

Bisi, Davide; Landini, Fabio; Rinaldi, Riccardo

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# Green Investments and Worker Voice<sup>\*</sup>

Davide Bisi

University of Parma

davide.bisi@unipr.it

Fabio Landini

University of Parma, GLO

fabio.landini@unipr.it

Riccardo Rinaldi

University of Parma

riccardo.rinaldi@unipr.it

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## Abstract

The interaction between organised employee representation (ER) and firms' engagement in the green transition remains insufficiently understood. Theoretically, two opposing mechanisms may operate. In the bargaining view, representation can slow green investments by increasing adjustment costs and exposing firms to rent-seeking pressures. In contrast, the employee voice perspective holds that ER enables sustainability by facilitating information exchange, eliciting workers' environmental preferences, and supporting joint problem-solving when organisational adaptation is required. We test these predictions using survey and administrative data from nearly 2,000 firms in Emilia-Romagna. Firms with ER are systematically more likely to pursue green investments, especially in climate mitigation, water use, circularity, and pollution prevention. These results also hold when accounting for the endogeneity of ER via IV. Consistent with the voice mechanism, the association between ER and green investments is stronger in firms employing younger and more educated workers, who are more likely to hold pro-environmental preferences and contribute specialised knowledge relevant for organisational change. Taken together, our findings challenge the view that organised labour inhibits the green transition. Instead, ER emerges as a strategic policy lever that can foster decarbonisation pathways that are technologically feasible, socially negotiated, and democratically anchored at the workplace level.

**Keywords:** worker voice; employee representation; sustainability; climate change; green investments.

**JEL Codes:** J50; O33; Q50.

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# 1 Introduction

*Do unions delay or enable the green transition?* The shift toward environmental sustainability entails profound transformations in how firms organize work, develop skills, and design production activities (Fankhaeser et al., 2008; Jakobsen et al., 2022; Ferguson-Cradler, 2024; Kamath et al., 2023). Beyond the risk of displacing workers most exposed to green socio-economic reconfigurations (Rodríguez-Pose and Bartalucci, 2024), the transition also requires substantial changes in job content, calling for new skills, competences, and knowledge (Consoli et al., 2016). Collective forms of employee representation can play an ambiguous role in shaping both the pace and direction of these adjustments (Kalt, 2022). On the one hand, unions may act as agents of change, fostering green transformations that align with their specific objectives. On the other, they can act as defenders of the status quo, seeking to protect jobs perceived as threatened by the transition. Which of these roles predominates, however, remains an open question.

In this paper, we contribute to this open debate by investigating whether green investments, namely actions undertaken by firms to promote the environmental sustainability of their productions, are influenced by the presence of shop-floor employee representation (ER). At the establishment level, this is the most common institutional form of employee voice (e.g. unions, works councils) through which workers can exert an influence on work organization and employment-related issues.

Theoretically, the effect of ER on green investment could operate through different mechanisms. The standard economic view, grounded in concerns about bargaining costs and hold-up risks, suggests that ER slows down the adoption of new technologies by increasing adjustment costs and delaying decisions, for example through rent-seeking behaviour or procedural rigidities (Grout, 1984; Genz et al., 2019). In this framework ER may induce firms to postpone green investments, thus retarding environment-friendly transformations. Conversely, industrial relations approaches emphasise ER as a *voice* institution (Hirschman, 1970) that facilitates coordination by conveying local information and workers' preferences to management (Freeman and Medoff, 1984; Freeman and Lazear, 1995). From this perspective, ER can ease the implementation of green investments by reducing the information asymmetries that are typically involved in the transition toward greener productions and favoring the emergence of collective concerns about the environment.

Based on these arguments, in this paper, we explore the ER-green investment relationship puzzle. To that end, we rely on original survey data from a representative sample of nearly 2,000 Italian firms operating in the Emilia–Romagna region (Italy). This dataset represents a unique source of information regarding the presence of shop-floor ER and the implementation of specific green actions at the firm level. Moreover, we complement this data with two additional information sources: balance-sheet data from the AIDA–BvD database by Bureau van Dijk; and job activations data from the SILER archive based on regional mandatory communications (see below).

Our analysis proceeds in three steps. First, we assess the baseline association between the presence of shop-floor ER and the firm’s decision to undertake green actions, comparing its validity across the six domains identified by the *EU sustainability taxonomy*<sup>1</sup>: climate mitigation, climate adaptation, water use, circular economy, pollution prevention, and biodiversity protection. Our estimates indicate the predominance of a voice effect, evidenced by the prevalence of a positive association between ER and green investments across most specifications. Then, through the inclusion of interaction terms between ER and workforce characteristics, we provide further evidence supporting the voice mechanism as an explanation for this association. Indeed, the positive effect of ER on green investments turns out to be stronger in firms with more educated and younger workers, precisely the contexts in which skill-related information asymmetries and workers’ concerns for environmental issues are likely be stronger. Finally, we deal with the potential endogeneity of ER using an instrumental-variable approach that corroborates our main findings.

Our paper contributes to two main streams of literature. First, it extends previous works examining how shop-floor ER shapes firm’s responses to technological change. A growing body of empirical research has analyzed the role of this labor institution, but predominantly in relation to processes of digitalization and automation (Belloc et al., 2023b,a; Berton et al., 2025; Genz et al., 2019). These studies show that ER can facilitate the adoption of technologies that entail organisational redesign, investments in training, or the reallocation of tasks, by improving information flows and easing coordination between workers and management. Much less is known, however, about whether similar mechanisms extend to environmental transformation.

Second, the paper contributes to research on the role of unions and collective in-

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<sup>1</sup>See <https://ec.europa.eu/sustainable-finance-taxonomy/>

stitutions in the green transition (Silverman, 2006; Montesano et al., 2023). Although large and growing, this literature is predominantly qualitative and focuses on the bargaining strategies pursued by unions (Thomas and Doerflinger, 2020; Kalt, 2022). In particular, Bartosch et al. (2025) use an employee voice framework to investigate the strategies used by board-level employee representatives to engage firms on environmental issues. Instead, our work relies on quantitative methods to assess whether the presence of shop-floor ER bodies and related voice mechanisms shapes firms' decision to make green investments. One contribution that is closely related to ours is Antonioli and Mazzanti (2017), which examines how union–management cooperation can foster eco-innovations in manufacturing.<sup>2</sup> Our results complement their findings in three respects: first, we focus on a broader set of policy-related green actions, thus going beyond a narrow definition of eco-innovations; second, we include in the analysis a set of service industries that are most directly affected by the green transition and have traditionally lower incidence of unionization compared to manufacturing (e.g., energy supply, waste management, transport); and third, we exploit the richness of our data to dig into the mechanisms that drives the relationship at stake. Finally, it is important to consider that while Antonioli and Mazzanti (2017) relies on data dating back to 2006-2008, our analysis focuses on the years 2019-2023, a period during which environmental awareness among firms and workers has changed considerably (Baiardi and Morana, 2021).

The remainder of the paper is structured as follows. Section 2 discusses the conceptual framework. Section 3 presents data and variables. Section 4 reports the main results and mechanism tests. Section 5 concludes.

## 2 Conceptual Framework

### 2.1 A Contested View on Unions and the Green Transition

The role of collective forms of employee representation has been the subject of increasing discussions in studies on the political economy of the green transition. While unions have a long history of struggling for the environment,<sup>3</sup> in recent years their

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<sup>2</sup>In a related quantitative study Damiani et al. (2025) investigate the effect of green innovation on the probability of Italian firms to rely on decentralized collective bargaining. They report a positive effect, especially for negotiations related to performance pay and welfare benefits.

<sup>3</sup>For instance, Räthzel et al. (2010) note that, even in the early years of industrialisation, trade unionists opposed air and river pollution in their communities. More recently, unions have addressed envi-

contribution to green transformations has been increasingly questioned. Many people, including some trade unionists, portray unions as institutions that tend to align their interests with climate skeptics, prioritizing concerns about job preservation over environmental action (Räthzel et al., 2010). At the same time, a growing number of contributions document that in many contexts unions are gradually changing their approach, broadening their missions to include environmental sustainability, not only as a normative commitment but also as a strategy to regain political relevance, expand membership, and influence decision-making (Silverman, 2006; Montesano et al., 2023). Although heterogeneous (Clarke and Sahin-Dikmen, 2020; Kalt, 2022; Bartosch et al., 2025) and often influenced by structural vulnerabilities (e.g., the exposure of the firm and workers to the risk of green restructuring, see Thomas and Doerflinger, 2020), this renewed commitment toward the environment positions unions as actors that can play a pivotal role in shaping both the speed and direction of the transition.

When moving from the broad political economy dimension to the actual influence of organized labour at the workplace, the ambivalent role of unions translates into alternative micro-organisational mechanisms through which ER can influence green transformations. Indeed, when present within the firm, employee representatives enjoy participation rights in the decisions made by the organization (ranging from mere information to plain co-determination), which allows them to exert an influence (whatever small) on a broad range of issues, including investments in sustainability (Markey et al., 2019). Whether this influence leads to greater support for green transformations, however, is difficult to determine *a priori*, as it depends on the theoretical lenses used to interpret the functions of ER.

## 2.2 Bargaining Frictions and “Hold up”

One traditional way of considering ER is to conceive it as an institution concerned primarily with wage and employment-related negotiations. Through organization and collective action, worker representatives can indeed exert some degree of monopoly power on labour supply, which allows them to raise wages above the competitive level (Burton, 1985; Addison et al., 2010). Moreover, during periods of economic restructuring and transformation, ER can exploit formal negotiation channels to defend jobs that

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ronmental concerns primarily through their longstanding involvement in workplace health and safety, a domain traditionally characterised by strong trade union presence and forms of intervention.

are at risk of being displaced or that are likely to face a worsening in working conditions (Grund et al., 2016). Finally, in many contexts, ER enjoy participation rights over health and safety measures undertaken within establishments, which directly affect employment conditions (Nienhüser, 2020).

When these bargaining mechanisms are active, ER can weaken a firm's propensity to invest in new technologies, including green ones, through two main channels. First, it can introduce frictions into managerial decision-making. As shown by Genz et al. (2019) in the context of digital transformations, employee representatives are often entitled to be informed and consulted about the changes associated with adopting new production methods. When such changes entail clear costs for workers, for example when green actions result in job losses, ER can mobilize its power resources to oppose the transformation (Kalt, 2022). In all the other cases, i.e., when green actions produce effects that are either neutral or positive for the workers, the presence of ER might still oblige firms to go through a negotiation process that considerably extends the time needed to introduce green innovations relative to firms without ER. Such delay may in turn impede firms to meet profitable market opportunities in a timely manner, ultimately discouraging green transformations.

Second, owing to its bargaining position, ER may undermine green investments through a standard "hold up" mechanism. In his seminal contribution, Grout (1984) describes the problem by applying a standard prisoner's dilemma logic. In this framework, managers and employee representatives initially reach a non-binding agreement on investment and wages, but once the investment is undertaken, rent-seeking representatives will start claiming for higher wages, thereby pushing employers to modify their decisions. Anticipating this risk, employers may decide to take actions and prevent quasi-rents generated by production improvements from being ex-post appropriated by labour, thus postponing investments in the first place. When applied to the case of sustainability practices this argument suggests that, as long as green transformations are likely to generate competitive rents through either efficiency improvements (Gallo et al., 2025) or consumption attitudes (Besley and Persson, 2023), the presence of ER may erode the benefits that employers expect from these interventions. ER might thus act as an implicit tax on green investments, which ultimately discourages employers from engaging with sustainability.<sup>4</sup>

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<sup>4</sup>The empirical evidence in support of the "hold up" hypothesis is controversial (Menezes-Filho and

## 2.3 Employee Voice

Alongside its function as a bargaining institution, however, ER also plays another important role as a channel of employee voice. An extended literature rooted in the seminal contribution by Hirschman (1970), later extended into the industrial relations domain by Freeman and Medoff (1984) and Freeman and Lazear (1995), is indeed supportive of the idea that the presence of ER represents a fundamental condition to ensure a real participatory mechanism for the workers. By reducing the costs of information transmission between workers and management, ER facilitate the development of shared courses of action and enable smoother adaptation to changing circumstances. Enhanced communication makes it easier for both parties to coordinate expectations, identify potential bottlenecks, and adjust organisational practices in a timely manner. In addition, by fostering trust within the organization, ER can strengthen the willingness of both sides to engage in cooperative ventures, thereby enhancing the firm's capacity to implement complex projects and capture the related benefits (Freeman and Rogers, 1993; Rogers and Streeck, 2009).

In the context of the green transition, this voice mechanism allows ER to sustain the introduction of environment-friendly transformations in two ways. First, it can help firms to overcome the information asymmetries that are involved in all processes of organisational change, which require firms to redesign workflows and integrate new competencies. As documented by an extended literature studying digital innovations (Belloc et al., 2023b,a; Krzywdzinski et al., 2023), the presence of ER enables managers and employees to elaborate reciprocal safeguard mechanisms (e.g., collective engagement, mutual commitments), which grant to both parties significant advantages following the introduction of new production methods. Also, by diminishing the risk of separations (Hirsch et al., 2010), ER reduces the opportunity cost of investing in firm-specific skills, thus favoring the acquisition of new competences via training (Bertoni et al., 2023). Whenever green transformations require this type of reciprocal engagement as well as the acquisition of new skills, firms with ER turn out to be in a better position to meet these conditions compared to firms without ER, thus raising their

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Van Reenen, 2003). Most of the early studies relying on US data find a negative effect of organized forms of employee representation on firm investment (Hirsch, 1992; Bronars and Deere, 1993; Connolly et al., 1986; Betts et al., 2001; Bradley et al., 2017). For Europe, most of the studies find a null effect (Addison and Wagner, 1994; Menezes-Filho et al., 1998; Schnabel and Wagner, 1992) and in some cases a positive effect (Bertoni et al., 2021; Wang et al., 2023), especially when investments in new technologies (Belloc et al., 2023b,a; Bertoni et al., 2025) and innovation-related capital are considered (Cetrulo et al., 2025).

probability of investing in green practices.

Second, ER can foster the firms' engagement with the green transition also by favoring the emergence of the underlying preferences of the workers. Indeed, through ER, employees may not only articulate how organisational changes can be implemented, but also promote the objectives they consider desirable. In fact, oftentimes, especially when it is not mandated by regulatory standards, green innovation can be considered as only marginally beneficial by firms, while at the same time providing large benefits to workers, either materially (e.g., through improvements of the working environment) or in terms of value considerations (e.g., by giving response to specific environmental concerns).<sup>5</sup> In all these cases ER can act as a forum for deliberation that helps aggregating and communicating employees' preferences and values to managers (Freeman and Lazear, 1995). In a context of reciprocal trust and collaborative attitudes toward common endeavors, this type of information can prompt managers to accord greater priority to environmental issues, eventually increasing the firm's probability to pursue green investments.

## 2.4 Summary

To summarize, the coexistence of alternative micro-organisational mechanisms implies that the overall effect of ER on green investments is theoretically ambiguous. If the bargaining logic prevails, ER acts as a constraint on firms' decisions, raising adjustment costs and delaying organisational change, thereby reducing the firms' propensity to pursue green investments. If the voice mechanism dominates, ER functions instead as a facilitating institution, improving information flows and enabling firms to implement complex environmental strategies, ultimately fostering green innovation. The empirical analysis that follows evaluates which of these channels prevails by: (i) assessing the net association between the presence of workplace ER and firms' engagement in sustainability practices, and (ii) investigating the theoretical mechanism that accounts for the observed relationship.

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<sup>5</sup>An emerging literature is documenting that, in many contexts, workers value positively the pro-environmental orientation of their jobs. Lanfranchi and Pekovic (2014), for instance, show that employees in environmentally certified firms report stronger identification with their organization and greater willingness to contribute beyond contractual obligations. Similarly, Landini et al. (2025a) document that the green content of individual occupations contributes to the self-reported perception of work meaning. Finally, having a more specific focus on political engagement with unions, Ringqvist (2022) finds that union members across European countries are more likely than non-members to prioritize environmental protection over growth and employment, even in pollution-intensive sectors.

### 3 Data and Descriptive Evidence

#### 3.1 Institutional Context

Our analysis is conducted in the context of the Emilia-Romagna, a Northern Italian region that is renowned for its production system specialised in manufacturing.<sup>6</sup> Such specialization has historically evolved alongside a well-established system of industrial relations, strong civic participation, and consistent political support, creating a distinctive socio-economic *milieux* (Putnam, 1994). This uniqueness is reflected in higher unionization rates and a greater incidence of firm-level collective representation compared to other Italian regions (Landini and Rinaldi, 2025).

In recent years, however, this region, like many others in Italy, has been intersected by two important transformations, which have exerted a growing pressure on both firms and workers. First, in coincidence with the launch of the European Green Deal, the region has been affected by a growing number of policy initiatives aimed at fostering the green transition.<sup>7</sup> This led to a sustained process of institutional innovation, which included the creation of a regional observatory on the green economy (called GreenER and managed by ART-ER, the regional development agency)<sup>8</sup> whose main aim is to produce data and information that can guide the action of policy makers on green-related issues.

Second, the region has experienced a gradual erosion of the cooperation attitude that had characterized the relations among social actors during the previous decades. This, in particular, is related to two trends. On the one hand, the increasing fragmentation of the labour market, which has progressively undermined the degree of social cohesion among co-workers and between them and the companies (Landini and Rinaldi, 2025). On the other, partly as a result of the transformations linked with the transition, the marked increase in the number of industrial crises. Indeed, regional administrative social security data show a substantial increase in the number of firms experiencing marked reductions in production activity and resorting to short-time work schemes (i.e., *cassa integrazione*) in recent years.<sup>9</sup> Such an increase appeared to be concentrated

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<sup>6</sup>As of 2018, the manufacturing sector employed roughly 34% of the regional workforce, generating about 35% of total value added, and contributing to nearly 60% of regional GDP (Pollio et al., 2025)

<sup>7</sup>For an overview see <https://www.osservatoriogreener.it/index.php/materiale/>

<sup>8</sup>See <https://www.osservatoriogreener.it/>

<sup>9</sup>Short-time work scheme provisions consists of wage supplements ensured in cases of interruptions or reductions of employment in firms that are either in the process of reorganization and restruc-

especially in sectors that are most exposed to green transformations, such as the machinery and fashion industries. Moreover, unions report the activation of around 50 company crisis negotiation tables across the region up to 2025, involving around 10 thousand workers.<sup>10</sup> Against this backdrop of weakening cooperative norms and rising industrial turbulence, analyzing the role organized forms of employee representation in shaping the green transition becomes especially compelling.

### 3.2 The ECOSISTER Survey

The empirical analysis relies on an original dataset collected in 2024 within the ECOSISTER project (*Ecosystems for the Sustainable Transition in Emilia–Romagna*), co-funded by the Italian National Recovery and Resilience Plan (PNRR) <sup>11</sup>. The survey covers firms operating in manufacturing, construction, and a set of service sectors particularly exposed to the ecological transition, such as transport and utilities. This industry selection enables us to concentrate on firms that are prone to pursue green investments, while at the same time capturing the distinctive productive specialisation of the regional economy.

The questionnaire was designed on the basis of similar firm-level surveys carried out in Italy and in other countries (e.g., INAPP's *Rilevazione Imprese e Lavoro*, European Company Survey). This approach ensures the reliability of most measures, as they draw on instruments that have already been validated in previous surveys. The target population comprised all firms from the selected industries with at least 5 employees and one production establishment in the region, as reported in the Company Registry maintained by the Italian National Institute of Statistics (ISTAT) (totalling 24.073 enterprises). A sample of 2,000 firms was judged sufficient to provide robust representation of the target population. Firms were randomly selected from the directory following a stratified sampling design. Predefined quotas by sector (2 digits), size class (5-20, 21-100, >100 employees), and province, reflecting the underlying population structure, were applied to ensure that the final sample was representative along these key dimensions.

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turing or facing a severe economic crisis. According to INPS data (Italian Institute for Social Security), in 2025 the number of hours covered by these schemes was around 34 million, with an increase of about 20% with respect to 2024, and 102% as of 2023. See: <https://servizi2.inps.it/servizi/osservatori/statistici/5>

<sup>10</sup>See the press conference of CGIL's regional branch ([link](#))

<sup>11</sup>The project involves all universities active in the Emilia-Romagna region in partnership with ART-ER. For more details, see <https://ecosister.it/>

sions. The survey was administered through computer-assisted telephone interviews in collaboration with a professional survey firm.<sup>12</sup>

The survey includes a range of information highly pertinent to our analysis. To begin with, it reports whether firms carried out any green investments. This part of the questionnaire was specifically designed to operationalize the EU taxonomy at the firm level.<sup>13</sup> Green investments are distinguished across the 6 domains identified by the EU framework, namely: climate mitigation, climate adaptation, water use, circular economy, pollution prevention, and biodiversity protection. For each domain, the questionnaire asks whether the firm has undertaken any relevant intervention in the period 2019–2023 among those reported in Table 1. Firms could also indicate that specific interventions were “not applicable” to their area of activity, which allows us to exclude non-pertinent activities when constructing domain-specific variables.

Beyond taxonomy-based items, the survey collects a wide range of additional firm-level information. First, it reports whether an ER body is present within the firm.<sup>14</sup>. Second, it provides detailed information on workforce composition, including the share of young, educated and permanent employees, as well as information about ownership structure, managerial characteristics, innovation and digitalization activities, and basic indicators of internationalization. Finally, the survey includes unique firm identifiers, allowing us to merge the questionnaire with administrative sources, such as balance-sheet data from AIDA–BvD and job activations data from the SILER archive.<sup>15</sup> These combined sources enable us to account for a broad set of factors that may be correlated with both ER and green investments.

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<sup>12</sup>Format Research (see <https://formatresearch.com/en/>), who is responsible for conducting other firm-level surveys, such as the MET survey, that are widely used by researchers, e.g., Brancati et al. (2017).

<sup>13</sup>The instrument was developed in close collaboration with ART-ER, which routinely applies the taxonomy to monitor the regional green economy. A full description of the taxonomy-based questions and items is reported in the Online Appendix B. The complete version of the whole questionnaire is available upon request.

<sup>14</sup>In the Italian context, ER bodies can take two forms: the *Rappresentanza Sindacale Aziendale* (RSA), which can be elected by workers who belong to unions that signed the national collective contract; and the *Rappresentanza Sindacale Unitaria* (RSU), which can be elected by all the workers. In most of the analysis we consider that an ER is present if either RSA or RSU is reported. As a robustness check, we also distinguish between these two forms; results remain consistent.

<sup>15</sup>SILER is a regional archive managed by ART-ER which collects all mandatory communications that employers are required to submit in cases of major employment events, including job activations. For more details, see Arrighetti et al. (2021).

### 3.3 Descriptive Evidence

Descriptive statistics are reported in Table 2. ER is present in about one in five firms in our sample (18.6%), which is consistent with comparable measures based on other surveys.<sup>16</sup> Roughly 27% of the firms report investments in any of the green domains included in the EU Taxonomy. Such investments tend to be more common among firms with ER. Figure 1 shows the share of firms reporting green investments by ER status, distinguishing between the whole economy (Panel A) and aggregated industrial categories (Panel B). Nearly one in two firms with ER report having undertaken at least one sustainability-related action, compared with 27% among firms without ER. This gap turns out to be present in both manufacturing and service sectors.

When we go into the details of the specific interventions undertaken by firms, we notice substantial heterogeneity across green domains and ER status. For all the firms that considered at least one of the interventions in each domain as applicable to their production activity, Figure 2 shows the incidence of green actions by domain and ER status. Notably, climate mitigation, circular economy, and pollution prevention are the most common areas of engagement. Across all domains, the share of firms reporting at least one green intervention is higher among those with ER compared to those without. For climate adaptation and biodiversity protection, however, the difference is not statistically significant.

## 4 Results

### 4.1 Baseline specification

We begin by considering the following regression model:

$$S_{ij} = \alpha + \beta ER_{ij} + \mathbf{X}'_{ij}\gamma + \varepsilon_{ij}, \quad (1)$$

where subscripts  $i$  and  $j$  denote the firm and the industry, respectively;  $S_{ij}$  is a dummy variable equal to 1 if firm  $i$  in industry  $j$  carried out at least one green intervention across any of the domains foreseen by the EU Taxonomy;  $ER_{ij}$  is a dummy variable for the presence of employee representatives at the firm level;  $\mathbf{X}_{ij}$  is a vector of controls;

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<sup>16</sup>Belloc et al. (2023b) report that ER is present in about 25% of Italian firms. The lower incidence observed in our data partly reflects the greater weight of small firms in our sample — a segment that is particularly prevalent in the regional economy, especially in manufacturing.

and  $\epsilon_{i,j}$  are residuals. Our coefficient of interest is  $\beta$ , which captures the conditional association between ER and green investment.

Table 3 reports the results from a set of linear probability models estimated with a stepwise inclusion of control variables. In column (1) we consider a very parsimonious specification that includes only the indicator for ER and a full set of industry and province fixed effects. The presence of ER is positively associated with the probability of pursuing green investments. In Column (2), we add firm-level controls: firm size (log employment), firm age, and family ownership. Column (3) expands the specification by including variables capturing the characteristics of the entrepreneur or manager (age, gender, and education) and membership in an employers' association. Column (4) further adds controls for workforce composition, namely the shares of graduate, young, and permanent employees, together with the export ratio. Finally, column (5) introduces variables related to economic performance such as labour productivity, profitability (ROS), and capital intensity.<sup>17</sup> Across models, the coefficient of *ER* remains positive and statistically significant. In our preferred specifications, the presence of ER is associated with a 8.9-8.2 percentage point increase in the likelihood of pursuing green investments.<sup>18</sup>

Among the covariates, a number of variables exhibit a statistically significant association with green investments. Firm size is consistently positive and highly significant across all specifications, confirming that larger firms are also more likely to invest in green practices. Membership in employers' associations also shows a strong positive correlation, which can be explained by the informative role these organizations play in support of the transition. The share of graduate workers is another important predictor: in the full-model specifications a ten-percentage-point increase in graduate employment is associated with roughly a 3-4 percentage-point higher probability of green investment. Finally, economic performance indicator turns out to have limited explanatory power, except for productivity, which shows a positive association.

Overall, these results point toward a positive association between ER and green investments. In light of the theoretical framework discussed above, this pattern is consistent with the predictions based on the *voice mechanism*, whereby representatives

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<sup>17</sup>In this last specification we observe a reduction in the number of observations due to missing information in balance-sheet data.

<sup>18</sup>We obtain qualitatively similar estimates when average marginal effects are obtained from probit and logit models. Results are reported in Table A1 in the Appendix.

facilitate green transformations by fostering information exchange, coordination and learning processes within the firm.

## 4.2 Robustness

We perform several robustness checks. First, we consider alternative measures for our dependent variable. Indeed, one potential concern in our baseline estimates is that the measure of green investments is self-reported and does not account for the intensity of the transformations. To rule out potential biases due to measurement issues, we complement survey data with administrative information on *green job activations* derived from the SILER archive of mandatory employment communications. Job activations are weighted by the “green content” of the corresponding occupation, as defined on the basis the ESCO classification.<sup>19</sup> For each firm, we compute the average number of green activations over the years 2019-2022. Being defined on the basis of administrative data, this measure cannot be affected by self-reporting biases. Moreover, it is a continuous measure, thus capturing the intensity of job transformations related to the green transition. In Figure A1 in the Appendix we provide suggestive evidence that firms reporting green investments are also characterized by a higher number of green job activations over the same period. This suggests that green transformations are mirrored in employment dynamics. Then, we regress green job activations against ER with the full model specification (with and without controls for economic performance). The results are reported in Table A2 in the Appendix. The presence of ER is associated with 0.16 percentage-point increase in green job activations.

Second, we compare the effects of different models of ER. As discussed above, the Italian system features two institutional forms of workplace representation: unionized bodies (RSA) and non-unionized bodies (RSU). One might expect the unionized model to be more exposed to adversarial industrial relations; if so, the bargaining mechanism, and thus a negative association between ER and green investments, should be more evident in this setting. To assess this possibility, we replicate our baseline analysis by distinguishing between RSA and RSU in the set of regressors. The results, presented in Table A3 in the Appendix, show that both forms of representation are positively

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<sup>19</sup>The European Skills, Competences, and Occupations (ESCO) database is a dictionary explicitly flagging green skills at the occupation level. The green content is computed as the share of essential green skills over the total number of skills in each 5-digit occupation. For more details about the procedures we followed to elaborate this index, see Landini et al. (2025b).

and significantly associated with green investments. This provides further evidence that a voice mechanism tends to prevail in both institutional configurations.

Finally, we test the robustness of our findings by estimating the effect of ER across the distinct domains and the related interventions defined by the EU taxonomy. We begin by considering green domains. For each of them, we build a dummy variable equal to 1 if the firm reports investments in at least one of the interventions listed therein. We exclude from the analysis firms that consider all domain-specific interventions not relevant to their business. Although such restriction leads to a loss in the number of observations, it ensures that only pertinent interventions are considered in the analysis. We regress domain-related dummy variables against ER and the full set of control variables. Tables 4 and 5 report the results, with and without controls for economic performance, respectively. In 4 domains out of 6 (i.e., *climate mitigation, water use, circular economy, pollution prevention*) the coefficient of ER is positive and statistically significant, with a magnitude similar to the one obtained in the baseline. In the remaining domains, the estimated coefficient is either zero or positive, but not statistically significant.<sup>20</sup>

For the domains in which green investments exhibit a positive association with ER, we further detail the analysis considering the specific interventions. As before, we exclude from the analysis firms that classify the intervention as not relevant to their business. Figure 3 reports the estimated coefficients of ER obtained in a full model specification, including controls for firm's economic performance. In nearly all models, the point estimates are positive, although the coefficient is not always statistically significant (as shown by the confidence interval crossing the line for the null effect). Interestingly, across all domains there is at least one intervention in which ER has a positive and statistically significant effect. In relation to the theoretical arguments discussed above, it is interesting to notice that in firms with ER there is a higher change that employees are involved in green-related training (e.g., on the circular economy), which confirms the role that workplace representation plays in fostering the acquisition of new competences.

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<sup>20</sup>These results are qualitatively similar in estimations based on probit and logit models. See, Tables A4-A9 in the Appendix.

### 4.3 Mechanisms

Having documented a positive association between ER and green investments, we now turn to explore the relevance of specific mechanisms driving this relationship. As argued above, ER can foster green transformations by operating as a voice mechanism that favours reciprocal commitment, information exchange and the transmission of pro-environmental values and attitudes between employees and managers. A direct implication of this argument is that the effect of ER should be stronger in firms characterized by a workforce composition that: i) is more prone to fall into problems of information asymmetry in processes related to the acquisition of new skills; and ii) is more likely to demand pro-environmental transformations in production.

To test the relevance of these mechanisms, we draw on information available in the survey. First, we use the share of employees with a university degree. Second, we consider the share of workers younger than 40 years old. Both variables can be interpreted as proxies for the potential severity of information asymmetries and the strength of green preferences at the firm level. Indeed, more educated and younger workers typically possess skills and competences that are newer and less easily observable, which may exacerbate informational frictions. At the same time, existing evidence shows that higher educational attainment (Meyer, 2015; Powdthavee, 2021; Wang et al., 2022) and younger age (Nawrotzki and Pampel, 2013) are associated with greater environmental awareness, concern, and willingness to engage in sustainable practices. In such contexts, the presence of a firm-level representation body can be particularly helpful in mitigating information asymmetries while channeling workers' demands for environmental action to management, thereby increasing the likelihood of green investments.

To empirically assess this intuition, we estimate a set of regressions in which ER is interacted, alternatively, with the share of graduate employees and with the share of young workers. If the voice mechanism is a meaningful channel through which ER shapes green investments, we should observe a positive and statistically significant interaction term. Moreover, if these channels partially mediate the influence of ER, the interaction terms should absorb at least part of the direct effect of ER. Table 6 reports the results of this empirical exercise, distinguishing between the main green domains for which we previously detected a positive association with ER. Across most specifications, the interaction terms are positive and statistically significant, indicating that

the effect of representation strengthens when the workforce is more likely to convey operational knowledge or pro-environmental preferences. Notably, once these interactions are included, the direct coefficient of ER becomes smaller and loses statistical significance, suggesting that part of the ER effect indeed operates through the informational and preference-based channels highlighted by the voice mechanism.

#### 4.4 Endogeneity

A final concern in our analysis relates to the potential endogeneity of ER, which may stem from several sources, including reverse causality, unobserved heterogeneity, and measurement error. Reverse causality would arise if firms already inclined toward green investments were also more likely to establish or attract employee representatives. Unobserved heterogeneity may reflect omitted factors, such as managerial attitudes, workplace climate, or long-standing organisational capabilities, which correlate simultaneously with the presence of ER and the propensity to undertake green actions. Measurement error may occur whenever key variables are systematically misreported or imprecisely measured. Any of these issues would bias our estimates.

Addressing endogeneity in a cross-sectional setting is inherently challenging, as we lack temporal variation that might help isolate causal effects. Nonetheless, we can strengthen confidence in our findings by showing that the results remain robust also when we adopt strategies specifically designed to mitigate concerns about the endogenous determination of ER. In particular, we rely on an instrumental variable (IV) approach, whose main advantage is that it can potentially deal with both time-invariant and time-variant omitted variable biases as well as simultaneity and measurement errors in ER status. The major challenge, however, is to find suitable instruments for ER. Ideally, we would instrument ER with a variable that is correlated with ER but not with the error term (i.e., it affects green investment only through ER). This approach is not a simple task and it requires the imposition of some exclusion restrictions.

To build our instrument we follow previous studies (e.g., Devicienti et al., 2018) and rely on the mean incidence of ER at the industry, province and size-class level.<sup>21</sup> Two considerations make this variable a suitable IV candidate. First, it is built as a contextual measure capturing institutional features that vary across industries, local contexts and firm categories. As such, it is expected to have no direct impact on green

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<sup>21</sup>We consider three size classes: < 10 employees; 11-40 employees; < 40 employees.

investments, once the presence of ER at the workplace level is controlled for. Second, the mean incidence of ER at the industry, territorial, and firm-size levels is a strong predictor of workplace representation. Empirically, this is evident in the first-stage statistics reported below. Moreover, conceptually, the instrument's predictive power is rooted in the institutional framework governing the formation of ER. In the Italian system, workplace representation is established following a request by workers; however, initiating and managing this process requires specialised knowledge and organisational support that local ER institutions, particularly union confederations, are well positioned to provide. In this sense, the prevalence of organized forms of workplace representation in a firm's broader industry–territorial–size environment effectively acts as a catalyst for the emergence of ER, shaping both the feasibility and the likelihood of its development.

Table 7 reports the results of our IV estimates. In column (1) we consider the full set of control variables available in the survey, whereas in column (2) we complement the analysis by including also economic performance indicators computed through balance sheet data. In line with our priors, in the first-stage regressions we find a positive association between the mean incidence of representation in the industry–province–size–class cell and the presence of workplace ER. Moreover, we note the relevance of the instrument: indeed, across all specifications, the F statistics are well above conventional thresholds. In the second-stage results, we find that ER positively affects green investments, with a coefficient that in magnitude terms is larger than in the baseline. This pattern is consistent with a downward bias in the OLS estimates, which may be due to measurement errors or to the existence of unobservable factors that make it more likely for ER to form while at the same time reducing the likelihood that green investments are pursued. Such factors may include political orientations or workplace climates that are both skeptical of the green transition and adversarial in their approach to management–labour relations, thereby motivating workers to organize. By correcting for these sources of bias, the IV estimates strengthen the conclusion that ER exerts a positive effect on green investments.<sup>22</sup>

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<sup>22</sup>Damiani et al. (2025) document a positive correlation between green investments and decentralized collective bargaining. This raises a potential concern for our identification strategy. If (i) the mean incidence of ER in the industry–province–size–class cell increases the likelihood that a firm signs a decentralized collective agreement, and (ii) such bargaining arrangements independently foster green transformations, then our exclusion restriction could be violated. In that case, the instrument would affect green investments not only through workplace representation but also through its influence on decentralized bargaining—an omitted channel in our baseline specification. To address this possibility,

## 5 Conclusions

Debates on a “just transition” stress that the distributional stakes of climate policy hinge on how change is governed inside firms. If representation systematically aligns with actions that reorganize work and develop green skills, then institutions of worker voice are not merely constraints to be managed; they are levers that can be activated to implement sustainability with fewer frictions and clearer commitments. This paper has examined how workplace employee representation relates to firms’ engagement in sustainability-oriented investments. Drawing on the theoretical distinction between the *bargaining frictions* and “*hold up*” channel on the one hand (Grout, 1984), and the *employee voice* mechanism on the other (Freeman and Medoff, 1984; Freeman and Lazear, 1995), we explored the relation between employee representation (ER) and green investments in a representative sample of Italian firms. Our results show that firms characterized by the presence of ER bodies are systematically more likely to pursue investments aligned with the EU sustainability taxonomy.

From a comparative perspective, these results are consistent with previous findings showing that cooperative and trust-based industrial relations foster environmental innovation (Antonioli and Mazzanti, 2017), and that workers can actively contribute to sustainability transitions when empowered with participatory and problem-solving roles (Moilanen and Alasoini, 2023). The concept of “sustainable voice” (Paulet et al., 2021) captures this shift: representation acts not only as a channel for transmitting information but as an institutional infrastructure enabling firms to internalize environmental and social objectives.

We acknowledge several limitations of our analysis, primarily related to the nature of the data. First, the cross-sectional design of the survey prevents us from tracking the timing and sequencing of green investments and representation. As a result, we can document robust associations but cannot fully disentangle dynamic adjustment processes or convincingly establish causal effects based on temporal ordering. Second, the survey does not collect information on the monetary value or intensity of green investments. Our outcomes therefore refer mainly to the extensive margin—whether firms undertake taxonomy-consistent actions—rather than to how intensively they in-

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we perform a robustness check in which we replicate the IV analysis while adding a dummy equal to 1 for firms that have signed a decentralized collective agreement among the controls. The results, reported in Table A10 in the Appendix, remain qualitatively similar.

vest. The robustness check based on green job activations partially compensates for this limitation, yet a more refined assessment of how labour institutions shape the intensive margin of green investment remains beyond the scope of this paper. Third, our identification strategy relies on an instrumental-variable approach that, while mitigating concerns about endogeneity, is constrained by the absence of sharp institutional discontinuities or quasi-experimental variation in ER. The IV estimates reinforce the main finding of a positive effect of representation on green investments, but residual caution is warranted when interpreting the results in strictly causal terms.

Finally, the empirical setting itself imposes some constraints on external validity. The analysis focuses on a single region — Emilia–Romagna — with a productive structure and traditions of industrial relations that make it particularly interesting for the case at stake. However, it may not be representative of other institutional environments. Moreover, several key variables, including the presence of ER and the adoption of green actions, are based on self-reported information, which, despite the care taken in questionnaire design and external validation, may still be subject to reporting biases. Future research could address these limitations by exploiting longitudinal data, richer investment measures, and multi-regional or cross-country designs, ideally combining survey evidence with administrative and qualitative sources to better capture both the quantitative and organisational dimensions of how worker voice shapes the green transition.

Overall, the results of the paper contribute to contemporary policy discussions in relation to green transitions. In particular, our findings suggest that debates on the green transition should pay greater attention to its governance within workplaces, much as is increasingly the case for transformations related to new advanced digital technologies (Aloisi, 2024; Hassel and Özkiziltan, 2023; Özkiziltan, 2024; Özkiziltan and Landini, 2025). Discussions on climate policy often focus on carbon pricing, technological standards and investment incentives, while leaving largely implicit the organisational processes through which firms reorganise work, redesign tasks and develop green skills. Our evidence indicates that institutions of worker voice can play a constructive role in this regard, acting as organisational infrastructures that help to manage distributional conflicts, reduce informational frictions and build support for green-oriented change. This points to the importance of integrating workplace governance into broader climate and industrial strategies, for instance by strengthening

information and consultation rights on environmental matters, encouraging the inclusion of green clauses in collective agreements, and supporting joint training initiatives on low-carbon technologies. Rather than being treated as a potential obstacle, employee representation can be envisaged as a policy lever for implementing decarbonisation pathways that are not only technologically feasible, but also socially negotiated and democratically anchored at the firm level.

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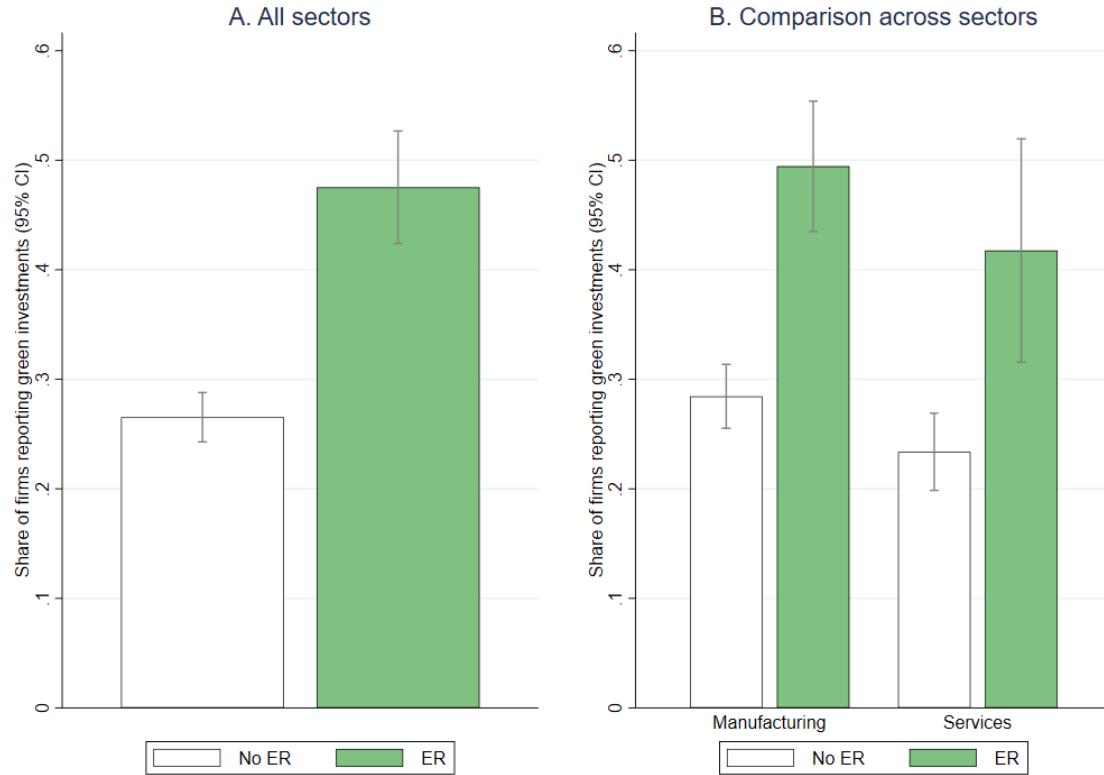
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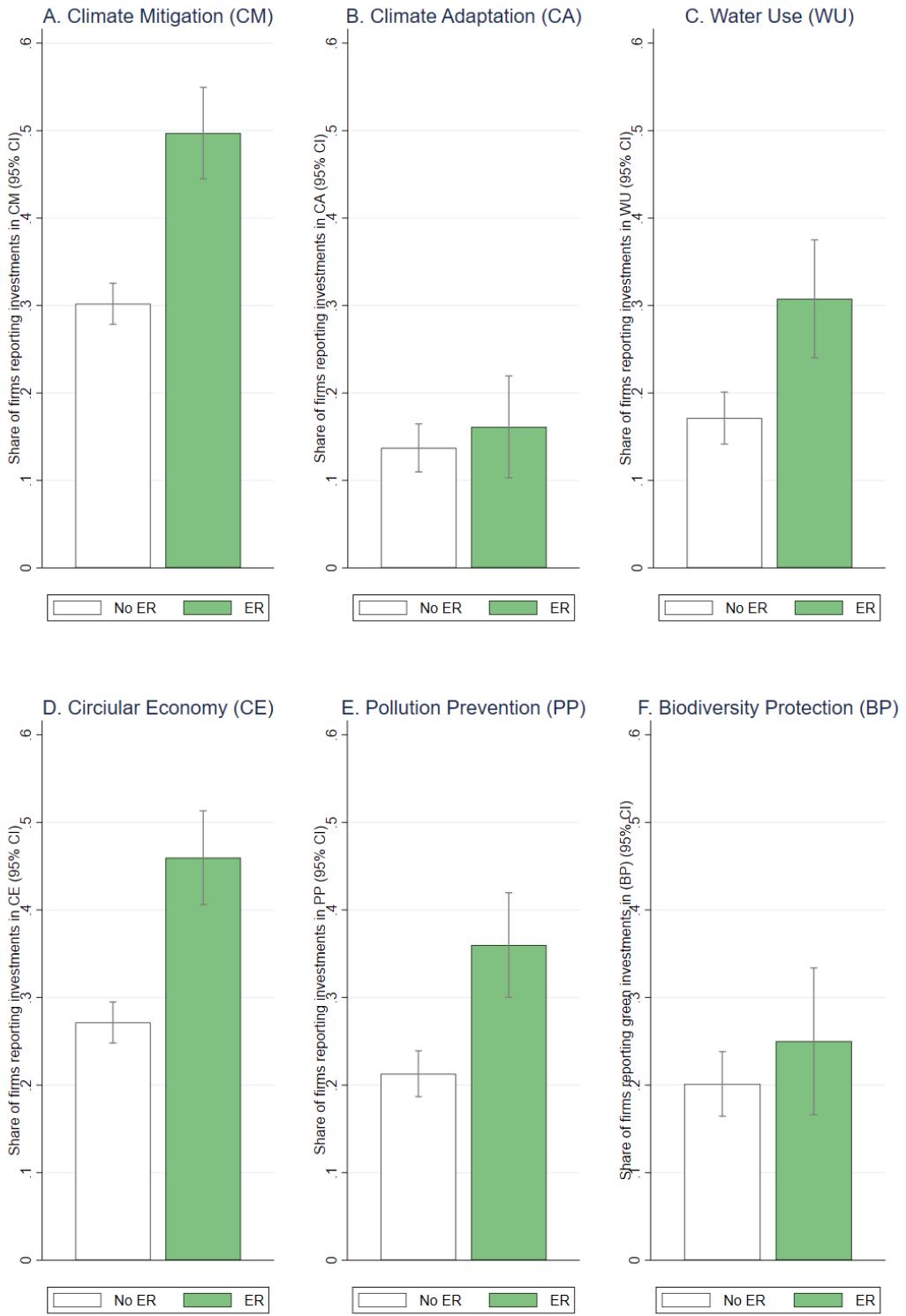
## Figures and tables

**Figure 1: Green investments and ER**



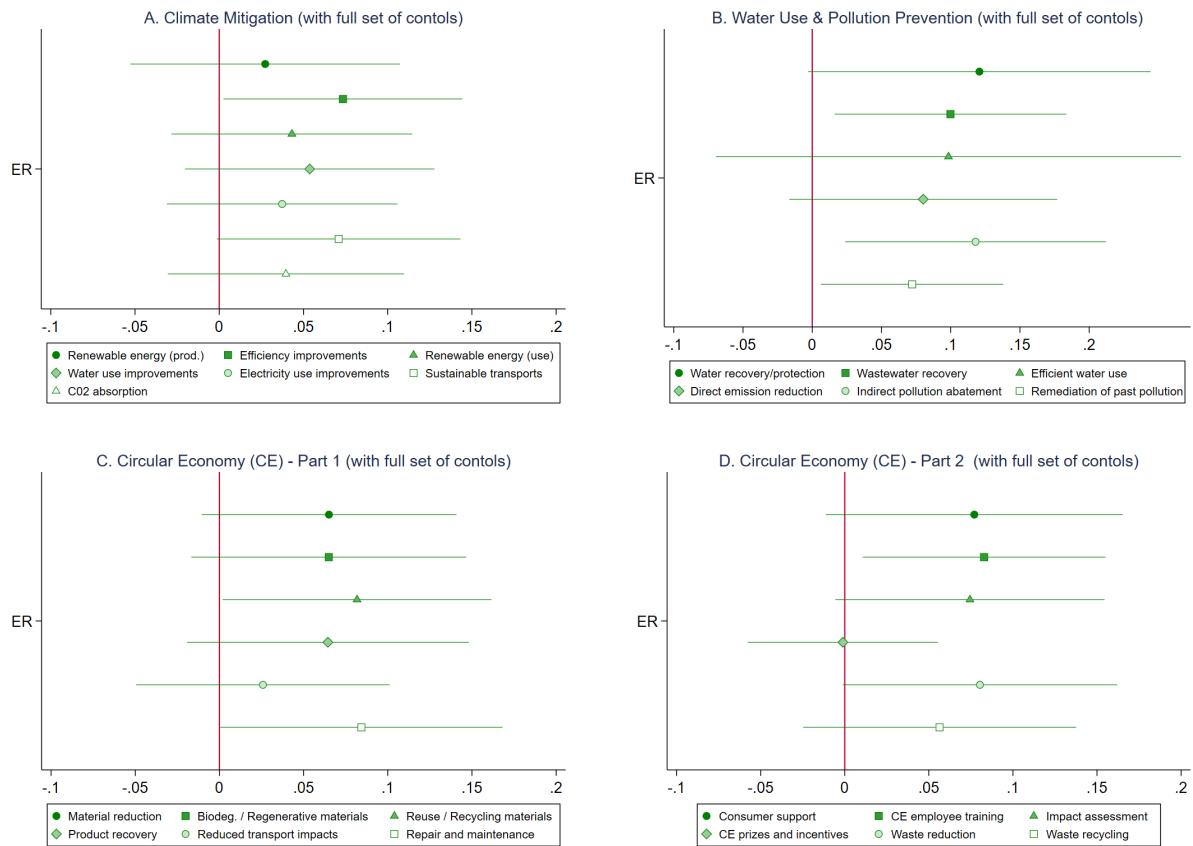
Notes: Pooled data from Ecosister Survey 2024. Green investments by ER status for the whole sample (A) and across industry groups (B). Green investments refer to firms that report having invested in any of the actions foreseen within the EU taxonomy for sustainable activities, namely: climate change mitigation, climate change adaptation, sustainable use and protection of water, transition to a circular economy, pollution prevention and control, protection and restoration of biodiversity.

**Figure 2: Green investments and ER: comparison across domains**



Notes: Pooled data from Ecosister Survey 2024. Investments in specific green domains by ER status. Investments refer to firms that report having invested in the corresponding green domain. Only firms that consider at least one of the intervention included in each domain as applicable to their production activity are considered.

**Figure 3: Green interventions and employee representation: coefficient estimates**



Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with robust standard errors. Dependent variable: investments undertaken by firms in each specific green intervention (0/1). Firms that consider the intervention as not relevant to their business are excluded from the analysis. Estimates obtained with full set of control variables. Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: export ratio, productivity, ROS, capital intensity. Industry and province fixed effects.

**Table 1:** Green domain and specific interventions

Green domains	Specific Interventions
Climate Mitigation	<ol style="list-style-type: none"> <li>1. Renewable energy production and distribution</li> <li>2. Efficiency of equipment/machines/transport</li> <li>3. Use of renewable energy in production</li> <li>4. Efficient water use in production</li> <li>5. Efficient electricity use in production</li> <li>6. Low-carbon technologies for transport and mobility</li> <li>7. CO2 absorption technologies and models</li> </ol>
Climate Adaptation	<ol style="list-style-type: none"> <li>8. Investments in green infrastructure</li> <li>9. Investments in blue infrastructure</li> <li>10. Investments in resilient agri-food supply chains</li> </ol>
Water Use	<ol style="list-style-type: none"> <li>11. Water recovery/protection</li> <li>12. Wastewater recovery (industrial/urban)</li> <li>13. Efficient water planning and management</li> </ol>
Circular Economy	<ol style="list-style-type: none"> <li>14. Reduce materials in product design</li> <li>15. Use regenerative/biodegradable materials</li> <li>16. Reuse internal waste or use recycled inputs</li> <li>17. Recover unused customer products</li> <li>18. Use local suppliers and reduce transport impact</li> <li>19. Repair and maintain defective products/materials</li> <li>20. Support customers in extending product life</li> <li>21. Employee training on circular economy</li> <li>22. Social/environmental impact assessments</li> <li>23. Awards/incentives for circular economy goals</li> <li>24. Waste reduction</li> <li>25. Deliver waste to companies reusing in production</li> </ol>
Pollution Prevention	<ol style="list-style-type: none"> <li>26. Reduce direct emissions of pollutants</li> <li>27. Eliminate indirect pollution</li> <li>28. Remediate past pollution effects</li> </ol>
Biodiversity Protection	<ol style="list-style-type: none"> <li>29. Conserve/improve semi-natural/natural ecosystems</li> <li>30. Sustainably use of managed ecosystems</li> </ol>

Notes: Description of the green domains and interventions as detailed in the ECOSISTER Survey 2024.

**Table 2:** Description and descriptive statistics of main variables

Variables	Description as in the Ecosister questionnaire	Mean	St. Dev.
ER	An official employee representation body currently exists in the establishment (yes/no)	0.186	0.390
Green investments	Investments in any of the green domains included in the EU taxonomy (yes/no)	0.267	0.4443
Firm size	Number of employees (log)	2.568	1.080
Firm age	Years since the establishment has been carrying out its activity	3.028	0.8090
Family firm	Majority share of ownership or direct control held by a single family (yes/no)	0.894	0.307
Entrepreneur age	Age of the person exerting direct control of the firm	56.417	10.756
Male entrepreneur	The person exerting direct control of the firm is male (yes/no)	0.870	0.336
Graduate entrepreneur	The person exerting direct control of the firm holds a university degree (yes/no)	0.213	0.410
Employer association	The firm is member of an employer association (yes/no)	0.621	0.485
% Graduate workers	% employees holding a university degree	0.060	0.124
% Permanent workers	% employees with an open-ended contract	0.617	0.408
% Young workers	% employees less than 40-years old	0.271	0.252
Export	% of foreign sales out of total revenue	0.106	0.218
Labour productivity	Added value per employee (millions Euro) [source AIDA]	0.063	0.267
ROS	Returns on sales index [source AIDA]	5.552	6.624
Capital intensity	Tangible assets per employee (millions Euro) [source AIDA]	57.861	158.081

Notes: Pooled data from the Ecosister Survey 2024.

**Table 3:** Green investments and worker voice: baseline estimates

	Dependent variable: green investments				
	(1)	(2)	(3)	(4)	(5)
ER	0.193*** (0.029)	0.096*** (0.031)	0.085*** (0.031)	0.089*** (0.030)	0.082** (0.034)
Firm size		0.089*** (0.011)	0.086*** (0.011)	0.077*** (0.011)	0.083*** (0.013)
Firm age		0.016 (0.013)	0.010 (0.013)	0.011 (0.013)	0.002 (0.016)
Family firm		-0.010 (0.036)	-0.004 (0.037)	0.015 (0.037)	0.007 (0.040)
Entrepreneur age			-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Male entrepreneur			0.009 (0.031)	0.004 (0.031)	-0.019 (0.036)
Graduate entrepreneur			0.014 (0.028)	-0.019 (0.030)	-0.040 (0.033)
Employer association			0.074*** (0.022)	0.072*** (0.022)	0.083*** (0.026)
% Graduate workers				0.365*** (0.100)	0.303*** (0.106)
% Permanent workers				0.014 (0.028)	0.041 (0.035)
% Young workers				0.054 (0.045)	0.036 (0.058)
Export				0.007 (0.054)	-0.035 (0.057)
Labour productivity					0.719*** (0.270)
ROS					-0.001 (0.002)
Capital intensity					0.000 (0.000)
Constant	0.299*** (0.026)	0.050 (0.064)	0.058 (0.083)	0.024 (0.085)	0.031 (0.097)
Observations	1,841	1,826	1,826	1,824	1,376
R-squared	0.049	0.088	0.094	0.105	0.120
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes

Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with robust standard errors in parentheses. Dependent variable: green investments undertaken by firms (0/1) (any domain). Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

**Table 4:** Green investments and worker voice: comparison across sustainability domains

	Mitigation	Adaptation	Water Use	Circular	Prevention	Protection
	(1)	(2)	(3)	(4)	(5)	(6)
ER	0.079** (0.032)	-0.000 (0.033)	0.077** (0.038)	0.081** (0.032)	0.092** (0.036)	0.051 (0.046)
Observations	1,650	616	660	1,560	1,051	427
R-squared	0.119	0.074	0.149	0.104	0.074	0.114
Province + industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Entrepreneur characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Workforce characteristics + export	Yes	Yes	Yes	Yes	Yes	Yes
Productivity + additional controls	No	No	No	No	No	No

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Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with robust standard errors in parentheses. Dependent variable: investments undertaken by firms in each specific domain (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

**Table 5:** Green investments and worker voice: comparison across sustainability domains, full controls

	Mitigation	Adaptation	Water Use	Circular	Prevention	Protection
	(1)	(2)	(3)	(4)	(5)	(6)
ER	0.062* (0.035)	0.027 (0.039)	0.113** (0.044)	0.088** (0.036)	0.102** (0.041)	0.066 (0.052)
Observations	1,255	476	524	1,199	801	320
R-squared	0.130	0.109	0.157	0.113	0.091	0.183
Province + industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Entrepreneur characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Workforce characteristics + export	Yes	Yes	Yes	Yes	Yes	Yes
Productivity + additional controls	Yes	Yes	Yes	Yes	Yes	Yes

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Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with robust standard errors in parentheses. Dependent variable: investments undertaken by firms in each specific domain (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

**Table 6:** Mechanisms: employee representation, workforce education and age

	Any Domain		Mitigation		Water Use		Circular		Prevention	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)	(9)
ER	0.041 (0.038)	0.004 (0.051)	0.018 (0.039)	-0.012 (0.053)	0.072 (0.048)	0.089 (0.066)	0.032 (0.039)	-0.052 (0.053)	0.044 (0.045)	0.041 (0.060)
% Graduate workers	0.210* (0.114)		0.170 (0.119)		0.094 (0.159)		0.191* (0.115)		0.075 (0.133)	
ER × % Graduate workers	0.460** (0.186)		0.510** (0.204)		0.420 (0.309)		0.597*** (0.200)		0.638*** (0.235)	
% Young workers		-0.008 (0.061)		-0.021 (0.064)		0.039 (0.071)		-0.035 (0.065)		-0.054 (0.067)
ER × % Young workers		0.273* (0.144)		0.258* (0.150)		0.087 (0.210)		0.499*** (0.151)		0.203 (0.172)
Observations	1,376	1,376	1,255	1,255	524	524	1,199	1,199	801	801
R-squared	0.123	0.122	0.134	0.132	0.160	0.157	0.118	0.121	0.099	0.092
Province + industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Entrepreneur characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Workforce characteristics + export	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Productivity + additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with robust standard errors in parentheses. Dependent variable: investments undertaken by firms in each specific domain (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

**Table 7:** Green investments and worker voice: instrumental-variable estimates

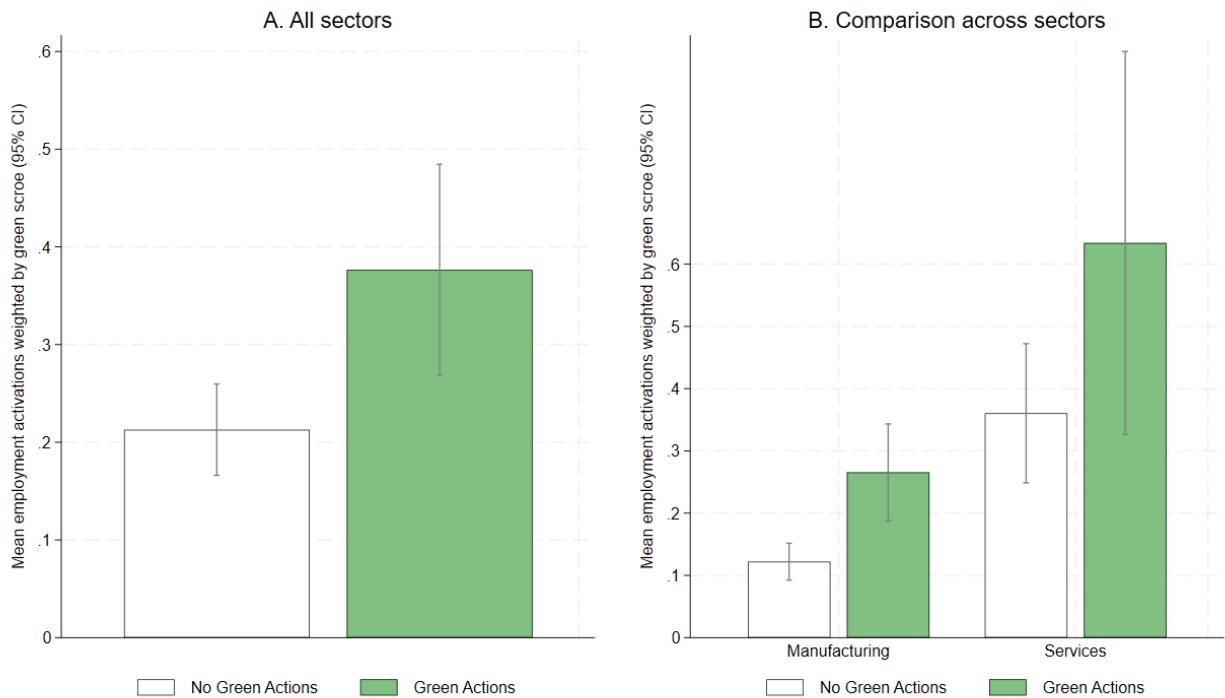
	(1)	(2)
<i>First stage: ER</i>		
ER local incidence	0.704*** (0.080)	0.681*** (0.087)
F	79.92 (1, 1800)	61.75 (1, 1349)
P>F	0.000	0.000
<i>Second stage: green investments</i>		
ER	0.288** (0.140)	0.339** (0.157)
Observations	1,824	1,376
R-squared	0.080	0.080
Province + industry fixed effects	Yes	Yes
Firm characteristics	Yes	Yes
Entrepreneur characteristics	Yes	Yes
Workforce characteristics + export	Yes	Yes
Productivity + additional controls	No	Yes

Notes: Instrumental-variable models with clustered standard errors. Dependent variable: green investments undertaken by firms (0/1) (any domain). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

# Online Appendix

## A. Supplementary Tables and Figures

**Figure A1:** Green investments and job activations



Notes: Pooled data from Ecosister Survey 2024. Green job activations by investment status. Employment activations are weighted by occupation-specific green scores computed using the ESCO taxonomy.

**Table A1:** Robustness checks: probit and logit estimates, any action

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Probit		Logit		Probit		Logit		Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.237*** (0.083)	0.076*** (0.026)	0.387*** (0.136)	0.073*** (0.025)	0.219** (0.094)	0.072** (0.031)	0.357** (0.154)	0.069** (0.029)								
Observations	1,824		1,842		1,376		1,376									
R-squared (pseudo)	0.084		0.085		0.097		0.098									
AIC	2,108		2,108		1,633		1,632									
BIC	2,240		2,240		1,774		1,773									
Province + industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		No		No		No		No		No		No	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments undertaken by firms (0/1) (any domain). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A2:** Green job activations and worker voice

	(1)	(2)
ER	0.165** (0.066)	0.160** (0.078)
Observations	1,754	1,339
R-squared	0.229	0.255
Province + industry fixed effects	Yes	Yes
Firm characteristics	Yes	Yes
Entrepreneur characteristics	Yes	Yes
Workforce characteristics + export	Yes	Yes
Productivity + additional controls	No	Yes

Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from ordinary least squares models with clustered standard errors in parentheses. Dependent variable: number of job activations weighted by the occupational green score. Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A3:** Comparison between RSA and RSU in sustainability engagement

	(1)	(2)
RSA	0.085** (0.043)	0.091* (0.049)
RSU	0.091** (0.037)	0.075* (0.041)
Observations	1,842	1,376
R-squared	0.105	0.120
Province + industry fixed effects	Yes	Yes
Firm characteristics	Yes	Yes
Entrepreneur characteristics	Yes	Yes
Workforce characteristics + export	Yes	Yes
Productivity + additional controls	No	Yes

Notes: Pooled data from Ecosister Survey 2024. Estimates obtained from linear probability models with clustered standard errors in parentheses. Dependent variable: green investments undertaken by firms (0/1) (any domain). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A4:** Robustness checks: probit and logit estimates, climate mitigation

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Probit		Logit		Probit		Logit		Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.213** (0.088)	0.067** (0.028)	0.348** (0.145)	0.066** (0.027)	0.172* (0.097)	0.056* (0.032)	0.278* (0.159)	0.054* (0.031)								
Observations	1,650		1,650		1,255		1,255									
R-squared (pseudo)	0.097		0.097		0.106		0.106									
AIC	1,898		1,899		1,498		1,497									
BIC	2,028		2,029		1,636		1,636									
Province + industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		Yes		Yes		Yes		Yes		Yes		Yes	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to climate mitigation undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A5:** Robustness checks: probit and logit estimates, climate adaptation

	(1) Probit		(3) Logit		(5) Probit		(7) Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.004 (0.185)	0.000 (0.028)	-0.024 (0.370)	-0.002 (0.029)	0.159 (0.196)	0.024 (0.030)	0.262 (0.386)	0.021 (0.031)
Observations	616		616		476		476	
R-squared (pseudo)	0.103		0.104		0.146		0.145	
AIC	392		392		327		327	
BIC	498		498		439		439	
Province + industry fixed effects	Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		Yes		Yes	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to climate adaptation undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A6:** Robustness checks: probit and logit estimates, water use

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Probit		Logit		Probit		Logit		Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.301** (0.151)	0.059** (0.029)	0.547** (0.274)	0.059** (0.029)	0.464*** (0.161)	0.101*** (0.035)	0.808*** (0.284)	0.099*** (0.034)								
Observations	660		660		524		524									
R-squared (pseudo)	0.166		0.165		0.168		0.166									
AIC	519		519		466		467									
BIC	626		627		581		582									
Province + industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		No		No		No		No		No		No	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to water use undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A7:** Robustness checks: probit and logit estimates, circular economy

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Probit		Logit		Probit		Logit		Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.222** (0.091)	0.069** (0.028)	0.368** (0.149)	0.067** (0.027)	0.239** (0.100)	0.076** (0.032)	0.392** (0.165)	0.074** (0.031)								
Observations	1,560		1,560		1,199		1,199									
R-squared (pseudo)	0.085		0.085		0.092		0.092									
AIC	1,763		1,762		1,409		1,409									
BIC	1,891		1,890		1,547		1,547									
Province + industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		Yes		Yes		Yes		Yes		Yes		Yes	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to the circular economy undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A8:** Robustness checks: probit and logit estimates, pollution prevention

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Probit		Logit		Probit		Logit		Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.289** (0.113)	0.079** (0.030)	0.491** (0.192)	0.077** (0.030)	0.336*** (0.125)	0.094*** (0.035)	0.558*** (0.212)	0.090*** (0.034)								
Observations	1,051		1,051		801		801									
R-squared (pseudo)	0.067		0.067		0.082		0.082									
AIC	1,074		1,074		850		850									
BIC	1,193		1,193		977		977									
Province + industry fixed effects	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		No		No		No		No		No		No	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to pollution prevention undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A9:** Robustness checks: probit and logit estimates, biodiversity protection

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Probit		Logit		Probit		Logit	
	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx	Beta	dy/dx
ER	0.214 (0.195)	0.040 (0.037)	0.386 (0.362)	0.040 (0.222)	0.272 (0.041)	0.050 (0.035)	0.484 (0.410)	0.048 (0.040)
Observations	427		427		320		320	
R-squared (pseudo)	0.130		0.131		0.212		0.213	
AIC	340		339		267		267	
BIC	437		437		369		369	
Province + industry fixed effects	Yes		Yes		Yes		Yes	
Firm characteristics	Yes		Yes		Yes		Yes	
Entrepreneur characteristics	Yes		Yes		Yes		Yes	
Workforce characteristics + export	Yes		Yes		Yes		Yes	
Productivity + additional controls	No		No		Yes		Yes	

Notes: Estimates obtained from probit and logit models with robust standard errors in parentheses. Dependent variable: green investments related to biodiversity protection undertaken by firms (0/1). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively

**Table A10:** Green investments and worker voice: instrumental-variable estimates

	(1)	(2)
<i>First stage: ER</i>		
ER local incidence	0.677*** (0.077)	0.665*** (0.084)
F	76.69 (1, 1799)	62.45 (1, 1348)
P>F	0.000	0.000
<i>Second stage: green investments</i>		
ER	0.287** (0.145)	0.341** (0.161)
Observations	1,824	1,376
R-squared	0.080	0.080
Province + industry fixed effects	Yes	Yes
Firm characteristics	Yes	Yes
Entrepreneur characteristics	Yes	Yes
Workforce characteristics + export	Yes	Yes
Productivity + additional controls	No	Yes
Firm-level collective contract	Yes	Yes

Notes: Instrumental-variable models with clustered standard errors. Dependent variable: green investments undertaken by firms (0/1) (any domain). Firm characteristics: firm size and age, family firm. Entrepreneur characteristics: entrepreneur age and gender, graduate entrepreneur, member of employer association. Workforce characteristics: % graduate workers, % permanent workers, % young workers. Additional controls: ROS, capital intensity. Observation unit: firm. \*, \*\*, \*\*\* indicate  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$ , respectively.

## **B. Taxonomy-based questions and items**

### **Section D – Knowledge and Awareness of the EU Taxonomy**

*The European Union has recently approved Regulation 852/2020 (“Taxonomy Regulation”) establishing a framework for sustainable investments. This framework covers investments related to the following areas: 1) climate change mitigation; 2) climate change adaptation; 3) sustainable use and protection of water and marine resources; 4) transition to a circular economy; 5) pollution prevention and reduction; 6) protection and restoration of biodiversity and ecosystems.*

#### **D1. Are you aware of Regulation 852/2020 (“Taxonomy Regulation” on sustainable investments)?**

No  Yes

##### **D1a. If yes, how did you become aware of it?**

- Directly
- Through initiatives from the corporate group
- Through initiatives from clients
- Through initiatives from suppliers
- Through initiatives from financial intermediaries
- Through initiatives from consultants/accountants
- Through initiatives from business associations

##### **D1b. If you learned about the Regulation through financial intermediaries, which aspects did they highlight regarding the Taxonomy Regulation? (Select all that apply)**

- Easier access to credit
- Reduction in the cost of credit
- Lower collateral requirements
- Better credit management

## Section E – Corporate Sustainability Actions and Strategies

### E1. Have you undertaken specific actions related to the sustainability areas covered by the Regulation?

*Overview: 1) climate mitigation; 2) climate adaptation; 3) sustainable use and protection of water and marine resources; 4) circular economy; 5) pollution prevention; 6) biodiversity protection*

No  Yes

### E2. [If E1 = No] Why have you not yet undertaken specific actions in these areas? (Multiple answers allowed)

- I was not aware of Regulation 852/2020
- The Regulation seemed too complex
- Implementation costs are too high
- These areas are not relevant to my firm
- Lack of internal expertise to implement such actions
- High costs for specialised consulting
- Other: \_\_\_\_\_

### E3. [If E1 = Yes] Did these actions lead to changes in the organisational structure?

- Yes, new organisational roles were introduced (e.g., sustainability reporting responsibilities)
- Yes, new personnel were hired (e.g., a sustainability manager)
- No

### E4. Past and/or future interventions: please specify whether you have invested, or plan to invest within the next 5 years, in actions associated with the sustainability areas of the Regulation.

For each item, indicate: (a) **Invested in the past 5 years (2019–2023)** [If E1 = Yes] (b) **Will invest in the next 5 years (2024–2028)** (Response options:  Yes  No  Not relevant to the business)

#### Area 1: Climate Change Mitigation

##### Production and distribution of renewable energy

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Efficiency improvements in equipment/machinery/vehicles**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Use of renewable energy in the production process**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Efficiency improvements in water use in the production process**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Efficiency improvements in electricity use (any source)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Low-carbon technologies for transport and mobility**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Technologies for CO<sub>2</sub> absorption**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Area 2: Climate Change Adaptation**

**Green infrastructure compensating CO<sub>2</sub> production (urban green spaces, reforestation, etc.)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Blue infrastructure compensating CO<sub>2</sub> production (riverbed restoration system, canals,**

etc.)

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Investments in resilient agri-food supply chains**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

### **Area 3: Sustainable Use and Protection of Water and Marine Resources**

#### **Water recovery/protection**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Recovery of wastewater (industrial or urban)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Planning and efficient water management (surface, groundwater, or marine)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

### **Area 4: Transition to a Circular Economy**

#### **Reduction of unnecessary materials/resources in product/service design**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Use of regenerative/biodegradable materials**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Reuse and recycling of internal waste materials, or use of recycled inputs from other firms**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Processes for recovering unused customer products/items**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Use of local suppliers and measures to reduce transport impacts**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Repair/maintenance of defective products/materials for reuse**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Providing customers with documentation/tools to extend product lifespan**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Internal training plans on circular economy practices**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Use of documented social/environmental impact assessments (national/international standards)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Internal awards or incentives linked to circular economy objectives**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

**Reduction of waste generated (per unit of output), including energy-recovering incineration**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Transfer of waste to other firms for use in their production cycles**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

### **Area 5: Pollution Prevention and Reduction**

#### **Reduction of direct emissions of greenhouse gases or other pollutants (air, water, soil)**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Elimination of indirect pollution**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Remediation of past pollution effects**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

### **Area 6: Protection and Restoration of Biodiversity and Ecosystems**

#### **Conservation/improvement of semi-natural or natural ecosystems**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant

#### **Sustainable use / reduced pressure / mitigation of impacts on managed ecosystems**

Past:  Yes  No  Not relevant

Future:  Yes  No  Not relevant