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Immigrants, Firms and Productivity: Evidence from Italy

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ABSTRACT

Immigrants, Firms and Productivity: Evidence from Italy

The recent positive immigration trend, that has characterized Europe over the last three decades, has generated an ongoing debate on the role played by immigrants on many aspects of the labour markets. We fill a gap in the literature by offering the first evidence for Italy, on the relationship between immigration from extra EU and labour productivity. We take advantage of a rich and unique firm level data from the *Rilevazione Imprese e Lavoro* (RIL) conducted by Inapp in 2007, 2010 and 2015 on a representative sample of Italian firms. We start by employing standard OLS pooled regression accounting for workforce and firm characteristics and finally, we deal with endogenity issues by estimating instrumental variable regressions. Our results are consistent across all specifications and reveal the presence of a negative and causal relationship between the share of immigrants and labour productivity. However, results needs to be considered in light of some important remarks. The Italian economy is first characterized by the presence of mainly low skilled immigration and second, by a stagnant and below the EU average, level of productivity since the beginning of the early 2000s. Furthermore, some robustness analysis reveals that results are mainly driven by small-medium firms operating in the manufacturing sector.

KEYWORDS: labour productivity, share of immigrants, firm-level analysis

JEL CODES: E23, F22, D22, D24

1. Introduction

International migration is a global phenomenon and there is an ongoing and lively debate on the effects of immigration for the receiving countries. On January the 24th 2019, the leaders of Germany, France, Italy and several other European Union nations, met in Brussels for an informal talk on differences over migration policy. Indeed, over the last three decades, migration flows have been rising and are unlikely to fall from their current levels, given the large demographic and economic imbalances (OECD 2018). Considering 14 countries, the percentage of foreign born increased by more than 4 percentage points: from less than 8% of the population in 1996 to more than 12% in 2007 (D'Amuri and Peri 2014). Moreover, in most southern European countries, the United Kingdom, the United States, and several Nordic countries, immigrants contributed to more than 40% of net job creation. In 2007, the share of immigrants in employment reached 12% on average in OECD countries (OECD 2009).

A large body of literature has analyzed the labour market effects of immigrants in the US and in other countries with large immigration flows, such as Canada and Australia. Empirical evidence in Europe is available for the UK (Dustmann *et al.* 2008), Germany (Glitz 2012) and Spain (González and Ortega 2013). Immigration has been analyzed in relation with many aspects: cultural environment (Ottaviano and Peri 2006), the crime rate (Moehling and Piehl 2009; Bianchi *et al.* 2012), employment (Ottaviano and Peri 2006; Martins *et al.* 2018; Esposito *et al.* 2019) or the attitudes of natives (Card *et al.* 2012; Mayda 2006). Also, a number of studies has investigated the effects of immigration for the Italian labour market: immigration on innovation of Italian regions (Bratti and Conti 2018), how immigration shapes the natives' voting behavior (Barone *et al*. 2016), the effect of immigration on public health spending (Bettin and Sacchi 2019), the impact on labor market outcomes of regularizing undocumented migrant workers (Di Porto *et al.* 2018). However, as far as we are aware, none of these studies investigated how immigration might influence the Italian firms' performance, such as labour productivity.

Concerning the latter aspect, there is some international evidence and the general consensus is that immigration exerts positive effects on firms' productivity. For instance, Peri (2012) analyzes the relationship between immigration and productivity in the US and finds that immigration had a strong and positive association with total factor productivity and a negative association with the high skill bias of production technologies. As for service-producing firms in the UK, Ottaviano *et al.* (2018) find that immigrants increase overall productivity. Mitaritonna *et al*. (2017), using micro-level data for French manufacturing firms, analyze the impact of an increase in local supply of immigrants on firms' immigrant employment and firm's productivity. They show that a supply-driven increase in foreign born workers in a department (location) increases the productivity of firms in that department at all percentiles of the distribution and that the effect is significantly stronger for firms with initially zero level of foreign employment.

As far we are aware, there is only a couple of studies reveling a negative relationship between immigrants and productivity. A study from Paserman (2013) exploits the episode provided by the mass migration from the former Soviet Union to Israel in the 1990s to study the effect of high skill immigration on productivity, using a unique data set on manufacturing firms. The analysis finds no correlation between immigrant concentration and productivity at the firm level in cross-sectional and pooled regressions, but using first-differences estimates it reveals a negative correlation between the

change in output per worker and the change in the immigrant share. Moreover, the immigrant share turns out to be strongly negatively correlated with productivity in low-tech industries. Likewise, a study of the Federal Reserve, conducted by Quispe-Agnoli and Zavodny (2002) for the U.S. manufacturing sector at the state level, indicates that changes in the labour supply due to immigration appear to lower labour productivity in both the low and high-skilled sectors. The authors attribute this results to the idea that labor productivity increased more slowly in states that attracted a larger share of immigrants during the 1980s. Finally, using firms and individual level data by sector and municipality for Barcelona and Madrid, Nicodemo (2013) demonstrates that immigration has a negative effect on productivity. Education and occupation are both variables with a positive effect on productivity, while permanent, public or full time contracts do not show any effect.

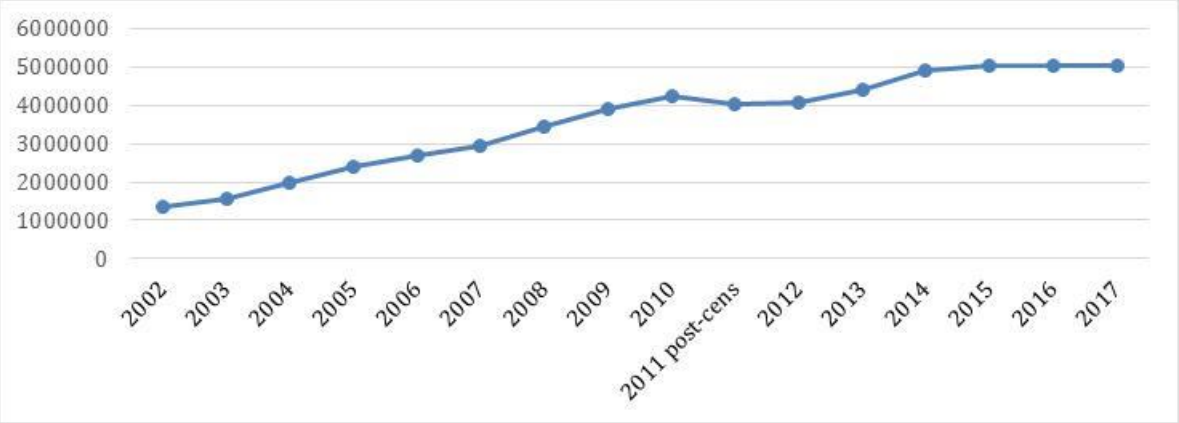
We offer the first contribution that investigates the microeconomic impact of migration on productivity on a representative sample of firms operating in the private sector of a developed country, Italy. We take advantage of a very rich and unique dataset the *Rilevazione Imprese e Lavoro* (RIL) conducted by Inapp in 2007, 2010 and 2015. Italy is a very interesting case of study because it presents some peculiarities. First of all, its economy is characterized by a stagnant productivity since the beginning of the early 2000s (see for instance Dosi *et al.* 2012). As documented by Dosy *et al.* compared to the EU average, the picture is worrisome. Data from Istat reveal that over the period 1995-2015 Italian labour productivity, as documented by Dosi *et al.* 2012, measured in terms of value added per work hour, grew at a rate of 0.3% compared to an EU average of 1.6%. Second, it is mostly characterized by young and low-skilled immigrants (Del Boca and Venturini 2005). Indeed our results need to be considered in light of the just described picture. We find robust evidence of a negative and causal relationship between the share of immigrants employed by a firm and its level of labour productivity. More in detail, we observe that a one percentage increase in the share of immigrants from extra EU translates into an average decline in labour productivity of about 0.5 percentage points, once firm's heterogeneity and endogeneity issues have been taken into account. We also perform some robustness checks and find that results are mainly driven by small-medium firms operating in the manufacturing sector.

The paper is structured as follows. In the next section we offer an overview of the Italian economy related to its migration flows. Section 3 goes on by describing our dataset. Section 4 follows with a discussion of the econometric strategy, the main results and some robustness analysis. Finally, section 5 draws out some preliminary conclusions.

2. The Italian case

Like other European Countries, during the 2000s, Italy was exposed to a very large wave of immigration. According to the Italian National Institute-Istat, the share of legally resident foreign population increased from 2.4% in 2002 to 7.6% in 2010 up to 8.3% in 2015 with the largest growth in Northern and Central Italy and in big cities like Rome and Milan (Bratti and Conti 2018). In absolute terms, data from the Labour Force Survey, reveal that the number of foreign-born people in Italy increased from 1,3 million to 5 million, over the period 2002-2017. Growth was particularly fast after 2001 due to the regularization taking place in 2001-2002, where over 650,000 immigrant workers were involved.

Figure 1. Absolute number of foreign residents in Italy: 2002-2017



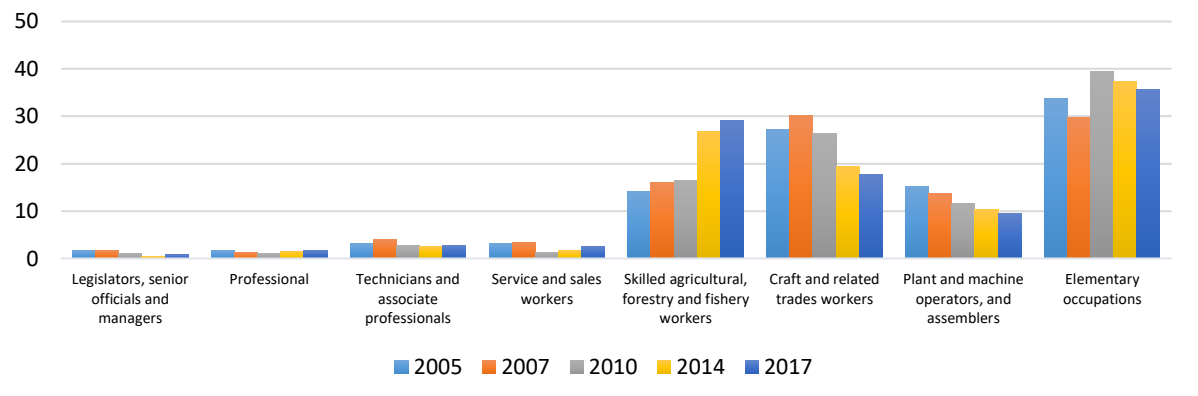
Note: Authors' elaboration based on Istat's "Labour Force Survey" dataset

However, compared with other countries, Italy is mostly characterized by young and low-skilled immigrants (Del Boca and Venturini 2005). As also documented by Bettin and Sacchi (2019), on average, the foreign population is younger with the working–age group being widely over–represented compared to the native population. Furthermore, the country of origin most represented is Eastern Europe, with nearly half of the immigrants coming from Romania and Albania, followed by Maroccans and Chinese immigrants. Focusing on immigrants from extra EU, data from Istat reveals that on the 1st of January 2018 the most representative countries of origin for immigrants from extra EU were Marocco (443.147), Albania (430.340), China (309.110), Ucraina (235.245) and Filippine (161.609).

The lack of attractiveness to highly skilled immigrants can be possibly explained by a productive system mainly characterized by specialization in traditional industries (De Benedictis 2005; Larch, 2005) and it is also due to lower returns to human capital for immigrants than for natives (Bratti and Conti 2018). Using data from Istat for the period 2005, 2007, 2010, 2014 and 2017, figure 2 illustrates the share of employed foreign workers (aged 15-64) from extra EU by ISCO level.

Between 30 and 40% of extra EU foreign born workers turns out to be employed in elementary occupations, while managerial and professional occupations only account for less than 5 percent of the foreign born population.

Figure 2. Share of foreign born workers from extra EU by ISCO level



Note: Authors' elaboration based on Istat's "Labour Force Survey" dataset

In addition, there is some empirical evidence suggesting that foreign born workers are more likely to be overeducated than native Italian and that work experience gained in the country of origin is not valued in the Italian labour market (Dell'Aringa and Pagani 2011).
In the table 1 that follows, we provide some additional evidence by showing the occupational distribution for graduates across native Italians and immigrants (from EU and extra EU).

Table 1. Distribution by occupation for graduates native and immigrants from EU and Extra EU (%)

	2007			**2010**			**2014**		
	Natives	Immigrants Eu	Immigrants Extra Eu	Natives	Immigrants Eu	Immigrants Extra Eu	Natives	Immigrants Eu	Immigrants Extra Eu
Legislators, senior officials and managers	6.55	11.17	2.97	5.28	5.01	3.22	4.53	1.68	1.31
Professional	52.55	24.33	8.44	50.26	27.49	7.92	54.36	30.08	10.53
Technicians and associate professionals	28.72	29.17	15.56	29.68	32.48	10.62	25.68	26.02	11.65
Service and sales workers	7.15	7.01	5.19	10.03	3.52	2.43	9.63	5.99	3.11
Skilled agricultural, forestry and fishery workers	3.83	12.67	19.51	3.68	8.91	14.66	4.76	16.49	33.47
Craft and related trades workers	0.43	5.8	14.44	0.41	5.22	12.13	0.43	4.39	4.57
Plant and machine operators, and assemblers	0.3	2.5	8.64	0.22	3.36	8.77	0.29	4.02	4.79
Elementary occupations	0.48	7.35	25.24	0.43	14	40.25	0.32	11.32	30.57
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Note: Authors' elaboration based on Istat's "Labour Force Survey" dataset

What clearly emerges is that, across the period considered, while over 50% of the Italian graduates are employed in occupations at the top level (Professional), only around or less than 10 percent of the immigrants for extra EU are employed in the same occupations. The main activities of the former are elementary and agricultural activities, accounting for around 30 percent in 2014. By contrast, only between 0.5% and 0.3% of the natives are employed in the latter occupations. These figures are less striking for immigrants from EU: between 24 and 30 percent of the immigrants coming from the European Union are employed in top level occupations and as far as elementary occupation are concerned, the share ranges between 7 and 14 percent. The just described figures reinforce some evidence on occupational mismatch, affecting in particular immigrants coming from extra EU.
As discussed in the previous section, the literature analyzing the effect of immigration on the Italian labour market has focused on several aspects. For instance, Bratti and Conti (2018), investigate the effect of immigration on the innovation of Italian regions over the period 2003-2008. Using instrumental variables estimation, they show that the overall stock of immigrants did not have any effect on innovation, but an increase of 1 percentage point in the share of low-skilled migrants on the

population is found to reduce patent applications by about 0.2%, Barone *et al.* (2016) analyse the role of immigration in shaping natives' voting behavior, using Italian municipality-level data on national elections. Their study reveals that immigration generates a sizable causal increase in votes for the centre-right coalition, which has a political platform less favourable to immigrants. Recently, Bettin and Sacchi (2009) study the effect of immigrants on public health spending across Italian regions. We bring some new causal evidence in the literature for Italy on the effect of immigration of firm's performance: firm's productivity.

3. Data

The empirical analysis is focused on the *Rilevazione Imprese e Lavoro* (RIL) conducted by Inapp during 2007, 2010 and 2015 on a representative sample of partnerships and limited liability firms. Each wave of the survey covers over 25000 firms operating in non-agricultural private sector. A subsample of the included firms (around 35%) is followed over time, making the RIL dataset partially panel over the period under study[1].

Each wave of the RIL questionnaire provides a rich set of information about the employment composition and personnel organization (type of contracts, training activities ecc.), industrial relations and other workplace and firms productive characteristics. In particular, for our purpose, the RIL survey provides information on the number of non native workers (from extra EU) and allows us to identify the share of immigrants employed by each firm over time[2]. Since our main variable of interest is the share of immigrants from extra EU, we exclude from the analysis the first wave of RIL, 2005, because it is not consistent with the definition of immigrants from extra EU in the following years. Indeed, some countries joined the EU from 2007 (Bulgaria and Romania).

The RIL survey contains, however, incomplete information on financial and accounting variables, which had to be recovered from another source. For this purpose, we use the national tax number to merge RIL data with AIDA archive provided by the Bureau Van Dijk for the period 2005-2014.

The AIDA data offers comprehensive information on the balance sheets of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries. In particular, this dataset contains yearly values of such variables as revenues, added value, net profits, book value of physical capital, total wage bill and raw-material expenditures. Consequently, we are able to use indicators of labour productivity (value added per employee), fixed capital (the total amount of physical asset per employee) and other balance sheet variables (raw material expenditures, net profits ecc.).

[1] The RIL Survey sample is stratified by size, sector, geographic area and the legal form of firms. Inclusion depends on firm size, measured by the total number of employees. This choice has required the construction of a 'direct estimator' to take into account the different probabilities of inclusion of firms belonging to specific strata. In particular, the direct estimator is defined for each sample unit (firm) as the inverse of the probability of inclusion in the sample. For more details on RIL questionnaire, sample design and methodological issues see: http://www.inapp.org/it/ril.

[2] Note that for the main variables the data collected by RIL survey in 2015 really refered to 2014, while those derived from the RIL survey in 2010 are aligned to the same year. Thus in what follows we mention the RIL sample 2007-2010-2015, even though the empirical analysis is based on data 2007-2010-2014. More details are available upon request.

As for sample selection, we excluded firms with less than ten employees to retain only those productive units characterized by a minimum level of organizational structure. After excluding also firms with missing information for the key variables, the RIL-AIDA longitudinal sample is made up of approximately 1800 limited liability firms observed in 2007, 2010 and 2015.
To deflate our monetary variables we relied on sectoral deflators (NACE 2 digit) provided by the National Statistical Institute (base year 2010) based on industrial production prices (see http://dati.istat.it/#)

3.1 Descriptive statistics

Table 2 shows the descriptive statistics for labour productivity and labour costs distributions in each sample year as well as the share of workforce and firm specific characteristics[3].
To begin with, we observe that on average the (log of) labour productivity declines over the period, ranging from 10.8 in 2007-2010 to 10.7 in 2014; this pattern pairs with the reduction of the (log of) number of employees while the intensity of physical capital increases over time.

Table 2. Descriptive statistics

	2007		**2010**		**2014**	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Ln (value added per employee)	10.81	0.58	10.80	0.51	10.71	0.64
Ln (physical capital per employee)	9.90	1.39	10.13	1.56	10.08	1.72
Workforce characteristics						
Presence of immigrants (0/1)	0.46	0.50	0.38	0.49	0.36	0.48
Share of immigrants (total empl)	0.05	0.09	0.04	0.08	0.04	0.08
Share of immigrants (on employees)	0.07	0.12	0.05	0.11	0.05	0.10
Share of executives	0.03	0.06	0.04	0.07	0.04	0.09
Share of white collars	0.33	0.27	0.37	0.28	0.41	0.29
Share of blue collars	0.63	0.29	0.59	0.30	0.55	0.31
Share of female	0.30	0.24	0.34	0.25	0.34	0.25
Share of temporary contracts	0.11	0.18	0.11	0.17	0.08	0.17
Share of trained	0.20	0.33	0.28	0.36	0.40	0.41
Share of new hirings	0.16	0.22	0.12	0.22	0.09	0.17
Vacancy	0.21	0.41	0.13	0.33	0.12	0.33
Second level bargaining	0.14	0.34	0.13	0.34	0.12	0.33
Union	0.23	0.42	0.25	0.43	0.23	0.42
Firms characteristics						
Mergers & acquisitons	0.03	0.16	0.08	0.27	0.06	0.24
Process innovation	0.47	0.50	0.43	0.50	0.35	0.48
Product innovation	0.62	0.49	0.52	0.50	0.42	0.49
Multinational	0.03	0.16	0.03	0.16	0.02	0.15
Trade agreements	0.24	0.43	0.16	0.37	0.16	0.37
N. of obs	1,771		1,877		1,800	

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015. Sampling weights applied

[3] The complete description of the entire set of variables used in the analysis is available upon request.

As for the workforce composition, note that the incidence of firms employing extra-EU immigrants reduced significantly from 46% in 2007, to 38% in 2010 and 36% in 2014, a feature that mirrors in a negative evolution of the share of extra-EU workers over the total employment, from 0.5% to 0.4% over the period under study. Further, we observe an increase of the average professional level of the workforce as a result of a rise of the share of both executives (from 0.3% to 0.4%) and white collars (form 33% to 41%) and a decline of the blue collars (63% in 2007 and 55% in 2014). As well, average share of employees undergoing some workplace training grows from 20% in 2007 to 40% in 2014, while the reduction of fixed term contracts (from 11% to 8%) may be associated with the break down in the propensity to hire new workers under temporary contractual arrangements in a period of economic downturn. This may suggest that firms faced the economic crisis protecting workplace specific competencies of "insiders" rather than recovering to general skills and/or new competencies with strategic hiring plans (Dosi *et al.*2018).
Our sample provides information on a set of firms' characteristics. In particular table 2 indicates that the incidence of firms that have undertaken product (process) innovation in the three years preceding each RIL survey reduced form 62% (47%) in 2007, to 52% (43%) in 2010 and 42% (35%) in 2014. As well, the incidence of firms with trade agreements on foreign markets decreased from 24% in 2007 to 16% in 2010-2014. Finally, to save space we do not report summary statistics about the distribution of our sample across regions and sector of activities. These are however available upon request.

4. Econometric analysis

In order to investigate the relationship between the share of immigrants and firms' productivity, our econometric specification is as follows. Labour productivity $ln(lab\ prod)_{i,t}$ defined as the (log of) values added per employee, is expressed as a function of the share of immigrants from extra EU $IMM_{i,t}$ (number of immigrants over total employment), a vector *Xi,t* including a wide set of control variables at the firm level (physical capital, age, sector of activity, size, macro-region ecc.) and employment composition (gender, education, age, contractual arrangement). Furthermore, for a specific sub period, 2010-2014, we are also able to include variables related with the level of management (results are shown in the robustness checks section).

$$ln(lab\ prod)_{i,t} = \alpha \cdot IMM_{i,t} + \beta \cdot X_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (1)$$

The model is estimated using pooled ordinary least squares, while controlling for time dummies, μ_t. Moreover, in order to account for unobserved individual firms' specific heterogeneity, we additionally include firm fixed effects η_i. Finally, we perform instrumental variable regressions to deal with endogeneity issues. Indeed, it is well known that estimating equation (1) with least squares, even in the presence of several fixed effects and controls, leaves open the possibility that some omitted local conditions may affect simultaneously the demand of immigrants and the productivity of firms as well as labour costs (see for instance Mitaritonna *et al.* 2017 for a discussion). Hence, we devote section 4.2 to identification issues and a description of our instrumental variable approach.

4.1 Main results

Table 3 reports pooled ols estimates for different specification of labour productivity equation for the period 2007, 2010 and 2015.

In column [1] we include the share of immigrants, time dummies and other basic controls for physical capital intensity, firms' size, sectoral 2 specialization and geographical location; in columns [2] we include workface composition and industrial relations while estimates in columns [3] also take into account a wide set of firms' characteristics. Labour productivity responds negatively to increases in the share of immigrants, across all specifications.

However, it is important to bear in mind that the share of immigrants is defined over total employment so it does also include any form of contractual arrangement and it is therefore likely to dampen the coefficient.

The observed correlation ranges between 0.6 and 0.3 (in absolute terms), when the model is fully specified. Hence, one percent increase in the share of immigrants reduces labour productivity by 0.3 percentage points, when workforce and firm characteristics are included.

Table 3. Pooled ols estimates. Dep Var: Labour productivity

	[1]	**[2]**	**[3]**
Immigr share	-0.584***	-0.302***	-0.324***
	[0.093]	[0.081]	[0.081
Ln (physical capital per employee)	0.122***	0.113***	0.111***
	[0.007]	[0.006]	[0.006]
Year 2010	-0.060***	-0.061***	-0.053***
	[0.01]	[0.01]	[0.011]
Year 2014	-0.082***	-0.102***	-0.092***
	[0.011]	[0.013]	[0.014]
Workforce characteristics	No	Yes	Yes
Firms' characteristics	No	No	Yes
2 digit sector	Yes	Yes	Yes
Constant	9.608***	10.886***	10.835***
	[0.092]	[0.173]	[0.169]
N. of obs	5683	5550	5449
R2	0.268	0.367	0.371

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015. Workforce characteristics: executives, white collar, blue collar, temporary workers, female, trained, share of hirings, second level bargaining, unions' presence. Firms characteristics: vacancy, product innovation, process innovation, patents, foreign ownership, trade agreements. All regression includes controls for firms size, ln (physical capital pc) and fixed effect for nuts_2 regions and sector of activity. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 4 replicates the same results when individual firms' specific heterogeneity, firm fixed effects η_i, are taken into account.

The share of immigrants turns out to be non-significant in column [1], but columns [2] and [3] confirm the presence of a negative and not negligible relationship between the share of immigrants and labour productivity.

Indeed, comparing column [3] across table 3 and 4, we observe only a small drop in the estimated coefficients that also accounts for firms' fixed effects: the reduction in productivity of labour is now around 0.23 percentage points as a response to a one percent increase in the share of immigrants from extra EU.

Table 4. Fixed effect estimates. Dep Var: Labour productivity

	[1]	[2]	[3]
Immigr share	-0.136	-0.195*	-0.228**
	[0.099]	[0.102]	[0.103]
Ln (physical capital per employee)	0.066***	0.065***	0.066***
	[0.009]	[0.009	[0.01]
Year 2010	-0.043***	-0.041***	-0.040***
	[0.009]	[0.009]	[0.009]
Year 2014	-0.073***	-0.071***	-0.066***
	[0.01]	[0.011]	[0.012]
Workforce characteristics	No	Yes	Yes
Firms' characteristics	No	No	Yes
2 digit sector	Yes	Yes	Yes
Constant	11.194***	11.138***	11.140***
	[0.170]	[0.193]	[0.188]
N. of obs	5683	5539	5445
R2	0.107	0.119	0.126

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015. Workforce characteristics: executive, white collar, blue collar, temporary workers, female, trained, share of, hiring second level bargaining, unions' presence. Firms characteristics: vacancy, product innovation, process innovation, patents, foreign ownership, trade agreements. All regression includes controls for firms size, ln (physical capital pc) and fixed effects for nuts_2 regions and sector of activity. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.2 Identification issues and Instrumental Variables

In order to identify the part of the change in the immigration share that is driven by supply changes rather than by local productivity shocks, the standard approach in literature consists in using the shift-share instrument based on initial spatial distribution of immigrants. This approach has been pioneered by Altonji and Card (1991) and then used in several studies since (among others see Card 2001; Card 2009; Peri and Sparber 2009; Lewis 2011).

The underlining idea is that new immigrants (especially with lower levels of schooling) tend to move to the same area where previous immigrants from the same country of origin already live and have established a community. For instance, Mitaritonna *et al.* (2017) in analysing the effect of immigration on firms' productivity and wages in France, deal with endogeneity by using as instrument the share of immigrants in each French department in the first year of their data, assuming that the distribution of immigrants in the first year across department is uncorrelated or has a rather week correlation with the distribution of demand shocks in the department after that year, once controlling for firm effects, region and sector specific trend.

In our setting, we combine three different instruments. The first is based on information directly provided by RIL, and it is a subjective measure indicating the reason why firms employ foreigner workers (from extra EU), rather than native Italians. The question reads something like: "Are there specific reasons why the firm has employed workers from extra EU?". Among the possible answers, we select two, reflecting that the firm has no other choice but to rely on foreigners rather than native Italians because the former workers are either not willing to work in that occupation or task or are considered not very professional. Indeed, we create a dummy variable taking the value of one if the answer is exclusively related to the following two answers: "Italian workers are not very professional" or "Italian workers are not interested or willing to work in some of the occupations and tasks of the firm". This can be considered a strongly correlated variable with the share of immigrants employed in

the firms but at the same time uncorrelated with other omitted factors related with the share of immigrants, such as a productivity demand shocks. Our IV approach first relies on this instrument only. Next, we combine the latter with another instrument expressed as the change in the share of immigrants at the municipality level across the period 2002-2004 and thus capturing the increase in the share of immigrants associated with an important policy change. Indeed, in 2002, a policy change related with immigration took place: the Law n. 189/2002, also known as the "Bossi-Fini". According to this law, every year the Prime Minister has to lay down the number of non-EU workers who can be admitted in the country in the following calendar. Our instrument is built as the change in the share of non EU immigrants (over the total population) at the municipality level, over the period 2002-2004, taking data provided by Istat[4]. Our data reveals that around 89 percent of the municipalities are characterized by an increase in the absolute number of immigrants (from extra EU) over the two periods considered. This is clearly an obvious result of the policy change. It is worth noticing that the increase in the number of regularized immigrants in local labour markets is likely to exert an attraction from other immigrants throughout parental connections and so on.

Table 5. IV-2SLS second stage estimates. Dep var: labour productivity

	[1]	[2]	[3]
Immigr share	-0.557***	-0.556**	-0.546**
	[0.214]	[0.222]	[0.277]
Ln (physical capital per employee)	0.137***	0.138***	0.127***
	[0.052]	[0.053]	[0.026]
Year 2010	-0.052***	-0.054***	-0.043**
	[0.018]	[0.018]	[0.018]
Year 2014	-0.101***	-0.103***	-0.092***
	[0.018]	[0.019]	[0.023]
Workforce characteristics	Yes	Yes	Yes
Firms' characteristics	Yes	Yes	Yes
2 digit sector	Yes	Yes	Yes
Constant	10.429***	10.456***	10.982***
	[0.602]	[0.613]	[0.394]
N. of obs	3442	3301	2108
R2	0.334	0.335	0.345
First stage statistics			
Subjective measure (RIL): natives not available to be hired 2004-05	0.114***		
	[0.000]	[0.000]	[0.000]
Change of immigrant share at municipality level 2002-2003		0.720***	
		[0.000]	[0.000]
Firm level regularization 2004-05			0.012***
			[0.000]
Ln (physical capital per employee) t-1	Yes	Yes	Yes
Weak identification test (Kleibergen-Paap rk Wald F statistics)	13.333	8.63	21.25

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015. Workforce characteristics: executive, white collar, blue collar, temporary workers, female, trained, share of hirings, second level bargaining, unions' presence . Firms characteristics: vacancy, product innovation, process innovation, patents, foreign ownership, trade agreements. All regression includes controls for firms size, ln (physical capital pc) and fixed effect for nuts_2 regions and sector of activity. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[4] We resort to the same data adopted in the paper by Barone *et. al* (2016) from Istat and we are grateful to the authors for sharing the data with us.

Finally, we also consider a third instrument directly taken from RIL, which can instead be considered an objective measure, indicating if the firm has actually regularized foreigner workers according to the 2002 policy. This is a dummy variable available in RIL at the panel level. We combine this information with the instrument based on a subjective measure related with the reason for employing foreigner rather than native Italian workers.

Table 5 reports estimates obtained using instrumental variable regression. Colum [1] displays results based on the first described instrument (subjective measure from RIL: natives not available to be hired 2004-05), column [2] shows results combining the first instrument with that based on the change of the share of immigrants at the municipality level (2002-2004), and finally, column [3], reports estimates obtained combining the information on the first instrument and the objective measure available in RIL on firm level regularization (2004-2005). Results confirm the previous evidence and reveal the presence of a stronger negative correlation between immigration and our outcome variable. Across all three specifications we observe that a one percent increase in the share of immigrants reduces labour productivity by around 0.5 percentage points.

4.3 Robustness checks: firms' size and sector of activity

This section provides some robustness checks. We first explore if there emerge some differences based on firms' size. Indeed, we replicate our estimates distinguishing between small-medium (below 100 employees) and large (above 100 employees) firms. Results are thereby reported in table 6 where we show pooled ols, fixed effect and 2-SLS-IV estimates of equation (1) obtained for separate regressions across the two samples.

Table 6. Pooled ols, FE and IV-2SLS estimates by firm size

	n of employees<=100			**n of employees>100**		
	OLS	FE	IV-2SLS	OLS	FE	IV-2SLS
Immigr share	-0.369***	-0.195*	-0.507**	0.011	-0.322	-0.899
	[0.082]	[0.116]	[0.221]	[0.265]	[0.253]	[1.050]
Ln (physical capital per emp)	0.096***	0.060***	0.132***	0.096***	0.051**	0.193**
	[0.006]	[0.011]	[0.048]	[0.015]	[0.022]	[0.097]
Year 2010	-0.040***	-0.026***	-0.045**	-0.054**	-0.066***	-0.107***
	[0.012]	[0.010]	[0.019]	[0.023]	[0.023]	[0.038]
Year 2014	-0.074***	-0.048***	-0.088***	-0.117***	-0.096***	-0.187***
	[0.014]	[0.012]	[0.020]	[0.033]	[0.029]	[0.057]
Workforce characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firms' characteristics	Yes	Yes	Yes	Yes	Yes	Yes
2 digit sector	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.823***	10.581***	7.379***	10.649***	11.593***	11.909***
	[0.151]	[0.277]	[0.525]	[0.470]	[0.593]	[0.972]
N. of obs	4396	4396	2839	1037	1037	457
R2	0.373	0.093	0.368	0.545	0.150	0.505

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015. Workforce characteristics: executive, white collar, blue collar, temporary workers, female, trained, share of hiring's, second level bargaining, unions' presence. Firms characteristics: vacancy, product innovation, process innovation, patents, foreign ownership, trade agreements. All regression includes controls for firms' size, ln (physical capital pc) and fixed effect for nuts_2 regions and sector of activity. Robust (bootstrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Likewise, table 7 displays the pooled ols, fixed effect and 2-SLS-IV estimates of equation (1) obtained for separate regressions by sector of activity. Here we distinguish between manufacturing firms and those operating in the nonmanufacturing sector.

Both robustness (table 6, 7) confirm our findings: the presence of a negative and non-negligible relationship between the share of immigrants and labour productivity. Nevertheless, some important remarks are in order. Our results are definitively driven by small-medium firms and those operating in the manufacturing sectors. Indeed, the "immgr share" coefficient across almost all specifications, turns out to be significant for small-medium and manufacturing firms (as we can observe by looking at the first three columns of table 6 and 7). This is simply the result of the structure of the Italian labour market, mainly characterized by those kind of firms. However, it is interesting to notice that fixed effects estimates reported in column [2] of table 7 are not significant.

This can instead be suggesting that the negative relationship between the share of immigrants and labour productivity in the manufacturing sector might be driven by firms' unobserved heterogeneity[5].

Table 7. Pooled ols, FE and IV-2SLS estimates by sector

	Manufacturing			**non Manufacturing**		
	OLS	FE	IV-2SLS	OLS	FE	IV-2SLS
Immigr share	-0.258**	-0.227	-0.779**	-0.340***	-0.225	-0.453
	[0.113]	[0.159]	[0.337]	[0.108]	[0.143]	[0.291]
Ln (physical capital per emp)	0.097***	0.062***	0.185*	0.098***	0.061***	0.119*
	[0.010]	[0.016]	[0.108]	[0.007]	[0.012]	[0.064]
Year 2010	-0.055***	-0.060***	-0.067*	-0.035**	-0.013	-0.045**
	[0.015]	[0.014]	[0.040]	[0.016]	[0.012]	[0.023]
Year 2014	-0.064***	-0.053***	-0.083*	-0.099***	-0.061***	-0.125***
	[0.019]	[0.017]	[0.043]	[0.019]	[0.015]	[0.023]
Workforce characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firms' characteristics	Yes	Yes	Yes	Yes	Yes	Yes
2 digit sector	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.735***	10.764***	10.047***	10.252***	11.072***	10.527***
	[0.230]	[0.367]	[1.041]	[0.227]	[0.282]	[0.873]
N. of obs	2508	2508	1367	2925	2925	1929
R2	0.340	0.076	0.237	0.454	0.185	0.437

Note: Authors' elaboration based on the RIL-AIDA merged dataset 2007-2010-2015.Workforce characteristcs: executive, white collar, blue collar, temporary workers, female, trained, share of hirings, second level bargaining, unions' presence. Firms' characteristics: vacancy, product innovation, process innovation, patents, foreign ownership, trade agreements. All regression includes controls for firms size, ln (physical capital pc) and fixed efffect for nuts_2 regions and sector of activity. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[5] In an extended version of the paper, we also carry out the same regressions by focusing the analysis on the last two waves of RIL (2010-2015). This exercise allows us to include some additional covariates in our regressions, like for instance the managerial characteristics, available only in the last two waves of the survey. The inclusion of these covariates might improve the accuracy of our model and some parts of the unobserved, firm specific, heterogeneity. Again, these results are available upon request.

5. Conclusions

In this paper we try to shed some light on a very important dimension of Italian firms: productivity of labour. We analyse it in relationship with immigration. It is well known that the recent immigration trend, in Europe as well as in Italy, has been positive and there is an ongoing debate on the role played by immigrants on the labour markets. However, Italy shows some important peculiarities.

We employ a unique and very rich firm level data from the *Rilevazione Imprese e Lavoro* (RIL) conducted by Inapp in 2007, 2010 and 2015 on a representative sample of Italian firms. We perform OLS regressions, fixed effects estimates to account for unobserved firm's specific heterogeneity and finally, we deal with endogeneity by employing three different instruments. Indeed, there are likely to be omitted local conditions that may affect simultaneously the demand of immigrants and the productivity of firms as well as labour costs (see for instance Mitaritonna *et al*. 2017 for a discussion). Results are consistent across all specifications and reveal that hiring more immigrants from extra EU exerts a negative affect on labour productivity. We verify that the negative impact of immigrants on the productivity holds for both ols and IV–2SLS regressions, as well as using a within fixed effect estimators that control for time invariant firms unobserved heterogeneity. However, results needs to be considered in light of some important remarks. The Italian economy is first, characterized by the presence of mainly low skilled immigration, and second, by a stagnant, and below the EU average, level of productivity since the beginning of the early 2000s (Dosi *et al.* 2012). Furthermore, some robustness analysis reveals that results are mainly driven by small-medium firms operating in the manufacturing sector.

Appendix

Table A1. Summary results for first-stage regressions: 1th IV strategy

			Under-id		Weak id
Endogenous Variables	F(2,1381)	P-val	SW Chi-sq(1)	P-val	SW F(1,1381)
Immigr share	169.01	0.000	261.33	0.000	257.34
Ln (physical capital per employee)	14.15	0.000	27.16	0.000	26.75
Weak identification test					
Cragg-Donald Wald F statistic	32.06				
Kleibergen-Paap Wald rk F statistic	13.33				

Table A2. Summary results for first-stage regressions: 2th IV strategy

			Under-id		Weak id
Endogenous Variables	F(3,1329)	P-val	SW Chi-sq(2)	P-val	SW F(2,1329)
Immigr share	107.45	0.000	236.72	0.000	116.45
Ln (physical capital per employee)	9.11	0.000	26.32	0.000	12.95
Weak identification test					
Cragg-Donald Wald F statistic	20.54				
Kleibergen-Paap Wald rk F statistic	8.63				

Table A3. Summary results for first-stage regressions: 3th IV strategy

			Under-id		Weak id
Endogenous Variables	F(2,1381)	P-val	SW Chi-sq(2)	P-val	SW F(2,835)
Immigr share	82.07	0.000	252.22	0.000	122.91
Ln (physical capital per employee)	23.14	0.000	64.24	0.000	31.31
Weak identification test					
Cragg-Donald Wald F statistic	238.27				
Kleibergen-Paap Wald rk F statistic	21.25				

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