



Export diversification dimensions and performance: Analysis and industrial policy insights from Italian territories over Covid-19 shocks

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ABSTRACT

Export diversification has been long discussed as a strategy to shield from external shocks and stabilize export levels. At the same time, it can proxy for the presence of specific productive and geoeconomic capabilities. This paper considers geographical and sectoral diversification of industrial exports proposing HHI-based indexes that consider different levels of aggregation. Specifically, we explore how these metrics are associated with each other, and how this association is moderated by different levels of export intensity and stability. Overall, they both explain well variations in export intensity over the COVID-19 asymmetric shocks. Further, exposure toward EU markets shows a positive association with stability. These findings and the heterogeneity lens used are then interpreted stressing the relevance of place-based policies in guiding export diversification strategies in the face of global economic challenges.

1. Introduction

Starting with the 2008 financial crisis, a season of global turbulence is affecting the global economy. The recent pandemic and emerging wars have further underscored the importance of stability in economic development with resilience becoming a prominent policy target [1–4]. While export intensity remains a critical objective, the ability to withstand shocks and maintain stability has become increasingly paramount [5,6].

Conventional theories in industrial economics and international trade have traditionally favored diversification as a risk-minimization strategy. This aligns with portfolio theory, which advocates spreading investments across a range of assets to minimize exposure to any single asset's volatility [7]. In the context of regional economies, diversification implies a broader range of industries and products, reducing vulnerability to sector-specific shocks. However, these traditional perspectives also acknowledge that agglomeration economies and specialization can have their merits. Larger firms, often associated with specialized industries, may possess the resources and expertise to compete more effectively in international markets [8]. Their economies of scale, access to capital, and established brand recognition can provide a competitive edge in global trade [9].

Recent developments in economics have challenged the

conventional wisdom, offering a fresh perspective on the export diversification debate. Diversification, in this context, extends beyond risk mitigation: indeed, the ability to combine and recombine different knowledges becomes a strong driver of innovation, productivity, and competitiveness in global markets [10]. In this, economic complexity, a measure of a territory's productive capabilities and knowledge base, further underscores the significance of diversification [11]. Furthermore, diversified economies, with their broader range of industries and destinations, are often better equipped to weather economic storms and maintain stability. In this regard, considering metrics that are related to resilience in designing industrial policy plans becomes a strong contributor to the success of the plans themselves [12,13].

Building upon these insights, this study proposes novel metrics separately looking at sectoral and geographical diversification of exports. Complementing the established concept of economic complexity, these indexes aim to capture a comprehensive picture of a province's development trajectory by analyzing its internal productive capabilities (through sectoral diversification) and its external connections within the global economic landscape (through geographical diversification). Putting these elements together, we first analyze the relation between geographical and sectoral diversification. Specifically, we explore how these metrics are associated with each other, and how this association is moderated by different levels of export intensity and stability. This is

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done for a crucial period, which spans over the Covid-19 pandemic, 2017–2021, and for Italian provinces, which as we will see constitute an ideal testbed for several reasons.

Italy, with its distinct North-South divide and the significant impact of the pandemic, provides a compelling case study for examining the interplay between diversification and export performance, a two-sided phenomenon composed of stability and intensity. The country is among the top ten manufacturing economies in the world and ranks twelfth at the global level for exports, according to World Banks' (2022) data. The considerable regional disparities (across and within) that mark the Italian economy, as well as its strong exposure to the Covid-19 pandemic, offer a significant field of research to analyze the heterogeneous local capacity to respond to economic shocks. The more diversified and complex economies of Northern Italy have generally outperformed their Southern counterparts, which tend to be more concentrated and less complex. This disparity, which unrolls also in the center-periphery dimension, underscores the need for tailored strategies that address regional differences and leverage local strengths. The Covid-19 pandemic has further exposed the vulnerabilities of concentrated economies. To this end, Italy's experience highlights the need to move beyond traditional perspectives and embrace a more nuanced understanding of the relationship between diversification and export outcomes across territorial units.

Our study makes notable contributions in three key areas. First and foremost, it delves into the geoeconomic and productive capabilities of provinces, proposing novel metrics that capture both sectoral and geographical diversification of exports. While economic complexity theory has established the significance of sectoral diversification as a proxy for productive capabilities, this research expands the framework to propose new metrics that encompass a crucial aspect often overlooked: a province's ability to navigate the global economic landscape. By analyzing both geographical and sectoral export diversification, this study aims to offer a more comprehensive picture of a province's development trajectory. The combined approach captures the crucial interplay between external connections (geoeconomic) and internal capacities (productive), providing valuable insights for policymakers and development practitioners seeking to foster economic growth and prosperity. Secondly, we present an alternative perspective on export intensity, examining stability of exports over an extended period as a connotation of resilience [5], in contrast to focusing solely on single-year results. In terms of research questions, we connect these export performance indicators with our proposed diversification metrics. Thirdly, we reinforce the stylized fact regarding the impact of local-level institutions by providing a detailed account of their associations with export intensity. All these elements are then combined in an in-depth exercise of policy proposals.

The work proceeds as follows: section 2 summarizes the most relevant literature on export diversification and performance and on its possible other explanatory factors, finishing with implications for regional and industrial policy in the Italian case; section 3 contains a description of the data, the relevant statistics, and explains the empirical approach, developing theoretically the two proposed metrics; section 4 reports our empirical results, section 5 concludes and section 6 discusses the policy implications.

2. Theoretical framework

2.1. Export performance and diversification dimensions as proxy of productive and geoeconomic capabilities

Studies on the determinants of export performance have a long history as they started to consistently appear in the 1970s. Nevertheless, most of them analyzed the relation either at country or at firm-level, leaving the regional perspective relatively on the background. While scholars now underline the importance of policy actions at sub-national levels, this article's contribution consists in proposing metrics that can

bridge this practice with export-oriented industrial policies. To do so, this section characterizes diversification dimensions as not only strategies to resist shock, but also as possible proxies for the presence of specific territorial capabilities.

First of all, export diversification can take place in at least two directions: a sectoral and a geographical one, with the latter sometimes referred to as international diversification. In this, well-established theoretical frameworks in classical political economy and trade models would suggest specialization as a superior strategy as it makes it easier to exploit each competitive advantage (Devereux, 1997). Contrarily, trade diversification of exports is important because it enables countries to withstand changes in demand caused not only by economic downturns in importing countries but also by price declines. An important aspect is connected to geographical diversification. As exporting involves fixed costs that vary by country [9], the direct advantage is that it allows businesses to exploit economies of scale and lower unit production costs by expanding market size.

Diversification on both dimensions – geographical and sectoral – allows firms (and production systems) to expand their growth potential by reaching new destinations and producing new goods and services. Moreover, the exploitation of specific demand trends from given areas/sectors, as well as likely knowledge flows, are additional arguments in favor of diversification [14]. On the one hand, in terms of impact on the export intensity, few studies addressed the issue explicitly: for instance, Cadot et al. [15] found that there exists a hump-shaped relationship between the intensive margin and the degree of diversification of an economy, with most of the positive effects concentrated in the development stage, thus suggesting that diversification plays vital roles when catching-up. On the other hand, in terms of export stabilization, most of the studies seem to agree that diversification, following a portfolio approach, leads to more stability. Looking more closely, Hirsch & Lev [16] measure diversification both as entropy and using the Herfindahl-Hirschman Index (HHI), and they establish a positive relationship with both measures. With different approaches but very similar results, we find Massell [17], who focuses only on sectoral diversification, Soutar [18] who establishes a positive relationship between geographic concentration of exports and instability, and Balabanis [19] who, studying export intermediaries, finds that both sectoral and geographical diversification are conducive to more stability.

Indeed, one of the most common metrics used to measure productive diversity is the HHI, proposed as an amendment of the Lorenz-Gini methodology in the context of industrial organization. The European Commission [20] specifies safe ranges for early merger control, using the Herfindahl-Hirschman index to quantify construction industry concentration. To understand how the market affects merger performance, competition authorities analyze the researched market and its competitive circumstances and use market shares and concentration measurements to assess a company's market power [21,22]. It is also frequently employed in the energy sector to assess energy and supplier diversification [23].

Existing research highlights the potential of export diversification metrics to serve as proxies for productive capabilities [11,24]. A further amendment to separately capture both geoeconomic and productive capabilities is possible. On the one hand, geoeconomic capabilities encompass a province's ability to navigate the global economic landscape and leverage external opportunities. Export diversification across destinations can be a strong indicator of such capabilities. Provinces with a wider range of export destinations are less susceptible to economic shocks concentrated in specific regions. This diversification suggests established trade networks, fostering access to diverse markets, resources, and potential partnerships. Productive capabilities, on the other hand, reflect an internal capacity to export a variety of goods and services. Sectoral export diversification serves as a valuable proxy for gauging these capabilities. A territory with a diverse export portfolio across different sectors likely signals a more complex and adaptable economy. This diversification implies a skilled workforce, access to

diverse technologies, and a robust production base that can cater to various market demands. It also suggests a capacity for innovation and adaptation, allowing the province to adjust to changing market dynamics and technological advancements.

2.2. Other relevant factors explaining export performance

When explaining territorial-level export performance, there are a few other factors that play a fundamental role. First, industrial concentration directly affects competitive dynamics and their outcomes. From a theoretical perspective, exporting is a resource-intensive business with high fixed costs that make larger companies inherently better suited. Nevertheless, having more large firms directly affects the firm size distribution towards more concentration, which might be detrimental to competitive forces. Trying to solve this apparent contradiction empirically, Pickering & Sheldon [25] find that higher levels of concentration implied weaker international trade performance for British firms. A similar finding is reported for Japanese industries in the paper by Sakakibara & Porter [26]. However, we highlight a general lack of studies explicitly addressing the issues of industrial concentration and trade stability. Here, the theoretical mechanisms may lie in the fact that larger firms are responsible for greater shares of exports in each economy and thus, their death or decline may constitute relevant shocks for the local economy. On the contrary, a stylized fact in firm growth studies is that older and larger firms have much higher probabilities of survival than smaller and younger ones [27], thus industry concentration could act as a stabilizer for turbulent times.

Also, institutions have a strong association with trade performance. This is an interesting couple, as most studies analyze the role of institutions in emerging and developing economies. Nevertheless, if we look at the aggregate, country-level picture, it becomes evident how they might also be useful for catching up with the so-called “left-behind places”, which are often regions that are part of advanced countries but characterized by weak institutions. Generally, in literature, institutions are characterized as positive contributors to trade performance and economic growth. This effect takes place following a multiplicity of transmission channels that may well extend from their role in shaping social capital to their direct influence on firms’ capabilities. From our point of view, good institutions foster collaborative relationships and knowledge sharing among firms, enhancing innovation through heterogeneous skills recombination. This perspective allows us to see the link between economic complexity and institutional quality [28].

Further, it is not only a matter of institutions with a general connotation, but as we will see in the next paragraph, it is also a matter of specific institutional aspects that are more conducive to superior export performance. For instance, regarding the Italian case, Boffardi [29] finds that institutional quality has a direct and fundamental role in healthcare system performance. In the energy sector, Sun et al. [30] show how long-term policies not only can address energy issues but are also positively influenced by the quality of institutions of bordering regions. Studying Cambodian exports, Soeng & Cuyvers [31] find a generally positive role for institutions, with the rule of law having the largest impact. Previous studies have shown how institutions are indeed fundamental for trade flow promotion [32–35]. Coherently, studies that focused on the impact of weak institutions established that those tend to make trade more fragile, making clear addresses of industrial policy harder to achieve [36] and increasing transaction costs among economic actors [37]. Finally, Nunn & Trefler [38] suggest that the relationship might be cyclical, meaning that not only good domestic institutions foster trade advantages but also that trade participation induces an improvement of local institutions over the long run. Trivially, these relationships are also moderated by the key role of the level of development, often proxied by GDP levels.

2.3. Designing policy interventions for heterogeneous territories: a case for Italy

Italy’s territorial divide represents a deeply entrenched and intricate issue interwoven within the country’s socio-economic fabric. Manifesting in various forms, this divide has historical roots and has been perpetuated by a myriad of factors, including disparities in industrialization, infrastructure development, and educational attainment. For instance, according to ISTAT, the national statistical office of Italy, the GDP per capita in the northern regions of Lombardy and Emilia-Romagna was €35,546 and €34,460 respectively in 2021, significantly higher than the €18,254 and €19,135 recorded in the southern regions of Calabria and Campania. This disparity is further reflected in the unemployment rate, which stood at 5.6 % in the North compared to 15.6 % in the South in 2022, as reported by Eurostat. A more detailed account of this divide can be found in Asso [39]: when it comes to initiatives that show evidence of dynamism and change—like the propensity toward innovation, exporting, or supporting high levels of entrepreneurial density—the southern provinces fall behind. Besides, southern regions share a deficiency in essential resources that draw external investment. A further axis of divide lies in the presence of significant core-periphery dynamics with non-urban centers that are consistently weaker in socio-economic terms than urban ones [40]. Additionally, although Italy has historically been a major player in the exporting markets, its industrial structure is characterized by significant trade concentrations among firms [41].

As we delve into this issue, it becomes evident that addressing these disparities necessitates a multifaceted approach that tries to overcome centralistic industrial policies. Recent contributions from regional economics have underscored the importance of adopting place-based approaches to address regional disparities [42,43]. These approaches recognize that the challenges faced by different regions are unique and cannot be effectively addressed through a one-size-fits-all policy framework. Instead, they advocate for tailored strategies that take into account the specific needs, strengths, and weaknesses of each region. By adopting this approach, policymakers can better target their interventions and promote balanced regional development. When doing so, it is also of utmost importance that the central government attach strong relevance to the development and improvement of production efficiency, which may hinder economic growth prospects if not correctly targeted [23].

A relevant example of regional industrial policy lies in the cluster-promoting operations that have consisted in a strengthened interest in the development of isolated high-value added sectors regarded as regional economic drivers at the detriment of sectoral diversification. However, highly specialized areas may be more susceptible to sector-specific shocks in the market than their more varied counterparts. To solve this apparent conundrum, Frenken et al. [44] came up with the idea of ‘related variety’, or related diversification. Doing so, industrial clusters can benefit from diversifying their production to include a broader range of products and services, enhancing the potential for inter-industry knowledge spillover and stability. Connecting to this, our proposed diversification metrics are indeed rooted in the concept of related variety, as we will see they consider diversification at two relevant levels of aggregation.

Finally, Italy, like many other European countries, is currently navigating the twin transition—a simultaneous shift towards a greener and more digitalized economy. While this transition presents significant challenges, it also offers an opportunity to revitalize struggling regions [45]. Investments in renewable energy, digital infrastructure, and, in general, meaningful diversification strategies can create new economic opportunities in historically disadvantaged areas. In this regard, the National Recovery and Resilience Plan (PNRR) and initiatives like Smart Specialization strategies and REPOWER EU provided Italy with a unique opportunity to reshape its socio-economic trajectory and to exploit possible synergies [46]. The PNRR, with its focus on green and digital

investments, can serve as a catalyst for transformation in regions that have lagged behind. Repower, as a community-driven initiative, empowers local communities to take charge of their economic destiny. By harnessing the potential of these initiatives, Italy can bridge its territorial divide and ensure that no region is left behind in the pursuit of a more prosperous and sustainable future [47].

2.4. Research questions (RQs)

In the dynamic realm of international economics, understanding the factors that drive economic performance and stability at the provincial level is crucial for crafting effective development strategies. The proposed RQs delve into the intricate relationship between export diversification, both sectoral and geographical, and economic outcomes, as proxied by export performance. As anticipated above, the contextualization of these RQs is rooted in the long-standing debate surrounding diversification and concentration in economic growth and development. Traditional theories support diversification as a risk-minimization strategy, while recognizing the potential benefits of concentration for larger firms competing in global markets. However, recent advances in regional science and economic complexity emphasize the importance of place-based policies, diversification for both performance and global competitiveness, and the critical role of local institutions in promoting them.

The first question probes the potential link between export diversification and intensity in local production systems. It seeks to determine whether a diversified export portfolio, encompassing a broader range of industries and geographical markets, contributes to enhanced economic performance.

RQ1: Are sectoral and geographical diversification of exports in local production systems related to performance?

The second question explores the potential association between export diversification and export stability at the provincial level. It investigates whether a diversified export base can act as a stabilizing force, mitigating the impact of external shocks and fostering greater stability.

RQ2: Are sectoral and geographical diversification of exports related to stability during a period of strong fluctuations due to exogenous shocks?

3. Empirical framework

Given the multi-dimensionality of the adopted perspective, we rely upon several data sources that proxy for the relevant aspects of the study, we propose an index of diversification that reports more information than standard ones, and we also derive measurements of concentration using micro-data at firm level. In order to correctly report all these elements, the next sub-sections will go into more detail for each aspect.

3.1. Data sources

In terms of data sources, the article exploits four different datasets. First, the main information source consists of CoE-web. It is an online database dedicated to foreign trade statistics and managed by ISTAT, the Italian national statistical office. It provides monthly information on the trade flows between Italy and the rest of the world. Once the data is received by ISTAT, it is first processed in accordance with EU regulations on foreign trade statistics and then reviewed and validated by reviewers. In its online version, it provides a precise accounting of all imports and export flows connecting Italy to foreign markets. In terms of disaggregation, it allows to analyze economic systems at the province-level (NUTS-3), looking at sectors defined up to 3 digits, and with the possibility of disaggregating also by the geographical destination of the

traded goods. Second, although limited to a cross-section for 2019, we have access to a firm-level database that stems from the connection between CoE-web and the Italian business register. This is called TECFRAME-SBS, and it allows us to compute micro-derived concentration ratios for each dyad of sector-province under analysis. Third, we use information retrieved from the ISTAT website regarding provincial GDP values and population in 2019. Thanks to these, it is possible to compute the export propensity of each province, defined as the ratio of their export values over GDP, while also controlling for additional scale effects using population.

Finally, to take the role of institutions at a local level into consideration, we merge all the above data with the IQI dataset developed by Nifo & Vecchione [48], which is freely available online. The index offers a province-level aggregate version, which is quite easy and straightforward to exploit and interpret. Then, it also gives the opportunity to analyze the role of different components of institutional quality. Precisely, the IQI can be disaggregated into: voice and accountability (social cooperatives, educational outcomes, election participation), government effectiveness (endowment of socio-economic facilities, health deficit, urban environment), regulatory quality (economic openness, local government employees, and business statistics), rule of law (crime rates, trial times, tax evasion) and corruption (crimes against public administration and related features). Table A5 in the Appendix reports each variable definition and the specific data-source.

3.2. Sectoral and geographical indexes of diversification

To characterize each province's export dimension, we developed two indexes of diversification that take into account both the sectoral and the geographic outreach of these areas. To do so, we compute ratios between the number of reached countries (or the number of 3-digit sectors) and the HHI computed at the level of macro-area (or at the 2-digit level for sectors). This simple yet insightful measure has many perks. First, it measures diversification accounting for two key dimensions: sectors and countries. Second, it does so by integrating insights from the related variety of literature and more standard approaches. Further, it is mathematically well-behaved, offering a rather straightforward interpretation. Finally, the proposed index can be analyzed either in its entirety or by looking at the numerator and denominator separately, while still conveying interesting insights. For instance, macro-specialization¹ or strong diversification strategies can emerge very quickly using this approach.

Putting this into scientific notation, we have that:

$$\text{sectoral_diversification}_i = \frac{n_sectors_3dig_i}{HHI_2dig_i} \quad \forall \text{ province } i \quad (1)$$

where $n_sectors_3dig_i$ is the number of sectors at the 3-digit level where a province exports more than 1/1000 of national export and HHI_2dig_i is the Herfindahl-Hirschmann Index computed at the 2-dig level.

¹ From here on, we will use the term macro-specialization, or related verbs, for provinces that concentrate their exporting activities in one or few 2-digit sectors (or, macro-sectors), or in one or few macro geographical areas (or, macro-areas).

$$\text{geographical_diversification}_i = \frac{n_countries_i}{HHI_macroareas_i} \quad \forall \text{ province } i \quad (2)$$

Where $n_countries_i$ is the number of countries where a province exports at least one million euros and $HHI_macroareas_i$ is the Herfindahl-Hirschmann Index related to macro areas.²

Finally, in terms of theoretical range, the two indexes share similar behaviours, with the only difference stemming from the maximum number of 3-digit sectors in manufacturing, which is 186, and the maximum number of destination countries reported by CoE-web, which is 235. Given these, the metric's theoretical range varies between a common minimum of 1/10'000, if all the province's exports are concentrated in one country or 3-digit sector, and a maximum of 53.76 for the sectoral index or 42.55 for the geographical index (assuming exports are present and uniformly distributed in all sectors/countries).

Leveraging the HHI, a standard measure of market concentration, these metrics assess diversification relative to the total number of potential markets or sectors. This approach resonates with the related variety framework within the economic complexity literature, emphasizing the importance of diverse capabilities within a broader economic system. The specific choice of 3-digit sectors and macro areas (groups of countries as defined at the end of Footnote 2 below) strikes a balance between granularity and feasibility. While finer details could be captured with lower-level classifications, data availability and potential noise limitations are mitigated by this choice. Additionally, the HHI calculated at the 2-digit level for sectors accounts for the inherent hierarchy within production structures.

The resulting metrics exhibit a critical strength: high autocorrelation. This characteristic, with values reaching up to 90 %, suggests the metrics are capturing fundamental and persistent structural features of provincial economies. In conclusion, these newly developed metrics offer a robust and insightful way to analyze provincial-level development. By connecting the concept of diversification with economic complexity and incorporating geographical reach, they provide a comprehensive picture of a province's internal productive capabilities and its external connections within the global economic landscape. This combined perspective empowers policymakers and development practitioners to design effective strategies for fostering growth and prosperity at the provincial level.

3.3. Estimations

Together with the conception of policy recipes to face these turbulent times, the introduction of novel dimensions and perspectives on international trade is central to this paper. More precisely, our focus entails two "target" variables, one for export intensity and the other for stability, and two diversification indexes, a geographical one and a sectoral one.

Starting from the target variables, we estimate two measures of export performance. On the one hand, following standard approaches, we use export intensity, measured as the ratio of export volume over GDP and averaged over the period 2017–2021. This offers a first correction for likely scale effects, and it allows us to compare territories of different sizes. On the other hand, we look at a measure of (in-

² Both thresholds may appear quite *ad-hoc* and with little theoretical basis. Nevertheless, we argue that it would be hard to establish these thresholds aprioristically. Given the empirical vocation of this article, the two thresholds emerged from visual inspection of the overall distributions, and they were also subject to several checks (i.e., moving the threshold, or endogenizing it to different fixed shares of national exports in each sector) to ensure that the arbitrariness of the choice does not affect the estimations in any significant manner. Macro areas are defined in accordance with the International Trade Commission, see Gurevich & Herman [56], and for the sake of robustness, the metrics have been re-estimated with two continent-based classifications and as above, the estimations are not affected.

stability, measured as the ratio of export standard deviation to its mean value along the period 2017–2021, strongly affected by the Covid-19 shock. This allows us to have a measurement of the variability that characterizes each territory under consideration, while still controlling for obvious scale effects.

Finally, with the aim of tracing the relationship between high industry concentrations and our two performance measures, we also compute the concentration ratios for each province. Furthermore, to allow for additional robustness checks, we employ two measurements: 1) a simple concentration ratio that looks at the share of exports represented by the top three firms; and 2) a micro-based HHI. All the above elements are also used as explanatory variables in a regression model estimated through OLS with errors clustered at the macro-regional level (NUTS-1), which in matrix notation takes the following form:

$$Y = \alpha + X\beta + \varepsilon \quad (3)$$

where X is an $n \times p$ matrix of regressors, including our diversification indexes, and as controls, the micro-derived industry concentration ratio (C3, or HHI), the institutional quality and GDP per capita. This is estimated for two dependent variables: export instability (measured as the ratio of the standard deviation to its mean) and export intensity (measured as export volume over GDP). The standard deviation is computed over the period 2017–2021, while we exclude data regarding 2020 to avoid asymmetric biases introduced by the heterogeneity of non-pharmaceutical interventions that characterized that year [49]. Finally, to deal with the skewness of our target variables and also to grant an easier interpretation to the models' coefficients, we estimate the model in log-log form, implying that the estimated coefficients correspond to elasticities.

The adoption of a panel approach was carefully considered before the start of the study. Nevertheless, several motivations convinced us that a cross-sectional one coupled with extensive data exploration was a superior choice. First, not all the variables were available in a panel format (i.e., the micro-derived concentration indexes). Second, as we are analyzing structural features with high autocorrelation, the panel estimates would bear little significance. Finally, to correctly account for the Covid shock, our measurement of stability consists of a multi-year average, which cannot be defined as a moving window (as it would miss the Covid crisis), and thus somehow forces the cross-sectional approach.

3.4. Summary statistics

With the aim of characterizing the variables under consideration and offering an overview of their behavior, we report the first two moments of each variables' distribution in Table 1.

The average export intensity is 0.246, indicating that exports account for approximately a quarter of the economic activity in Italian provinces. The standard deviation of 0.186 suggests considerable variation in export intensity across provinces. The average GDP per capita is €28,128.10, suggesting a moderate level of economic development across Italian provinces. The standard deviation of €7591.15 confirms significant variation in economic prosperity among provinces. Looking at concentrations, the average micro-derived C3 is 0.418, suggesting a moderate level of industrial concentration in Italian provinces. The standard deviation of 0.229 indicates some variation in industrial concentration across provinces. Finally, the export exposition data reveals that Italian provinces have the highest average export exposure to the Americas (29.8 %), followed by the European Union (24.1 %), Asia (18.1 %), Africa (15.4 %), and Oceania (5.1 %). A small note is due

Table 1
Summary statistics.

	Variable	Mean	SD	min	max
Dependent variables	Export intensity	0.246	0.186	0.004	0.797
	Export in-stability	0.120	0.101	0.011	0.516
Diversification metrics	Sectoral diversification	0.030	0.027	0.000	0.094
	Geographical diversification	0.038	0.018	0.011	0.124
Control variables	GDP per capita (€/population)	28'128.10	7'591.15	161791.00	55980.00
	Quality of Government	0.580	0.244	0.000	1.000
	Micro-derived C3 (%)	0.418	0.229	0.050	0.955
	Micro-derived HHI	1293.40	1493.92	38.48	7567.16
Further geoeconomic insights	Export exposition to Africa (%)	0.154	0.101	0.039	0.984
	Export exposition to Americas (%)	0.298	0.098	0.001	0.577
	Export exposition to Asia (%)	0.181	0.068	0.013	0.530
	Export exposition to EU (%)	0.241	0.099	0.001	0.605
	Export exposition to Oceania (%)	0.051	0.025	0.000	0.168
		Number of observations		99	

relative to the number of observations, which are only 99 out of the 107 current provinces that compose Italy.³

The above-presented elaborations on our data sources lead to the following aggregate picture in terms of descriptive statistics. Nevertheless, we stress how the average values reported here are quite unrepresentative of the complex and polarized Italian situation, as also suggested by the values of the standard deviation.

4. Emerging evidence

4.1. The macro-regional outlook

Our analysis follows a funnel approach consisting of a progressively more detailed characterization of the objects of study made possible by the increasing disaggregation in terms of sectors and geography. In this respect, we start with an overview of our variables of interest and their mean values across the 5 macro-regions (NUTS-1) that compose Italy (see Table 2).

As expected, the North-eastern region emerges as the leader in export intensity, signifying a robust presence in international markets. The North-western region also shows strong export intensity, and similarly to the North-East, it shows a noteworthy level of export stability. In terms of standard deviation, North-eastern provinces show smaller values, implying fewer within-region asymmetries. This suggests that its industries are not only active on the global stage but also relatively stable when subject to external economic fluctuations. Furthermore, the Northern regions appear to have a high level of governance quality, which can be a contributing factor to their economic performance. In contrast, the central regions exhibit considerably less sectoral diversification, but they still achieve comparable levels of geographical diversification. Generally, not only a north-south divide emerges, but it is also clear that there are strong within-region inequalities likely due to core-periphery dynamics. In this regard, picking provinces as units of analysis becomes of utmost importance to obtain a correct picture of the phenomena under consideration.

The Southern region faces challenges in export stability, suggesting a susceptibility to external economic shocks, which is also accompanied by higher variance, implying that variations take place in a wider range of values and suggesting higher heterogeneity in the phenomenon. This underscores the need for strategies to enhance its economic stability and reduce its vulnerability to global market fluctuations. The region's

³ This is caused by changes in the administrative borders of some provinces, which led to data limitations in our dataset that particularly for the stability measure exploits a time window spanning from 2017 to 2021. Nevertheless, we stress how the issue is not particularly relevant for the reported empirical results as it almost only affects Sardinia, and the analysis still considers almost the entirety of Italian exports in the studied period.

relatively lower quality of governance may also warrant attention for potential policy interventions. The insular regions have a strong dependence on a few sectors.

It is compelling to notice how almost all indicators follow a rather ordered, decreasing path that goes from North to the Islands, passing through the Southern regions. Unfortunately, this is a tale that characterizes Italy, and it is largely due to historical trends and geographical specificities. Finally, we draw attention to two elements: on the one hand, the strong characterization that sectoral diversification gives to the territories under study, with the geographical one that transmits a more blurred picture; on the other hand, a first hint at possible detrimental effects of industry-level concentration for export stability and intensity, with the southern and central regions showing exactly this situation with respect to the north.

If instead of looking at mean values, we plot each province in a graph where the two axes represent our two target variables, additional insights emerge in Fig. 1. First, we notice how virtually all insular regions and most southern ones occupy the left part of the graph, with a strong presence especially in the top left part. This confirms how these regions export less intensively in terms of value-to-GDP and are more subject to fluctuations. Central regions tend to be quite dispersed according to these two measurements, while a more ordered pattern emerges for Northern ones. Here, we notice how north-eastern regions tend to be slightly more unstable than their north-western counterparts, especially at higher export intensities.

This first overview clearly shows at least two elements. First, the strong heterogeneity that characterizes Italian territories at large, with almost unique mixes of economic, institutional, and social characteristics. This already points to the need for well-designed policy recommendations that carefully take into account each lagging dimension in its interrelated nature. Indeed, the second emerging element is the relative order in this heterogeneity, meaning that from North to South, each dimension follows a descending pattern in virtually all dimensions, underscoring again the importance of holistic approaches.

4.2. Diversification dimensions and a possible taxonomy

We now move to the indexes that were developed in Section 3b, and Fig. 2 shows a plotting of the two dimensions that compose the indexes: the number of 3-digit sectors and a 2-digit HHI for sectoral diversification, and the number of destination countries and a "continental HHI" for geographical diversification. The purpose of this is to establish possible relationships between the two dimensions.

On the one hand, a tradeoff between diversification and 2-digit specialization emerges very clearly. Indeed, looking at Fig. 2a on the left-hand side, it would be possible to draw a bisector that divides almost perfectly Italy into two groups: a diversified one and a macro-specialized one. There, we observe how Milan ranks at the top in terms of diversification and how, more generally, Northern provinces tend to be among

Table 2
Mean and SD values of the variable of interest by macro-region.

Macro-region	Export intensity	Export instability	Sectoral diversification	Geographical diversification	GDP per capita	Quality of Government	Micro-C3	Micro-HHI
North-east	0.372	0.085	0.05	0.042	0.035	0.823	0.281	562.37
	0.137	0.046	0.023	0.009	0.005	0.077	0.176	831.25
North-west	0.320	0.084	0.043	0.041	0.032	0.724	0.335	1047.87
	0.153	0.058	0.027	0.025	0.006	0.100	0.228	1617.41
Center	0.276	0.113	0.021	0.041	0.029	0.637	0.452	1673.96
	0.194	0.077	0.021	0.017	0.005	0.157	0.245	1791.07
South	0.113	0.182	0.015	0.032	0.021	0.373	0.484	1540.17
	0.130	0.146	0.020	0.012	0.003	0.124	0.168	1605.04
Islands	0.031	0.167	0.003	0.036	0.02	0.264	0.581	1788
	0.030	0.130	0.003	0.020	0.004	0.120	0.220	1158.59
National average	0.246	0.12	0.03	0.039	0.028	0.598	0.409	1269.59
	0.186	0.101	0.027	0.018	0.008	0.229	0.228	1514.17

Note: mean is reported in the first row of each macro-region, while the second one reports the SD.

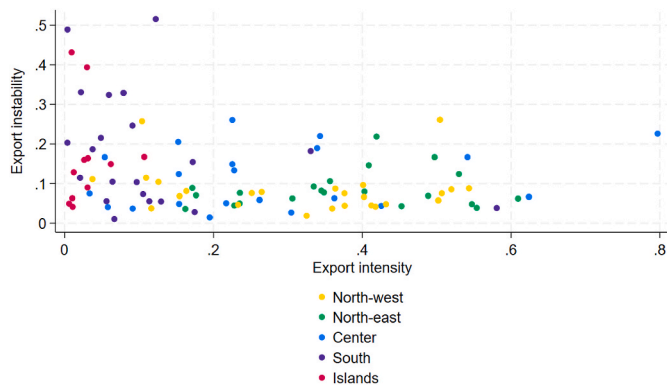


Fig. 1. Italian provinces according to their export intensity and instability.

central part of the graph, which suggests the existence of a number of provinces that are able to reach a rather high number of countries but do not diversify uniformly across continents. Here, the role of trade agreements is likely to be prominent, giving access to several countries within a specific macro-area.

If we combine the two indexes above, a clear positive relationship between the two types of diversification emerges (see Fig. 3). All Italian territories are now quite ordered around the bisector, while conserving the emerging features mentioned above. Indeed, Milan is still the top performer in both dimensions. The capital city of Rome shows similarly good performances. Northern provinces are rather concentrated in the top-right part of the graph, while Southern ones tend to be more present in the bottom part. Indeed, it is possible to make a hypothesis about the positive association between these two dimensions. Areas that are better equipped in terms of productive capabilities (sectoral diversification) have more possibilities of activating diverse geographic relations with

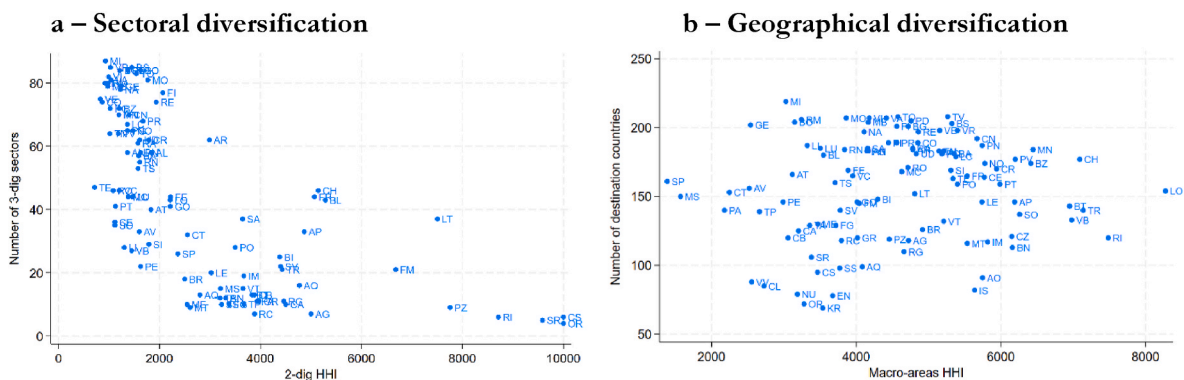


Fig. 2. The disaggregation of the two diversification indexes a – Sectoral diversification b – Geographical diversification.

the diversified ones. Contrarily, southern and insular provinces exhibit a strong tendency toward macro-specialization. In terms of interpretation, this is likely due to either resource limitations, where provinces with limited resources (capital, workforce, infrastructure) might prioritize focusing on a few sectors where they have a comparative advantage, rather than spreading their resources thinly across a wider range of sectors.

On the other hand, the picture of the geographical diversification index is much more confused and does not show clear tradeoffs as in the sectoral case. Nevertheless, it is still possible to note that Milan still is the top performer in terms of destination countries, and La Spezia, an important Italian port, shows the best performance in terms of continental diversification. Differently from sectoral patterns, in terms of geographical dimensions, we notice a dense cloud of provinces in the

countries whose demand for goods is itself diversified. To the contrary, territories that specialize in a few sectors can only satisfy the demand for those sectors, which is not necessarily distributed across a wide variety of countries. Certainly, it is possible that this hypothesis fails to explain territories specialized in a few ubiquitous and globally requested products. Nevertheless, Fig. 3 suggests that this might be an exception rather than a rule for the Italian case.

Fig. 3 also allows us to propose a diversification typology⁴ that simultaneously considers the two selected dimensions characterizing the exporting industrial structure of Italian provinces. To do so, we compute

⁴ The interested reader can find the table reporting the full list of provinces by typological group in Table A1 of the Appendix.

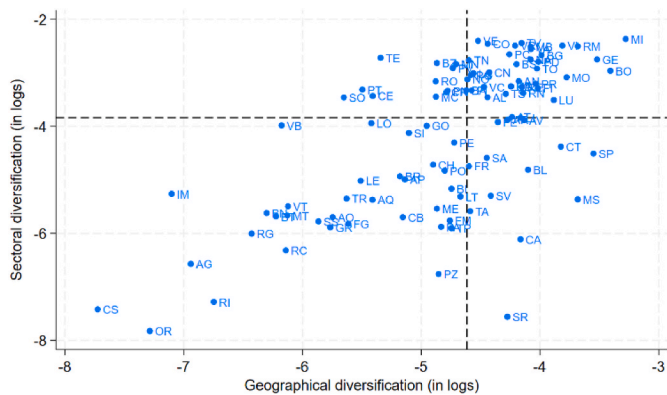


Fig. 3. The two diversification dimensions and a median-based typology.

the median values of each diversification index, and we plot the relevant axis to divide the figure into four parts. In the top-right area, we have the territories that are the most diversified in both terms, while the opposite is true for the provinces that are found in the bottom-left area. Intermediate and more outlying cases are the provinces that occupy either the top-left or the bottom-right areas, indicating provinces that perform well in one dimension but that lag behind in the other. Again, this multiplicity of structural situations directly points to the need for specific and place-based solutions rather than panaceas that fit all provinces.

Given the high density of the first quadrant and anticipating a possible limitation in the upcoming regression approach, we begin exploring the relationship between our target variables and the proposed diversification metrics graphically. This not only can take care of likely multicollinearities between the regressors, but also give a first unbiased intuition of it. Thus, Fig. 4 decomposes Fig. 3 according to 4 quartiles of export intensity (with number 4 being the most intense). Apparently, the relation between sectoral and geographical diversification goes hand-in-hand for the two extremes of the export intensity distribution, quartile 1 and 4, while the association is more blurred in the central quartiles. Economically, this suggests that provinces with low reliance on exports (potentially focused on domestic markets) when diversifying in one dimension (sectors) might incentivize or necessitate diversification in the other (geographical) to maintain overall market access and economic activity. Similarly, for highly export-dependent provinces, it could indicate that success in international trade often requires both a diverse range of goods and services to offer and a diverse

range of markets to sell them in. Specialization in a few sectors might limit access to markets with different preferences or economic conditions. Contrarily, the central quartiles likely encompass a wider range of provinces with varying economic structures and development trajectories. This heterogeneity might mask any underlying relationships between diversification measures.

Moving to the same exercise using export stability as a discriminating variable (see Fig. 5), some more interesting facts emerge. Indeed, here the relationship between our two diversification metrics holds for more stable quartiles, while it becomes much more blurred in the two less stable ones. This implies that for provinces with stable export levels (potentially indicating established trade relationships and reliable production structures), diversification across both sectors and destinations might be a strategy employed by these provinces to maintain stability. By having a diverse export portfolio and established trade networks, they might be better equipped to withstand fluctuations in specific sectors or markets. Contrarily, provinces with high fluctuations in exports are more likely to be associated with potentially volatile markets, reliance on specific sectors, or other factors.

4.3. Regression results and discussion

To complement and substantiate the previous findings and emerging relationships with stronger tools, we close the empirical analysis with a series of simple regression models whose aim is to confirm or disprove the intuitions that have emerged so far. To account for the evident macroregional differences, all models below are estimated through OLS with errors clustered at the macro-regional level. We start the regression analysis with the possible determinants of export intensity among Italian provinces. Given the non-negligible correlation between the diversification indexes (see Table A2 in the Appendix), we proceed with a stepwise approach, introducing the variables of interest one-by-one.

Doing so, interesting associations with our metrics emerge quite clearly in Table 3. First, as expected, diversification is a good contributor to export intensity. Sectoral diversification is likely associated with export intensity through several mechanisms. Nevertheless, a candidate explanation is that greater product variety implies exposure to a wider range of technologies, production processes, and market demands. This knowledge accumulation can enhance firms' ability to identify new export opportunities, adapt to changing market conditions, and develop innovative products tailored to specific markets. Differently, geographical diversification corresponds to exporting to diverse markets, which requires firms to acquire knowledge about different cultures, regulations, business practices, and logistical requirements. This

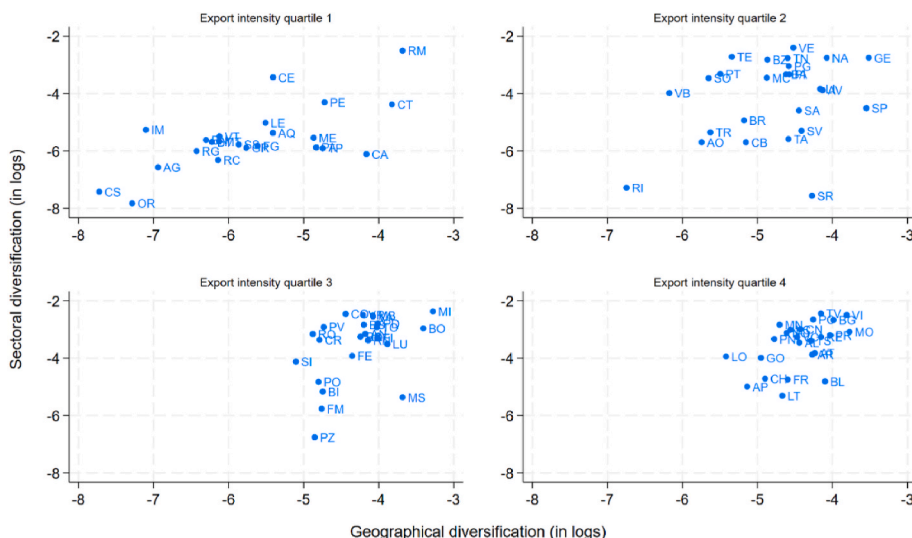


Fig. 4. The two diversification dimensions along the quartile distribution of export intensity.

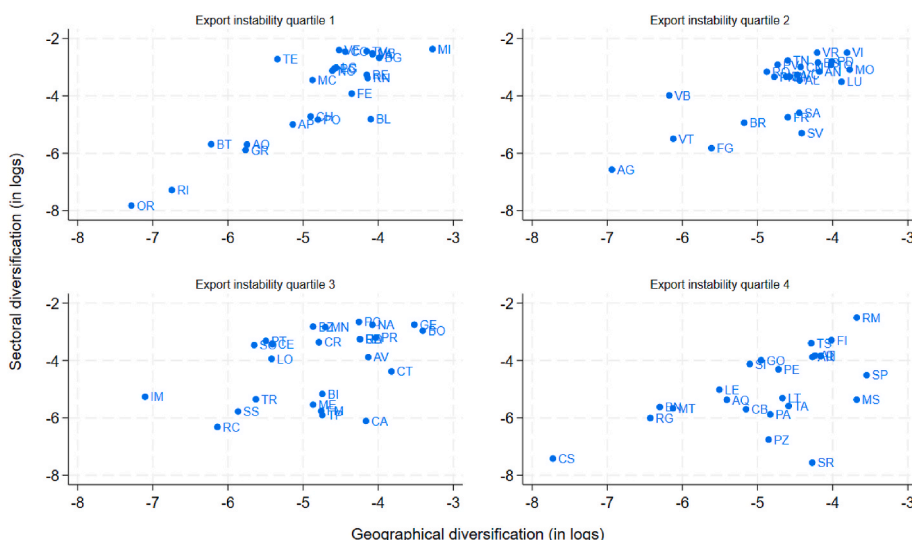


Fig. 5. The two diversification dimensions along the quartile distribution of export instability.

Table 3
Stepwise regression results – export intensity.

Variables	Export intensity		
Sectoral diversification	0.285*** (0.0892)		
Geographical diversification		0.605*** (0.0948)	
Micro-derived C3 ratio			-0.379*** (0.122)
Institutional quality	1.225*** (0.189)	1.297*** (0.159)	1.582*** (0.211)
GDP per capita	0.0415 (0.131)	-0.0938 (0.141)	0.101 (0.140)
Constant	14.06*** (0.527)	15.35*** (0.593)	12.84*** (0.480)
Observations	99		
R-squared	0.609	0.688	0.551

Robust standard errors in parentheses - ***p < 0.01, **p < 0.05, *p < 0.1.

knowledge accumulation can enhance firms’ ability to navigate the complexities of international trade, build relationships with foreign buyers, and effectively manage their export operations. In this, the acquisition of new production skills and the increase in destination areas clearly enhance the exporting potential of provinces that produce more and more complex products that can be sold in more and farther areas. Over time, provinces that consistently engage in diversified exports can accumulate a wealth of knowledge and expertise in both product development and international trade. This can lead to the development of specialized institutions and support networks, such as research centers, trade associations, and government agencies, that further enhance the province’s export capabilities.

At the micro-level, firms need to adapt their products and services to cater to the specific needs and preferences of different markets. This process can encourage innovation in production processes, product design, and marketing strategies. The introduction of new products and services can potentially lead to increased export potential. Further, engaging with diverse markets exposes firms to new knowledge and technologies, which can further enhance their capabilities and the associated knowledge recombination potential, finally leading to increased export intensity.

Although conceptually distinct, sectoral and geographical diversification are often interrelated. Provinces with a wider range of products might be more likely to find export opportunities in diverse markets. Conversely, engaging with diverse markets can stimulate the

development of new products tailored to specific regional needs. This interdependence can possibly lead to positive feedback loops where we observe initial diversification efforts, whether sectoral or geographical, that can lead to increased export opportunities. Indeed, increased export experience in turn facilitates greater knowledge accumulation in both product development and international trade practices. Finally, greater knowledge accumulation strengthens the ability to further diversify and achieve higher export performance.

Contrarily, concentration is negatively associated with export intensity, suggesting that provinces with firms responsible for large exporting shares in many sectors tend to export less with respect to their income levels. Finally, it is very compelling to notice how the most robust emerging evidence regards the role of local institutions, which shows high, positive, and statistically significant coefficients across all estimations. To delve more into the issue of institutional quality, while also offering important opportunities for robustness checks, in Table A3, we re-estimate the model using the disaggregated components of the institutional quality index by Nifo & Vecchione [48]. This shows that virtually all components, with the exception of government effectiveness, which mainly proxies for the provision of social services, are positive and significant explanatory powers of export intensity.

In Table 4, shifting our focus from export intensity, a measure of the propensity of a province to export considering its production output, to export instability, different facts emerge. First, the diversification indexes that explained so much in the previous estimations, are not significant anymore, with only geographical diversification exhibiting a

Table 4
Stepwise regression results – export instability.

Variables	Export instability		
Sectoral diversification	-0.0673 (0.0654)		
Geographical diversification		0.0634 (0.0900)	
Micro-derived C3 ratio			0.321*** (0.122)
Institutional quality	-0.447** (0.184)	-0.660*** (0.149)	-0.447*** (0.161)
GDP per capita	0.162** (0.0717)	0.148* (0.0751)	0.136* (0.0714)
Constant	-2.427*** (0.326)	-2.011*** (0.414)	-1.882*** (0.243)
Observations	99		
R-squared	0.140	0.148	0.203

Robust standard errors in parentheses - ***p < 0.01, **p < 0.05, *p < 0.1.

mild negative influence on stability in the studied period. Considering how Covid-19 disrupted global value chains and export patterns, this is far from a surprise, and it confirms the potential of our proposed measures. However, there are also two variables that consistently show robust explanatory power. One is the micro-derived industry concentration index, which under both measurements (C3 and HHI), shows a positive relation with instability, implying that the more concentrated the export of industries in each province, the more unstable its export performance will be. The other variable of interest is the one tracing the local institutional quality, which is a powerful moderator of instability. Joining the implications derived from the previous estimations with these ones, it clearly emerges how high levels of concentration and poor institutional performance are strongly associated with inferior export intensities and superior instability.

Looking more in detail at each institutional component (see Table A4), we notice that in terms of instability moderation, the fight against corruption is of utmost importance and it relates directly to more stability. Also, the other components have some weaker but still significant moderating effects, except for the “voice and accountability” component, which proxies the presence of civic and social participation.

Finally, given the lack of significance of our diversification measures in explaining export stability, we try to gain more insights. To do so, we focus on the geographical aspects of diversification, given that the few emerged significance was there, and we disaggregate the index into simple ratios that report each province’s exposure toward vast continental areas. In this regard, the rational is that there might be exporting destinations that shielded territories who were strongly dependent on them, or vice versa, destinations that might imply detrimental effects for them. Figure A1 reports the distribution of each exposure.

From Table 5, what emerges very clearly is the anchoring effect of the European Union. Indeed, re-estimating the model with export exposure instead of geographical diversification, yields robust results for the previously identified coefficients and it shows how the more exposed provinces were to export toward the EU, the more stability they exhibited. This is an important confirmation of the relief that a single market can give to joining countries, especially in turbulent times. Further, it is noteworthy that substituting the geographical diversification index with the continental export shares in the instability estimates yields an r-squared that is roughly twice (from 15.7 % to 27.9 %), underscoring again the importance of considering export destinations among the explanatory variables.

Table 5
Stepwise regression results – export instability.

Variables	Export instability		
Sectoral diversification	−0.0766 (0.0631)		
Export share – Africa		−0.212 (0.258)	
Export share – Americas		−0.0561 (0.321)	
Export share – Asia		−0.232 (0.251)	
Export share – EU		−0.856*** (0.272)	
Export share – Oceania		0.0843 (0.183)	
Micro-derived C3 ratio			0.321*** (0.122)
Institutional quality	−0.460** (0.185)	−0.483*** (0.162)	−0.447*** (0.161)
GDP per capita	0.156** (0.0702)	0.157* (0.0858)	0.136* (0.0714)
Constant	−2.486*** (0.307)	−4.109*** −1.371	−1.882*** (0.243)
Observations	99		
R-squared	0.157	0.279	0.203

Robust standard errors in parentheses - ***p < 0.01, **p < 0.05, *p < 0.1.

5. Conclusion

Most studies focus on export diversification as a strategy that minimizes risk and stabilizes export levels. However, in our research, we sought to delve deeper into the economic activity structures of Italian provinces using updated data, a novel dual perspective on export intensity and stability, and comprehensive indexes of diversification together while controlling for concentration and institutional quality. The heterogeneity of Italian provinces offers an optimal opportunity to study economic activities and their behavior over time. The goal was to understand how export performances interact with export geographical and sectoral diversification and provide a classification of Italian provinces based on their dynamic trajectory. In this context, our research aimed to develop two diversification indexes based upon the HHI, which shall be seen as amendments to it. By analyzing both geographical and sectoral export diversification, the proposed approach offers a comprehensive picture of a province’s development. This combined analysis captures the interplay between external connections (geoeconomic) and internal capacities (productive), providing valuable insights for policy-makers and development practitioners.

From the results obtained, the Northeast region is the leader in terms of export intensity, indicating a strong presence in global markets. Like the North-East, the North-West also revealed a notable degree of export consistency and considerable export intensity. The export stability of the Southern region is instead challenged and vulnerable to external economic shocks. Further, we observed a stronger association between sectoral and geographical diversification for provinces in the extreme quartiles (lowest and highest) of export intensity. This suggests that provinces with limited reliance on exports or highly export-dependent economies might find diversification across both sectors and destinations to be a strategic tool for maintaining market access and overall economic activity. Furthermore, the relationship between diversification dimensions across stability quartiles displayed similar nuances. Provinces with more stable export performance exhibited a clearer link between their diversification strategies. This implies that diversification across sectors and destinations might be a strategy employed by these provinces to maintain stability in the face of potential market fluctuations.

These observations highlight the importance of considering both export intensity and stability when analyzing the relationship between different forms of diversification. Different levels of engagement in international trade and export performance fluctuations can influence the way provinces leverage diversification strategies to achieve their development goals.

From the regression analysis, sectoral and geographical diversification emerged as key strategies associated with higher export intensity, enabling provinces to access new markets and enhance international trade capabilities. Moreover, the presence of well-functioning institutions played a crucial role in achieving high export performances, as effective governance, regulations, and transparent policies fostered a conducive business environment for export. However, while sectoral diversification was significant for export intensity, it did not explain export instability. Otherwise, the ability to absorb exogenous shocks like Covid-19 and to return to “normal trends” appears more related to low level of industry concentration, stronger exposure to European markets, and still high institutional quality, which ultimately leads to a greater ability to recombine local resources cooperatively and implement effective adjustment policies.

In conclusion, our research contributes to a better understanding of the complexities surrounding export propensity and instability in Italian local production systems. By exploring diversification in various dimensions and employing novel indexes, we shed light on the dynamic performance of regions and provinces and offer valuable insights for policymakers and researchers seeking to enhance economic growth and stability.

Moreover, our analysis reveals that sectoral and geographical

diversification alone cannot fully explain the stability of exports at the local level, although it is evident that diversification is positively associated with export propensity. To promote stable and intensive export growth, several designable amendments can be considered, such as the need to strengthen institutions by focusing on effective governance, transparent policies, and robust regulations. Furthermore, enhancing local competences and recombination potential can foster innovation and resilience, contributing to export performance. Addressing the impacts of industry distribution is crucial to mitigate the negative effects of over-reliance on specific sectors.

5.1. Policy implications

Shifting our attention to the development of policy recommendations that can help redirecting the divergent paths undertaken by Italian regions and spur sustainable growth, we start from stressing the necessity and relevance of data-informed decision for policymakers. This is the direction that best motivates our empirical exercise, which is not to be intended in a strictly academic sense, but it shall also offer useful indicators that summarize in a simple but rich manner the structural condition of exporting regions. From the results, it is quite clear that at least “two Italies” emerge in terms of export features, one that is well diversified and the other one that tends toward the macro-specialization. In this situation, considerable effort shall be devoted to improving the geographical and sectoral presence of weaker regions, with stronger regions that are perfect candidates to contribute to this process.

More precisely, incentives shall be designed to favor the transfer of knowledge and human capital to needy regions, inducing for example the choice of suppliers or the opening of plants in these areas. Productive and institutional knowledge is not absent, but rather badly distributed. For example, tools that may favor this redistribution consist of special economic zones combined with conditionalities on investment or partnership projects between stronger and weaker areas.

To foster balanced and sustainable regional economic development, it appears imperative to design and implement place-based policies. These policies should be rooted in a nuanced understanding of each macro and micro-region’s unique economic characteristics and challenges [42]. A necessary condition for the success of such policies is the substantial improvement of institutional quality, ensuring that governance structures are transparent, efficient, and responsive. A strong emphasis on governance can underpin the effectiveness of any regional development strategy [50], as it sets the foundation for regulatory clarity and the efficient allocation of resources.

Moreover, the orientation of industrial evolution in these regions must be guided toward sectors that promise resilience and prosperity in the future. This demands a forward-looking approach that considers global economic trends and emerging industries. In this, the development of technological application capabilities shall be prioritized regarding the enhancement of pure technological strength [51]. Enhancing local competences and the recombination potential of existing industries is equally vital. This approach encourages innovation, facilitates knowledge transfer, and positions regions to seize

opportunities in new and dynamic sectors. Considering the persistent challenge of industry concentration in various regions, encouraging Foreign Direct Investment (FDI) can be instrumental in diversifying the economic landscape [52,53]. FDI can infuse fresh capital, expertise, and international market access into regions where industry concentration is a concern. Further, integrating regional economies more deeply into the European Union’s Global Value Chains (GVCs) can expand market reach, reduce economic vulnerabilities, and boost local competitiveness. In terms of FDI attraction, it becomes key to attach conditionalities to the interested enterprises in order to enhance effectiveness and avoid short-term strategies [54]. For instance, this can be done with the involvement of universities and the design of medium- and long-term objectives.

Finally, in the pursuit of these policy objectives, it is crucial to consider the distributional impacts, ensuring that the benefits of economic growth are equitably shared among the population, within and across regions. Lastly, a systematic approach to regular monitoring and evaluation is essential to assess the effectiveness of regional development policies over time [55]. This allows for the necessary adjustments and refinements in response to changing economic conditions, ultimately contributing to more balanced and sustainable growth across Italy’s macro-regions.

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CRediT authorship contribution statement

Elisa Barbieri: Funding acquisition, Investigation, Supervision, Writing – original draft, Writing – review & editing. **Luigi Capoani:** Investigation, Writing – original draft, Writing – review & editing. **Sebastiano Cattaruzzo:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis. **Giancarlo Corò:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing.

Data availability

The authors do not have permission to share data.

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Appendix

1. Italian provinces by diversification typology

Table A1
List of Italian provinces by typology

Bottom - left	Bottom - right	Top - left	Top - right
Low - low	High geo. - low sect.	Low geo - high sect.	High - high
Cosenza	Cagliari	Catanzaro	Roma
Palermo	Catania	Nuoro	Napoli
Agrigento	Taranto	Caserta	Genova
Oristano	La Spezia	Sondrio	Perugia
Sassari	Salerno	BARI	Venezia
Reggio Di Calabria	Siracusa	Pistoia	Trento
Benevento	Livorno	Bolzano-Bozen	Pisa
Trapani	Savona	Teramo	Milano
Ragusa	Avellino	Macerata	Rimini
Messina	Ferrara	Rovigo	Ancona
Viterbo	Massa-Carrara	Pavia	Torino
Imperia	Belluno	Cremona	Padova
Lecce	Frosinone	Pordenone	Como
Matera	Arezzo	Mantova	Ravenna
Foggia			Firenze
Grosseto			Udine
Pescara			Verona
Barletta-Andria-Trani			Bologna
L'aquila			Monza e Brianza
Rieti			Lucca
Brindisi			Brescia
Valle D'aosta			Varese
Campobasso			Cuneo
Verbano-Cusio-Ossola			Parma
Terni			Bergamo
Siena			Lecco
Fermo			Trieste
Prato			Novara
Potenza			Treviso
Biella			Modena
Ascoli Piceno			Alessandria
Gorizia			Asti
Latina			Vercelli
Lodi			Piacenza
Chieti			Reggio nell'Emilia
			Vicenza

2. Pairwise correlation matrix

Table A2
Pairwise correlation matrix of the variables of interest

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Export intensity	1.00												
(2) Export stability	-0.29*	1.00											
(3) GDPpc	0.23*	0.05	1.00										
(4) Sectoral diversification	0.63*	-0.28*	0.16	1.00									
(5) Geo diversification	0.69*	-0.07	0.27*	0.64*	1.00								
(6) C3 index	-0.43*	0.37*	0.02	-0.62*	-0.42*	1.00							
(7) Institutions	0.72*	-0.35*	0.17	0.64*	0.47*	-0.36*	1.00						
(8) HHI	-0.20*	0.19	0.07	-0.47*	-0.24*	0.75*	-0.14	1.00					
(9) Exposure toward Africa	-0.16	0.07	-0.05	0.20*	-0.22*	0.05	-0.15	-0.06	1.00				
(10) Exposure toward Americas	-0.10	0.29*	-0.01	-0.10	0.08	0.19*	-0.17	0.22*	-0.30*	1.00			
(11) Exposure toward Asia	0.37*	-0.11	0.17	0.48*	0.28*	-0.38*	0.33*	-0.29*	-0.31*	-0.37*	1.00		
(12) Exposure toward EU	0.08	-0.33*	-0.02	-0.24*	-0.26*	0.06	0.16	0.13	-0.38*	-0.42*	-0.01	1.00	
(13) Exposure toward Oceania	-0.21*	0.17	-0.11	0.07	-0.02	-0.16	-0.06	-0.31*	-0.10	0.04	0.09	-0.28*	1.00

***p < 0.01, **p < 0.05, *p < 0.1.

3. Institutional quality (IQI) disaggregated components

Table A3
Stepwise regression results – IQI disaggregated components - intensity

Variables	Export intensity			
Sectoral diversification	0.157 (0.108)	0.274** (0.116)	0.204** (0.0987)	0.0709 (0.0934)
Geographical diversification	0.504*** (0.115)	0.483*** (0.132)	0.304** (0.116)	0.525*** (0.0993)
Micro-derived C3 ratio	-0.00397 (0.174)	-0.0999 (0.193)	-0.118 (0.168)	-0.0704 (0.144)
Corruption	2.076*** (0.482)			
Government effectiveness		0.0295 (0.147)		
Regulatory quality			0.874*** (0.155)	
Rule of law				1.150*** (0.189)
Voice and accountability GDP per capita	-0.0405 (0.123)	0.0622 (0.150)	0.0136 (0.140)	-0.0500 (0.127)
Constant	15.41*** (0.739)	15.59*** (0.820)	14.94*** (0.773)	15.28*** (0.626)
Observations	99			
R-squared	0.604	0.496	0.600	0.674

Robust standard errors in parentheses - ***p < 0.01, **p < 0.05, *p < 0.1.

Table A4
Stepwise regression results – IQI disaggregated components - instability

Variables	Export instability			
Sectoral diversification	-0.0634 (0.0680)	-0.0679 (0.0697)	-0.108* (0.0565)	-0.0869 (0.0658)
Geographical diversification	0.208** (0.103)	0.213** (0.107)	0.297*** (0.108)	0.207** (0.0993)
Micro-derived C3 ratio	0.321** (0.125)	0.373*** (0.133)	0.381*** (0.123)	0.365*** (0.134)
Corruption	-1.219*** (0.394)			
Government effectiveness		-0.268** (0.116)		
Regulatory quality			-0.400** (0.153)	
Rule of law				-0.295* (0.149)
Voice and accountability GDP per capita	0.0799 (0.0711)	0.0367 (0.0788)	0.0469 (0.0621)	0.0549 (0.0788)
Constant	-1.340*** (0.480)	-1.423*** (0.533)	-1.192** (0.511)	-1.389*** (0.485)
Observations	99			
R-squared	0.266	0.227	0.243	0.216

Robust standard errors in parentheses - ***p < 0.01, **p < 0.05, *p < 0.1.

Table A5
Variable definitions

Variable	Definition	Source
Export intensity	Ratio of export over GDP	Own elaborations from CoE-web data
Export in-stability	Export standard deviation over its mean	
Sectoral diversification	See Section 3b	ISTAT
Geographical diversification	See Section 3b	
GDP per capita (€/population)	Total value of goods and services for final use produced by resident producers in an economy over population	Nifo & Vecchione [48] Own elaboration from TEC data
Quality of Government	A composite indicator named Institutional Quality Index (IQI)	
Micro-derived C3 (%)	The share of export represented by the top three firms in each province	
Micro-derived HHI	A firm-based HHI over export shares in each province	
Export exposition to Africa (%)	Share of export whose destination is Africa	Own elaboration from CoE-web data

(continued on next page)

Table A5 (continued)

Export exposition to Americas (%)	Share of export whose destination are the Americas
Export exposition to Asia (%)	Share of export whose destination is Asia
Export exposition to EU (%)	Share of export whose destination is EU
Export exposition to Oceania (%)	Share of export whose destination is Oceania

4. Kernel densities of the export exposure variables

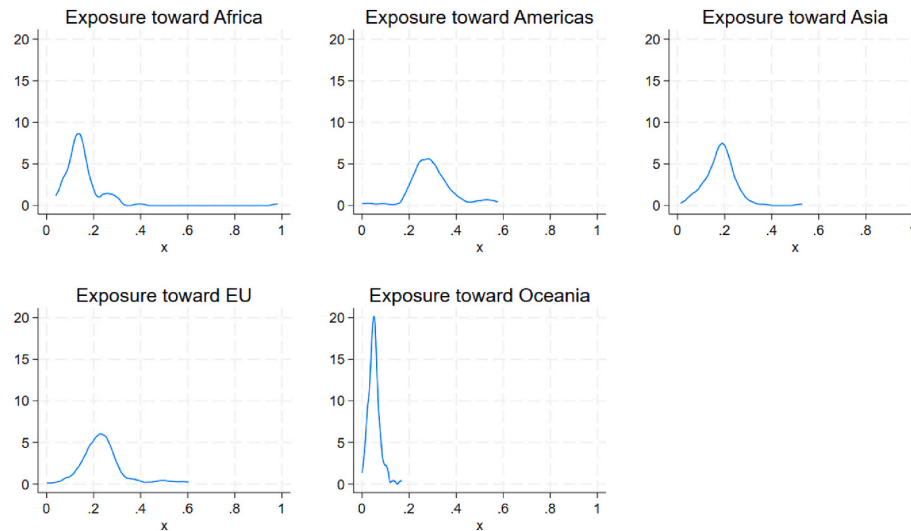


Fig. A1. Kernel densities of the export exposure variables

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