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Does institutional quality moderate the relationship between the green transition and regional competitiveness? Evidence from Italian provinces

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EXTENDED ABSTRACT

The primary aim of this paper is to deliver empirical evidence on the relationship between the green propensity of Italian provinces (measured in terms of green innovation, green-labelled degrees and green jobs) and their international competitiveness, focusing attention on the moderating role played by institutional quality.

The green transition can have a significant positive or negative impact on local competitiveness, depending on how regions adapt to and implement sustainability measures.

On the one hand, regions that invest in green technologies and sustainable practices can become leaders in emerging sectors like renewable energy, electric vehicles, green construction, and sustainable agriculture. This drives innovation and boosts efficiency and productivity with an expected positive effect on international competitiveness. As it is known, green capacity can significantly reduce dependence on imported fossil fuels, leading to greater energy security and potentially lower long-term energy costs, which can improve competitive advantage, too. Moreover, provinces that align with global sustainability goals may attract funding from international organizations, governments and private investors who are increasingly prioritizing environmental, social and governance (ESG) objectives, leading to greater access to capital for green firms. The green

transition can also create new jobs in sectors like renewable energy, energy efficiency, sustainable agriculture, and green construction. Provinces investing in green degrees can build a skilled green workforce that enhances their competitive edge. In essence, the green transition can improve regional competitiveness if regions embrace sustainability as an opportunity for innovation, investment and job creation.

However, regions may fail to adapt to green transition falling behind in the face of increasing regulatory pressures, higher costs, and diminished access to capital and investment. Furthermore, in regions where traditional, non-green industries dominate (e.g., coal mining, fossil fuels), the green transition may lead to job losses and increased unemployment. A high dependence on conventional energy sources may generate higher transition costs, affecting local industries and competitiveness in the short term. In addition, provinces with slow adoption of green policies may face stricter regulations, increasing costs and reducing the competitiveness of local businesses in global markets.

To our limited knowledge, no study has investigated the effect of green propensity on international competitiveness at the NUTS 3 level. This study addresses this gap by examining the Italian provinces over the period 2005–2022 and explicitly investigating the moderating role of local institutional quality on the relationship between the two key variables.

Our empirical analysis is based on an original dataset that combines provincial data on exports and imports with provincial data on green capacity, plus institutional quality indices (IQI) and additional control variables.

As a measure of green innovation, we consider the number of green patents defined at the provincial level. Patents are classified as green if they belong to the Y02/Y04S climate change mitigation technology tagging scheme (CCMT) of the Cooperative Patent Classification (CPC) (Bellucci et al., 2023; De Hass and Popov, 2023; Agostino and Rondinella, 2025). Data are taken from the Orbis Intellectual Property (IP) database, provided by Bureau van Dijk. Green innovation - also known as sustainable, environmental or eco-innovation - is gauged by the number of granted green patents, referring to new products, processes or technologies reducing the human environmental footprint, through pollution control, waste recycling, energy efficiency, and transition to renewable sources of energy (Lian et al., 2022; Han et al., 2024). Patent data are publicly available, cover long periods and large numbers of firms, and do not potentially suffer from sample selection. A key advantage for our purpose is that patent data are easily available and comparable, whereas other potential measures of innovation activity like R&D expenditures or product/process innovations are not always available and comparable or they are reported only by large firms.

The second variable we use to capture provincial green capacity or propensity? (la chiamerei sempre allo stesso modo, o propensity o capacity) refers to green-labelled degrees. As far as higher education (HE) is concerned, institutional quality may positively influence HE institutions' decisions on where to offer their “green degrees” among the regions where they have established branches (Cattani et al., 2024). On the other hand, institutional quality is also deemed to drive regional differences in terms of employment growth and workers’ attractiveness (Di Cataldo and Rodríguez-

Pose, 2017), as well as regional innovation capacity (Rodríguez-Pose & Di Cataldo, 2015; Sleuwaegen & Boiardi, 2014).

Green-labeled degrees are defined as programs whose titles explicitly refer to themes such as "environmental protection, natural conservation, resource-saving and rational utilization, and advocacy of environmental friendliness" (Xiong et al., 2013, p. 101). These degrees are identified through a content-based analysis of the list of degree curricula published annually by the Italian Ministry of University and Research via the National Graduate Register.

Finally, we consider green skills - drawn from the European multilingual Classification of Skills, Competences and Occupations (ESCO) - which labels as "green" those skills that are deemed as relevant to reducing the impact of human activity on the environment (Maldonado et al., 2024), and then linked to the occupational composition (at the 3-digit level ISCO-08 code) of each Italian province through the information provided by the Italian Labour Force Survey about 3-digit level.

To capture international competitiveness at the provincial level, we compute the export propensity index and the trade openness index for each province. The first measure is calculated as the ratio between exports and GDP at the provincial level in percentage terms, and the latter measure is given by the ratio between a province's total trade (exports plus imports) and its GDP in percentage terms. The export propensity index, reflecting the province's export performance, represents an ex-post measure of international competitiveness since it assesses the extent to which provinces gain or lose market share on external markets. According to Bela Balassa (1962), international competitiveness is defined as the "ability to sell" on international markets; thus, the higher the province's export propensity index, the higher its international competitiveness. Trade openness can be a significant driver of international competitiveness by increasing competition, providing access to larger markets, facilitating technology transfer, and improving efficiency. For instance, trade openness can drive domestic firms to become more efficient and innovative to survive; this leads to improved international competitiveness. Trade can improve competitiveness by increasing the size of the market available to domestic firms. Firms gain access to larger markets, allowing them to achieve economies of scale and specialize in producing goods and services where they have a comparative advantage. This enhances their competitiveness. Similarly, trade openness facilitates the flow of technology and knowledge across borders. This can stimulate innovation and further productivity, making a province more competitive.

The study, hence, contributes to a better understanding of the mechanisms through which different measures of green propensity affect export competitiveness and trade openness by considering the role of the quality of institutions within provinces. Some policy implications conclude the work.

Keywords: green transition, institutional quality, regional competitiveness

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