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‘Get back to where you once belonged’? Effects of skilled internal migration on Italian regional green growth

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ABSTRACT

The paper investigates the effects of internal migration on green growth in Italian regions. We use employment in "sustainable" sectors to measure green growth, resorting to a novel measure based on the EU taxonomy for sustainable activities. Using data from 103 Italian regions (NUTS3) from 2008 to 2018, we find that highly skilled interregional migrants are positively related to green employment in their destinations. The effect is possibly due to return migrants to the Southern regions. Overall, the evidence emphasizes the importance of human capital migration in sustainable development.

1. Introduction

The aim of the paper is to investigate the impact of interregional migration flows on green growth, i.e. employment growth in green sectors in the destination regions. To this end, we draw from two strands of literature – the first on green growth and the second on human capital migration - to explore whether the migration of skilled workers affects regional sustainable economic growth, innovation and competitiveness. The concept of green growth emerged in policy discourses after the Rio + 20 Conference on Sustainable Development in 2012. Since then, the literature has focused on three dimensions: green processes, green innovation, and green employment. However, despite the large attention to the topic, two gaps still emerge. First, the regional perspective has been only scantly addressed, even though green growth is generally acknowledged as a key leverage for regional development (Montresor and Quatraro, 2020; Sun et al., 2020; Belik et al., 2019; Panzer-Krause, 2019). Second, although the role of human capital endowments and migration in supporting innovation and shaping regional economic growth has been widely acknowledged (Faggian et al., 2017; Dotti et al., 2013; Simonen and McCann, 2010; Faggian and McCann, 2009), little has been written on their relationship with “green” growth. This paper aims at filling these gaps by investigating the extent to which interregional migration of heterogeneously skilled workers can affect employment growth in green industries in the Italian context. Italy is a particularly interesting case study in this context because of its historical North-South divide which triggers interregional migration (Bratti and Conti, 2018; Iammarino and Marinelli, 2015; Fratesi and Percoco, 2014). It is also interesting in terms of green growth, as the current Italian post-Covid National Recovery and Resilient Plan (NRRP) invests a substantial amount of resources (€ 55.52 billion, 28.56 % of the total investments in the Plan[1]) in the so-called green transition towards a more sustainable economy. To identify “green” sectors, we use the EU taxonomy of environmentally sustainable economic activities (European Commission, 2020a), consisting of a classification specifically established at European level to identify environmentally sustainable activities by looking at the firms’ contribution to climate change mitigation and adaptation (Lucarelli et al., 2020). As such, the EU taxonomy can be considered a useful tool to direct financial investment on those economic activities and firms which will support green growth in the future (Lucarelli et al., 2020). To explore the

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[1] https://www.italiadomani.gov.it/content/sogei-ng/it/it/il-piano/missioni-pnrr/rivoluzione-verde-transizione-ecologica.html, last accessed on January 6th 2024.

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relationship between green growth and interregional migration, we resort to a well-established IV approach using data for the 103 Italian provinces (NUTS3) on annual (from 2008 to 2018) employment in sustainable manufacturing and service activities, combined with interregional migration flows by educational attainment. All the data come from the Italian National Statistics Institute (ISTAT). The remainder of the paper is organised as follows. Section 2 outlines the background literature against which we build our main hypotheses; Section 3 introduces the data and variables used; Section 4 presents the estimation strategy; Section 5 discusses the results and finally Section 6 concludes.

2. An empirical exploration: background studies and testable hypotheses

The aim of our contribution is to test whether interregional migration flows of human capital foster green growth, i.e., employment growth in 'green sectors' in the destinations. As such, we combine two different strands of literature. The first on green growth. The second on human capital migration and its potential for regional economic growth, innovation and competitiveness.

2.1. Green growth

Most of the recent empirical literature on green growth focused on three dimensions. First, a specific stream of literature addresses *green processes, goods and services* provided by industries (Arora et al., 2020; De Melo and Vijil, 2016), defined as all the services and products (technology included) that may reduce environmental risks, minimize pollution, and allow for an efficient use of natural resources (OECD, 2017). These studies are often connected to a second dimension of green growth, which the literature indicates as *green innovation.* This concept generally refers to those products or services that increase business value while decreasing environmental impacts and ensuring an efficient use of natural resources (Oltra and Saint Jean, 2009; Kemp and Pearson, 2007). Within this specific stream of research, great attention has been paid to the analysis of the determinants of green technologies adoption (Montresor and Quatraro, 2020; Zhang et al., 2019; Horbach et al., 2013) and their effects on firm performance (Marín-Vinuesa et al., 2020; Padilla-Pérez and Gaudin, 2014; Antonietti and Cainelli, 2011). Finally, a third, and more recent, stream of literature looks at the employment dimension, i.e. "*green jobs*" (Barbieri and Consoli, 2019; Vona et al., 2019, 2018). More specifically, the relationship between green growth and employment has been mainly focused on:

i) the possible occupational shifts - at both national and subnational level - induced by this transition.
ii) the profile of the so-called 'green jobs'. Although there is no consensus on the definition of "green jobs" (Bowen et al., 2018; Consoli et al., 2016), several authors pointed out that the difference to "non green jobs" relies mainly on the specific skills and knowledge required for green and sustainable activities. For example, Consoli et al. (2016), using cross-sectional data based on the O*NET (Occupational Information Network) taxonomy, found that "green jobs" require a "*high level of cognitive skills*" (Consoli et al., 2016, p. 1047) and a higher level of education. Similarly, the European Commission, in different policy documents, put emphasis on the specialized high skills and knowledge (e.g. compliance with environmental regulations, monitoring resources efficiency) required by green jobs (European Commission, 2022; 2021).

Even though there is an agreement on specialized skills required by green jobs and on the fundamental role of skills to foster green transition (Losacker et al., 2023; Sulich et al., 2022; Barbieri and Consoli, 2019), the effect of skilled workforce in shaping new industrial paths at the local level received very limited attention (Stanef-Puică et al., 2022; Sulich et al., 2022; Barberi and Consoli, 2019). An even more limited number of studies (Capasso et al., 2019; Sern et al., 2018) specifically investigates the role of human capital endowments and the related effect on employment changes. This is a relevant gap, particularly from a policy perspective, since understanding the determinants of green employment and its dynamics represents a crucial challenge for policy makers in a time when many industrialised countries are still facing persistent unemployment problems, as in the case of Italy.

2.2. Interregional migration

The second relevant strand of literature is on interregional migration, especially of skilled individuals, and its impact on local economic development. Even though evidence of undesirable effects on either migrants and/or locals have been found with reference, for instance, to wages (Borjas, 2000) and employment opportunities (Suedekum, 2004), there is plenty of evidence on the positive effects induced by skilled migrants in their destinations. In fact, skill heterogeneity between in-migrants and locals can result in important complementarities, especially if the in-migrants are highly skilled (Card, 2001). Second, substantial evidence supports the idea that skilled migrants favour innovation and the creation and diffusion of new knowledge, which, in turn, leads to regional economic development and employment growth (Faggian et al., 2017; Gagliardi, 2015; Boschma et al., 2014; Faggian and McCann, 2009). In fact, a relatively higher availability of qualified migrants increases the stock of new knowledge (Hornung, 2014; Kerr and Lincoln, 2010) which results in the development of breakthrough ideas and favours human capital accumulation (Caviggioli et al., 2020; Bratti and Conti, 2018; Vecchione, 2018; Schlitte, 2012). As for employment growth, Boschma et al. (2014) analysed the relationship between labour market externalities and regional growth in Sweden showing how, when migrants moved across skill-related sectors, intraregional mobility fostered productivity and, to a minor extent, employment rates, while reducing unemployment when moving across skill-unrelated sectors. Other empirical studies found evidence of positive effects on labour productivity (Boschma et al., 2014; Timmermans and Boschma, 2014). The increased productivity of labour in the destination regions is confirmed also by Granato et al. (2015) for Germany. These positive effects are even clearer when restricting to only high-skilled migrants. For example, Caviggioli et al. (2020) and Morrison (2023), focusing on Europe and U.S., found that high skilled migration improves the regional innovation capabilities and the emerging of new technologies in "*more complex and less ubiquitous fields*" (Caviggioli et al., 2020, pp. 13), making migrants agents of structural change (Morrison, 2023). Fassio et al. (2019), in a study based at the industry-level, highlight that both high-skilled natives and migrants have a positive impact on innovation and the positive effect of the latter increases where there are high level of Foreign Direct Investments (FDIs) and when international trade is concerned. In a European study, Bosetti et al. (2015) found a positive impact of skilled migrants in the destinations, both in terms of technological innovations as well and on tacit knowledge circulation. Moreover, several empirical studies confirm also that the productivity of unskilled local workers is increased by highly skilled in-migrants, due to either complementarities (Fassio et al., 2019; Bosetti et al., 2015; Nathan, 2014; Dustmann et al., 2008; Ottaviano and Peri, 2006) or increased incentives to innovate for local firms with expanded skilled labour bases (Shlitte, 2012).

Yet, no previous contribution has explored the extent to which these mechanisms (i.e., circulation of new ideas, cross-pollination and complementarity of skills) support employment growth in green sectors, where, at the one hand, the relevant role of skills is widely recognized (Losacker et al., 2023; Bowen et al., 2018; Consoli et al., 2016) and, on the other hand, innovation represents a central issue. More specifically, we posit that the potential knowledge (re)combination is also, or even particularly, relevant in supporting green innovation and employment growth. In fact, since a complex knowledge base is needed to eco-innovate (Montresor and Vezzani, 2023; Cicerone et al., 2022; Montresor and Quatraro, 2020; Barbieri and Consoli, 2019), the combination and re-combination of pre-existent knowledge in the host regions with newly acquired knowledge from high skilled migrants can be beneficial in green sectors. In other words, we want to test whether:

H1. *Destination regions receiving relatively larger shares of highly skilled interregional migrants perform better in terms of employment growth in green sectors.*

However, this is not the only channel through which we expect that selective interregional migration positively affect sustainable activities. In fact, there is convincing empirical evidence that product diversity is favoured by the increasing stock of human capital in a region (Nathan, 2015; Florida, 2002), due to either supply (Kerr, 2013; Wadhwa et al., 2012; Drori et al., 2009) or demand effects (Mazzolari and Neumark; 2012). Moreover, Graves (1979) showed how more educated (and paid) workers are drawn by natural amenities (Dotzel, 2017), suggesting that selective interregional migration might support green growth locally from the demand side as well, thanks to an increased environmental sensibility and awareness. An additional source of positive effects on sustainable activities can be represented by highly skilled return migrants. Although migration literature provides also evidence of negative outcomes of return migration flows (Borjas and Bratsberg, 1996), the majority of studies highlight the positive labour market externalities associated with highly educated return migrants that may trigger skill complementarities and circulation of new knowledge in their original regions (Winters and Xu, 2014). This is a particularly relevant category of individuals to be analysed in the Italian context, which is characterized by relatively high levels of sub-national mobility of individuals with tertiary education.

2.3. The territorial context

Italy is a very interesting case to study interregional migration, given the widely recognized economic dualism between the North and the South (Biagi et al., 2023; Bratti and Conti, 2018; 2014). The determinants of the differences in migration inflows among metropolitan areas have long been investigated (Furceri, 2006; Cannari et al., 2000) along with those macroeconomics factors, such as GDP per capita and unemployment rates, which have been found to be an important determinant of migration movements (Basile et al., 2019; Piras, 2017; Marinelli, 2013; Etzo, 2011). On top of this, interregional migration flows in Italy have become more selective of highly skilled individuals, who are mainly directed from South to North and from peripheral and rural areas to core metropolitan ones (Basile et al., 2019; Di Berardino et al., 2019; Bonasia and Napolitano, 2012). The substantial increase of high skilled migrants from the South to the North has also been linked to the increasing divergence in regional economic growth (Fratesi and Percoco, 2014).

As such, focusing the analysis on Italy has three main advantages. First, the North-South divide implies the existence of a diverse and dynamic economic environment in which interregional migration is very common. Second, the combination of the diverging regional growth paths, and the increasing selectivity of migration, increases the heterogeneity of migrants and their skills. Overall, this makes it easier to detect the effects of different types of migration on regional growth. Third, Italy recently experienced a notable increase in value added and employment in green sectors, becoming one of the most dynamic European countries. In 2020 Italy was third in the EU for so-called green jobs (European Commission, 2020b). The creation of green jobs is favoured by the introduction of eco-innovations at firm level, in turn favoured by large intakes of skilled interregional migrants. More importantly, the beneficial effect of green innovation on employment variations has been found to be larger for SMEs (Cecere and Mazzanti, 2017), whose share on the total number of firms is higher In Italy than the other European countries. Several national and regional green policies have been implemented over the past decade in Italy, but their effect on energy efficiency, although positive across the board, was larger for regions with higher GDP per capita and larger shares of STEM graduates employed (Meleddu and Pulina, 2018). All in all, Italy hosts a dynamic green economy, with a high degree of territorial heterogeneity, worthwhile of being analysed.

3. Data and modelling

Our data include observations on the 103 Italian provinces (corresponding to NUTS3), over the period 2008–2018. We use data at NUTS3 level since this is the most territorial disaggregated level available for migration and employment data in Italy. As we are interested in analysing the potential green growth of selective internal interregional migration flows, we regress employment levels in sustainable sectors on inflows of high skilled migrants. We thus have:

$$greenGrowth_{i,t} = \beta_0 + \beta_1 Mig^{high}_{i,t-1} + \quad \beta_n X_{i,t-1} + \quad \varepsilon_{i,t} \tag{1}$$

where $greenGrowth_{i,t}$ is our measure of green growth for region $i=1,2,\ldots,103$ and year $t=2008$, 2009,..., 2018, proxied by employment in sustainable sectors; $Mig^{high}_{i,t-1}$ is the focal regressor, measuring inflows of high skilled migrants for region i and year *t-1*; $X_{i,t-1}$ is a vector of controls.

3.1. Dependent variable

Our proxy for green growth is the natural logarithm of employment levels in sectors deemed to be ‘sustainable’ at regional (NUTS-3) level. To measure green employment, we refer to the literature trying to identify “green jobs”. As Consoli et al. (2016) and Peters et al. (2011) show, there are four main approaches: *i*) jobs in the production or delivery of green products (i.e. goods and/or services contributing to environmental and conservation objective), to intermediate or final users; *ii*) jobs in green processes at firm level, e.g., waste management; *iii*) workers (rather than jobs) employed in green industries; *iv*) green occupations, where jobs are assessed based on metrics referred to tasks intensity use of green skills, knowledge and other job characteristics. Although ideally ‘purer’, the green occupation approach is difficult to be implemented and, in our view, can suffer from many of the limitations already highlighted for job-analysis approaches often discussed in education economics. Being based on occupational classifications, in fact, this approach has severe limitations in terms of data availability and the possibility to conduct cross-country comparisons (e.g., while O*Net provides information on green occupation for the US, no such information is available for Italy[2] and many other EU member states). Moreover, as revising a classification is costly (Hartog, 2000; Mason, 1995), and the review process is exposed to potentially conflicting interests expressed by different stakeholders (Elias and MacKnight, 2001), these are rarely updated. Hence, time series are difficult to implement. Thus, Groot and Van Den Brink (2000) argued that these types of measures are only valid for short periods and should not be used to track the evolution of employment over time. Consequently, we adopt a green industry approach based on the recently released EU taxonomy for sustainable activities that has a series of benefits for our empirical exercise. First, this taxonomy is based on the European sectoral classification NACE, allowing crosswalks to different classifications, both national (i.e., the Italian ATECO classification) and international (i.e., ISIC, etc.). More importantly, the availability of translating tables

[2] While INAPP (i.e., the Italian national institute for vocational training) in collaboration with the Italian national statistical office ISTAT did run two waves of the “Indagine Campionaria sulle Professioni”, a survey collecting extensive data on knowledge, skills and tasks on Italian professions, this survey does not include a dedicated section on “green occupations” as the American O*Net does. As a consequence, it is not possible to identify green jobs based on such data source when reference is made to the Italian context.

Table 1
Structure of the EU taxonomy and CEPA classification.

	EU_T	CEPA			EU_T	CEPA	
Manufacture	total	total	Overlap	**Service**	total	total	Overlap
2 digit	5	8	5	2 digit	3	1	~
3 digit	4	7	1	3 digit	7	8	~
4 digit	20	42	6	4 digit	8	2	~
% equal	41.38 %	21.05 %		% equal	0 %	0 %	

Note: Number of items/industries labelled as 'sustainable' according to EU T and CEPA at 2, 3 and 4-digit level.

between different updates of the same classification potentially facilitates measurement and consistency over time. Second, as we refer to official standards, data availability does not constitute a problem even when looking at very detailed territorial levels (i.e., NUTS3). Third, it facilitates cross-country comparisons, allowing for possible future extensions to other territorial contexts. In addition, we test the robustness and validity (Adcock and Collier, 2001; Cattani et al., 2018) of our results also using an alternative measure, based on a definition of green jobs (i.e., the Classification of Environmental Protection Activities CEPA), more linked to the green product approach. These two measures share, to a certain extent, the same conceptual background, while being operationalised in different ways. While CEPA captures only activities whose primary purpose is environmental protection, the EU taxonomy also accounts for prospective environmental goods and services that are currently being developed. Thus, using this taxonomy allows us to enrich our analysis by showing the regional potential in terms of green employment growth as induced by skilled human capital migration, in addition to its effects on current green activities.

The EU taxonomy of environmentally sustainable economic activities was defined by a Technical Experts Group (TEG) and was published in the Official Journal of the European Union in 2020 (European Commission, 2020a). This taxonomy provides a list of economic activities that potentially contribute to six environmental objectives: climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition to circular economy, pollution prevention and control, protection and restoration of biodiversity and ecosystems (Dumrose et al., 2022). Developed as an operational tool, the EU taxonomy will inform investors, large companies, as well as policy makers, in directing future investment on those companies which are classified as potentially sustainable according to the EU criteria (Lucarelli et al., 2020) thus clarifying which investments are environmentally sustainable in the wake of the EU Green Deal (Dumrose et al., 2022; Lucarelli et al., 2020). The classification is available at 4-digit level NACE Rev.2 (see Appendix A.1) and includes activities such as "forestry" (e.g. forest conservation activities), "manufacturing" (e.g. production of organic and inorganic chemicals), "energy" (e.g. energy production and storage, production of PV devices, etc.), "water, sewerage, waste management and remediation" (e.g. centralized wastewater treatment, composition of bio-waste) and "service" activities (e.g. telecommunications, technical consultancy). To the best of our knowledge this is the first time that this taxonomy is used to construct a novel measurement of green employment/growth.

Using this taxonomy, we calculated the employment growth rate of sustainable activities further distinguishing between manufacturing and services. Data has been retrieved from the Italian 'Archivio statistico delle imprese attive (ASIA)', an administrative dataset on Italian firms released and constantly updated by ISTAT. However, for robustness check, we also run our estimates using an alternative definition of sustainable sectors referring to CEPA, which does not include the idea of future green potential. In fact, CEPA was established in 2000 by Eurostat as an international standard to solely classify products, activities and expenditures whose primary purpose is environmental protection. Specifically, we refer to the "activities section" of that classification and we measure employment growth in the sectors (NACE, 4-digit) included in CEPA (see Appendix A.2). Table 1 compares the two classifications used and displays, for different levels of aggregation, the number of industries included in the EU taxonomy and CEPA, respectively. The two classifications show limited overlapping in the manufacturing sector, with only about 40 % of industries included in the EU taxonomy that are also included in CEPA and slightly above 20 % vice versa. No overlapping exists in the service sector. However, the EU taxonomy and CEPA classification deliver very similar levels of employment at regional level and the two alternative measures of green employment display a positive and significant correlation in the correlation matrix (see Appendix A.4). Moreover, the inspection of the correlation matrix does not raise any serious collinearity problem among the other covariates.

Fig. 1(a) shows similar growth trends between manufacturing and services industries identified as sustainable. These trends are characterized by a strong relapse following the 2008 recession (2009–2013), especially in manufacturing. Results using the CEPA definition are similar (Fig. 1b). During the crisis, employment in sustainable activities fell all over Italy. However, in the recovery phase, employment growth was faster in services.

Fig. 2(a-b) show a heterogeneous spatial distribution of employment growth within sustainable activities (both manufacturing and services), which at least partially differs from the traditional North-South divide (Basile et al., 2019; Gitto and Mancuso, 2015; Crescenzi et al., 2013; Mastromarco and Woitek, 2006). Looking at manufacturing and services separately, the employment growth has been mainly concentrated in sustainable services, with some Southern regions performing particularly well (Fig. 2b). For the sake of comparing our two green employment measures, it is worth noticing that, while manufacturing industries seem to share a common trend across the two alternative definitions, the service sector behaves very differently. Namely, when growth rates are estimated using the EU taxonomy, Southern regions have a relatively better performance, while the opposite is true if using the CEPA definition (see top ten regions Appendix A.3).

3.2. Main regressor: Interregional Migration data

Our main regressors are inflows of highly skilled interregional migrants. Data for interregional migration flows comes from the ISTAT Demographic Portal.[3]

Interregional migration inflows are measured as percentage shares of skilled migrants in the destination region with a one-year lag to make them predetermined with respect to the dependent variable (Eq. 4 and Table 2). Fig. 3 shows the evolution of interregional migration in Italy over the whole period which, due to the 1-year lag of the main regressor, is restricted to 2009–2018. Setting the initial share of 2009 equal to 100 (Fig. 3a), it is possible to see how interregional skilled migration flows were strongly influenced by the crisis, with a peak in 2012. On average, highly skilled migrants increased over the period, mainly heading to the Northern regions.

[3] Access to anonymized micro-data concerning migration flows and migration destinations at NUTS-3 level in Italy was granted by ISTAT following a specific request from our side, in compliance with all applicable laws and regulations concerning statistical confidentiality and personal data protection.

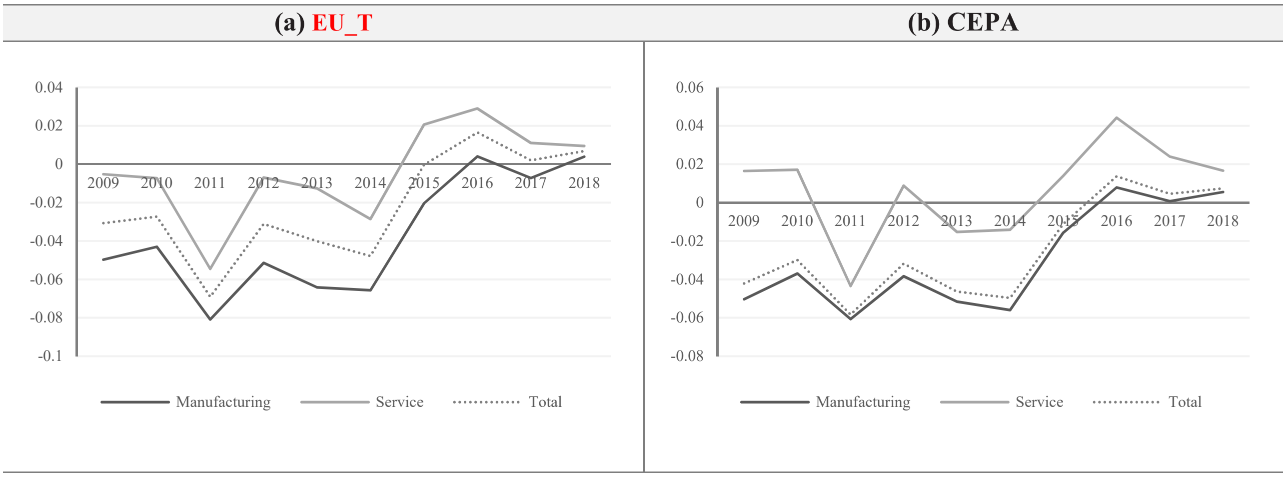

Fig. 1. Employment growth in green sectors. Notes: Employment growth in green sectors (2009–2018) by macro-sector. Measures: (a) EU taxonomy (EU_T); (b) CEPA classification.

Fig. 4 visually confirms these trends, showing a clear North-Centre and South divide. The preferred locations of high skilled migrants are metropolitan areas (such as Bologna and Milan), but also medium-sized cities (e.g., Parma and Pisa).

3.3. Endogeneity and IV approaches to migration measures

A potential issue arising in our model is endogeneity, due to either simultaneity or reverse causality, of the main regressors (i.e., high skilled migrants over total population) with the dependent variable. In fact, destination regions are usually selected by individuals based on expectations concerning their future economic performances (Shen and Liu, 2016; Gagliardi, 2015). Consequently, relatively more dynamic and innovative regions attract more migrants thus letting room for reverse causality to emerge (Faggian et al., 2017). Although we include our main regressors with a one-year lag to partially address reverse causality in our base model, we then resort to a standard IV approach (Baum et al., 2007; Card, 2001) to better address the endogeneity issue, following the approach used by Pinate et al., (2022) and Fratesi and Percoco (2014). In fact, these two studies applied this IV strategy to interregional migrants in the Italian context. The basic intuition behind this well-established approach is that migration flows, be they across (Ortega and Peri, 2014; Hunt and Gauthier-Loiselle, 2010; Kerr and Lincoln, 2010) or within (Pinate et al., 2022; Fratesi and Percoco, 2014) countries or regions, are path-dependent. Hence, the initial share of migrants, in a given region, can be used as a predictor of its future values. On the other hand, the supply-push of migrants is also uncorrelated with subsequent regional shocks and should thus prove to be both valid and exogenous. Our final instrument thus is:

$$Mig_{i,t}^{s} = \sigma_{2004}^{s}\left(\frac{Mig_{t}^{s}}{pop_{i,t}}\right) \tag{2}$$

where

$$\sigma_{2004}^{s} = \left(\frac{Mig_{i,2004}^{s}}{Mig_{2004}^{s}}\right) \tag{3}$$

Where $Mig_{i,t}^{s}$ is the predicted flow of migrant in each destination region i and year t; Mig_{t}^{s} is the overall number of individuals that migrated at a national level with education s at time t; $pop_{i,t}$ is the population of the destination region i at time t; superscript $s \in [high, medlow]$ indicates the types of skills retained by migrants and it is restricted to *high* in our empirical exercise; σ_{2004}^{s} is the number of individuals that move to region i with skill s over the total number of migrants with the same skill s that moved across Italian NUTS3 regions in 2004, which constitutes the first available year in our time series of internal migration flows and falls well before the period of interest of our analysis. This is reassuring as we can assume that the distribution of migrants in 2004 is uncorrelated with those unobserved factors that are capable to affect the regions' growth paths and that occurred five to fourteen years later.[4]

Our final model is described by Eq. (4):

$$greenGrowth_{i,t} = \beta_0 + \beta_1 Mig_{i,t-1}^{high} + \quad \beta_n X_{n,i,t-1} + \beta_k D_{k,i,2008} + \quad \varepsilon_{i,t} \tag{4}$$

where the dependent variable is the natural logarithm of employment levels in green sectors in region i in year t; $Mig_{i,t-1}^{high}$ denotes our variables of interest and captures the regional inflow of skilled migration. $X_{n,i,t-1}$ is a vector of additional n time-variant controls; $D_{k,i,2008}$ is a set of controls fixed over time and $\mu_{i,t}$ is the error term. Controls in vector D include the population ($Population_{2008}$) in region i at the beginning of the period in natural logarithm (2008) and the natural logarithm of graduates ($Graduates_{2008}$) in region i at the beginning of the period (2008) as a proxy of the local endowments of human capital. Controls in vector X include: Value Added (GDP) per employee (*VA p.e.*) in region i and year *t-1*; entrepreneurial capital (*Ent. Capital*), measured as the number of newly established firms per employee in region i and year *t-1*; capability (*Export*) of the local productive system, measured as the ratio of exports in dynamic global sectors[5] over total exports in region i and year *t-1*; finally, in order to account for structural economic features of the different regions we include firm size composition (i.e., share of workers employed in SMEs over total employment, named *SMEs* in the tables and described in detail in Table 2). In addition, we also include employment shares for all NACE 2-digit level non-sustainable sectors (*Ind. Emp. Shares*).[6] Finally, $\varepsilon_{i,t}$ is the idiosyncratic error.

Eq. 4 includes temporal dummy variables and standard errors clustered by NUTS-3 region to allow for intra-group (within) serial correlations. Table 2 present the summary statistics of the variables included in the model.

We present two different specifications, with alternative sets of controls for the structural features of the local economy. In model 1 we

[4] Our instrument can be still suspected to be not fully exogenous. In fact, migrants may select their destination regions partly based onto unobservable which are linked to the error term. In addition to that, instruments need also to be relevant.

[5] Dynamic global sectors are defined based on the Istat indicator for "Internationalisation of firms" included among the Territorial indicators for development policies. Data and metadate can be retrieved at the following link: https://www.istat.it/it/archivio/16777

[6] The share of employment by economic activities are built by aggregating ATECO 2-digit code. See Table 2 for description.

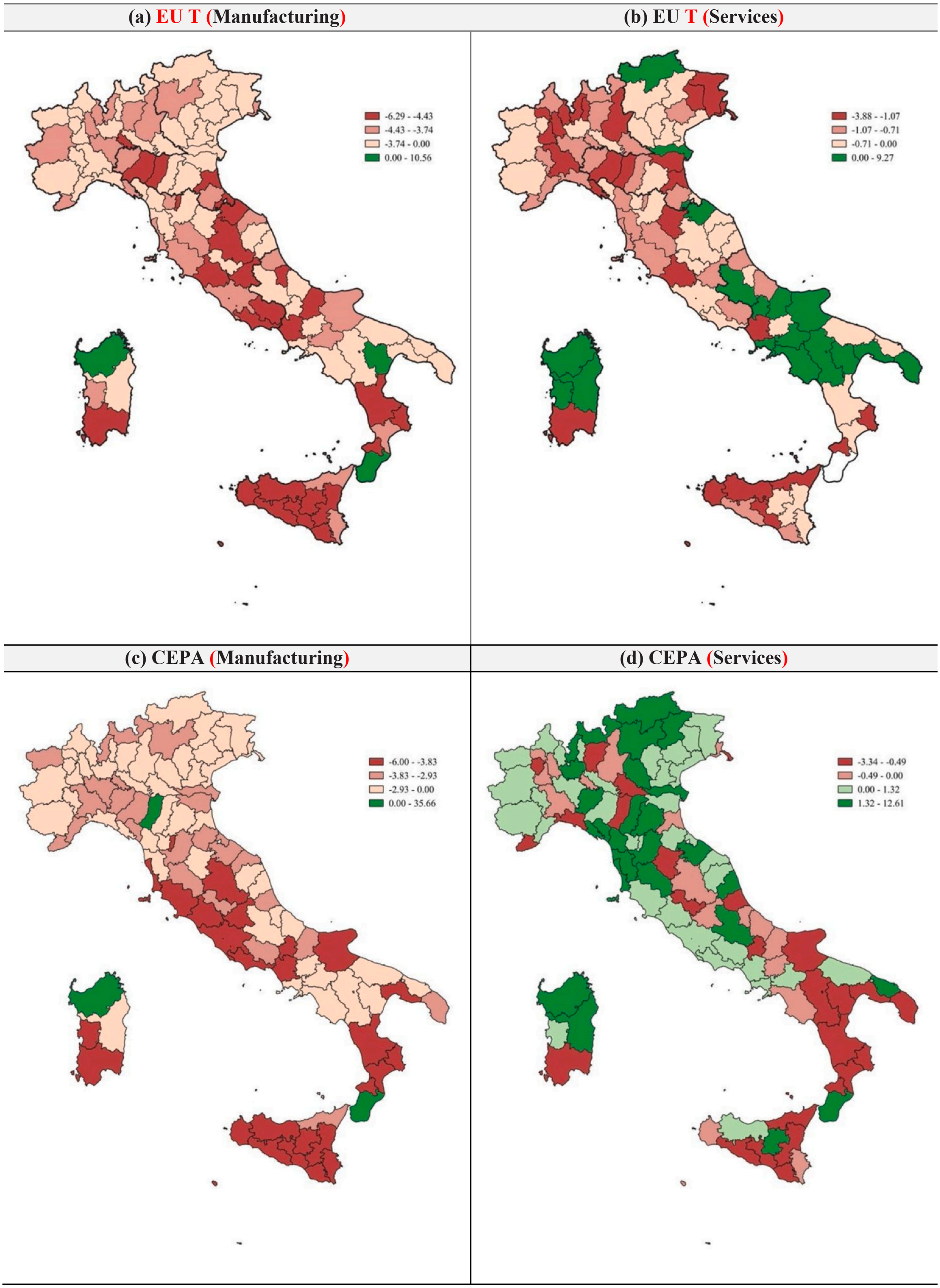

Fig. 2. Employment growth in sustainable activities by macro-sector (Italian provinces, NUTS-3). Notes: Mean growth (%) over the period (2009–2018) of the number of individuals employed in sustainable activities per 1000 inhabitants. Measures: (a-b) EU taxonomy (c-d) CEPA classification.

include the share of employment in SMEs (1–249 employees) on total employment; in model 2, we include the shares of employment in each NACE 2-digit sector (with the exclusion of sustainable sectors included in our dependent variable). We repeat our analysis splitting manufacturing and services.

4. Results

4.1. Employment growth of sustainable activities

Table 3 displays the results for our 2SLS-IV baseline model, where the dependent variable varies across specifications by measuring the

Table 2
Variables description and descriptive statistics.

Variable	Description	Mean	Std.Dev	B-SD	W-SD
Dependent variables					
greenGrowth (EU Tax.)	Natural logarithm of employment levels in sustainable activities (Eu taxonomy)	2.301	0.078	0.078	0.010
greenGrowth (EU Tax.) - Manufacturing	Natural logarithm of employment levels in sustainable manufacturing activities (Eu taxonomy)	2.243	0.077	0.076	0.015
greenGrowth (EU Tax.) - Services	Natural logarithm of employment levels in sustainable service activities (Eu taxonomy)	2.209	0.095	0.096	0.007
greenGrowth (CEPA)	Natural logarithm of employment levels in sustainable activities (CEPA)	10.085	0.807	0.801	0.124
greenGrowth (CEPA) - Manufacturing	Natural logarithm of employment levels in sustainable manufacturing activities (CEPA)	9.928	0.811	0.802	0.138
greenGrowth (CEPA) - Services	Natural logarithm of employment levels in sustainable service activities (CEPA)	8.128	0.813	0.813	0.082
Explanatory variables					
Mig^{high}	Inflow of interregional migrants with tertiary or higher education	0.108	0.060	0.055	0.024
Control variables					
Demographics					
Population	Natural logarithm of the number of inhabitants – fixed 2008-	12.926	0.703	0.706	0.000
Graduates[a]	Share of individuals with tertiary education in the working age population (%) -fixed 2008-	9.431	1.422	1.428	0.000
Local economy					
Value Added p.e.	Share of gross domestic product (i.e. Value Added GDP) in total employment	9.689	1.435	1.117	0.906
Ent. Capital	Natural logarithm of the number of newly registered firms over total population	3.506	0.275	0.266	0.076
Export	Share of exports to dynamic global sectors in total exports (%)	49.150	249.609	86.070	234.439
SMEs	Share of employment in SMEs (1–249 employees) in total employment (%)	80.944	9.237	7.137	5.901
Sectoral composition of the labour force					
SMEs-manufacturing	Share of employment in SMEs in manufacturing industries (1–249 employees) in the total employment (%)	48.903	8.246	4.758	2.437
SMEs-services	Share of employment in SMEs in services industries (1–249 employees) in the total employment (%)	32.041	5.327	6.967	4.459
Ind. Empl. Shares[b]	Share of employment by industries (ATECO 2-digit), excluding those listed in *EU_T/ CEPA*, over the total employment (%)				

Notes: Data has been retrieved from ISTAT databases (Demographic portal and Archivio Statistico delle Imprese Attive ASIA) for the period 2009–2018. Observations are 1030 for all variables. The variables enter the model with a 1-year lag, except for *population* and *graduates* that are fixed at 2008 values.

[a] The number of individuals with tertiary education is just available at NUTS2 level and has been weighted on population at NUTS3.

[b] The share of employment by economic activities are built by aggregating ATECO 2-digit codes.

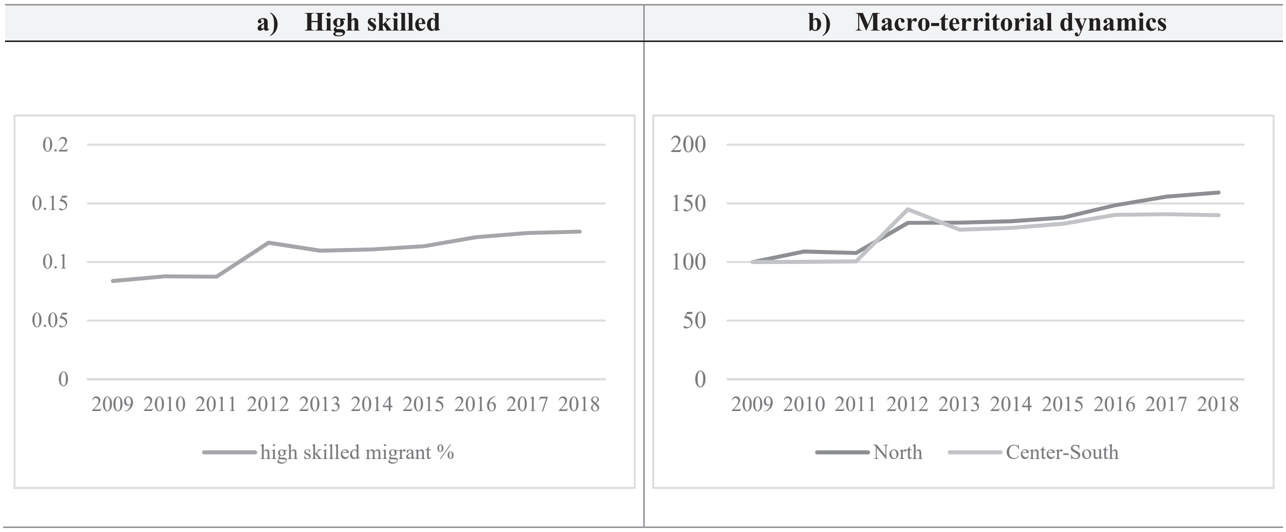

Fig. 3. Interregional migration flows of high skilled in Italy. Notes: Macro-territorial migration dynamics over the period 2009–2018. Percentage of high skilled migrants at a national level; (b) evolution over time (2009 = 100) of high skilled migrants per by macro-area.

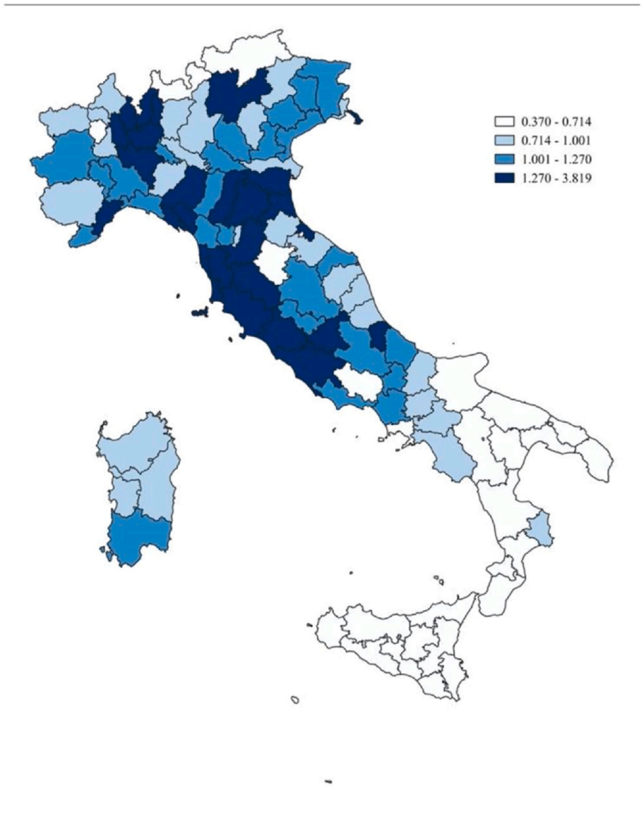

Fig. 4. Interregional migration of high skilled (Italian regions, NUTS-3). Notes: Averages of interregional high skilled migrants per 1000 inhabitants over the period 2009–2018.

natural logarithm of total employment in all sustainable sectors (Columns a), in sustainable manufacturing (Columns b) and services activities (Columns c),[7] respectively.

The coefficient associated with the shares of highly skilled migrants is positive and significant across all specifications, as expected, except for specification (1b) where it is insignificant.

Interesting insights come also from the results on the control variables. Most of the results are in line with the existing literature, but with few exceptions. First, the coefficient associated with *graduates* is significant only for two specifications with the expected sign. This seems counter-intuitive, as human capital is normally important. Nevertheless, this could be partially explained by the fact that employment in green sectors evolved relatively well in the Southern (see Section 3.1) regions where the shares of graduate workers over the total labour force is lower (Aronica et al. 2023; Piacentino and Vassallo, 2011; Scoppa, 2007). Second, *VA per employee* is negative and significant, while *entrepreneurial capital* is mostly insignificant. This seems to point to "sustainable" firms being possibly more likely to be located in peripheral areas where firms tend to be smaller. Third, the capability to *export* in dynamic global sectors has a (weakly) negative and significant coefficient, thus reinforcing the idea that sustainable activities can be located in relatively less thriving areas. Finally, *SMEs* play an important role, as the share of SMEs has a positive and significant coefficient. This result is robust across all specifications, except when the dependent variable is restricted to employment in services. This suggests that it is especially SMEs that take advantage of the green revolution.

Table 4 shows the results of our baseline model, but with an alternative definition of our dependent variable based on CEPA. The coefficient of our main variable of interest does not change and it is positive and robust across all specifications, with the only exception of model 1b, thus constituting a further endorsement to our hypothesis. As for the controls, using the alternative measure of employment in sustainable activities mostly confirms our previous findings, with a couple of exceptions. First, the share of graduates is now insignificant across all specifications. Second, the capability to export reverses its sign. This last result is somewhat controversial and can be related to the different structure of the two classifications. In fact, the EU taxonomy captures activities that are *potentially* sustainable because they are currently being developed, whereas CEPA includes environmental protection activities that are already reasonably established.

4.2. Macro-territorial estimations

Given the importance of macro-regional differences in the Italian context, we also estimate the 2SLS-IV model by splitting the sample into North and Centre-South (Table 5). Controlling for regional diversities is vital to capture territorial specificities capable of affecting the interplay between the mobility of individuals and green growth.

[7] Full tables for IV-2SLS-IV models with all controls are displayed in Appendix A.5 and A.6.

Table 3
Employment in green sectors (greenGrowth - EU Tax.) and interregional migration of high skilled workers (Mig^{high}): 2SLS-IV main results.

	Overall		Manufacturing		Services	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
Mig^{high}	0.129***	0.188***	-0.008	0.133*	0.288***	0.257***
	[0.049]	[0.058]	[0.049]	[0.072]	[0.077]	[0.065]
Population $_{2008}$	0.101***	0.103***	0.100***	0.108***	0.119***	0.113***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]	[0.004]
Graduates $_{2008}$	0.003*	0.002	0.003**	0.002	0.003	0.002
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
Value Added p.e.	-0.002***	-0.001***	-0.002***	-0.001***	-0.002***	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Ent. Capital	-0.003	-0.003	-0.004*	-0.003	-0.004	-0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Export	-0.000	-0.000*	-0.000	-0.000**	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
SMEs	0.000*		0.000**		0.001	
	[0.000]		[0.000]		[0.000]	
Constant	1.028***	1.152***	0.996***	1.123***	0.689***	0.771***
	[0.042]	[0.066]	[0.046]	[0.076]	[0.063]	[0.093]
NUTS3 regional FE	NO	NO	NO	NO	NO	NO
Time dummies	YES	YES	YES	YES	YES	YES
Ind. Empl. Shares	NO	YES	NO	YES	NO	YES
Observations	1030	1030	1030	1030	1030	1030
R-squared	0.948	0.959	0.935	0.950	0.924	0.947
First-stage F-Test	85.76	78.64	85.76	78.64	85.76	78.64

Notes: The dependent variable varies across columns, measuring the natural logarithm of employment in (a) all sustainable economic activities; (b) manufacturing sustainable activities; (c) services sustainable activities. See Table 2 for variables' definitions. Full models are displayed in the Appendix A.5. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Standard errors are clustered at a regional (NUTS-3 level). SE are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 4
Employment in green sectors (greenGrowth - CEPA) and interregional migration of high skilled workers (Mig^{high}): 2SLS-IV main results.

	Overall		Manufacturing		Services	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
Mig^{high}	1.104**	1.808***	0.796	1.727***	2.797***	2.305***
	[0.525]	[0.492]	[0.544]	[0.501]	[0.694]	[0.626]
$Population_{2008}$	0.996***	1.023***	0.989***	1.024***	1.020***	1.013***
	[0.026]	[0.029]	[0.027]	[0.031]	[0.031]	[0.033]
$Graduates_{2008}$	0.014	0.013	0.013	0.012	0.015	0.011
	[0.014]	[0.013]	[0.015]	[0.013]	[0.018]	[0.011]
Value Added p.e.	-0.026***	-0.011***	-0.027***	-0.012***	-0.016***	-0.007***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]
Ent. Capital	-0.071***	-0.036	-0.082***	-0.038	-0.013	-0.028*
	[0.017]	[0.023]	[0.018]	[0.025]	[0.022]	[0.015]
Export	0.002**	0.000	0.003***	0.001	-0.002*	-0.002***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
SMEs	0.008***		0.010***		0.003	
	[0.003]		[0.003]		[0.002]	
Constant	-2.176***	-0.752	-2.148***	-0.620	-4.924***	-4.378***
	[0.425]	[0.534]	[0.468]	[0.574]	[0.455]	[0.483]
NUTS3 regional FE	NO	NO	NO	NO	NO	NO
Time dummies	YES	YES	YES	YES	YES	YES
Industry shares	NO	YES	NO	YES	NO	YES
Observations	1030	1030	1030	1030	1030	1030
R-squared	0.944	0.958	0.936	0.953	0.936	0.960
First-stage F-Test	85.76	77.44	85.76	77.44	85.76	77.44

Notes: The dependent variable varies across columns, measuring the natural logarithm of employment in (a) all sustainable economic activities; (b) manufacturing sustainable activities; (c) services sustainable activities. See Table 2 for variables' definitions. Full models are displayed in the Appendix A.6. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Standard errors are clustered at a regional (NUTS-3 level). SE are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Interestingly, the positive effect of highly skilled migrants appears significant on employment growth in sustainable activities only in the Centre-South (Table 5, columns 1–2 a). Moreover, this correlation seems to be driven mostly by services (column 2 a-c). These findings suggest that even if Southern regions are not the preferred destinations for migrants, they have received some inflows of human capital, especially during the post-crisis period (see Fig. 3b). Among many possible explanations, worth exploring further in the future, it may be that these human capital flows towards the Southern regions might be *return migrants*, (Faggian and McCann, 2009). This is also in line with previous evidence by Marinelli (2013) who, analyzing the migration of graduates in Italy in the year 2007, found that the regions in the South (together with Marche in the Centre) are the only net recipients of *return migrants*. This result is especially important for policy, as it suggests that

Table 5
Macro-territorial estimations:2SLS-IV main results.

	Overall		Manufacturing		Services	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
EU taxonomy of sustainable activities (EU Tax.)						
North						
Mig^{high}	-0.008	0.010	-0.138***	-0.068**	0.113**	0.082**
	[0.028]	[0.024]	[0.034]	[0.032]	[0.047]	[0.041]
Observations	460	460	460	460	460	460
R-squared	0.965	0.989	0.956	0.982	0.943	0.978
Centre-South						
Mig^{high}	0.400***	0.500***	0.264***	0.449***	0.633***	0.610***
	[0.082]	[0.127]	[0.088]	[0.129]	[0.114]	[0.161]
Observations	570	570	570	570	570	570
R-squared	0.947	0.948	0.939	0.941	0.923	0.945
Classification of Environmental Protection Activities (CEPA)						
North						
Mig^{high}	-0.159	0.236	-0.355	0.223	0.838**	0.331
	[0.278]	[0.251]	[0.331]	[0.293]	[0.420]	[0.364]
Observations	460	460	460	460	460	460
R-squared	0.972	0.983	0.967	0.980	0.958	0.986
Centre-South						
Mig^{high}	3.424***	3.322***	2.806**	2.915**	6.708***	5.399***
	[1.105]	[1.248]	[1.120]	[1.165]	[1.178]	[1.798]
Observations	570	570	570	570	570	570
R-squared	0.935	0.957	0.931	0.954	0.913	0.943

Notes: The dependent variable varies across columns, measuring the natural logarithm of employment in: (a) all activities; (b) manufacture activities; (c) service activities. See Table 2 for variables descriptions. All models include the controls described in Section 3.3, common time trends (year dummies), ATECO 2-digit level industry employment shares. No regional FE is included. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Standard errors are clustered at a regional (NUTS-3 level). SE are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

intranational movements of human capital positively influence the growth of sustainable activities in the poorer regions of the South.

These macro-territorial results are once again robust when the alternative CEPA measure of green employment is adopted. Finally, the strength of our instruments was confirmed with the appropriate tests.[8]

4.3. Robustness check

As discussed in Section 3.3, one possible identification issue of our approach is represented by endogeneity, as destinations with relatively higher employment rates do attract higher shares of migrants (Shen and Liu, 2016; Gagliardi, 2015). We address the potential reverse causality problem by lagging our main regressor and implementing a standard IV approach based on Card et al. (2001). This latter approach is based on the idea that past migration flows are good predictors of current ones at a local level, making it possible to allocate shares of overall national flows that are uncorrelated with subsequent regional shocks. While the application of this approach is well documented in the literature also in relation to internal migration flows, especially when referring to Italy (Pinate et al., 2022; Fratesi and Percoco, 2014), it still can suffer from a set of possible drawbacks. First, a further potential endogeneity issue may arise from unobservable factors that are correlated with both employment in green sectors and migration of skilled human capital. To partially address this problem, we re-estimate our baseline model including regional FE at the NUTS-3 level, thus ruling out possible influences deriving from time-invariant unobservable.[9]

Table 6 shows estimates obtained from this exercise, where inflows of skilled migrants still show a robust and positive effect on employment in green sectors. The magnitude is remarkably similar to that of our baseline model (Table 3). This result is also robust to our alternative definition of green sectors, displayed in columns 1b and 2b of Table 6. Interestingly, the effects of entrepreneurial capital and firm size (SMEs shares) are confirmed to be negative and positive, respectively.

Our initial IV approach, as described in Eq. (3), may conflate the short- and long-run responses to immigration shocks, as pointed out by Jaeger et al. (2018, p. 7). To address this concern, we implement a modified procedure proposed by Jaeger et al. (2018) that allows us to estimate the short and medium-run effects separately. This approach involves using two different instrumental variables, each with a distinct temporal relationship and base-year. Specifically, we define the following two instruments:

$$Mig^s_{i,t} = \sigma^s_{2004}\left(\frac{Mig^s_t}{pop_{i,t-1}}\right) \text{and} Mig^s_{i,t-1} = \sigma^s_{2004}\left(\frac{Mig^s_{t-1}}{pop_{i,t-2}}\right) \quad (5)$$

The first instrument, $Mig^s_{i,t}$, captures the short-run effect by using the contemporaneous migration flow of skilled migrants (Mig^s_t) scaled by the population in the previous year ($pop_{i,t-1}$). This instrument enters the model without any lag. The second instrument, $Mig^s_{i,t-1}$, captures the medium-run effect by using the lagged migration flow of skilled migrants (Mig^s_{t-1}) scaled by the population two years prior ($pop_{i,t-2}$). This instrument enters the model with a one-year lag. By using these new instruments we aim to estimate separately short and medium run effect, as opposed to what we did in Eq. (3) where the only proposed instrument was intended to determine migration flows based on the past distribution of migrants (σ^s_{2004}) and the current local demand conditions $\left(\frac{Mig^s_{i,2004}}{Mig^s_{2004}}\right)$.

Columns (1) and (2) in Table 7 show the estimates obtained using this multiple instrumentation procedure. The lagged flows of skilled migrants continue to have a positive and significant effect on employment in green sectors, further endorsing the robustness of our results. However, the magnitude of the effect is slightly smaller compared to our initial IV estimates.

[8] Tables showing coefficients associated with all controls for the macro-territorial analyses and the relative IV tests are available upon request.

[9] Notwithstanding the importance of this robustness check, our baseline model is represented by pooled IV-OLS with standard errors clustered at the NUTS-3 level. In fact, the economic literature provides several alternatives to the use of FE estimates when the persistence over time of the variables of interest is relatively high, from clustered standard errors to spatial filters (Patuelli et al., 2012).

Table 6
Robustness check: baseline model including regional FE (2SLS-IV).

	EU Taxonomy		CEPA	
	(1a)	(2a)	(1b)	(2b)
Mig^{high}	0.245**	0.169**	3.424*	2.631*
	[0.123]	[0.080]	[1.827]	[1.417]
$Population_{2008}$	0.020**	0.015**	0.214**	0.167**
	[0.009]	[0.006]	[0.095]	[0.076]
$Graduates_{2008}$	0.014	0.000	0.075	-0.050
	[0.015]	[0.015]	[0.220]	[0.220]
Value Added p.e.	-0.010	-0.002	-0.260*	-0.171*
	[0.010]	[0.008]	[0.134]	[0.103]
Ent. Capital	-0.005***	-0.002***	-0.050*	-0.031**
	[0.002]	[0.001]	[0.027]	[0.014]
Export	0.000	0.000	0.001	0.001
	[0.000]	[0.000]	[0.001]	[0.001]
SMEs	0.001***		0.004**	
	[0.000]		[0.002]	
Constant	1.954***	2.201***	7.786**	9.847***
	[0.231]	[0.212]	[3.138]	[2.984]
NUTS3 regional FE	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES
Industry shares	NO	YES	NO	YES
Observations	1030	1030	1030	1030
R^2	0.529	0.652	0.332	0.440

Notes: The dependent variable is the natural logarithm of employment in sustainable sectors according to EU taxonomy (panel A) and CEPA classification (panel B). See Table 2 for variables descriptions. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Robust standard errors in brackets. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 7
Robustness check: IV approach reconsidered.

	Model A	
	(1)	(2)
Mig^{high}	0.014	0.012
	[0.015]	[0.010]
Mig^{high}_{t-1}	0.051***	0.044***
	[0.016]	[0.012]
Controls	YES	YES
NUTS3 regional FE	YES	YES
Time dummies	YES	YES
Industry shares	NO	YES
Observations	927	927
R-squared	0.939	0.943

Notes: The dependent variable is the natural logarithm of employment in sustainable sectors (EU Tax.). See Table 2 for variables descriptions. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Robust standard errors in brackets. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10.

A further concern about our identification strategy is represented by the possible path-dependency over time of the dependent variable. In fact, it may be that initial shares of employment in green sectors are predictive of relatively higher shares in the future. To check for this, we implement a partial adjustment model by including among our regressors the previous level of employment in green sectors. We refer to this exercise in the Table as "Model A".Columns (1) and (2) in Table 8 display the results from this further robustness check that mostly confirms our results, with a positive and significant coefficient that falls in between the estimates from the baseline model and those obtained with the Jeager et al. (2018) approach.

Since employment shares are likely to be spatially correlated, we include in our baseline models (Tables 3, 4 and 5) clustered standard errors at a regional (NUTS-3) level to partially mitigate the probable spatial autocorrelation in the error terms. To test whether flows of skilled immigrants in a particular province have an impact on employment in green sectors of the neighbouring provinces, we implement a fixed effect Spatial Durbin Model (SDM):

$$Y_{i,t} = \alpha_i + \rho W Y_{i,t} + \beta X_{i,t} + \gamma W X_{i,t} + \vartheta Z_{i,t} + \theta T_t + \quad \varepsilon_{i,t} \quad (6)$$

where $Y_{i,t}$ is the natural logarithm of total employment in green sectors in region i at time t, W is the is the 103 × 103 row-standardised inverse-distance spatial weight matrix, $X_{i,t}$ is skilled migration inflows in region i at time t, $Z_{i,t}$ is a vector containing the usual controls, T_t measures common time trends and $\varepsilon_{i,t}$ is the idiosyncratic error while, finally, ρ and γ are the coefficients capturing the impact of the spatially lagged dependent variable and the spatially lagged regressor, respectively. We refer to this exercise in the Table as "Model B". Columns 3, 4 and 5 in Table 8 show the estimates from the Spatial Durbin model. We do not find evidence of spatial spillover effects from skilled migrant flows in one location to employment in green sectors in neighboring locations, as the coefficient (γ) associated with the interaction term between the skilled migrant flows (X) and the spatial weight matrix (W) is not statistically significant. We conclude that our estimates are not affected by spatial correlation in the main regressor, while presenting a significant spatial autocorrelation (ρ) as far as the dependent variable is concerned. Therefore, care should be taken in interpreting the effect of the main regressor on the outcome variable due to the presence of spatial patterns that may affect the parameters associated with the covariates (Patuelli et al., 2011). In this scenario, the coefficient associated with the skilled migrant flows (the non-spatially lagged regressor) can be interpreted as the direct effect of skilled migrant flows on employment in green sectors within the same location. However, due to the spatial autocorrelation in the dependent variable, this direct effect can potentially propagate indirectly to neighbouring locations through the spatial multiplier process. To fully understand the overall impact of skilled migrant flows on employment in green sectors, both the direct and indirect (spillover) effects should be considered and we consequently report direct, indirect and total effects in Columns 3, 4 and 5, respectively. Results in Columns 3–5 of Table 7 show how the coefficient associated with our instrument for high skilled migration is still positive and significant and thus robust to this further check.

Finally, we test the robustness of our baseline model on alternative specifications of the dependent variable and focal regressor. On the former, to make sure that the detected effect of skilled migration on employment can be attributed to green sectors solely and it is not

Table 8
Robustness check: Partial adjustment model (Model A); Spatial Durbin Model (Model B).

	Model A		Model B		
	(1)	(2)	(3) Direct	(4) Indirect	(5) Total
Mig^{high}_{t-1}	0.102*	0.084*	0.056**	0.037*	0.093**
	[0.062]	[0.046]	[0.028]	[0.022]	[0.045]
$greenGrowth_{t-1}$	0.681***	0.644***			
	[0.058]	[0.073]			
Mig^{high} * W			0.000	0.009	0.009
			[0.001]	[0.117]	[0.118]
ρ			0.401***	0.401***	0.401***
			[0.105]	[0.105]	[0.105]
Controls	YES	YES	YES	YES	YES
NUTS3 regional FE	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Industry shares	NO	YES	YES	YES	YES
Observations	1030	1030	1133	1133	1133
R-squared	0.731	0.744	0.887	0.887	0.887

Notes: The dependent variable is the natural logarithm of employment in sustainable sectors (EU Tax.). See Table 2 for variables descriptions. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Robust standard errors in brackets. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10.

simply due to a generalised positive employment impact across the board. Even if we do include employment in brown sectors in the panel FE robustness check presented above, we go on and estimate at a national and macro-territorial (North vs Centre-South) level a set of 7 alternative specifications to detect possible effects of skilled migration on: overall employment; employment in high tech sectors; employment in the 10, 20 and 30 sectors with largest employment growth; overall unemployment; employment in manufacturing sectors; and employment in services sectors. Table A.7 in Appendix shows the estimates from this additional test, highlighting that there is no correlation between skilled migration and the alternative dependent variables, except for a negative and (weakly) significant correlation with the fastest growing sectors.

On the latter, by estimating our model with an alternative focal regressor, we test whether the positive effect of migration on green jobs is due to skilled migrants only or can be linked to inflows of migrants, irrespectively of their educational background. We thus substitute our main regressor with two separate regressors, one measuring levels of total migration and one measuring the share of high skilled migrant over total migration. Estimates from this specification are reported in Table A.8 in the Appendix and clearly show that it is only the skilled fraction of skilled workers that drives the positive correlation between migration and employment in green sectors.

5. Conclusions

The aim of our contribution is to investigate the effects of interregional selective migration in Italy on the employment growth in sustainable industries, further distinguishing between manufacturing and services. With respect to the extant literature, the novelties are twofold. First, this is the first study investigating the effect of interregional migration specifically on green employment growth. Second, in our empirical analysis we use a novel measure of green employment based on the EU taxonomy for sustainable activities.

Overall, our results show an heterogenous effect of human capital mobility on green employment growth across the Italian regions. The results from our 2SLS-IV model suggest that the effect of interregional migration differs by sectors (i.e., services vs. manufacturing). More precisely, NUTS3 regions that received higher shares of skilled migrants outperformed the other ones in terms of employment in green sectors, as measured by both the EU taxonomy and the alternative CEPA.

Altogether, these findings bear important policy implications. First, they confirm the need to incorporate skills and human capital in the sustainable development discourse. Basile et al. (2019) suggest that the specificity of migrant skills can no longer be ignored when analysing the effects of internal mobility on the regional labour markets. Moreover, providing evidence of the type of skills that may support future green growth and transition may support the national and European policy makers in defining and implementing evidence-based policy to foster an effective green transition.

Second, by looking at the literature on the effect of interregional migration on regional development, our study extends to green employment previous findings on the positive effects of human capital migration on regional development, such as the promotion of innovation, which in turn can favour the regional economic and employment growth.

Third, we find some important differences at macro-regional level. In particular, the positive effect of high-human capital migrants on green jobs is mainly relevant in the Centre-South and in services, and is possibly driven by *return migrants*. Should this hypothesis be confirmed by future research, it would show the importance of return high-skilled migration for the Italian South, also in terms of green transition.

Notwithstanding the novelty, some limitations need to be acknowledged. First, a more granular approach to measuring human capital endowments of migrants would enable a better understanding of which are the best drivers of regional green growth. Future research may investigate the specific migrants' knowledge, skills and competences that are more relevant in supporting the transition to greener products and services. Second, even if our results are robust across different definitions of green sectors, a larger set of outcome variables is more suitable to fully disentangle the potential heterogeneity in the response to internal migrations from all of the dimensions of green growth, e.g. environmental and resource productivity, natural assets base, environmental quality of life, value added, technology and innovation, and finance. Third, the exploration of the possible channels through which the sub-national mobility of human capital generates positive externalities for local labour markets in the destinations, although beyond the scope of the present study, needs to be addressed in the future.

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Appendix

Appendix A.1. . EU taxonomy of Environmentally Sustainable Economic Activities: NACE Rev.2

NACE Rev.2 - Description	
C - Manufacturing	
20.11	industrial gases
20.13	other inorganic basic chemicals
20.14	other organic basic chemicals
20.15	fertilisers and nitrogen compounds
20.16	plastics in primary forms
23.51	cement
24.1	basic iron and steel and of ferro-alloys
24.2	tubes, pipes, hollow profiles and related fittings of steel
24.3	other products of first processing of steel
24.42	aluminium production
24.51	casting of iron
24.52	casting of steel
D - Electricity, Gas, Steam and Air Conditioning Supply	
35.11	production of electricity
35.12	transmission of electricity
35.13	distribution of electricity
35.21	manufacture of gas
35.30	steam and air conditioning supply
E - Water supply, sewerage, waste management	
36	water collection, treatment and supply
37	sewerage
38.11	collection of non-hazardous waste
38.21	treatment and disposal of non-hazardous waste
38.32	Recovery of sorted materials
39	remediation activities and other waste management services
F - Construction	
41	construction of buildings
42.11	construction of roads and motorways
42.12	construction of railways and underground railways
42.13	construction of bridges and tunnels
42.91	construction of water projects
43	specialised construction activities
H - Transport and storage	
49.10	passenger rail transport, interurban
49.20	freight rail transport
49.31	urban and suburban passenger land transport
49.32	taxi operation
49.39	other passenger land transport
49.41	freight transport by road
49.50	transport via pipeline
50.30	inland passenger water transport
50.40	inland freight water transport
53.10	postal activities under universal service obligation
53.20	other postal and courier activities
J - Information and communication	
61	telecommunications
62	computer programming, consultancy and related activities
63.11	data processing, hosting and related activities
K - Financial and insurance activities	
65.12	non-life insurance
L - Real estate activities	
68	real estate activities
M - Professonal, scientific and technical activities	
71.12	engineering activities and related technical consultancy
N - Administrative and support service activities	
77.11	renting and leasing, and light motor vehicles

Notes: The EU taxonomy also covers a number of agriculture, forestry and fishing activities which we have excluded from the analysis since the data is not available for Italy at NUTS-3 level and on an annual basis. Manufacturing sustainable activities are listed in sections: C, D, E, F; all other activities correspond to service sustainable activities. Source: European Commission, EU taxonomy for sustainable activities (2020).

Appendix A.2. . Classification of Environmental Protection Activities (CEPA): NACE Rev.2

NACE Rev.2 - Description	
C - Manufacturing	
13.92	made-up textile articles, except apparel
13.96	other technical and industrial textiles
16.1	sawmilling and planing of wood
16.23	other builder's carpentry and joinery
16.24	wooden containers
16.29	other products if wood; articles of cork, straw and plating materials
17	paper and paper products
20.14	other organic basic chemicals
20.16	plastics in primary forms
20.59	other chemical products
22.19	rubber products
22.21	plastic plates, sheets, tubes and profiles
22.22	plastic packing goods
22.23	builder's ware of plastic
22.29	other plastic products
23.12	shaping and processing of flat glass
23.14	glass fibres
23.61	concrete products for construction purposes
23.62	plaster products for construction purposes
23.65	fibre cement
23.99	other non-metallic mineral products
24.33	cold forming or folding
24.51	casting of iron
25.12	doors and windows of metal
25.21	central heating radiators and boilers
25.29	other tanks, reservoirs and containers of metal
25.99	other fabricated metal products
26.11	electric components
26.51	instruments and appliances for measuring, testing and navigation
27.4	electric lighting equipment
27.51	electric domestic appliances
27.52	non-electric domestic appliances
28.11	engines and turbines, except aircraft, vehicle and cycle engines
28.13	other pumps and compressors
28.14	other taps and valves
28.21	ovens, furnaces and furnace-burners
28.25	non-domestic cooling and ventilation equipment
28.29	other general purpose machinery
28.41	metal forming machinery
29	motor vehicles, trailers and semi-trailers
30	other transport equipment
33.1	repair of fabricated metal products, machinery and equipment
33.2	installation of industrial machinery and equipment
D - Electricity, Gas, Steam and Air Conditioning Supply	
35.11	production of electricity
35.21	manufacture of gas
35.3	steam and air conditioning supply
E - Water supply, sewerage, waste management and remediation	
36	water collection, treatment and supply
37	sewerage
38.1	waste collection
38.2	waste treatment and disposal
38.32	recovery of sorted materials
39	remediation and activities and other waste management services
F - Construction	
41	construction of buildings
42.21	construction of utility projects for fluids
42.22	construction of utility projects for electricity and telecommunications
42.99	construction of other civil engineering projects
43	specialised construction activities
M - Professonal, scientific and technical activities	
71.1	architectural and engineering activities and related technical consultancy
71.2	technical testing and analysis
72.1	research and experimental development services on natural sciences and engineering
74.9	other professional, scientific and technical
N - Administrative and support service activities	
81.29	other cleaning activities
O - Public administration and defence; compulsory social security	
84.1	administration of the State and the economic and social policy of the community
P - Education	
85.4	higher education
85.5	other education
85.6	educational support activities
R - Arts, Entertainment and recreation	

91.04	botanical and zoological gardens and nature reserve activities
S - Other Service Activities	
94	activities of membership organisations

Source: European Commission.

Appendix A.3. . Top-10 provinces by employment in green sectors

EU Taxonomy					
(a) Manufacturing			(b) Services		
Reggio di Calabria	South	10.557	Reggio di Calabria	South	9.272
Matera	South	1.558	Sassari	South	5.335
Sassari	South	1.042	Salerno	South	1.682
L'Aquila	South	-0.220	Isernia	South	1.214
Bolzano	North	-1.417	Foggia	South	1.132
Nuoro	South	-2.008	Potenza	South	1.119
Genova	North	-2.149	Pesaro and Urbino	Centre	0.829
Brindisi	South	-2.181	Nuoro	South	0.670
Udine	North	-2.245	Lecce	South	0.546
Cremona	North	-2.253	L'Aquila	South	0.372
CEPA activities					
(c) Manufacturing			(d) Services		
Reggio di Calabria	South	35.658	Reggio di Calabria	South	12.607
Reggio nell'Emilia	North	3.261	Pesaro and Urbino	Centre	4.788
Sassari	South	2.366	Sassari	South	4.765
Matera	South	-0.042	Florence	Centre	4.531
Potenza	South	-0.694	L'Aquila	South	3.999
Bolzano	North	-0.897	Livorno	Centre	3.534
Biella	North	-1.387	La Spezia	North	2.582
Trieste	North	-1.753	Bologna	North	2.407
Vicenza	North	-1.772	Ascoli Piceno	Centre	2.331
L'Aquila	South	-1.820	Belluno	North	2.240

Notes: Averages over the period 2009–2018. Measures: (a) EU taxonomy -sustainable manufacturing activities-; (b) EU taxonomy -sustainable services activities-; (c) CEPA classification -manufacturing activities-; (d) CEPA classification -services activities-.

Appendix A.4. . Pairwise correlation matrix

ID	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1	greenGrowth (EU Tax.)	1												
2	greenGrowth (EU Tax.) - Manufacturing	0.9873*	1											
3	greenGrowth (EU Tax.) - Services	0.9850*	0.9465*	1										
4	greenGrowth (CEPA)	0.9741*	0.9677*	0.9555*	1									
5	greenGrowth (CEPA) - Manufacturing	0.9653*	0.9633*	0.9432*	0.9986*	1								
6	greenGrowth (CEPA) - Services	0.9761*	0.9468*	0.9783*	0.9570*	0.9406*	1							
7	Mig^{high}	0.2943*	0.2172*	0.3598*	0.2995*	0.2830*	0.3727*	1						
8	Population	0.9274*	0.9174*	0.9099*	0.8923*	0.8795*	0.9213*	0.1806*	1					
9	Graduates	0.1011*	0.0718*	0.1312*	0.1081*	0.1045*	0.1106*	0.4130*	-0.0351	1				
10	Value Added p.e.	-0.1115*	-0.1463*	-0.0812*	-0.1872*	-0.2104*	-0.0545	0.0711*	0.0479	-0.0452	1			
11	Ent. Capital	-0.3654*	-0.3495*	-0.3767*	-0.4604*	-0.4735*	-0.3584*	-0.3659*	-0.0877*	-0.2085*	0.3662*	1		
12	Export	0.0671*	0.0596	0.0718*	0.0599	0.0564	0.0724*	0.0104	0.0789*	0.1301*	0.0371	0.0294	1	
13	SMEs	-0.2475*	-0.2309*	-0.2541*	-0.2911*	-0.2945*	-0.2524*	-0.2166*	-0.1508*	-0.1276*	0.4317*	0.4522*	-0.0467	1

Notes: Mean VIF values in all models are lower than 3.

Appendix A.5. . Employment in green sectors (greenGrowth – EU Tax.) and interregional migration: 2SLS-IV

	Overall		**Manufacturing**		**Services**	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
Mig^{high}	0.129***	0.188***	-0.008	0.133*	0.288***	0.257***
	[0.049]	[0.058]	[0.049]	[0.072]	[0.077]	[0.065]
Population $_{2008}$	0.101***	0.103***	0.100***	0.108***	0.119***	0.113***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.004]	[0.004]
Graduates $_{2008}$	0.003*	0.002	0.003**	0.002	0.003	0.002
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]
Value Added p.e.	-0.002***	-0.001***	-0.002***	-0.001***	-0.002***	-0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Ent. Capital	-0.003	-0.003	-0.004*	-0.003	-0.004	-0.003
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Export	-0.000	-0.000*	-0.000	-0.000**	0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

SMEs	0.000*		0.000**		0.001	
	[0.000]		[0.000]		[0.000]	
Industry (share of employment %)						
B mining and quarrying		-0.006		0.001		-0.018**
		[0.005]		[0.006]		[0.008]
C manufacturing		-0.001*		-0.002***		0.000
		[0.001]		[0.001]		[0.001]
DE supplies		-0.008		-0.003		-0.019
		[0.010]		[0.012]		[0.014]
F construction		0.006		0.010		0.002
		[0.007]		[0.007]		[0.009]
G trade		-0.001		-0.002		0.002
		[0.001]		[0.002]		[0.002]
H transportation		0.000		-0.002*		0.003**
		[0.001]		[0.001]		[0.002]
I accommodation		-0.001		-0.002		0.001
		[0.001]		[0.002]		[0.001]
J communication		0.009		-0.000		0.016
		[0.007]		[0.007]		[0.010]
KL finance and real-estate		0.003		-0.000		0.010***
		[0.002]		[0.002]		[0.003]
M professional and technical		-0.011***		-0.015***		-0.008*
		[0.004]		[0.005]		[0.005]
N rental and business support		-0.001		-0.002		0.002
		[0.001]		[0.001]		[0.002]
PQ education and human health		-0.006***		-0.007***		-0.005**
		[0.002]		[0.002]		[0.002]
R entertainment and recreational		0.010**		0.009		0.016**
		[0.005]		[0.006]		[0.006]
S other activities		-0.008*		-0.007		-0.008
		[0.004]		[0.004]		[0.005]
Constant	1.028***	1.152***	0.996***	1.123***	0.689***	0.771***
	[0.042]	[0.066]	[0.046]	[0.076]	[0.063]	[0.093]
NUTS3 regional FE	NO	NO	NO	NO	NO	NO
Time dummies	YES	YES	YES	YES	YES	YES
Observations	1030	1030	1030	1030	1030	1030
R-squared	0.948	0.959	0.935	0.950	0.924	0.947

Notes: The dependent variable varies across columns, measuring the natural logarithm of employment in: (a) all sustainable activities; (b) manufacturing sustainable activities; (c) service sustainable activities. See Table 2 for variables definition. Estimations are at province level (NUTS3) for Italy, 2008–2018. Clustered standard errors are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix A.6. . Employment in green sectors (greenGrowth - CEPA) and interregional migration: 2SLS-IV

	Overall		**Manufacturing**		**Services**	
	(1a)	(2a)	(1b)	(2b)	(1c)	(2c)
Mig^{high}	1.104**	1.808***	0.796	1.727***	2.797***	2.305***
	[0.525]	[0.492]	[0.544]	[0.501]	[0.694]	[0.626]
Population $_{2008}$	0.996***	1.023***	0.989***	1.024***	1.020***	1.013***
	[0.026]	[0.029]	[0.027]	[0.031]	[0.031]	[0.033]
Graduates $_{2008}$	0.014	0.013	0.013	0.012	0.015	0.011
	[0.014]	[0.013]	[0.015]	[0.013]	[0.018]	[0.011]
Value Added p.e.	-0.026***	-0.011***	-0.027***	-0.012***	-0.016***	-0.007***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]
Ent. Capital	-0.071***	-0.036	-0.082***	-0.038	-0.013	-0.028*
	[0.017]	[0.023]	[0.018]	[0.025]	[0.022]	[0.015]
Export	0.002**	0.000	0.003***	0.001	-0.002*	-0.002***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
SMEs	0.008***		0.010***		0.003	
	[0.003]		[0.003]		[0.002]	
Industry (share of employment %)						
B mining and quarrying		-0.013		-0.019		0.023
		[0.050]		[0.052]		[0.053]
C manufacturing		-0.010**		-0.012**		-0.000
		[0.005]		[0.006]		[0.005]
DE supplies		-0.266***		-0.314***		0.033
		[0.102]		[0.108]		[0.122]
F construction		0.013		0.004		0.079
		[0.055]		[0.056]		[0.058]
G trade		-0.021*		-0.021		-0.013
		[0.012]		[0.013]		[0.011]
H transportation		-0.017**		-0.021***		0.009
		[0.007]		[0.008]		[0.009]
I accommodation		-0.022**		-0.027**		0.010
		[0.011]		[0.012]		[0.008]
J communication		0.043**		0.032*		0.097***
		[0.019]		[0.020]		[0.021]

KL finance and real-estate		-0.005		-0.008		0.018
		[0.017]		[0.018]		[0.015]
M professional and technical		-0.138***		-0.151***		-0.078**
		[0.037]		[0.040]		[0.032]
N rental and business support		-0.030***		-0.032***		-0.017*
		[0.010]		[0.010]		[0.009]
PQ education and human health		-0.075***		-0.079***		-0.050***
		[0.015]		[0.017]		[0.013]
R entertainment and recreational		0.046		0.044		0.048
		[0.040]		[0.043]		[0.032]
S other activities		-0.114***		-0.123***		-0.041
		[0.041]		[0.043]		[0.044]
Constant	-2.176***	-0.752	-2.148***	-0.620	-4.924***	-4.378***
	[0.425]	[0.534]	[0.468]	[0.574]	[0.455]	[0.483]
NUTS3 regional FE	NO	NO	NO	NO	NO	NO
Times dummies	YES	YES	YES	YES	YES	YES
Observations	1030	1030	1030	1030	1030	1030
R-squared	0.944	0.958	0.936	0.953	0.936	0.960

Notes: The dependent variable varies across columns, measuring the natural logarithm of employment (CEPA) in: (a) all sustainable activities; (b) manufacturing sustainable activities; (c) service sustainable activities. See Table 2 for variables definition. Estimations are at province level (NUTS3) for Italy, 2008–2018. Clustered standard errors are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix A.7. . Robustness check: employment in non-green sectors and skilled migrants (2SLS-IV)

	Emp. (1)	**High-tech** (2)	**10** (3)	**20** (4)	**30** (5)	**Unemp.** (6)	**Manuf.** (7)	**Service** (8)
Overall								
Mig^{high}	-0.355	5.385	-0.683	-0.975	-0.798*	2.029	0.191	-0.640
	[0.610]	[7.339]	[0.904]	[0.669]	[0.432]	[2.821]	[1.088]	[0.657]
Obs.	1030	1030	1030	1030	1030	1030	1030	1030
R-squared	0.876	0.051	0.499	0.430	0.219	0.576	0.782	0.899
North								
Mig^{high}	-0.414	0.785	-1.824**	-1.191*	-0.772*	2.432	-1.493	-0.440
	[0.483]	[3.051]	[0.896]	[0.643]	[0.409]	[3.204]	[0.937]	[0.518]
Obs.	460	460	460	460	460	460	460	460
R-squared	0.800	0.688	0.358	0.242	0.360	0.347	0.238	0.907
Centre-South								
Mig^{high}	1.368	43.273	11.337	-0.684	-2.646	7.936	21.617	-2.767
	[8.522]	[265.011]	[60.511]	[7.323]	[13.846]	[57.368]	[112.603]	[15.573]
Obs.	570	570	570	570	570	570	570	570
R-squared	0.909	0.109	0.195	0.201	0.0180	0.114	0.0326	0.928

Notes: The dependent variable varies across columns, measure the natural logarithm of employment in non-green sectors for: (1) all non-green sectors; (2) high-tech sectors; (3 − 5) 10, 20 and 30 fastest growing sectors, respectively; (6) unemployment; (7) employees in manufacturing; (8) employees in services. All models include the controls described in Section 3.3, common time trends (year dummies), ATECO 2-digits level industry employment shares. No regional FE is included. Estimates on Italian provinces (NUTS3) over the period 2008–2018. Yearly fixed effects included. Standard errors are clustered at a regional (NUTS-3 level). Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Appendix A.8. . Robustness check: employment in green sectors and total vs skilled migrants (2SLS-IV)

	EU_T (1)	EU_T (2)
Skilled share of migrants	0.019**	0.017***
	[0.009]	[0.006]
Total migration	-0.000	-0.000*
	[0.000]	[0.000]
Population $_{2008}$	0.110***	0.110***
	[0.005]	[0.005]
Graduates $_{2008}$	0.005***	0.004***
	[0.002]	[0.001]
Value Added p.e.	-0.002***	-0.001***
	[0.000]	[0.000]
Ent. Capital	-0.002	-0.003
	[0.002]	[0.002]
Export	-0.000	-0.000
	[0.000]	[0.000]
SMEs	0.000	
	[0.000]	
Constant	0.904***	0.947***
	[0.067]	[0.088]
NUTS3 regional FE	NO	NO
Time dummies	YES	YES
Industry shares	NO	YES
Observations	1030	1030

R-squared	0.949	0.962

Notes: The dependent variable is the natural logarithm of employment in green sectors (EU_T). See Table 2 for variables definition. Estimations are at province level (NUTS3) for Italy, 2008–2018. Clustered robust standard errors are in brackets. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

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