectors, namely Agriculture, forestry and fishing, Constructions, Information and communication, Financial services and insurance. The results for these sectors imply perfect substitutability between immigrant and native workers in the same education-experience cell. It is worth noting that Agricultures and Constructions are characterized by shares of immigrant workers which are relatively high compared to the other sectors (see Table 1, second column). On the contrary, the shares of immigrant workers are among the lowest the other two sectors, namely Information and communication and Financial services and insurance. The remaining nine sectors show imperfect substitutability between native and immigrant workers: Manufacturing, mining and quarrying, Electricity, Gas and water supply ($1/\sigma_{IM}$= -0.030); Wholesale and retail trade ($1/\sigma_{IM}$= -0.103); Hotel and Restaurants ($1/\sigma_{IM}$= -0.089); Transportation and storage ($1/\sigma_{IM}$= -0.040); Real estate, administrative and support service activities ($1/\sigma_{IM}$= -0.041); Public Administration ($1/\sigma_{IM}$= -0.090); Education, human health and social work activities ($1/\sigma_{IM}$= -0.039); Other community, social and personal services activities ($1/\sigma_{IM}$= -0.043). Overall the sectors show a value which ranges between to 0.03 (Manufacturing, mining and quarrying, Electricity, Gas and water supply) and . 0.103 (Wholesale and retail trade). In terms of elasticity the range is between 33.3 and 9.7, which shows a noticeable sectoral heterogeneity. These sectors all together represent more than the 86% of total employment.

Table 4. Estimate of the coefficient – ($1/\sigma_{IM}$) by sector.

Sector	***$1/\sigma_{IM}$***	
Overall	-0.038	***
	(0.011)	
Agriculture, forestry and fishing	0.014	
	(0.024)	
Manufacturing, mining and quarrying, Electricity, Gas and water supply	-0.030	**
	(0.015)	
Construction	-0.014	
	(0.016)	
Wholesale and retail trade	-0.103	***
	(0.022)	
Hotel and Restaurants	-0.089	***
	(0.020)	
Transportation and storage	-0.040	**
	(0.019)	
Information and communication	0.028	
	0.0308	
Financial services and insurance	-0.034	
	(0.059)	
Real estate, administrative and support service activities	-0.041	***
	(0.015)	
Public Administration	-0.090	***
	(0.031)	
Education, human health and social work activities	-0.039	**
	(0.018)	
Other community, social and personal services activities	-0.043	**
	(0.019)	
Adjusted R-squared	0.46	
Observations	864	

*Note: The dependent variable is the logarithm of the relative immigrant-Italians average wage in each education-experience cell. The method is least square, with each observation weighted by its employment. Heteroskedasticity robust standard errors, clustered over 144 sector-education-experience groups are in brackets. Constant term included but not reported. *** significant 1%, ** significant 5%, * significant 10%.*

6. Concluding remarks

This paper provides estimates for the elasticity of substitution between native and immigrants workers in Italy at sector level. The results point out to an overall higher elasticity of substitution within the education experience group compared to the aggregate estimate. This implies that immigrant and native workers working in the same sector and sharing the same education-experience are closer substitute than immigrant and native workers in the same education-experience group but working in a different sector. An important outcome which is worth to point out is that imperfect substitutability results for nine out of the twelve sectors, representing altogether more than the 86% of total employment. An important implication of these results is that the effects of increasing foreign labor supply on wages might be heterogenous across sectors as well.

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