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Full Research Article

# Immigrant workforce and labour productivity in Italian agriculture: a farm-level analysis

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**Abstract.** The objective of this paper is to detect stylized facts and put forward testable hypotheses on the presence and role of immigrant workforce in Italian agriculture. This research focuses on professional agriculture as represented by the Italian FADN over the period 2008-2015. Descriptive statistics show that immigrants are an important component of the workforce employed in professional agriculture over this period, even with wide disparities between regions, sectors and classes of economic size. Immigrants are concentrated in larger and more productive farms and their presence is positively correlated with farm's labour productivity (LP). To understand whether they are more productive, or they are just occupied by more productive farms, the relationship between LP and their contribution to agricultural production, in terms of Annual Working Units (AWU), is modelled at the farm level, by assuming alternative model specifications. Results emphasize that, in many cases, statistically significant relationships between the contribution of immigrants and farm-level LP can result from model misspecifications. Accounting for farms' heterogeneity can greatly influence the dimension of this link. Moreover, when assuming persistence of LP with a dynamic specification, this relationship disappears.

**Keywords.** Immigrant workforce, FADN sample, labour productivity, dynamic panel models.

**JEL codes.** Q12, J24, J61.

## 1. Introduction

According to official statistics, in Italy, in 2015, immigrants represented almost 10% of the total workforce and were mainly employed in the services sector (66%), followed by the manufacturing sector with 29% (mainly construction) and, finally by the agricultural sector (6%) (ISTAT, 2016). A strand of scientific literature supports the idea that immigrants contribute to economic growth because they provide relatively cheap workforce especially in those cyclical or seasonal sectors strongly based on cost competition,

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such as construction or agriculture (Somerville and Sumption, 2009a and 2009b). Moreover, against a background of declining employment in agriculture, they play a crucial role in meeting seasonal labour demand of the sector because they represent a highly mobile workforce (Hanson and Bell, 2007).

However, as immigrant workers frequently replace native ones in less skilled jobs, they often appear to be less productive. This also motivates why in non-scientific literature and in the media immigrant workforce is often regarded just as unskilled and cheap labour. Nonetheless, in sectors like agriculture where skillness is not necessarily linked to human capital accumulation (i.e., education) but mostly to experience and traditional knowledge, it can be rather the case that immigrant workers are more productive and that they can increase the productivity of other factors of production.

The main objective of the present work is to assess the contribution of immigrant to market-oriented Italian farms' production and productivity. In particular, the attention is on the empirical relationship between the presence of immigrants and farm-level labour productivity. While this empirical assessment in not completely new (see section 2 for a brief review of the recent literature in this respect) the main interest here is in performing such analysis not with aggregate (national or regional) sectoral data but on the basis of farm-level (micro) data. A balanced panel of farms allows detecting the high heterogeneity occurring within Italian agriculture in terms of presence and performance of immigrant workforce.

To pursue this research objective, we use here the Italian Farm Accountancy Data Network (FADN) sample, which includes information on professional and market-oriented farms and excludes all those farming practices that do not exceed a minimum economic size. This FADN panel is extracted over years 2008-2015 (section 3) and the presence, the distribution and the main features of immigrant workers across farm typologies, farm size and geographic location is firstly investigated (section 4). Then, the relationship between farm-level labour productivity and the presence of immigrant workforce is estimated adopting alternative panel model specifications and the respective estimators (section 5). Section 6 concludes.

## 2. Labour productivity and migration: overview of the literature

Between 1960 and 2010, the proportion of foreign-born in the population of high-income OECD countries has increased from less than 5% to about 11%, and the proportion of immigrants originating from developing countries has grown from 1.5% to 8.0%. Although on average this workforce can be regarded as low-educated, an increasing proportion of these migrants has a higher education level. Therefore, it should not surprise that, on the one hand, the effects of immigration on the economy and, above all, on the labour market of the rich receiving countries have been widely investigated. On the other hand, within these countries immigration and its labour market effects have become a major political issue (Brunello *et al.*, 2017; Docquier and Machado, 2017). Though still lagging behind countries such as the US, Canada and Australia, this interest has particularly increased in those countries where immigration, and its implications, are relatively more recent.

This wide literature largely agrees on the fact that immigration flows increase employment, raise total output and per capita income of natives, but it also redistribute income

among factors of production (Lalonde and Topel, 1997; Devadoss and Luckstead, 2008; Clemens, 2013). In fact, immigration has important effects because it increases the relative supply of some types of workers, changing factor proportions and relative prices. Therefore, while the overall impact is expected to be positive, this is not necessarily true for all the components of an economy, i.e., all groups of workers and all sectors. Eventually, most of the policy debate about immigration relates to its effects on income distribution. This redistribution effect has mostly to do with the quality of this labour force (education and skillness) but also with the activities and sectors where it is eventually employed.[1]

On the one hand, low skilled immigration increases the supply of low-skilled labour mostly concentrated in low-productivity sectors. One major consequence of this is that immigrant workforce induces a higher supply of low skills thus reducing the wages and employment probabilities of low skilled natives especially in low-productivity sectors. Therefore, immigration tends to be regarded as a major source of unfair competition and potentially social dumping (Rye and Andrzejewska, 2010), on native low-skills workers and this seems particularly critical in the case of unauthorized or irregular immigrant workers (Edwards and Ortega, 2017). On the other hand, however, when low and high skills are complements in production, immigration increases the productivity and wages of high skilled workers: the returns to education raise and natives have stronger incentives to acquire additional schooling (Brunello *et al.*, 2017). This may justify why countries that receive migrants regularly (US and several other migrant-receiving countries such as Canada, Australia, and New Zealand) have in place skills-based admission procedures (Stark *et al.*, 2017).

All the arguments above about the impact of immigrant workforce on the domestic labour market and economy eventually calls back the impact of migrant workforce on aggregate, sectoral and firm-level productivity and, consequently, on respective wages (Anderson *et al.*, 2006). Nonetheless, the results in the empirical literature concerning the existence of productivity differentials between migrants and native workers are mixed and controversial.[2] At the aggregate level, a negative relationship between immigrant workforce and labour productivity is very likely to emerge whenever this workforce (due either to lower quality or to any other reason) concentrates in low-productivity sectors. Agriculture, construction and some service sectors are typically among these. But if we remove this composition effect and concentrate on the impact of immigrant workers on labour productivity at the sector or firm-level, the evidence is much less clear and, more importantly, the underlying assumption that these workers are of lower quality (skills and education) may be seriously questioned.

If we limit the attention to agriculture, i.e. one of the most relevant and studied sector in this respect, recent evidence suggests that the immigration inflow seems to have generated a productivity slowdown within the agricultural sectors of countries where the phenomenon is much more recent. This does not occur in countries that have traditionally seen substantial immigration like US and UK (Kangasniemi *et al.* 2012). This difference can be attributed, again, to the different migrant labour quality in the UK.

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[1] This effect may also occur because of internal migration especially from rural to urban areas (Combes *et al.*, 2017).

[2] For example, Peri *et al.* (2015) and Albarrán *et al.* (2017) present evidence of the positive impact of STEM (Scientists, Technology professionals, Engineers, and Mathematicians) immigrant workers on total factor productivity in US.

Despite these country differences, however, evidence in favour of a positive effect of migration on agricultural productivity seems to prevail. Bove and Elia (2017) point out that such positive impact depends on the fact that immigrant workers carry a new range of skills and perspectives, which stimulate technological innovation and fuel entrepreneurship and this contribution seems to be more relevant in developing countries. For instance, Klocker *et al.* (2018) show that migrant workers' knowledge represents a key resource for climate change adaptation in agricultural production. This role played by immigrants in agriculture as environment builders, bringing expertise encouraging productivity improvements also within the wider rural economy, is confirmed by other studies and in other contexts like Australia (Hanson and Bell, 2007), Greece (Kasimis *et al.* 2003; Kasimis and Papadopoulos 2005; Labrianidis and Sykas, 2009) and Spain itself (Gómez–Tello and Nicolini, 2017).

Another relevant aspect pointed out within this strand of empirical studies is that in cyclical or seasonal sectors, such as agriculture, immigrants may contribute to production performance as they represent a highly mobile workforce thus playing a crucial role in meeting seasonal labour demand despite the declining employment of natives (Hanson and Bell, 2007; Somerville and Sumption, 2009a and 2009b). In this respect, Siudek and Zawojska (2016) analyse migrant agricultural workers from Poland to the UK finding that immigrant workers are very relevant for old Member States' agricultures, since the natives are less likely to accept low wages and bad working conditions and not always meet the employers' demands in terms of work motivation and mobility.

An often disregarded aspect dealing with the immigrants' productivity in agriculture is that such contribution may largely differ within the sector due to the wide heterogeneity across farms especially in terms of size and production specialization. Those agricultural specializations, such as horticulture and fruits production, that rely heavily on unskilled and cheap labour to meet their seasonal demand, could greatly benefit from the presence of an abundant immigrant workforce (Wells, 1996). On the other hand, livestock production, that requires specialized workers along production phases similar to those of the manufacturing sector could be a less suitable activity for unskilled immigrants while, on the contrary, may take advantage from immigrants with long-term experience in animal breeding (Huffman and Evenson, 2001). Analysing California vegetable production, Devadoss and Luckstead (2008) show that immigrant workers positively influence productivity of the other factors of production, i.e., native skilled workers, material input, and capital.

Within this recent literature, contributions on the Italian agriculture case are rare. This seems surprising considering that Italy, like Spain, is one of the affluent countries where intense immigration is a relatively new phenomenon and, also for this reason, the majority of immigrants originate from developing countries and are relatively low skilled. Moreover, Italian agriculture is very heterogeneous and shows strong geographical specificity. Therefore, immigrant workers tend to concentrate in specific farm typologies and areas. According to Ievoli and Macrì (2008) and Macrì *et al.* (2017) the presence of immigrants in Italian agriculture is higher in two specific and quite different contexts: areas characterised by high seasonality of labour demand (mostly fruit and vegetable productions in the Southern part of the country);[3] areas experiencing a lack of permanent labour

[3] Coderoni *et al.* (2015) also stresses the presence, in these specific contexts, of a significant and growing amount of irregular and over-exploited immigrant workers.

supply in specific agricultural activities (mostly the intensive livestock productions in Northern Italy).

As a consequence, Italian agriculture seems to be an interesting case to investigate whether the relationship between immigrant workers and labour productivity occurs because of the specific quality of this workforce or because of a pure intrasectoral composition effect, that is, immigrants concentrate in farms with higher (or lower) labour productivity. Such kind of assessment evidently requires farm-level data and the Italian case is particularly suitable in this respect thanks to the availability of the FADN sample allowing the extraction of a pretty numerous and heterogeneous balanced panel of farms.

## 3. The FADN sample

Official statistics might be inaccurate in representing the real immigrant workforce in Italian agriculture (Coderoni *et al.*, 2015).[4] Indeed, due to the presence of undeclared and seasonal workers, the number of immigrant workforce employed in agriculture could be largely underestimated.[5] Additionally, these data do not involve only the Italian professional agriculture, that is, the real market-oriented farms, but all the farms operating on the Italian territory, regardless of their professional nature.

The well-known problem concerning "real" labour data collection cannot be easily overcome with any data surveyed. Instead the issue of assessing only the market oriented farms can be addressed by referring to proper surveys. For this reason, we used the Farm Accountancy Data Network (FADN) dataset, which includes only professional farms intended as an entrepreneurial market-oriented activity. According to the Italian FADN, on average the sample covers 97% of Standard Output (SO), 95% of Utilized Agricultural Area (UAA), 92% of Annual Working Units (AWU) and 91% of LU at national level.[6] The reference population from which the FADN sample is drawn includes only those farms with an Economic Size (ES) of more than a certain threshold that changes over the years (4,800 Euro of yearly Standard Gross Margin until 2013 and more than 8,000 since 2014). In this respect, the FADN sample is only representative of a sub-population of Italian farms that can be here referred to as professional or commercial farms (Sotte, 2006).

Data used to describe the relevance of immigrant workforce in Italian agricultural professional farms in the first part of the analysis refer the full unweighted Italian FADN sample observed from 2008 to 2015. This sample consists of 24,950 farms, each recorded up to eight years; the total number of observations is thus 87,351. The share of farms by specialization and classes of economic size is presented in the Table 1.a. Farms are grouped into three categories: small farms (with a SO less than 25,000 euros), medium farms (with a SO between 25,000 and 100,000 euros) and large farms (with a SO higher than 100,000 euros).

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[4] The UN Migrant Workers' Convention (Article 2.1) defines a migrant worker as "a person who is to be engaged, is engaged or has been engaged in a remunerated activity in a State of which he or she is not a national", irrespective of his/her migratory legal status (UN, 1990). Though in the EU policy context, mobility refers to movements within the EU, while migration – to movements between EU and non-EU countries, in this paper we will use the term immigrant worker to refer to both EU (other than Italians) and not-EU workers.

[5] See among others Fondazione ISMU (2017) and Amnesty International (2012) for data on the estimation of the presence of irregular immigrant workforce in Italian agriculture.

[6] http://www.rica.inea.it/public/it/presentazione.php.

Instead, to study the relationship between farms' productivity and the presence of immigrants in the second part of the research, only the 2008-2015 FADN constant sample has been used, which consists of 2,233 farms that sum up to 17,856 observations (Table 1.b). The use of the balanced panel has the advantage of preventing issues that might be caused by the random nature of the sample, i.e., farms entering and exiting the market. However, it might decrease the representativeness of results. In this particular case, the constant sample includes a larger share of medium-sized farms and a smaller share of smaller farms with respect to the full unweighted sample. However, these aspects do not represent a major problem for the analysis proposed (see Section 5 for further details).

**Table 1.** Numbers and shares of observations in the FADN sample 2008-2015 by typology and size: a) full Italian sample and b) constant sample.

| | a) Italian FADN | | b) Italian FADN constant sample | |
|---|---|---|---|---|
| | Nr. Observations | % | N. Observations | % |
| *Type of farming* | | | | |
| Dairy | 8,566 | 9.80 | 1,999 | 11.20 |
| Cereals | 10,528 | 12.10 | 2,371 | 13.28 |
| Grazing livestock | 11,101 | 12.70 | 1,904 | 10.66 |
| Fruits | 11,605 | 13.30 | 3,020 | 16.91 |
| Granivores | 3,456 | 4.00 | 383 | 2.14 |
| Mixed | 7,477 | 8.60 | 1,613 | 9.03 |
| Olives | 3,637 | 4.20 | 401 | 2.25 |
| Horticulture | 10,440 | 12.00 | 2,183 | 12.23 |
| Arable crops | 10,317 | 11.80 | 1,721 | 9.64 |
| Wine | 10,224 | 11.70 | 2,261 | 12.66 |
| *Economic size* | | | | |
| Large | 30,112 | 34.50 | 5,774 | 32.34 |
| Medium | 37,010 | 42.40 | 8,843 | 49.52 |
| Small | 20,229 | 23.20 | 3,239 | 18.14 |
| Total | 87,351 | 100.00 | 17,856 | 100.00 |

## 4. Immigrant workforce in Italian agriculture thorough FADN data

The FADN dataset gives interesting insights on the presence of immigrant workforce in Italian agriculture highlighting their relevant contribution to Italian agricultural production (Table 2).

In the sample analysed, total immigrant workforce in 2015 is of 4,684 units, which represent 22.5% of total salaried workforce in the sample. These shares are quite similar to what Macrì *et al.* (2017) find analysing the sub-sample of farms that employ salaried workers in the Italian Agricultural Census. According to the authors, immigrant workforces in 2010 is 25% of agricultural workforce (233,055 units on a total employment of 938,103).

Since 2008, the share of immigrants on total occupation is increased on average by 33%.

Seasonal immigrants, as expected, represent 89% of total immigrant workforce and this share is almost stable over the period analysed. Indeed, the share of seasonal immigrants on total seasonal workers, which is 22% in 2015, is increasing over time (by an average 31%), denoting a growing relevance of this type of flexible workers for Italian seasonal agricultural activities. In terms of AWU, absolute figures are rather different from the numbers of immigrants, in particular they are lowered by the presence of not fully employed workforce. However, shares of immigrants' AWU are quite similar.

As regard the qualification of these workers, information provided by FADN reveal that unskilled workers (both permanent and unseasonal) represent around the 95% of total immigrants in 2015. This evidence somehow confirms the idea that immigrant work in Italy is generally unskilled (Brunello *et al.*, 2017).

For what concerns country of origin, the majority of immigrants comes from a single European country, Romania. In 2015, they account for 37% of the total immigrant workforce in Italy. Asia and Africa[7] are respectively the second and third most important areas of origin of immigrants. Workers from Slovakia and Czech Republic exhibited the fastest growth rates, though their shares are small (Table 3). As regards the country of origin, thus, we could distinguish also for immigrant agricultural workers, the same characteristics underlined by Rye and Andrzejewska (2010) of a Southern European model of migration, with heterogeneity of immigrants' nationalities and related differentiation of cultural origins.

Besides aggregated figures, analysing the relevance of immigrants by disaggregating data at different levels can provide more interesting insights on their actual relevance. Firstly, looking at percentages of immigrants on total workers by farm specialization and economic size, as an average value of the overall sample (Table 4), some well-known patterns seem to emerge. Indeed, not all labour-intensive sectors show a high presence of immigrants.[8] The concentration of immigrants is higher in the dairy sector (41%), horticulture and grazing livestock sector (30%), fruit production (27%) and arable crops production (25%), while for other specializations, such as olives and cereals, it is less important. Again, immigrants are mostly seasonal workers, with higher shares in fruits production, horticulture and livestock. In the farm typologies where they are most occupied, they represent an important share of the total seasonal workforce.

Table 4 shows also data on the presence of immigrants in relation to the economic size of farms. Results are quite clear: at national level, medium and large farms have a higher presence of immigrants. On average, they almost have three times the concentration of small farms. The share of immigrants on employed workforce is 8% in small farms, 22% in medium-sized farms and 23% in large ones.

In terms of AWU, proportions do not change significantly, apart from the lower share of seasonal immigrants over total immigrants, for all the categories analysed. Sig-

[7] The dataset does not contain the information necessary to disaggregate further locations of origins for these two groups.

[8] The labour-intensive sectors in the sample are those with a labour factor share higher than 40% (horticulture, wine, cereals and mixed crops and livestock), those with more than 50% (arable crops), and those with more than 60% (fruits and olives). Data on factor shares are available upon request.

**Table 2.** Numbers and shares of immigrants and working units of immigrants by year. Italian FADN sample 2008-2015.

| Year | Numbers | | | | |
|---|---|---|---|---|---|
| | Immigrant workforce (n) | Employees (n) | Immigrant/ Employees (%) | Immigrant seasonal/total seasonal (%) | Immigrant seasonal/tot immigrants (%) |
| 2008 | 4,778 | 28,429 | 16.81 | 16.84 | 89.07 |
| 2009 | 6,119 | 27,191 | 22.50 | 23.32 | 92.04 |
| 2010 | 5,500 | 29,856 | 18.42 | 18.28 | 89.73 |
| 2011 | 5,777 | 28,293 | 20.42 | 20.54 | 91.34 |
| 2012 | 6,152 | 29,106 | 21.14 | 21.01 | 89.91 |
| 2013 | 7,213 | 27,370 | 26.35 | 26.66 | 90.97 |
| 2014 | 6,983 | 23,700 | 29.46 | 29.79 | 89.85 |
| 2015 | 4,684 | 20,823 | 22.49 | 22.06 | 87.66 |
| Δ%15/08 | -1.97 | -26.75 | 33.84 | 31.00 | -1.59 |
| Year | AWU | | | | |
| | Immigrant workforce (n) | Employees (n) | Immigrant/ Employees (%) | Immigrant seasonal/total seasonal (%) | Immigrant seasonal/tot immigrants (%) |
| 2008 | 1,391 | 9,610 | 14.47 | 15.30 | 73.14 |
| 2009 | 1,570 | 8,473 | 18.53 | 21.01 | 75.73 |
| 2010 | 1,540 | 8,426 | 18.28 | 19.57 | 74.20 |
| 2011 | 1,648 | 8,402 | 19.61 | 21.50 | 77.70 |
| 2012 | 1,821 | 8,936 | 20.38 | 21.27 | 74.63 |
| 2013 | 2,199 | 8,861 | 24.81 | 27.07 | 78.11 |
| 2014 | 2,133 | 8,015 | 26.61 | 28.80 | 77.10 |
| 2015 | 1,453 | 6,748 | 21.53 | 21.42 | 70.86 |
| Δ%15/09 | 4.46 | -29.78 | 48.76 | 40.03 | -3.12 |

**Table 3.** Nationality of major groups of immigrants per year and average variation (2008/2015).

| Year | Africa | Albania | Asia | Poland | Czech Republic | Romania | Slovakia | Total |
|---|---|---|---|---|---|---|---|---|
| 2008 | 715 | 1,217 | 273 | 544 | 89 | 1,230 | 164 | 4,232 |
| 2009 | 649 | 1,438 | 433 | 812 | 312 | 1,541 | 300 | 5,485 |
| 2010 | 885 | 1,224 | 693 | 453 | 127 | 1,425 | 108 | 4,915 |
| 2011 | 690 | 1,151 | 707 | 600 | 53 | 1,643 | 325 | 5,169 |
| 2012 | 940 | 747 | 1148 | 447 | 60 | 1,779 | 318 | 5,439 |
| 2013 | 1152 | 864 | 1459 | 385 | 112 | 2,231 | 441 | 6,644 |
| 2014 | 1149 | 473 | 1423 | 353 | 89 | 2,292 | 677 | 6,456 |
| 2015 | 764 | 234 | 488 | 232 | 175 | 1,527 | 711 | 4,131 |
| % 2015 | 18.49 | 5.66 | 11.81 | 5.62 | 4.24 | 36.96 | 17.21 | 100.00 |
| Average Growth (%) | 4.30 | -16.84 | 20.28 | -6.35 | 44.14 | 5.16 | 44.99 | 1.85 |

**Table 4.** Shares of immigrants by farm specialization and economic size. Italian FADN sample 2008-2015.

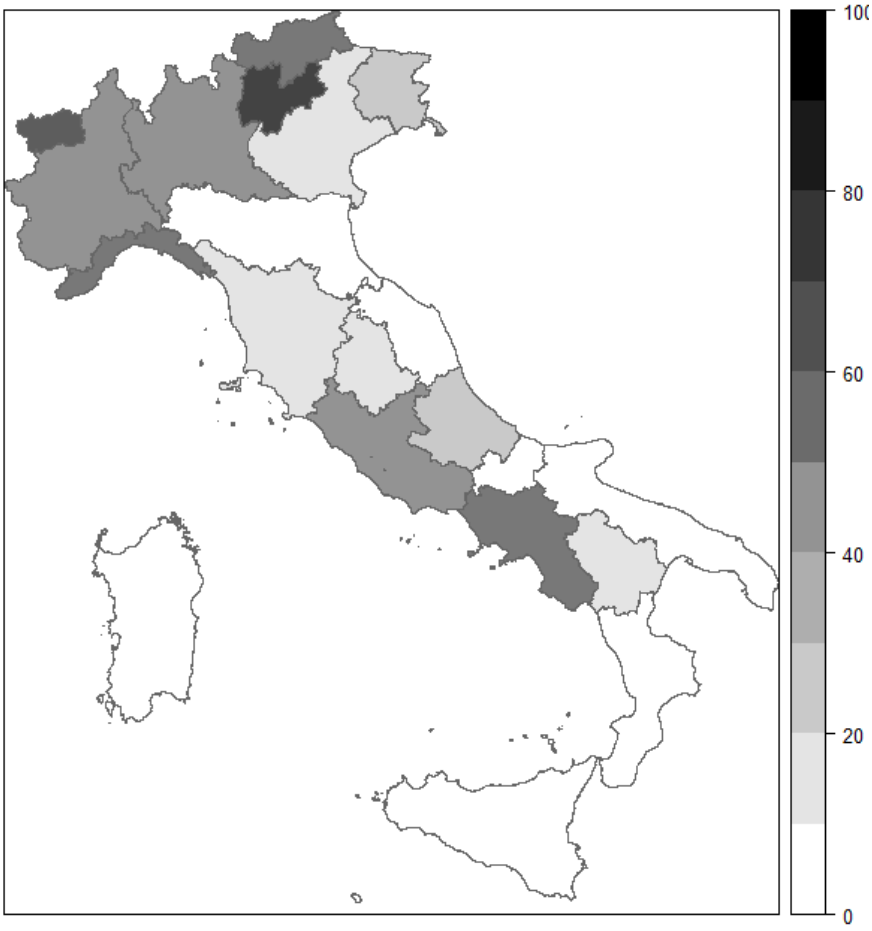
| Type of farming | Numbers | | | AWU | | |
|---|---|---|---|---|---|---|
| | Immigrant/ employees | Immigrant seasonal/Tot. Seas. | Immigrant seasonal/Tot. Imm. | Immigrant/ employees | Immigrant seasonal/Tot. Seas. | Immigrant seasonal/Tot. Imm. |
| Dairy | 41.20 | 42.22 | 82.39 | 36.38 | 40.93 | 61.57 |
| Cereals | 9.83 | 9.37 | 76.01 | 8.03 | 9.48 | 51.34 |
| Grazing livestock | 29.77 | 28.47 | 67.21 | 27.16 | 26.63 | 49.17 |
| Fruits | 26.70 | 27.16 | 97.14 | 21.43 | 22.95 | 89.64 |
| Granivores | 10.77 | 7.73 | 49.15 | 11.75 | 7.37 | 28.48 |
| Mixed crops and livestock | 14.10 | 13.66 | 86.24 | 14.46 | 14.63 | 66.23 |
| Olive | 4.10 | 3.69 | 87.97 | 3.91 | 2.83 | 65.97 |
| Horticulture | 29.74 | 30.34 | 92.42 | 27.05 | 29.22 | 86.12 |
| Arable crops | 25.15 | 25.84 | 95.79 | 22.38 | 25.65 | 88.64 |
| Wine | 10.32 | 10.35 | 89.29 | 10.23 | 11.35 | 70.70 |
| Economic size | | | | | | |
| Large | 23.18 | 23.68 | 89.12 | 20.42 | 22.29 | 74.37 |
| Medium | 21.51 | 21.06 | 93.33 | 21.99 | 22.27 | 80.62 |
| Small | 8.27 | 7.82 | 91.43 | 10.12 | 10.06 | 77.02 |
| Italy | 21.98 | 22.09 | 90.19 | 20.39 | 21.92 | 75.46 |

nificant differences can however be hidden by aggregate data. Table 5 shows the shares of immigrants by type of contract and region. When disentangling data at sub-national level, the question of reliability of the information provided becomes much more relevant. Two issues regarding data must be underlined here: first, the problem of FADN data representativeness becomes more important when disaggregating data; secondly, it is likely that data in some regions are influenced by the higher presence of not regularly employed workforce (Ievoli and Macrì, 2008, Coderoni *et al.*, 2015), thus their presence can be underestimated in regions where these workers are not declared (neither for statistical purposes), especially in seasonal activities (MAC, 2013).

Even with the issue of data reliability, disentangling figures by regions still gives some interesting information on the distribution of immigrant workforce in the Italian agriculture. Figure 1 maps the average share of immigrants by region as obtained with the FADN dataset over the period 2008-2015. Regions differ quite remarkably in terms of their concentration of immigrant workforce on regularly employed workers. Against a national average value of 22%, Trentino Alto Adige, Liguria, Campania and Valle d'Aosta show percentages higher than 50% (70% for Valle d'Aosta) of immigrant workforce on total salaried workforce, while Apulia, Emilia Romagna and Calabria have a value equal or less than 5%.

About the type of contract, in some regions (Piemonte, Sicilia, Valle d'Aosta, Liguria, Abruzzo, Puglia, Calabria, Lazio and Lombardia) - mostly of the South - more than 90% of these workers are seasonal. The importance of seasonal immigrant workers in the Southern regions reflects the specific agricultural specializations of these regions. In fact,

**Figure 1.** Share of immigrants by Region. Italian FADN sample 2008-2015.




with few exceptions, the share of immigrants in the total seasonal workforce is larger in the South.

Looking at AWU, the picture is quite similar even if shares are lower.

## 5. Immigrant Workforce and Farm Level Labour Productivity

### *5.1 Correlation coefficients at farm level*

Given that immigrant workers are a relevant part of Italian professional agriculture's workforce, and that they represent the bulk of the workers in some regions and farm types that are the more productive ones (like bigger farms), it is essential to understand whether their contribution is associated or not with higher levels of productivity. To analyse the possible relation between the incidence of immigrant work and farm's productivity, we

**Table 5.** Shares of immigrants by region and type of contract. Italian FADN sample 2008-2015.

| Region | Number | | | AWU | | |
|---|---|---|---|---|---|---|
| | Immigrant/ employees | Immigrant seasonal/Tot. Seas. | Immigrant seasonal/Tot. Imm. | Immigrant/ employees | Immigrant seasonal/Tot. Seas. | Immigrant seasonal/Tot. Imm. |
| Abruzzi | 27.07 | 25.81 | 81.23 | 35.30 | 39.05 | 70.60 |
| Apulia | 5.16 | 5.04 | 97.09 | 7.63 | 7.13 | 88.25 |
| Basilicata | 12.92 | 12.59 | 95.76 | 15.33 | 14.76 | 91.51 |
| Bolzano | 57.27 | 58.70 | 99.85 | 47.56 | 52.67 | 99.45 |
| Calabria | 0.57 | 0.57 | 100.00 | 0.48 | 0.49 | 100.00 |
| Campania | 52.38 | 53.88 | 99.19 | 33.86 | 37.37 | 95.99 |
| E.Romagna | 1.63 | 1.61 | 92.65 | 1.80 | 1.85 | 82.74 |
| F.V.Giulia | 26.07 | 27.38 | 89.81 | 22.20 | 29.27 | 72.30 |
| Lazio | 42.44 | 46.39 | 77.46 | 38.17 | 46.44 | 68.72 |
| Liguria | 51.49 | 50.43 | 91.77 | 58.39 | 58.52 | 90.98 |
| Lombardy | 44.70 | 50.48 | 61.91 | 37.01 | 64.38 | 43.36 |
| Marche | 8.26 | 7.73 | 76.80 | 7.87 | 9.30 | 62.79 |
| Molise | 8.28 | 7.52 | 86.20 | 10.25 | 7.80 | 60.62 |
| Piedmont | 44.89 | 48.29 | 81.86 | 37.28 | 49.77 | 55.68 |
| Sardinia | 6.74 | 6.02 | 69.39 | 7.83 | 5.61 | 30.30 |
| Sicily | 8.52 | 8.80 | 97.43 | 13.29 | 14.64 | 96.39 |
| Toscany | 19.00 | 21.82 | 77.57 | 16.05 | 21.88 | 56.27 |
| Trento | 73.43 | 73.98 | 99.27 | 70.21 | 75.61 | 94.69 |
| Umbria | 12.68 | 12.77 | 75.87 | 12.97 | 15.38 | 59.57 |
| V.d'Aosta | 69.55 | 70.55 | 68.08 | 72.60 | 81.50 | 58.94 |
| Veneto | 15.61 | 17.07 | 83.19 | 14.19 | 19.03 | 66.86 |

have used a measure of partial productivity, i.e. labour productivity (LP), defined as $LP_{it} = NVA_{it}/AWU_{it}$ where, for any i-th generic farm and year t, NVA is the Net Value Added and AWU are the Annual Working Units at the farm level. This indicator has been calculated for the entire sample.

Statistical relationships between farms' productivity and the contribution of immigrant workers, in terms of the share of immigrant AWU over the total AWU, have been inspected by means of a correlation analysis. Table 6 shows correlation coefficients for the total observations in the sample between the share of immigrant AWU and LP for regions, farm typologies and economic size. Data reveal a generalized positive relation between the share of immigrant AWU and labour productivity at both farm typology and regional level. Regions with higher correlation coefficients are Trentino and Campania and, consistently, farm typologies are fruits production and horticulture, which are very relevant in these regions. Indeed, it could be argued that the "real relationship" between economic performance and the share of immigrants is better captured at the level of types of farming rather than at geographical level. The magnitude of correlation coefficients for the different classes of economic size are lower and a slightly negative coefficient is found for

**Table 6.** Correlation coefficients between the share of immigrants AWU and LP at farm level. Italian FADN sample 2008-2015.

| Region | Correlation coefficient | T-value | Types of farming | Correlation coefficient | T-value |
|---|---|---|---|---|---|
| Trentino | 0.332 | 16.505 | Fruits | 0.130 | 14.126 |
| Campania | 0.216 | 14.640 | Horticulture | 0.125 | 12.823 |
| Liguria | 0.185 | 11.706 | Dairy | 0.073 | 6.736 |
| Lombardy | 0.141 | 10.006 | Mixed | 0.071 | 6.176 |
| Tuscany | 0.131 | 9.459 | Grazing livestock | 0.066 | 7.019 |
| Sardinia | 0.135 | 8.595 | Olives | 0.055 | 3.33 |
| Alto Adige | 0.172 | 8.423 | Granivores | 0.049 | 2.863 |
| Basilicata | 0.130 | 7.471 | Cereals | 0.038 | 3.913 |
| Emilia Romagna | 0.078 | 6.585 | Arable_crops | 0.035 | 3.594 |
| Umbria | 0.103 | 6.270 | Wine | 0.012 | 1.189 |
| Friuli Venezia Giulia | 0.097 | 6.249 | | | |
| Abruzzi | 0.090 | 5.623 | | | |
| Valle d'Aosta | 0.110 | 4.711 | | | |
| Veneto | 0.060 | 4.500 | | | |
| Marche | 0.045 | 2.774 | | | |
| Molise | 0.054 | 2.761 | | | |
| Sicily | 0.038 | 2.620 | Economic size | Corr. coefficient | t-value |
| Lazio | 0.034 | 2.171 | Small | 0.061 | 8.650 |
| Apulia | 0.020 | 1.345 | Medium | 0.020 | 3.890 |
| Piedmont | 0.010 | 0.896 | Large | -0.014 | -2.462 |
| Calabria | 0.004 | 0.258 | ITALY | 0.049 | 14.516 |

larger farms. This could hint at a possible spurious correlation due to size effects between the share of immigrants and other farms characteristics.

This generalised positive relationship between LP and the share of immigrant AWU is an aspect that requires deeper investigation. Though small, this link exists and signals that more productive Italian farms are associated with higher presence of immigrant work. Correlation, of course, does not imply causality and the direction of the possible link between the two indicators needs to be tested.

### *5.2 The empirical model*

To more properly assess the possible nexus between LP and immigrant workforce at farm level, a panel data analysis has been performed. As already clarified, data used for this part of the analysis refer to the constant FADN Italian sample of N=2,233 farms observed over the years from 2008 to 2015. The use of the balanced sample can decrease the representativeness of results, however, for the purposes of our analysis this can be a minor problem, as less represented farms in the constant sample (i.e. small farms) have,

on average, a lower concentration of immigrant workers. A major advantage, however, is that using a balanced sample minimizes the possible attrition due to farms entering and exiting the agricultural sector (and the FADN sample). In particular, working with a constant sample of farms eliminates the risk that the actual farm-level productivity performance, its evolution and its relationship with immigrant workforce is confused with change in the composition of the sample and, thus, by the different productivity and presence of immigrants of the entering farms with respect to the existing ones.

To model the relationship, we assume that the farm's share of AWU immigrant workers (on the total workforce) influences farm's LP. The argument underlying this link is that immigrants have been found to be a highly relevant workforce for some regions, farm typologies and sizes and their contribution is correlated with farm LP. This relationship is specified with the following dynamic polynomial form:

$$LP_{it} = \alpha + \eta_1 LP_{it-1} + \eta_2 LP_{it-2} + \beta I_{it} + \Sigma_a \rho_a I_{it,a} + \gamma Alt_{it} + \mu Age_{it} + \Sigma_f \omega_f T_{it,f} + \Sigma_m \delta_m s_{it,m} + \Sigma_k \varphi_k d_{t,k} + \Sigma_r \tau_r R_{it,r} + \varepsilon_{it} \quad (1)$$

where $i$ indicates the generic $i$-th farm ($\forall i \in N$) and $t$ the year ($\forall t \in$ 2008-2015); $LP$ is the labour productivity; $Alt$ is the log of the average elevation of the farm; $Age$ is the age of the farm holder; $I$ the share of immigrant AWU on total farm AWU while $I_a$ is the share of immigrant AWU per type of farm activity (i.e., $a$= livestock, cultivation, generic/not specified); $s_m$ the Economic Size expressed by 3 dummies (namely, $m$=small, medium and large); $T_f$ is the farm specialization typology (i.e., $f$=arable crops, cereals, dairy, etc.); $d_t$ are time dummies; $R_r$ regional dummies (where $r$ indicates the region); ε is the usual spherical disturbance; $\alpha,\eta_1,\eta_2,\beta,\rho_a,\mu,\gamma,\omega_f,\delta_m,\varphi_k,\tau_r$ is the set of unknown parameters to be estimated.

Equation (1) is estimated following a sequence of steps in order to elicit the role of exclusion/inclusion of variables in determining the observed linkage between labour productivity and the presence of immigrants of interest here (i.e., parameters $\beta$ or $\rho_a$). A static model is first estimated ($\eta_1,\eta_2 = 0$) also disregarding the different activities where immigrant workers are employed within the farm ($\beta \neq 0$ and $\rho_a = 0$, $\forall a$) and the heterogeneity among farms both in terms of specialization ($\omega_f = 0$, $\forall f$) and size ($\delta_m = 0$, $\forall m$) (Model 1). Then, farm heterogeneity is admitted ($\omega_f \neq 0$, $\forall f$; $\delta_m \neq 0$, $\forall m$) (Model 2), and the activities where immigrants are employed are detailed ($\beta = 0$ and $\rho_a \neq 0$, $\forall a$) (Model 3).[9] Finally, a dynamic specification is adopted ($\eta_1,\eta_2 \neq 0$) in order to take the typical time dependence (i.e., serial correlation) of agricultural labour productivity into account (Esposti, 2012 and 2014). The dynamic model is estimated through the same sequence of specifications of the static case (Models 4 to 6).[10]

Therefore, all the estimated models assume that farm LP is a function of the share of immigrants' AWU, the altitude of the farm location, the age of the farm's owner and regional and time dummies controlling for spatial and time dependence of the farm-level LP. As panel Models 1 to 3 are static, they can be treated as conventional pooled models

[9] In this latter case, farm typology dummies are not included ($\omega_f = 0$, $\forall f$) as they overlap with information about immigrants' activity.

[10] Two lags of the dependent variable LP are included in this dynamic model as this AR(2) specification turns out to be the best fitting lag order.

and estimated via Ordinary Least Squares (OLS).[11] On the contrary, dynamic panel Models 4 to 6 are estimated via Generalized Method-of-Moments (GMM).[12]

### *5.3 Results and discussion*

Results of the static models are reported in Table 7. Besides other control variables[13], in all these models the existence of a positive contribution of immigrant workforce to farms' *LP,* seems to be confirmed by the high value of the statistically significant parameters associated with *I*. In model (1), this coefficient is at first very high. However, when introducing farms' heterogeneity this effect seems to weaken considerably; besides, when controlling by immigrants' activities, this positive effect appears to be linked only to crop-related activities. Indeed, fruits and horticulture farm types have shown the highest correlation coefficients between the immigrants' work and *LP* at the farm level. However, when assuming persistence of *LP*, results change substantially (Table 8). In the simplified model (4), migrant workforce still plays an important role in explaining the *LP* performance, as it may capture all the other characteristics of the farms that are not accounted for (e.g. as immigrants are mostly occupied in biggest and more productive farms, without controlling for farm size, can make emerge a spurious relationship). In fact, when introducing farms' heterogeneity, the link between *I* and *LP* disappears, both the in the aggregate and disaggregate specifications.

These results would suggest that in the case of Italian agriculture the relationship between productivity and immigrant workforce essentially is a composition effect, that is, it depends on the fact that these workers concentrate in more productive farms in terms of size and specialization. The main consequence of this, is that many empirical studies assessing this relationship in agriculture may suffer from a severe misspecification problem whenever the farm heterogeneity in this respect is not properly taken into account. In such cases, the positive contribution of immigrant workforce to the farms' labour productivity would just be the result of an improper specification of the relationship. Introducing a more complex specification this relationship eventually disappears.

## 6. Concluding remarks and policy implications

This research analyses the presence of immigrant workforce in Italian agriculture by exploiting farm-level data and proposes an evaluation of their role in explaining farm level labour productivity using panel data econometrics. Immigrants emerge as a relevant component of Italian agriculture, representing 22.5% of the employed workforce in 2015. There are wide disparities in the share of immigrants between regions, sectors and classes of economic size, that underline quite well known territorial patterns of seasonal and permanent migration. More seasonal or labour-intensive farm typologies (namely cultivations

[11] The pooled model is here preferred to a Fixed-Effect specification as the dummies included among regressors in (1) already take most of farm heterogeneity into account.
[12] The estimator chosen is System GMM for its asymptotic properties (Arellano, 2003).
[13] All the models confirm the importance of the altitude of the farm, the age of the farm owner, the year and the region in which the farm operates.

**Table 7.** OLS estimation of Models 1 to 3 (standard error in parenthesis).

| Coefficient | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $\alpha$ | 50.598* | 31.480* | 33.981* |
| | (1.083) | (1.193) | (1.038) |
| $\beta$ | 24.447* | 6.696* | |
| | (1.661) | (1.556) | |
| $\gamma$ | -1.715* | -0.914* | -1.156* |
| | (0.182) | (0.179) | (0.168) |
| $\mu$ | -0.234* | -0.097* | -0.104* |
| | (0.015) | (0.014) | (0.014) |
| $\rho$_livestock | | | 2.276 |
| | | | (1.950) |
| $\rho$_cultivation | | | 13.043* |
| | | | (2.714) |
| $\rho$_generic | | | -3.099 |
| | | | (0.695) |
| $\omega$_arable | | 3.178* | |
| | | (0.802) | |
| $\omega$_cereals | | 8.724* | |
| | | (0.761) | |
| $\omega$_dairy | | 1.212 | |
| | | (0.818) | |
| $\omega$_fruits | | 0.826 | |
| | | (0.745) | |
| $\omega$_granivores | | 0.179 | |
| | | (1.342) | |
| $\omega$_grazing | | -0.328 | |
| | | (0.806) | |
| $\omega$_horticulture | | -1.080 | |
| | | (0.878) | |
| $\omega$_olives | | 10.261* | |
| | | (1.328) | |
| $\omega$_wine | | -5.050* | |
| | | (0.766) | |
| $\delta$_large | | 19.989* | 19.432* |
| | | (0.416) | (0.409) |
| $\delta$_small | | -10.917* | -9.305* |
| | | (0.495) | (0.493) |
| Region[a] | yes | yes | yes |
| Year[a] | yes | yes | yes |

[a]Estimates of the regional and time dummy coefficients are available upon request.
*Statistically significant at 5% level.

**Table 8.** GMM estimation of Models 4 to 6 (standard error in parenthesis).

| Coefficient | Model 4 | Model 5 | Model 6 |
|---|---|---|---|
| $\eta_1$ | 0.387* | 0.410* | 0.398* |
| | (0.028) | (0.024) | (0.025) |
| $\eta_2$ | 0.097* | 0.120* | 0.116* |
| | (0.025) | (0.022) | (0.022) |
| $\beta$ | 8.844* | -0.199 | |
| | (2.086) | (1.784) | |
| $\gamma$ | -0.667* | -0.530* | -0.604* |
| | (0.299) | (0.253) | (0.259) |
| $\mu$ | 0.024 | -0.085* | -0.003 |
| | (0.057) | (0.036) | (0.050) |
| $\rho$_livestock | | | -5.031 |
| | | | (7.144) |
| $\rho$_cultivation | | | 1.904 |
| | | | (2.498) |
| $\rho$_generic | | | -2.384 |
| | | | (2.618) |
| ω_arable | | 1.049 | |
| | | (0.780) | |
| ω_cereals | | 5.034* | |
| | | (0.901) | |
| ω_dairy | | 0.192 | |
| | | (0.889) | |
| ω_fruits | | 0.468 | |
| | | (0.739) | |
| ω_granivores | | -1.918 | |
| | | (2.151) | |
| ω_grazing | | -0.953 | |
| | | (0.770) | |
| ω_horticulture | | 0.142 | |
| | | (1.050) | |
| ω_olives | | 2.310 | |
| | | (3.554) | |
| ω_wine | | -2.472* | |
| | | (0.766) | |
| δ_large | | 9.678* | 9.060* |
| | | (0.939) | (0.970) |
| δ_small | | -5.380* | -5.542* |
| | | (0.605) | (0.579) |
| Region[a] | yes | yes | yes |
| Year[a] | yes | yes | yes |

[a]Estimates of the regional and time dummy coefficients are available upon request.
*Statistically significant at 5% level.

and livestock breeding) seem to attract the bulk of the available immigrant workforce, while their concentration is less relevant in other sectors. The geographic distribution is quite uneven and is strictly linked to farm typology.

The positive correlation between share of immigrants and labour productivity at the farm level, which is robust across all farm sizes and typologies, seems to indicate these two measures go by some means together. However, when analysing this relationship with more sophisticated model specifications, results do not confirm a clear link between the two measures. When a static modelling framework is adopted, results point to a positive relationship between immigrants' work and farms' labour productivity. When introducing the assumption of temporal persistency of LP and controlling for farms' heterogeneity, this effect seems to disappear. Indeed, it can be also argued that another source of misspecification arises from the choice of indicators. In fact, LP might not be a proper indicator of farm's productivity because it does not account for all factors of production. Thus, further extensions of the present analysis include to improve the measure of farms' productivity with an indicator of total factor productivity that better represents the economic performance of farms.

Even if results do not point to a positive relationship between immigrant workforce and LP, this research confirms, using farm-level data, that immigrants are a relevant and growing component of the Italian agriculture. They are concentrated in large and medium-sized farms and their presence is associated with higher level of LP. Moreover, their contracts are largely (90%) seasonal ones.

Given this picture, it is clear why (not only) Italian agriculture needs a legislative framework more adapted to facilitating the hiring these workers to complete several of the critical farm operations. Indeed, the issue of agricultural seasonal immigrant workers, in Italy, is not exclusively a legislative issue, as many of these workers are – in some regions more than in others – irregular ones. In these cases, legislation must be at first enforced, to improve the workers deprecable conditions, even to avoid regular (both domestic and immigrant) workers occupation to be displaced by this "social dumping". However, for the legally and regularly occupied immigrant workforce, the legislative framework is part of the problem. The European Union has a specific directive promoting the use of selection and recruitment procedures of immigrant workforce directly in the areas of origin.

The current legislative framework, is represented by the EU directive 2014/36/UE "on the conditions of entry and stay of third-country nationals for employment purposes as seasonal workers". This is, in principle, consistent with European migration policy and the needs of the agricultural production. However, for obvious reasons, excludes European workers that are, in the Italian case, the bulk of immigrant workers. A more coordinated vision of the subject could help governing the phenomenon and facilitate the regular and reciprocally fruitful employment of these workers to complete several of the critical farm operations. To this respect, studies on this field can provide evidence and suggestions for policy making.

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