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How does the social economy contribute to social and environmental innovation? Evidence of direct and indirect effects from a European survey

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ABSTRACT

This study represents the first empirical attempt to conduct a cross-country comparison of social economy (SE) enterprises with other enterprises in the development of social and environmental innovation. Using data from a European survey with >16,000 respondents, we estimate a bivariate probit model with correlated random effects to identify the direct and indirect effects of the SE on social and environmental innovation. We demonstrate that the primary impact of SE enterprises on environmental innovation is through their influence on other enterprises. We also identify the specific levers of innovation in SE and non-SE enterprises. Our empirical findings are consistent with previous research on the SE as a laboratory of innovation and a yardstick for transformative change. Our original findings regarding contextual effects highlights a strong implication advocating public policies to promote SE for its assumed benefits as well as the tendency of SE to foster innovation within non-SE enterprises.

1. Introduction

Social economy (SE) enterprises, including cooperatives, nonprofit organizations, and mutuals, have a pivotal role in developing and fostering social innovation (Bouchard, 2012, 2013; Tortia et al., 2020; Campopiano and Bassani, 2021; Wittmayer et al., 2022). As democratically based organizations embedded in communities, SE enterprises respond to social needs and aspirations that are not met by the state or the market in a wide range of sectors such as housing (Bouchard, 2012), renewable energy (Bauwens et al., 2016), support services for small and medium-sized enterprises (SMEs) (Musson and Rousselière, 2020), and cultural services (Laudiero, 2020).

This contribution to fostering social innovation is crucial for contemporary societies. Social innovation highlights the social dimension of sustainable development and the search for solutions to inter-related social, environmental, and technological challenges. The multiple correlations between social and environmental innovation have been studied extensively in recent years (Van der Have and Rubalcaba, 2016; Henry et al., 2020; Ziegler et al., 2022, 2023). Literature reviews indicate that the field of social innovation research has experienced impressive and fragmented growth in conjunction to

several deep-seated technological, economic, political, and sociocultural changes (Van der Have and Rubalcaba, 2016; Edwards-Schachter and Wallace, 2017; Solis-Navarrete et al., 2021). For Moreau et al. (2017), SE may help an economy come “full circle” since, societal decisions in SE enterprises can be made in terms of what materials should be reduced or reused or what materials should be recycled as a priority, to advance the common good, regardless of economic profitability.

At the empirical level, only mixed evidence has been produced concerning the contribution of SE enterprises to environmental innovation. For example, on the one hand, agricultural cooperatives may have negative environmental impact by increasing the use of pesticides or non-renewable energy, whereas they may facilitate access to organic market in some cases (Candemir et al., 2021). On the other hand, at the local/micro scale, SE enterprises may encourage social innovation to reduce emissions and advance ongoing energy transitions, as shown by Bauwens et al. (2016) in case studies of renewable energy cooperatives. More generally a recent collaborative policy brief of the Organization for Economic Co-operation and Development (OECD)/European Commission (2022) highlighted contributions of SE enterprises to advancing the circular economy, including promoting more circular and sustainable behaviors and furthering stakeholder engagement to improve the social

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acceptance of circular products and green technologies. These other contributions shed light on an interesting and important point regarding the indirect effect of the SE on environmental innovation. These indirect effects can be conceived as contextual effects, referred to in the social sciences as the insight that individuals or organizations with similar characteristics may exhibit different behaviors when exposed to different circumstances (Blalock, 1984).

To our knowledge, no previous quantitative study has attempted to evaluate the specific contributions of SE enterprises to social and environmental innovation. Using data from the Flash Eurobarometer 486 (FL486) survey, which allows us to distinguish SE enterprises from other types of enterprises (i.e., for-profit, family, and state-owned), our analysis is the first to provide a cross-country comparison of SE enterprises with other enterprises. We estimate a bivariate probit model with correlated random effects to consider the correlations between social and environmental innovation. The model separates direct effects (higher probability for SE enterprises to develop social and environmental innovation) and contextual effects (presence of SE enterprises increasing the probability of every SMEs to develop social and environmental innovation) of SE. In the robustness checks, we demonstrate that this empirical finding remains consistent even when considering different interpretations of the context, whether at the country level or at the sector-country level. Additionally, it remains robust when accounting for the endogenous behavior of a particular enterprise in response to the actions of others.

Aligning with Pacheco and Khoury (2023), we show that while being more innovative than other enterprises at the social and environmental level, SE enterprises have a distinctive feature. Their main contribution to environmental innovation is through influencing other enterprises. Moreover, the model estimates probabilities for various types of enterprises, highlighting the specificity of SE enterprises. We examine the external and internal levers for SE and non-SE enterprises, including the positive effect of export status, size, and age. Finally, we also reveal the positive impact of external support (membership in a cluster and location in a city) on the development of environmental and social innovation. These empirical findings are consistent with the literature concerning the SE as laboratory of social innovation (Bouchard, 2013) and as yardstick for transformative change (Novkovic, 2022), with strong public policy implications.

The remainder of this paper is organized as follows. In section II, we develop five hypotheses to be tested on SE, social innovation, and environmental innovation based on a literature review. In section III, we present the data and econometric strategy used in the study. The results in section IV successively present the direct and contextual effects, and the internal and external levers for SE and non-SE enterprises. In section V, we discuss the generality of our findings on contextual effects. Finally, after examining the validity of our hypotheses in section VI, we conclude with implications for public policy toward the SE.

2. Literature review and hypotheses

As noted in the Introduction, SE can have direct and indirect impact. Therefore, two propositions can be made regarding the contributions of SE to social and environmental innovation.

The first hypothesis at the heart of SE concerns the impact of the organizational dimension of enterprises on social and environmental innovation. In previous literature, the SE has been defined by a specific set of rules enshrined in constitutive laws or bylaws (Demoustier and Rousselière, 2006). According to these researches, SE enterprises appear to be private, democratic, and collective organizations in which ownership and control reside with the members (Bouchard and Rousselière, 2015). Thus, members who voluntarily participate in such organizations are simultaneously users and owners. As SE enterprises' economic objectives are subordinated to a social mission, these organizations have a specific nonprofit or limited profit orientation (Villalba-Eguiluz et al., 2023). These features integrate the enterprise's social

purpose into concrete rules of behavior, and the degree to which they are embedded in legal frameworks establishes long-term stability (Bouchard et al., 2015). Therefore, SE enterprises are considered to represent the ideal type of social innovation (Tortia et al., 2020), which inherently involves the phenomena of social innovation, social entrepreneurship, and cooperation (Catala et al., 2023). The SE is an important vector of social innovation, developing new processes for fostering new more equitable and just social relationships within the enterprise and the economy. The SE also emphasizes concern for the community as embodied in declaration of cooperative identity (Novkovic, 2022).

This combination of rules fosters specific behaviors in terms of innovation. For example, Carchano et al. (2023) demonstrated that cooperatives are influenced by internal and external stakeholders in the implementation of eco-innovations, while limited liability companies are only influenced by internal stakeholders. The role of communities and embeddedness of users through the whole innovation process is a distinctive feature of the SE, as found in recent surveys of SE enterprises in the UK (de Souza João-Roland and Granados, 2023) and Spain (Espasandín-Bustelo et al., 2023).

As suggested by previous literature on SE, the positive effects of SE enterprises on society may also positively influence environmental protection. For example, Bellemare et al. (2022) examined the intersection between the circular economy and the SE, suggesting the potential for advancing a more inclusive and participatory circular economy. We expect that the probability for SE enterprises to develop social and environmental innovation is higher than for other enterprises, even if family enterprises may also develop social or environmental innovation (Heider et al., 2022). This leads to our first hypothesis.

- H1: Social economy enterprises have a higher probability of developing social and environmental innovation than for-profit enterprises with the highest probability for social innovation.

Our second proposition concerns the contextual effects of SE, which is defined in the Introduction as the effect of the influence of the SE in a given institutional environment on firms' innovation behavior.

Even with the general consensus on their positive contribution, various empirical and theoretical perspectives on these effects have been proposed. The SE may be an intermediate for social and environmental innovation and SE enterprises may collaborate with other organizations to foster innovation in a given industry. Some organizations are central actors in "business ecosystems" (Moore, 1993) and can leverage leadership positions over innovative development; not through control and command, but through the ability to influence and disseminate information and emerging innovations. Another perspective has contended that the interaction between heterogeneous ecosystem actors foster the alignment required for a focal value proposition to materialize (Adner, 2016: 43). Mousavi and Bossink (2020) conducted a case study of a collaboration between a nongovernmental organization (NGO) and a for-profit enterprise in the aviation biofuels sector, showing that nonprofit organizations may accelerate industry development. The SE may also foster innovation by decreasing innovation costs in a given industry as such costs and limits can be barriers to entry (Valdés et al., 2021). For example, according to Pacheco and Khoury (2023), in the solar energy industry, larger social movements act in a compensatory role to elicit entry when ecological conditions are least favorable to entry. SE enterprises may also be a laboratory for the development of innovations that can eventually be used by for-profit enterprises. For example, whereas the SE has been a pioneer in implementing circular practices in repairing, reusing and recycling activities, these activities are now largely developed by for-profit companies in Italy (Ghisellini and Ulgiati, 2020). Finally, contextual effects may be related to the more traditional yardstick competition effect (Rousselière et al., 2020). This effect can also be understood as "The Red Queen effect" (Derfus et al., 2008), referring to a contest in which each firm's performance depends

on the firm's matching or exceeding the actions of rivals. Therefore, cooperatives may change the sector, the industry, and the economy, altering the practices of competitors that are compelled to imitate cooperatives. The SE effect can be conceived as “yardstick for transformative change” (Novkovic, 2022) or a “transformative force for embedding circularity” (Ziegler et al., 2023). The SE can serve as a normative yardstick regarding efforts to provide contextual social indicators for sustainability reporting that aim at instigating transformative change. Previous research has indicated that the contextual effect is higher for environmental innovation than for social innovation (Novkovic, 2022; Pacheco and Khoury, 2023).

However, we suspect that such contributions will vary according to the national ecosystem of SE (Borzaga et al., 2020; Chaves and Monzón, 2017; Defourny et al., 2021; Fontan and Lévesque, 2023) as European countries may implement specific national policies (Chaves and Monzón, 2017). According to Pel et al. (2020), evolutionary diversity is an integral element of transformative social innovation processes, reflecting the historical and international diversity of the transformative ambitions of social innovation initiatives and the diverse motivations of the people involved in them. This dynamic leads to an important international heterogeneity, which leads to our second proposition.

- H2: The social economy has contextual effects based on each type of innovation, with the highest impact on environmental innovation, depending on the national social economy model.

Finally, three standard propositions on social and environmental innovation levers can be elaborated. These propositions are supported by the literature reviews of Dangelico (2016), Hojnik and Ruzzier (2016), and Saunila (2020).

The first proposition regards the impact of the size of the market. By extending this size, exports may also be a lever for social and environmental innovation. Hanley and Semrau (2022) and Torrecillas and Fernández (2022) demonstrated that exportation has a huge impact on environmental innovation, while enterprises that only operate in national markets tend to develop less social and environmental innovation. Although empirical evidence is scarce, these previous studies have also shown that the effect is higher for environmental innovation than for social innovation as “export activity relates to the environmental catch-up progress of Europe's laggard economies” (Hanley and Semrau, 2022: 693). This leads to our third proposition.

- H3: Exportation has a positive effect on innovation, with a higher effect on environmental innovation than on social innovation.

Most research on innovation has highlighted the impact of organizations' age and size on innovation. According to the organizational ecology, these organization features are related to higher economies of scale and economies of learning, even if the relationship may be nonlinear (Petruzzelli et al., 2018; Sørensen and Stuart, 2000). For example, Udayasankar (2008) found a significant relationship between enterprise size and environmental innovation. This leads to our fourth proposition.

- H4: Organizations' size and age have a positive effect on environmental and social innovation.

Finally, supportive public policies such as industry clusters or business support organization have a positive effect on social and environmental innovation (Edler and Fagerberg, 2017). Being located in a city may increase the probability of developing innovation (Marchesi and Tweed, 2021). This leads to our fifth proposition.

- H5: External support (membership in a cluster and location in a city) has a positive impact on environmental and social innovation.

An important question is whether H3–H5 hold true in general or only for a portion of our sample such as SE or non-SE enterprises. For example, if the impact of exportation on environmental innovation is higher than the impact of SE/non-SE status, the combination of H1 and H3 may lead to circumstances in which local SE enterprises have a lower probability of developing environmental innovation than exporting non-SE enterprises. Concerning the combination of H1 and H5, the question is whether SE enterprises benefit more from external support than non-SE enterprises. Concerning H1 and H4, SE enterprises are smaller and younger than other enterprises, on average; therefore, they may not benefit from the economies of scale or economies of learning experienced by other enterprises. For example, Campopiano and Bassani (2021) found a negative relationship between age and social and environmental innovation. In contrast, according to a literature review (Ziegler et al., 2022), location in a city can promote social and environmental innovation and primarily benefit SE enterprises.

3. Methodology

3.1. Data and variables

The FL486 survey on “SMEs, start-ups, scale-ups and entrepreneurship” was conducted in the EU27 and an additional 12 non-EU countries.¹ The survey focused on the barriers and challenges that SMEs in Europe faced when growing, transitioning to more sustainable business models, and advancing digitization. The survey collected responses via >16,000 telephone interviews with enterprises' employing one or more persons between February and May 2020. The survey serves as a key input for the European Commission's “SME strategy for a sustainable and digital Europe.” Enterprises were asked about their strategies to advance sustainable development, encompassing social, environmental, and economic dimensions. The FL486 specifically focused on SMEs and did not consider innovation in the largest enterprises; however, as noted by Nasiri et al. (2022), the majority of research on sustainable innovation applies to large enterprises although the nature and levers of innovation differ and SMEs account for a large proportion of pollution production (Constantinos et al., 2010; Ukko et al., 2019). Therefore, although our empirical findings are limited to SMEs, the results should still be of considerable interest to informing public policies.

Following Bouchard et al. (2015), SE enterprises are defined with various criteria such as nonprofit orientation, collective ownership, autonomy and independence, and organized production of goods and services. The first two criteria were included in the survey,² and the last two can be inferred from the sample design.

Social and environmental innovation were respectively measured as dependent dummy variables in the survey, and were understood as “innovation with social benefits” (Tortia et al., 2020) and “innovation with environmental benefits”³ (D'Attoma and Ieva, 2022). Referencing previous literature and research on the levers for the development of social and environmental innovations (Del Río et al., 2016; Rousselière et al., 2019), we select the type of products produced, exportation status, and enterprises' age, size, location, sector, and membership in a cluster as explanatory variables (see descriptive statistics in Appendix A.1).

According to Alonso-Martínez et al. (2020), three main drivers compel firms to alter activities to reduce impact on the environment and

¹ Bosnia and Herzegovina, Brazil, Canada, Iceland, Japan, North Macedonia, Norway, Serbia, Turkey, The United Kingdom, the United States, and Kosovo.

² The two questions are “Which of the following statements applies to your enterprise? It is a nonprofit enterprise,” and “In terms of the ownership, is your enterprise... Jointly owned by its members (e.g., cooperative, mutual society).”

³ Environmental innovation is defined in the FL486 as “An innovation with an environmental benefit, including innovations with an energy or resource efficiency benefit” and social innovation is defined as “new products, services or processes that have the aim of improving society.”

may explain the difference between countries, including the regulatory environment, which both constrains and stimulates the firm's activities; technological trajectories or innovation capabilities, which support the development of more sustainable production processes or developing new product features; and the market pressure, including any demand from the consumers or other stakeholders that might push companies toward sustainability. Referencing Coisson et al. (2019) and Marsat et al. (2022), we employ additional country-level variables of GDP per habitant (from the World Bank's World Development Indicators) and the Environmental Performance Index produced by Yale University (Wenling et al., 2018) as control for potential confounders.⁴

3.2. Econometric strategy

We estimate a correlated random effect model (Mundlak, 1978; Wooldridge, 2010) to control for unobserved heterogeneity. As our two outcome variables are dummies, a bivariate probit is relevant; therefore, our benchmark model is as follows:

$$\begin{cases} y_{1ij}^* = \alpha_1 X_{1ij} + \beta_1 \bar{X}_{1j} + \gamma_1 C_{1j} + U_{1j} + \epsilon_{1ij} \\ y_{2ij}^* = \alpha_2 X_{2ij} + \beta_2 \bar{X}_{2j} + \gamma_2 C_{2j} + U_{2j} + \epsilon_{2ij} \end{cases} \quad (1)$$

where i represents the enterprise, j is the country, X denotes a vector of variables at the enterprise level, C represents a vector of country-level variables, U is a country-level random effect, and ϵ_{ij} denotes an error term at the enterprise level.

Each random effect and error term follow a normal distribution, with θ_{12} and φ_{12} respectively indicating the correlations between ϵ_{1ij} and ϵ_{2ij} and between U_{1j} and U_{2j} . The correlated random effect models include the mean of various country-level variables \bar{X}_j . A Mundlak or variable added test can be performed to assess the superiority of the correlated random effect model over a random effect model (Wooldridge, 2010).

These averaged variables (\bar{X}_j) can be understood as the contextual effect, which was defined by Manski (1993) as the propensity of individuals to behave in a certain way according to the characteristics of a group. In our case, the contextual effect is the average difference in the probability of innovation for two enterprises that differ from the national mean of a given variable by one unit, representing the potential differential effect of the response from belonging to groups or contexts with different means (Bell et al., 2019). U_j refers to the correlated effect (Manski, 1993) in which an enterprise in the same group (in this study, a shared country) tend to behave similarly because they have similar individual characteristics or navigate similar institutional environments. We estimate alternative models as robustness checks. We suspect that impact of SE status may vary according to various national characteristics; thus, a cross-level interaction variable is also introduced (Aguinis et al., 2013). Finally, the bivariate probit model with random effect is extended to include a random slope. Bayesian model selection based on Akaike Information Criterion (AIC) was used to select the best model (Burnham and Anderson, 2004). All models are presented in the Appendix (see Table A.2.1.) and marginal effects for the benchmark model in Appendix A.2.2. The Bayesian model selection is reported in the Appendix (see Table A.3.1.).

To address the social desirability bias that may lead to mis-measurement of the variables of interest (Roxas and Lindsay, 2012), we conduct sensitivity analysis referencing Blackwell et al. (2017). We test various scenarios from 10 % to 50 % of the observations to be miscoded for each of the variables describing innovation. We examine a conservative scenario considering that only SE enterprises may be subject to desirability bias as social and/or environmental innovation could be

more anticipated for such enterprises. As shown in the Appendix (see Table A.3.2.), a reasonable upper limit of 25 % of the observations to be miscoded yields similar results. The original findings for environmental innovation are no longer supported by the data in the case when the proportion of observed variance due to measurement error exceeds 50 %, a scenario that can be ruled out since FL486 survey design implements best practices to reduce social desirability bias (Roxas and Lindsay, 2012).

We apply the conditional mixed process framework proposed by Roodman (2011), which employs a maximum likelihood simulation algorithm to estimate a system of simultaneous equations. Standard errors are computed using bootstrap accounting for clusters at country and industry levels referencing Field and Welsh (2007) and Cameron et al. (2008).

4. Results

The estimated parameters for all models are presented in the Appendix (Table A.2.1.); however, only the correlated random effects model has been interpreted, since according to the AIC and the Mundlak tests, it is the best model. Since the differences between AIC values are sufficiently high, the probability of incorrectly selecting a model that differs from the data generation process is close to zero (Burnham and Anderson, 2004) (see Table A.3.2). Moreover, the Mundlak test rejects the random effects model over the correlated random effects model ($\chi^2(18) = 518.96, p\text{-value} < 0.000$). Finally, we obtain $\theta_{12} = 0.414$ (with a standard error of 0.015) and $\varphi_{12} = 0.748$ (with a standard error of 0.079). These two parameters validate the use of the bivariate probit model with correlated random effects. All the results are reported using *coefplot* developed by Jann (2014). All conditional and unconditional marginal effects are presented in the Appendix (Table A.2.2.). Random effects at the country level are also reported in the Appendix (Figs. A.4.1 and A.4.2.).

4.1. Direct effect of the social economy on innovation

The unconditional and conditional marginal effects for the variables at the enterprise level are illustrated in Fig. 1. Conditional effects are the probability of environmental and social innovation conditional on the development of the other type of innovation.

Even if both unconditional effects are significant, the impact of SE status is larger on social innovation than environmental innovation. Notably, the conditional marginal effects are asymmetrical. Conditioned on the development of social innovation, SE enterprises did not have a higher probability to develop environmental innovation; however, SE enterprises that develop environmental innovation tend to have a higher probability to develop social innovation.

Concerning our control variables, the impact of membership in a cluster or business supporting organization and size align with previous research findings (De Marchi, 2012; Xu et al., 2019). Younger enterprises have a higher probability of developing innovation with social benefits. Notably, enterprises that only operate in national markets tend to develop less social and environmental innovation (Torrecillas and Fernández, 2022).

4.2. The indirect effect of the presence of social economy on innovation

Referencing Wooldridge (2010) and Kere et al. (2017), we next estimate the contextual effects (Fig. 2), revealing that SE enterprises increase the probability for all enterprises to develop social and environmental innovation, and this probability is higher for environmental innovation. This is the most significant contextual effect, whereas the direct effect shown in Fig. 1 seems to be relatively small, albeit significant. Concerning control variables, membership in a cluster or business supporting organization increases the probability of all

⁴ Alternative covariates such as the Environmental Policy Stringency Index (Kruse et al., 2022) are not available for most of the countries in our sample.

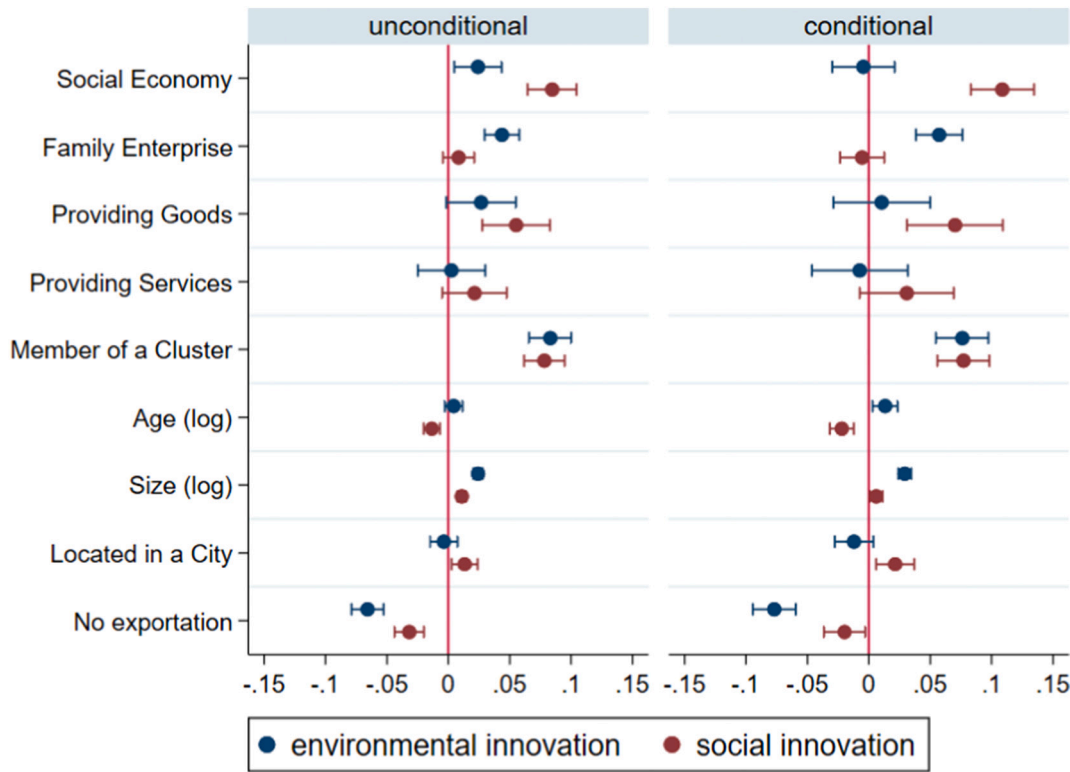


Fig. 1. Unconditional and Conditional Marginal Effects.
Note: 90 % level confidence interval reported.

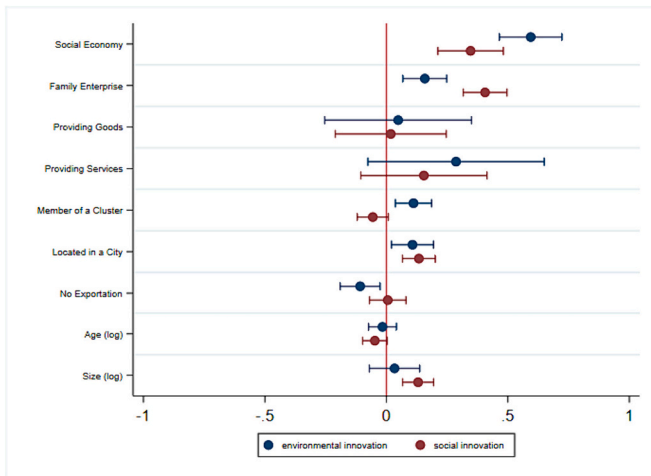


Fig. 2. Contextual Effects.
Note: 90 % level confidence interval reported.

enterprises developing environmental innovation, including those that are not members of a cluster and do not benefit directly from a business supporting organization.

We next report the contextual effects for each country in the sample (Fig. 3). Contrary to the figure in the Appendix (see Fig. A.4.3.) concerning marginal effects of SE, impact and variance is higher for environmental innovation. Most notably, whereas countries are minimally differentiated according to the marginal effect of SE on environmental innovation, the contextual effect of SE on environmental innovation appears to be highly country dependent, indicating specificity regarding national orientations of the SE toward environment. In contrast, as countries' ranking is largely the same for social innovation, the highest

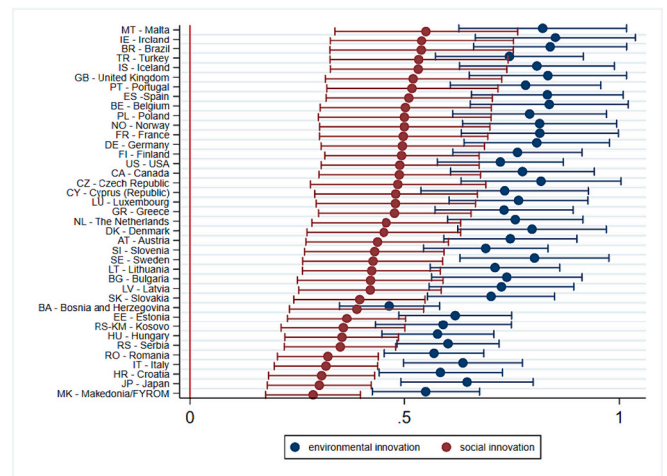


Fig. 3. Contextual Effect of Social Economy Enterprises on Social and Environmental Innovation.
Note: 90 % level confidence interval reported. Ranking based on descending social innovation marginal effects.

contextual effect is in countries where the probability for SE to develop social innovation is also the highest. This indicates that the relationship between SE and social innovation is less country dependent. Hence, social innovation is a key feature of SE at the international level (Tortia et al., 2020).

4.3. Comparing social economy and non-social economy enterprises to identify internal and external levers

Referencing Bouchard and Rousselière (2016) and Long and Mustillo (2021), we use estimated probabilities to compare SE enterprises to

other enterprises and assess the significance of the various levers for social and environmental innovation. We examine internal levers (market operating orientation, nature of product provided, size, and age) and external levers (location and supporting organizations). The econometric specification is dependent on the predictors operating independent of each other. This hypothesis may not prove to be true if, for example, the effect of the variable of interest is higher for SE than for non-SE enterprises. Therefore, we also test alternative specifications for each lever using the interaction between SE status and the variable of interest. The AIC is higher in all cases, indicating a poor fit to the data, confirming that the hypothesis of independence holds (see in the Appendix Table A.3.1). Referencing Burnham and Anderson (2004), we compute the probability of each model to be better supported by the data than the other models by comparing the set of models in competition. Our benchmark model has a probability of 0.69, whereas the model with interaction for exportation only has a probability of 0.21 and the others essentially do not indicate support.

Fig. 4 presents the results from combining SE and market operating status. We test differences between predicted probabilities using pairwise comparison with Bonferroni adjustment for multi-comparison (Mitchell, 2015) (see Appendix Table A.5.1). For social innovation, all predicted probabilities are significantly different; therefore, SE enterprises have a higher probability of developing social innovation than other enterprises, regardless of the market operating status. This is not the case for environmental innovation, wherein local enterprises have a lower probability of developing environmental innovation than enterprises that operate also on an international market.

We present the predicted probabilities for various levels of age and size and accounting for SE status (see Fig. 5).⁵ As demonstrated previously by Udayasankar (2008), we find a significant relationship between size and environmental innovation. Enterprises with the highest probability of developing social innovation are young and small SE enterprises. Regardless of the SE status, old and large enterprises have the highest probability of developing innovation with environmental benefits. Pairwise comparisons of margins reported in the Appendix (Table A.5.2) show that these differences are significant.

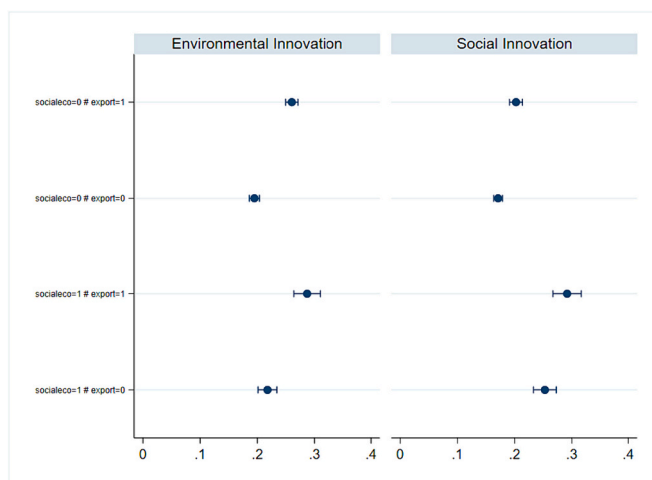


Fig. 4. Predicted Probabilities for Environmental and Social Innovation Based on Social Economy and Exportation Status.

Note: 90 % level confidence interval reported.

⁵ Age and size are categorized into terciles with the following categories for age: young (up to 15 years), medium (16–28 years), and old (29 years or more), and for size: small (up to 4 employees), medium (5–13 employees), and large (14 employees or more).

Finally, we investigate the impact of external support on innovation, in this study, location and membership in a cluster (see Fig. 6). Pairwise comparisons of margins reported in the Appendix (Table A.5.3) show the significance of the support of clusters to environmental innovation, indicating that SMEs that are members of a cluster have in any case (whether SE or non-SE, located in a city or not) the highest probability of developing environmental innovation. The situation differs for social innovation as SE enterprises are found to have the highest probability of developing social innovation (except in the case of non-SE enterprises located in a city and those that are members of a cluster). Finally, we highlight the influence of location in a city on fostering social and environmental innovation; a result that aligns with Ziegler et al. (2022).

We report two additional results in the Appendix. First, as expected, SE enterprises in human health, social work, education, and arts sectors have the highest probability of developing social innovation (see in the Appendix Fig. A.6.1.). Second, no significant difference is evident regarding the nature of the product developed (services, goods, or mixed) (see in the Appendix Fig. A.6.2.).

5. Robustness checks regarding the generality and validity of contextual effects

We apply two alternative approaches to help us better characterize the nature of the contextual effects.

The first approach is to disentangle the endogenous effects using linear-in-means models. According to Manski (1993), the three possible effects are correlated, contextual and endogenous effects. Endogenous effects are defined as the propensity of an individual to behave in some way varying in accordance with the behavior of the group. The propensity of a given enterprise toward innovation may depend on another enterprise's propensity toward innovation. Our benchmark model is based on the idea that the contextual effect is given and exogenous; a hypothesis that may be controversial.

Therefore, we estimate a linear-in-means model (e.g., Goetzke and Weinberger, 2012) to disentangle endogenous and contextual effects. Doing so requires suitable instruments (i.e., variables that may only have an impact on individual innovation through the mediation of average innovation). Good candidates include the institutional variables for innovation in the Global Innovation Index (GII) developed by the World Intellectual Property Organization (Dutta et al., 2021). The GII ranks the innovation performance of 132 economies and proposes seven variables based on 82 specified items. Because we estimate our equation model using full information maximum likelihood, there is no directly equivalent test for the validity of the instruments as in limited information estimation approaches to endogeneity (e.g., control function or two-step estimators). We reference Roodman and Morduch (2014), including instruments in the outcome equation to test their significance and determine whether their only impact on the outcome variable is through mediation by the selection variable. Even in that case (non-exclusion restrictions), the model is still identified through its non-linearities (Roodman, 2011).

The estimations are reported in the Appendix (see Table A.7.1.), supporting the previous results. We compute the marginal effects referencing the method proposed by Cameron and Trivedi (2010). The impact of the contextual effect of SE is 0.618 (with a standard error of 0.193) on environmental innovation and 0.303 (with a standard error of 0.101) on social innovation, these effects are comparable to those reported in the Appendix (see Table A.2.2.) for the benchmark model. Notably, we are able to characterize the nature of the indirect impact of SE enterprises on innovation more precisely. As the estimated parameter in the first stage is positive and significant and insignificant in the second stage, the impact of SE enterprises is through a general increase in innovation, which has an indirect impact on innovation for all enterprises.

We examine contextual effects at the country level in our benchmark model and in the previous robustness checks. These contextual effects

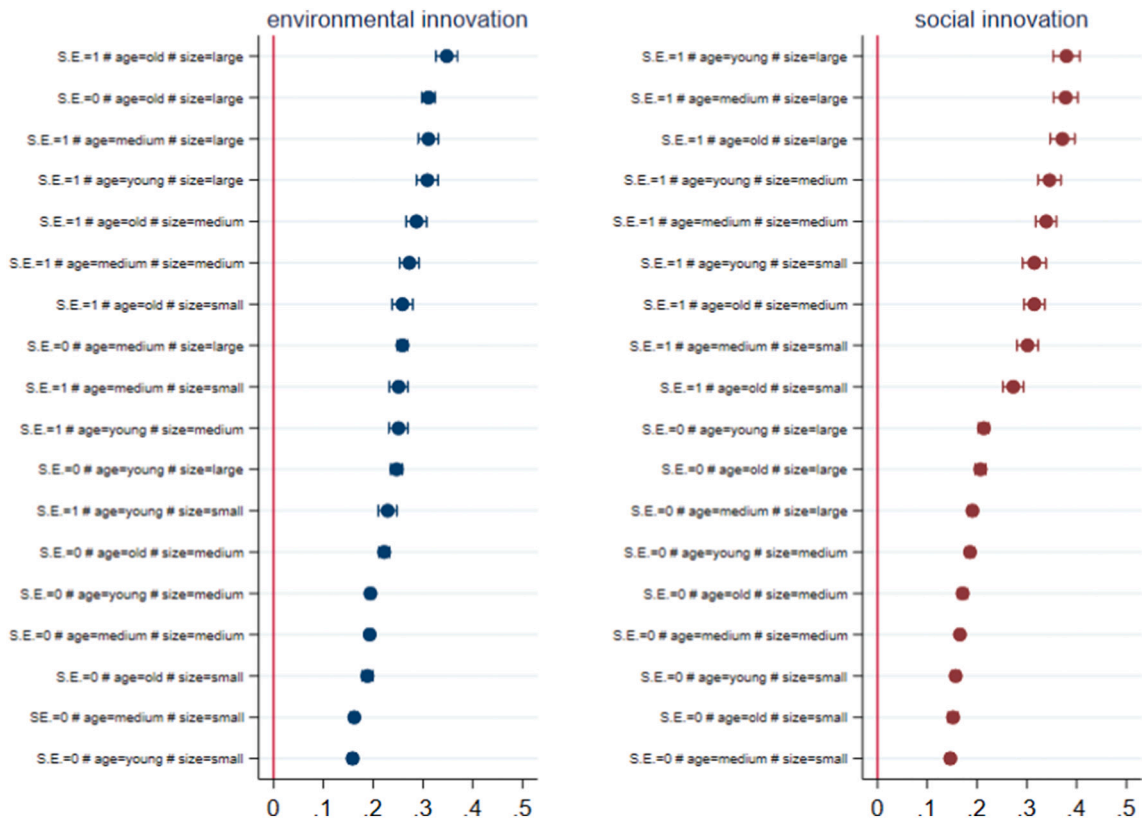


Fig. 5. Predicted Probabilities for Environmental and Social Innovation Based on Social Economy Status, Age, and Size. Note: 90 % level confidence interval reported. Ranking based on descending probabilities.

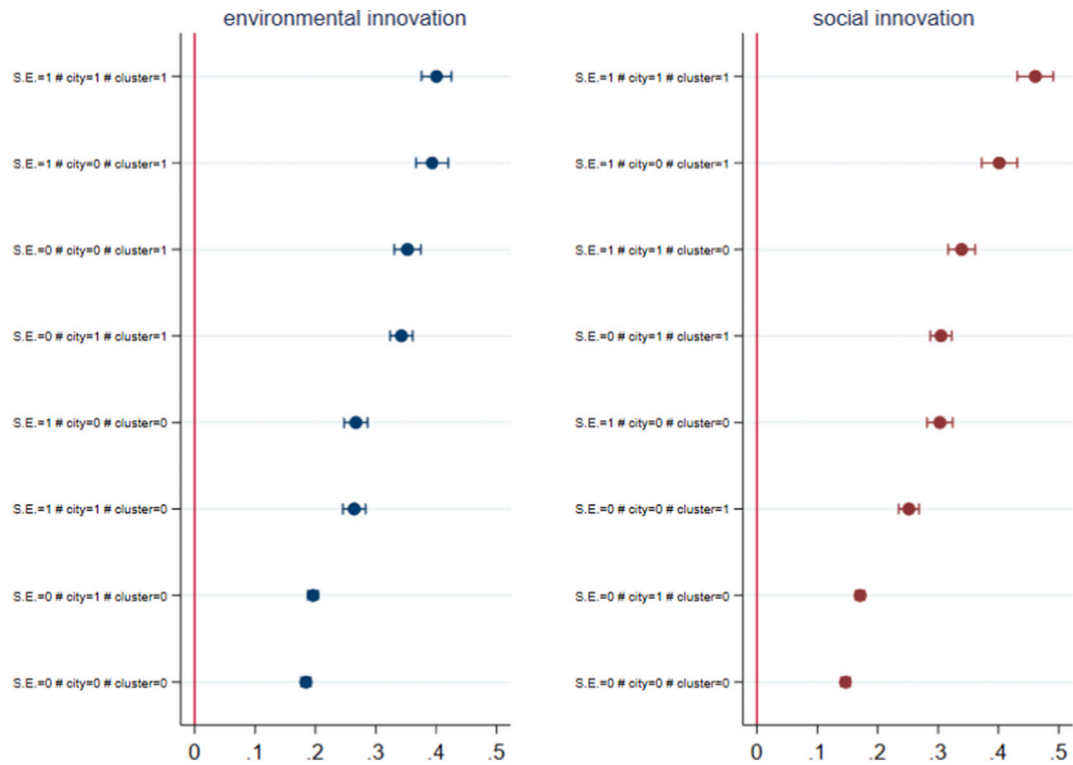


Fig. 6. Predicted Probabilities for Environmental and Social Innovation Based on Social Economy Status, Location, and Membership in a Cluster. Note: 90 % level confidence interval reported. Ranking based on descending probabilities.

are consistent with the idea of a national SE ecosystem (Borzaga et al., 2020). In unreported results, we determine that the effects still hold at the sectoral level for the whole sample; however, this hypothesis could be criticized as being overly macro, as the economic dynamics for each sector within each country may differ. Hazenberg et al. (2016) demonstrated that different SE ecosystems coexist in Europe, some having validity at the national level, while others have particular dynamics at the micro level. We can assume the existence of a different logic in each country at the sectoral level because of a particular institutional dimension. If SE enterprises tend to operate in sectors that are not traditionally high tech and innovative, they tend to gradually undergo a technological transformation and explore all sectors (Calderini et al., 2023), with different dynamics in each country. For example, the reuse sector in Belgium clearly benefits from the importance of SE (OECD/European Commission, 2022), while cooperatives may have specific effects on the development of renewable energy in the Netherlands, but not in France, where they have not yet reached a necessary threshold (Bauwens et al., 2016). Following previous research, we estimate additional models with contextual effects depending on the national sector, resulting in 586 different groups (corresponding to the combination of sector and country). Two different models are tested. The first one examines each national sector covering the full sample. The second examines subsamples for the 341 mixed sectors (with both SE and non-SE enterprises), representing 58 % of the sectors in the total sample and 82 % of the observations.

As shown in the Appendix (see Table A.7.2.), the results of our benchmark models are confirmed with this new specification, as SE enterprises still have significant contextual effects on social and environmental innovation.

6. Discussion and conclusion

Using data from a European survey of over 16,000 SMEs, we develop a bivariate probit model with correlated random effects to estimate direct and contextual effects of the SE on environmental and social innovation. We also identify the specific levers of innovation in SE and non-SE enterprises. Our analysis highlights the positive contribution of SE to social and environmental innovation, justifying the development of public policies to promote SE at national and international levels. Our model allows us to test the five hypotheses regarding social innovation, environmental innovation, and SE (Table 1).

As shown in Table 1, two empirical findings directly support H1 and H2. These findings suggest that SE tends to act as a laboratory with a higher impact on environmental innovation than social innovation. This reflects SE enterprises' roots in the community, the community's influence on firms' orientation through democratic and participative governance, and SE enterprises' ability to reinvest in social or environment innovation rather than being pressured by shareholders to pay dividends. SE enterprises primarily have an indirect effect that can be understood in different complementary ways. The various explanations in competition, such as SE as an intermediate, lever, or laboratory of innovation, are consistent with our analysis based on a cross-section study. A longitudinal study integrating new waves of the survey may be able to disentangle the validity of alternative explanations. However, our additional analysis characterizes the nature of this indirect impact: the impact of SE enterprises is through a general increase in innovation, which has an indirect impact on innovation for all enterprises.

Three additional findings concerning the comparison between SE and non-SE enterprises are notable, which are a combination of H1 with H3–H5. The findings for H3 and H4 indicate a higher probability for SE enterprises to develop social innovation in most cases; however, the dynamic differs for environmental innovation as the largest SMEs tend to have a higher probability of developing innovation with environmental benefits. These enterprises may have access to financial levers and economies of scale, they may be able to recover environment-related investments through accrued benefits, or they may possess

Table 1
Results.

Hypothesis	Test	Corroboration
H1: Social economy enterprises have a higher probability of developing social and environmental innovation than for-profit enterprises with the highest probability for social innovation.	Conditional and unconditional marginal effects are reported in Fig. 1.	Yes
H2: The social economy has contextual effects based on each type of innovation, with the highest impact on environmental innovation, depending on the national social economy model.	Unconditional marginal effects are reported in Figs. 2 and 3.	Yes
H3: Exportation has a positive effect on innovation, with a higher effect on environmental innovation than on social innovation.	Unconditional marginal effects are reported in Fig. 1 and predicted probabilities are reported in Fig. 4.	Yes The impact of exportation on environmental innovation is higher than the impact of SE status, which is inverted for social innovation (higher impact of SE status).
H4: Organizations' size and age have a positive effect on environmental and social innovation.	Unconditional marginal effects are reported in Fig. 1 and predicted probabilities are reported in Fig. 5.	Yes The impact of age and size on environmental innovation is higher than the impact of SE status, which is inverted for social innovation (higher impact of SE status).
H5: External support (membership in a cluster and location in a city) has a positive impact on environmental and social innovation.	Unconditional marginal effects are reported in Fig. 1 and predicted probabilities are reported in Fig. 6.	Yes The impact of membership in a cluster on environmental innovation is higher than the impact of location and SE status, which differs for social innovation (higher impact of SE status).

superior negotiation leverage to benefit from better terms with green material suppliers (Balasubramanian et al., 2021).

Finally, the finding for H5 indicates that public policies facilitating innovation clusters can foster innovation, particularly environmental innovation. As noted by Vickers et al. (2017) the interplay between public organizations, for-profit enterprises, and social enterprises, of which most belong to SE (Borzaga et al., 2020: 109) fosters public service innovation. The interplay of logics shaping social innovation also occurs in relationships with key stakeholders; notably public sector funders, service users, and service delivery partners. Therefore, clusters and public supporting organizations have positive direct and indirect effects on SMEs' environmental innovation. Urban SE enterprises primarily benefit from such public policies (Ziegler et al., 2022). Policymakers could also promote partnerships among SE enterprises through specific initiatives (Calderini et al., 2023). We also show that the presence of family enterprises has benefits for innovation. As highlighted by the organizational ecology perspective (Carroll and Hannan, 2000; Huang, 2020), organizational diversity can have a positive impact on societal outcomes. Because contextual factors such as the composition of firms in a region may explain regional innovation performance, Huang (2020) argued that policymakers should focus on the ecological structure of the population of organizations. Although it should be confirmed in future research, our empirical results tend to support this proposition.

Our analysis surely has some limitations. Even if we test for

desirability bias, we acknowledge that our definitions of social and environmental innovation are limited by reason of context. A second limitation is that our data are obtained using a cross-section analysis, and we were not able to separately test the various theoretical approaches to contextual effects. Access to panel or pseudo-panel data is needed to test the innovation laboratory hypothesis, which is by nature dynamic (innovation developed by SE and eventually developed by non-SE enterprises). Therefore, we hope that future waves of will include the same version of this module.

Our original findings regarding contextual effects highlights a strong implication advocating public policies to promote SE for the assumed benefits as well as the tendency of SE to foster innovation within non-SE enterprises. As shown by [Chaves and Savall-Morera \(2019\)](#), public policies supporting SE tend to suffer more from austerity policies than other public policies. Following our analysis, this may lead to an indirect and unexpected long-term negative effect on overall innovation and eventually on economic growth ([Aldieri et al., 2019](#)). At the methodological level, it is difficult to evaluate the impact of SE without considering enterprises' impact on other stakeholders and competitors ([Bouchard and Rousselière, 2022](#)). These indirect impacts are hardly considered in traditional static and comparative evaluations of SE (e.g., [Borzaga et al., 2019](#)) which, despite their merits in evaluating SE size, may lead to an underestimation of the positive impact of SE for the development of innovation. As highlighted in [Rousselière et al. \(2020\)](#), microsimulations calibrated with real data and based on the explicit modeling of the behavior and interactions of economic agents may be a fruitful avenue to address this issue.

Appendix A

A.1. Descriptive statistics

Variable	Mean	Std. dev.	Min	Max
Environmental Innovation	0.221	0.415	0	1
Social Innovation	0.192	0.394	0	1
Social Economy	0.092	0.289	0	1
Family Enterprise	0.204	0.403	0	1
Providing Goods	0.395	0.489	0	1
Providing Services	0.564	0.496	0	1
Member of a Cluster	0.147	0.354	0	1
Age (Log)	2.950	0.800	0	6.930
Size (log)	2.332	1.511	0	11.270
Located in a City	0.492	0.500	0	1
No Exportation	0.660	0.474	0	1
GDP (log)	10.124	0.711	8.526	11.582
EPI (log)	4.267	0.117	3.734	4.430

A.2. Results

Table A.2.1

Alternative Specifications.

VARIABLES	(1)		(2)		(3)		(4)	
	Envir.	Social	Envir.	Social	Envir.	Social	Envir.	Social
Social Economy	0.089** (0.040)	0.308*** (0.040)	0.086** (0.040)	0.304*** (0.043)	1.712 (2.317)	−0.778 (2.547)	0.086** (0.041)	0.303*** (0.046)
Family Enterprise	0.153*** (0.029)	0.043 (0.030)	0.153*** (0.032)	0.033 (0.033)	0.153*** (0.032)	0.034 (0.033)	0.153*** (0.029)	0.035 (0.030)
Providing Goods	0.095 (0.061)	0.209*** (0.064)	0.096 (0.072)	0.216*** (0.060)	0.095 (0.070)	0.217*** (0.060)	0.096 (0.061)	0.217*** (0.065)
Providing Services	0.009 (0.061)	0.078 (0.064)	0.009 (0.065)	0.086 (0.062)	0.008 (0.064)	0.086 (0.062)	0.010 (0.061)	0.085 (0.064)
Member of a Cluster	0.285*** (0.033)	0.288*** (0.034)	0.280*** (0.035)	0.287*** (0.033)	0.280*** (0.035)	0.287*** (0.032)	0.280*** (0.033)	0.288*** (0.034)
Age (log)	0.015	−0.054***	0.016	−0.053***	0.016	−0.053***	0.016	−0.054***

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CRediT authorship contribution statement

Damien Rousselière: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Marie J. Bouchard:** Writing – review & editing, Writing – original draft, Validation, Supervision. **Samira Rousselière:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Table A.2.1 (continued)

VARIABLES	(1)		(2)		(3)		(4)	
	Envir.	Social	Envir.	Social	Envir.	Social	Envir.	Social
Size (log)	(0.016) 0.088*** (0.008)	(0.016) 0.044*** (0.009)	(0.016) 0.088*** (0.009)	(0.015) 0.044*** (0.009)	(0.016) 0.088*** (0.009)	(0.015) 0.044*** (0.009)	(0.016) 0.088*** (0.008)	(0.016) 0.043*** (0.009)
Located in a City	−0.015 (0.025)	0.060** (0.025)	−0.013 (0.025)	0.053* (0.027)	−0.013 (0.025)	0.053** (0.027)	−0.013 (0.025)	0.053** (0.026)
No Exportation	−0.232*** (0.027)	−0.123*** (0.028)	−0.232*** (0.031)	−0.125*** (0.034)	−0.232*** (0.030)	−0.125*** (0.034)	−0.232*** (0.027)	−0.126*** (0.028)
B- Mining and quarrying	0.363** (0.146)	−0.094 (0.165)	0.363** (0.145)	−0.100 (0.232)	0.363** (0.145)	−0.100 (0.231)	0.366** (0.146)	−0.106 (0.165)
D - Electricity, gas, steam and air con	0.562*** (0.139)	0.103 (0.156)	0.560*** (0.149)	0.098 (0.208)	0.560*** (0.153)	0.098 (0.209)	0.559*** (0.139)	0.091 (0.156)
E - Water supply,sewerage,waste management	0.355*** (0.115)	0.210* (0.123)	0.353*** (0.117)	0.212* (0.109)	0.354*** (0.116)	0.211* (0.108)	0.355*** (0.115)	0.207* (0.123)
F - Construction	−0.035 (0.050)	−0.113** (0.054)	−0.035 (0.060)	−0.112 (0.071)	−0.035 (0.059)	−0.112 (0.071)	−0.036 (0.050)	−0.109** (0.054)
G - Wholesale and retail trade, repair	−0.011 (0.036)	0.101*** (0.037)	−0.012 (0.035)	0.101** (0.041)	−0.012 (0.036)	0.101** (0.041)	−0.012 (0.036)	0.100*** (0.037)
H - Transportation and storage	0.059 (0.059)	−0.149** (0.066)	0.059 (0.067)	−0.149** (0.072)	0.060 (0.067)	−0.150** (0.072)	0.057 (0.059)	−0.148** (0.066)
I - Accommodation and food service activities	0.203*** (0.057)	0.059 (0.061)	0.200*** (0.057)	0.061 (0.060)	0.200*** (0.056)	0.060 (0.059)	0.200*** (0.057)	0.062 (0.061)
J - Information and communication	−0.187*** (0.072)	0.224*** (0.068)	−0.187** (0.075)	0.227*** (0.077)	−0.188** (0.075)	0.227*** (0.077)	−0.188*** (0.072)	0.231*** (0.068)
K - Financial and insurance activities	0.024 (0.085)	0.048 (0.089)	0.024 (0.084)	0.049 (0.078)	0.023 (0.084)	0.050 (0.078)	0.024 (0.085)	0.055 (0.089)
L - Real estate activities	0.258*** (0.080)	0.008 (0.089)	0.256*** (0.091)	0.010 (0.085)	0.254*** (0.091)	0.010 (0.085)	0.253*** (0.081)	0.009 (0.089)
M - Professional, scientific and techni	−0.088* (0.052)	−0.019 (0.054)	−0.090 (0.058)	−0.017 (0.062)	−0.090 (0.057)	−0.017 (0.062)	−0.091* (0.052)	−0.021 (0.054)
N - Administrative and support service	−0.178*** (0.068)	0.063 (0.068)	−0.178*** (0.067)	0.063 (0.066)	−0.179*** (0.066)	0.063 (0.067)	−0.180*** (0.068)	0.066 (0.068)
P - Education	0.129 (0.083)	0.494*** (0.081)	0.121* (0.072)	0.502*** (0.113)	0.121 (0.074)	0.501*** (0.113)	0.123 (0.083)	0.506*** (0.082)
Q - Human health and social work activities	−0.151** (0.073)	0.557*** (0.068)	−0.155** (0.073)	0.558*** (0.067)	−0.153** (0.072)	0.558*** (0.068)	−0.157** (0.073)	0.552*** (0.068)
Arts, entertainment and recreation	0.152 (0.093)	0.415*** (0.091)	0.147 (0.096)	0.417*** (0.090)	0.147 (0.095)	0.416*** (0.090)	0.147 (0.093)	0.410*** (0.091)
GDP (log)	0.081 (0.103)	0.208* (0.117)	−0.041 (0.048)	0.147*** (0.050)	−0.045 (0.045)	0.152*** (0.049)	−0.033 (0.089)	0.114 (0.082)
EPI (log)	0.754 (0.604)	−0.388 (0.681)	0.652*** (0.218)	−0.746*** (0.233)	0.683*** (0.226)	−0.777*** (0.238)	0.633 (0.475)	−0.480 (0.441)
Social Economy # GDP					0.040 (0.114)	−0.056 (0.108)		
Social Economy # EPI					−0.473 (0.768)	0.388 (0.793)		
mean(Social Economy)			2.156*** (0.284)	1.379*** (0.328)	2.149*** (0.289)	1.382*** (0.346)	2.175*** (0.670)	1.319** (0.579)
mean(Family Enterprise)			0.574*** (0.200)	1.616*** (0.218)	0.574*** (0.209)	1.614*** (0.239)	0.627 (0.389)	1.394*** (0.347)
mean(Providing Goods)			0.176 (0.667)	0.072 (0.553)	0.182 (0.667)	0.082 (0.584)	0.260 (1.186)	−0.011 (1.056)
mean(Providing Services)			1.041 (0.803)	0.614 (0.628)	1.052 (0.775)	0.624 (0.659)	0.775 (1.361)	0.731 (1.216)
mean(Member of a Cluster)			0.405** (0.164)	−0.222 (0.154)	0.405** (0.158)	−0.223 (0.154)	0.261 (0.346)	−0.070 (0.302)
mean(Age (log))			0.390** (0.191)	0.532*** (0.163)	0.389** (0.178)	0.534*** (0.166)	0.299 (0.254)	0.657*** (0.217)
mean(Size (log))			−0.392** (0.181)	0.023 (0.182)	−0.395** (0.184)	0.026 (0.205)	−0.317 (0.360)	−0.126 (0.324)
mean(Located in a City)			−0.058 (0.127)	−0.189 (0.122)	−0.054 (0.127)	−0.191 (0.122)	−0.153 (0.226)	−0.152 (0.202)
mean(No Exportation)			0.122 (0.229)	0.519*** (0.155)	0.118 (0.226)	0.521*** (0.147)	0.208 (0.275)	0.607** (0.254)
Constant	−5.073*** (1.810)	−1.546 (2.035)	−4.485*** (1.479)	−1.139 (1.223)	−4.590*** (1.461)	−1.077 (1.238)	−4.296* (2.302)	−2.213 (2.155)
Insig_1	−1.311*** (0.126)	−1.167*** (0.124)	−1.631*** (0.082)	−1.794*** (0.091)	−1.631*** (0.141)	−1.794*** (0.117)	−1.632*** (0.133)	−1.634*** (0.135)
Insig_1_1							−3.232 (3.194)	−2.081*** (0.472)
atanhrho_1_12	1.140*** (0.193)		0.967*** (0.179)		0.964 (1.096)		−2.081*** (0.472)	
atanhrho_12	0.440*** (0.017)		0.440*** (0.018)		0.440*** (0.018)		0.441*** (0.017)	
atanhrho_1_2_1_1							−0.016	

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Table A.2.1 (continued)

VARIABLES	(1)		(2)		(3)		(4)	
	Envir.	Social	Envir.	Social	Envir.	Social	Envir.	Social
atanhrho_1_2_1_2							(0.151) –0.945*** (0.177)	
AIC	28,927.71		28,911.86		28,918.64		28,928.12	
BIC	29,371.94		29,493.96		29,531.37		29,533.19	
Observations	15,665		15,665		15,665		15,665	

Note: Bootstrapped Standard errors in parentheses (200 replications).

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

Table A.2.2

Marginal effects for the benchmark model.

	Unconditional m.e.		Conditional m.e.	
	Envir.	Social	Envir.	Social
Social Economy	0.024** (0.011)	0.084*** (0.013)	–0.004 (0.016)	0.109*** (0.017)
Family Enterprise	0.044*** (0.009)	0.008 (0.008)	0.057*** (0.012)	–0.005 (0.012)
Providing Goods	0.027 (0.020)	0.055*** (0.015)	0.011 (0.028)	0.070*** (0.022)
Providing Services	0.003 (0.018)	0.021 (0.015)	–0.007 (0.024)	0.031 (0.022)
Member of a Cluster	0.083*** (0.011)	0.078*** (0.010)	0.076*** (0.014)	0.077*** (0.012)
Age (log)	0.004 (0.004)	–0.013*** (0.004)	0.013** (0.006)	–0.022*** (0.006)
Size (log)	0.024*** (0.002)	0.011*** (0.002)	0.029*** (0.003)	0.006* (0.003)
Located in a City	–0.004 (0.007)	0.013* (0.007)	–0.012 (0.010)	0.021** (0.010)
No Exportation	–0.066*** (0.009)	–0.032*** (0.009)	–0.077*** (0.012)	–0.020 (0.012)
B - Mining and quarrying	0.113** (0.049)	–0.023 (0.050)	0.162** (0.069)	–0.073 (0.078)
D - Electricity, gas, steam and air con	0.182*** (0.054)	0.024 (0.054)	0.214*** (0.063)	–0.024 (0.075)
E - Water supply,sewerage,waste management	0.109*** (0.039)	0.055* (0.030)	0.116*** (0.043)	0.040 (0.037)
F - Construction	–0.010 (0.016)	–0.025 (0.016)	0.001 (0.023)	–0.036 (0.024)
G - Wholesale and retail trade, repair	–0.003 (0.010)	0.025** (0.010)	–0.018 (0.015)	0.040** (0.016)
H - Transportation and storage	0.017 (0.019)	–0.033** (0.015)	0.044 (0.028)	–0.060** (0.025)
I - Accommodation and food service activities	0.059*** (0.017)	0.015 (0.015)	0.074*** (0.022)	–0.000 (0.021)
J - Information and communication	–0.048*** (0.018)	0.060*** (0.021)	–0.101*** (0.028)	0.113*** (0.031)
K - Financial and insurance activities	0.007 (0.023)	0.012 (0.019)	0.003 (0.032)	0.016 (0.028)
L - Real estate activities	0.077*** (0.029)	0.002 (0.020)	0.103*** (0.036)	–0.025 (0.029)
M - Professional, scientific and technic	–0.024 (0.015)	–0.004 (0.015)	–0.034 (0.022)	0.004 (0.022)
N - Administrative and support service	–0.046*** (0.017)	0.016 (0.016)	–0.078*** (0.025)	0.046* (0.025)
P - Education	0.035 (0.021)	0.145*** (0.037)	–0.014 (0.031)	0.185*** (0.047)
Q - Human health and social work activities	–0.040** (0.018)	0.164*** (0.021)	–0.125*** (0.029)	0.245*** (0.030)
Arts, entertainment and recreation	0.043 (0.029)	0.117*** (0.028)	0.006 (0.034)	0.146*** (0.032)
GDP (log)	–0.011 (0.013)	0.037*** (0.013)	–0.035** (0.017)	0.060*** (0.017)
EPI (log)	0.180*** (0.060)	–0.188*** (0.059)	0.355*** (0.078)	–0.358*** (0.080)
mean(Social Economy)	0.594*** (0.078)	0.347*** (0.082)	0.679*** (0.112)	0.263** (0.121)
mean(Family Enterprise)	0.158*** (0.055)	0.406*** (0.055)	0.020 (0.077)	0.539*** (0.078)
mean(Providing Goods)	0.048	0.018	0.061	0.006

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Table A.2.2 (continued)

	Unconditional m.e.		Conditional m.e.	
	Envir.	Social	Envir.	Social
mean(Providing Services)	(0.184)	(0.139)	(0.252)	(0.198)
	0.287	0.154	0.334	0.107
mean(Member of a Cluster)	(0.221)	(0.158)	(0.306)	(0.228)
	0.111**	−0.056	0.189***	−0.132**
mean(Age (log))	(0.045)	(0.039)	(0.061)	(0.054)
	0.107**	0.134***	0.086	0.154***
	(0.053)	(0.041)	(0.073)	(0.059)
*mean(Size (log))	−0.108**	0.006	−0.159**	0.055
	(0.050)	(0.046)	(0.069)	(0.065)
mean(Located in a City)	−0.016	−0.047	0.001	−0.064
	(0.035)	(0.031)	(0.049)	(0.045)
mean(No Exportation)	0.034	0.131***	−0.018	0.181***
	(0.063)	(0.039)	(0.087)	(0.056)
Observations	15,665			

Note: Bootstrapped Standard errors in parentheses (200 replications).

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

A.3. Model selection and robustness checks

Table A.3.1

AIC and BIC for various models.

Model	AIC	BIC	Δ AIC	Δ BIC	P(model)
Benchmark model	28,911.86	29,493.96	0	0	0.69
Model with interaction for Exportation	28,914.22	29,511.64	2.36	18.28	0.21
Model with interaction for Age and Size	28,960.92	29,634.93	49.06	141.57	<0.00
Model with interaction for Cluster and City	28,915.85	29,528.58	3.99	35.22	0.09

Note: P(model) is the probability of the model to be better supported by the data than the other models given the set of models in competition. Probability calculated following [Burnham and Anderson \(2004\)](#).

Table A.3.2

Estimated parameters concerning social economy according to various miscoded scenarios.

Scenarios		Envir.		Social	
N°	characteristics	socialeco = 1	mean_socialeco	socialeco = 1	mean_socialeco
1	10 %	0.0864**	2.182***	0.293***	1.489**
2	20 %	0.0849**	2.198***	0.291***	1.529**
3	30 %	0.0915*	2.247***	0.312***	1.524**
4	40 %	0.0999**	2.412***	0.340***	1.565**
5	50 %	0.0982	2.549***	0.403***	1.720**
6	Only social economy enterprises	0.0827**	2.241***	0.264***	1.442*

Note: Scenarios 1 to 5: from 10 % to 50 % of the enterprises have a probability to misreport environmental or social innovation. Scenario 6: only social economy enterprises are susceptible to misreport environmental or social innovation. The specifications correspond to the benchmark model, other parameters not reported. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A.4. Results at country level

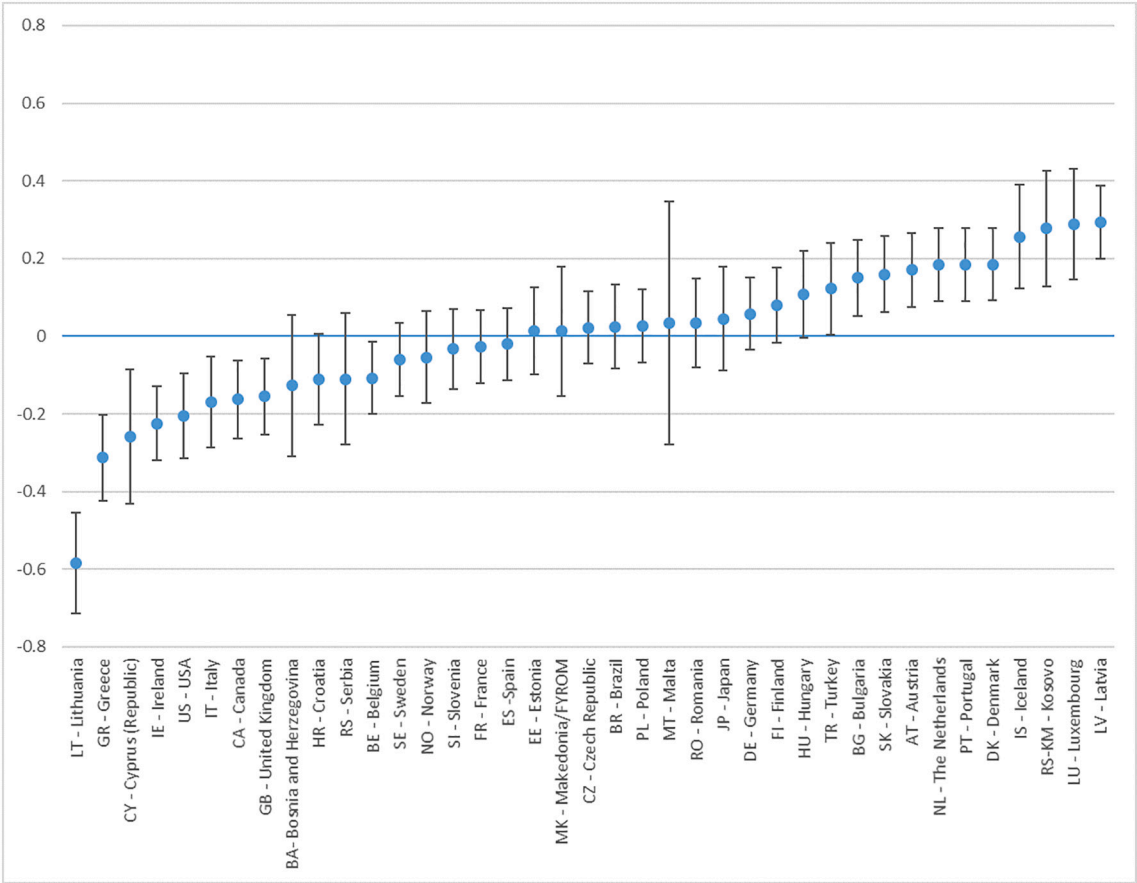


Fig. A.4.1. Environmental Innovation Random Effects.
Note: 90 % level confidence interval reported. Ranking based on ascending random effects.

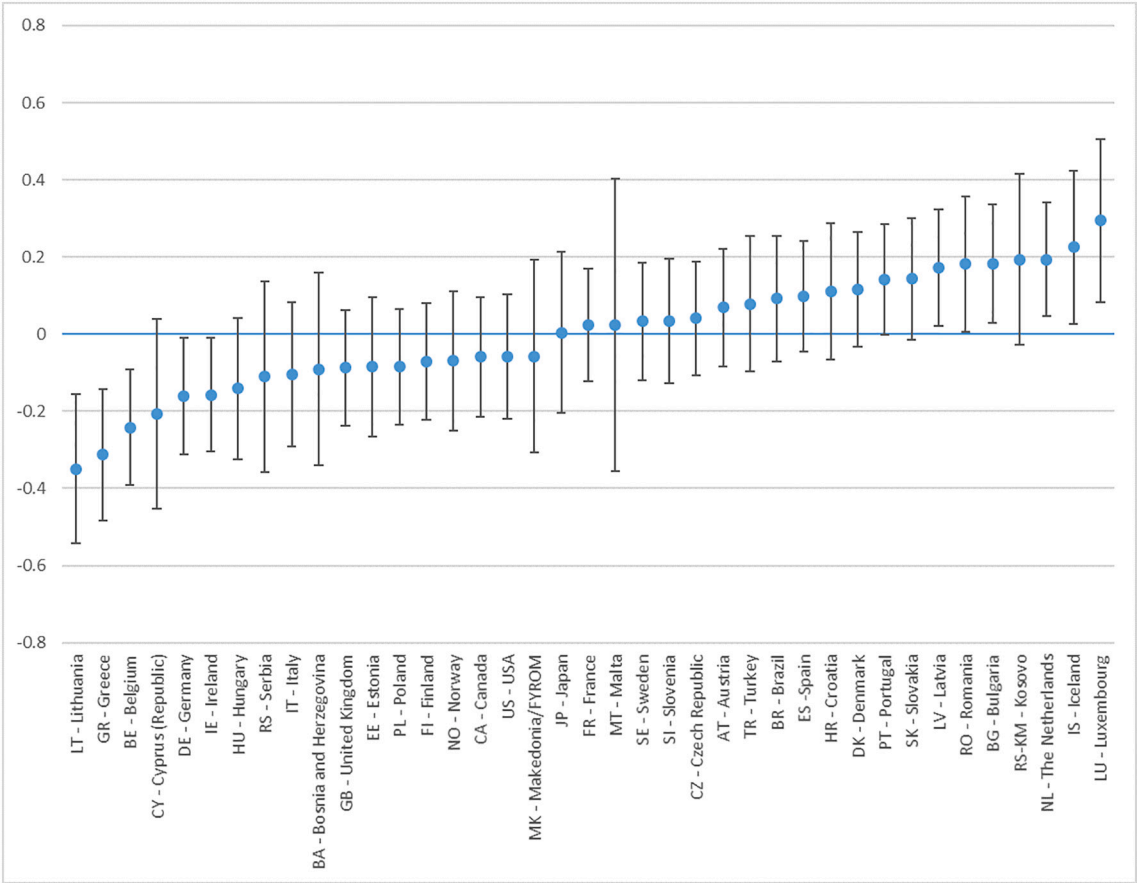


Fig. A.4.2. Social Innovation Random Effects.
Note: 90 % level confidence interval reported. Ranking based on ascending random effects.

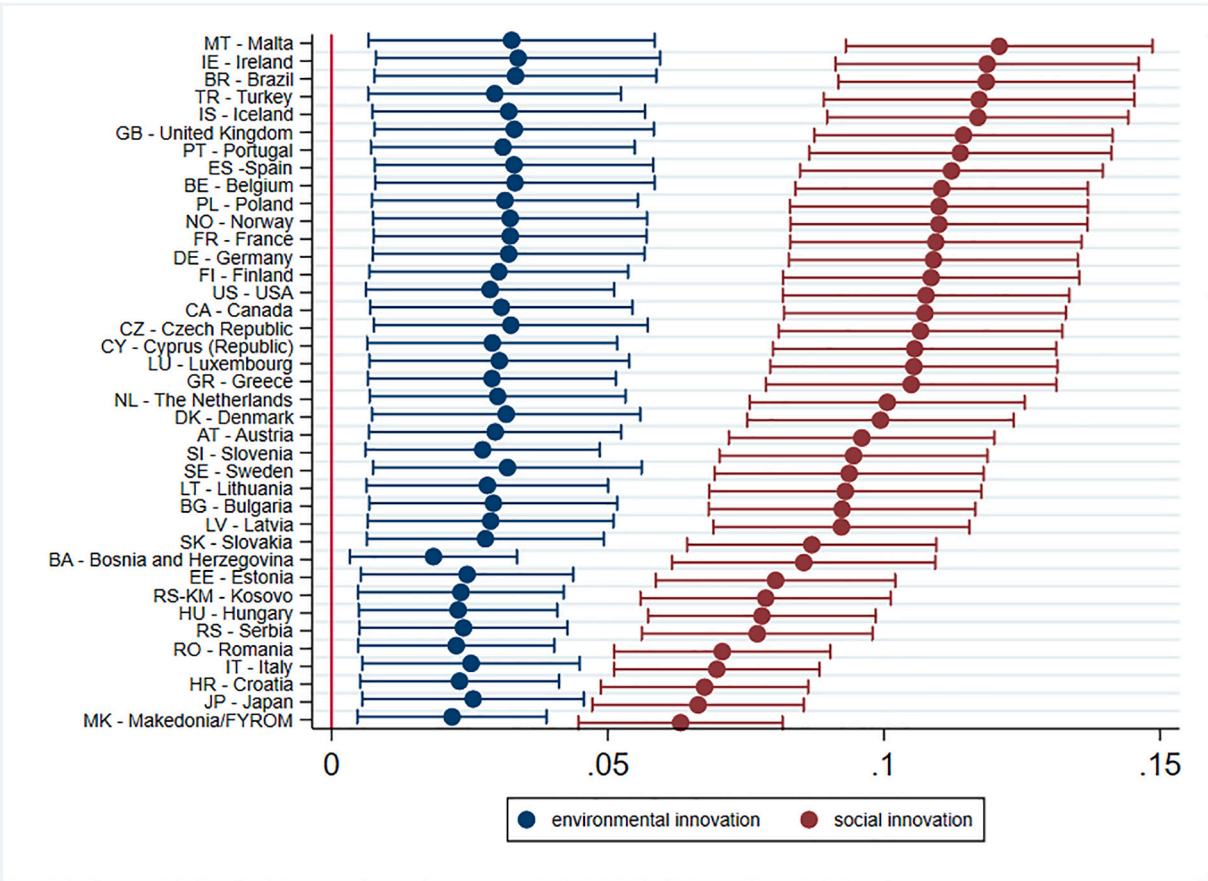


Fig. A.4.3. Unconditional Marginal Effect of Social Economy on Environmental and Social Innovations.
Note: 90 % level confidence interval reported. Ranking based on descending social innovation marginal effects.

A.5. comparisons between social economy and non-social economy enterprises

Table A.5.1
Pairwise comparisons.

social eco	export	environmental innovation			social innovation		
		margins	standard er.	group	margins	standard er.	group
0	0	0.195	0.005	A	0.171	0.005	
0	1	0.260	0.007	B	0.203	0.007	
1	0	0.218	0.010	A	0.253	0.012	
1	1	0.287	0.014	B	0.292	0.015	

Note: Margins sharing a letter in the group label are not significantly different at the 10 % level.

Table A.5.2
Pairwise comparisons.

Social eco.	Age	Size	Environmental innovation			Social Innovation		
			Margins	s.e.	group	Margins	s.e.	group
0	young	small	0.159	0.005	A	0.157	0.005	AB
0	young	medium	0.195	0.005	B	0.186	0.005	CD
0	young	large	0.247	0.007	CDEFG	0.214	0.006	E
0	medium	small	0.162	0.005	A	0.146	0.004	A
0	medium	medium	0.193	0.004	B	0.166	0.004	B
0	medium	large	0.259	0.006	EFG	0.191	0.005	C
0	old	small	0.189	0.006	B	0.152	0.006	A
0	old	medium	0.222	0.006	CD	0.171	0.005	BC
0	old	large	0.311	0.008	HIJ	0.207	0.006	DE
1	young	small	0.229	0.011	BC E	0.315	0.014	F
1	young	medium	0.251	0.011	D F	0.346	0.014	GH
1	young	large	0.309	0.013	I	0.380	0.016	I
1	medium	small	0.251	0.011	D F	0.301	0.013	F
1	medium	medium	0.273	0.012	FGH	0.339	0.013	H

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Table A.5.2 (continued)

Social eco.	Age	Size	Environmental innovation			Social Innovation		
			Margins	s.e.	group	Margins	s.e.	group
1	medium	large	0.311	0.012	I	0.378	0.015	I
1	old	small	0.259	0.013	CDEFG	0.273	0.013	
1	old	medium	0.287	0.012	GHI	0.315	0.013	FG
1	old	large	0.347	0.013	J	0.372	0.015	HI

Note: Margins sharing a letter in the group label are not significantly different at the 10 % level.

Table A.5.3

Pairwise comparisons.

social eco	city	cluster	environmental innovation			social innovation		
			margins	standard er.	group	margins	standard er.	group
0	0	0	0.196	0.005	A	0.147	0.005	
0	0	1	0.352	0.013	CD	0.252	0.010	
0	1	0	0.184	0.005	A	0.171	0.004	
0	1	1	0.342	0.011	C	0.305	0.011	AB
1	0	0	0.267	0.012	B	0.303	0.013	A
1	0	1	0.393	0.016	DE	0.402	0.018	
1	1	0	0.264	0.011	B	0.339	0.014	B
1	1	1	0.400	0.015	E	0.461	0.018	

Note: Margins sharing a letter in the group label are not significantly different at the 10 % level.

A.6. Sectoral effects

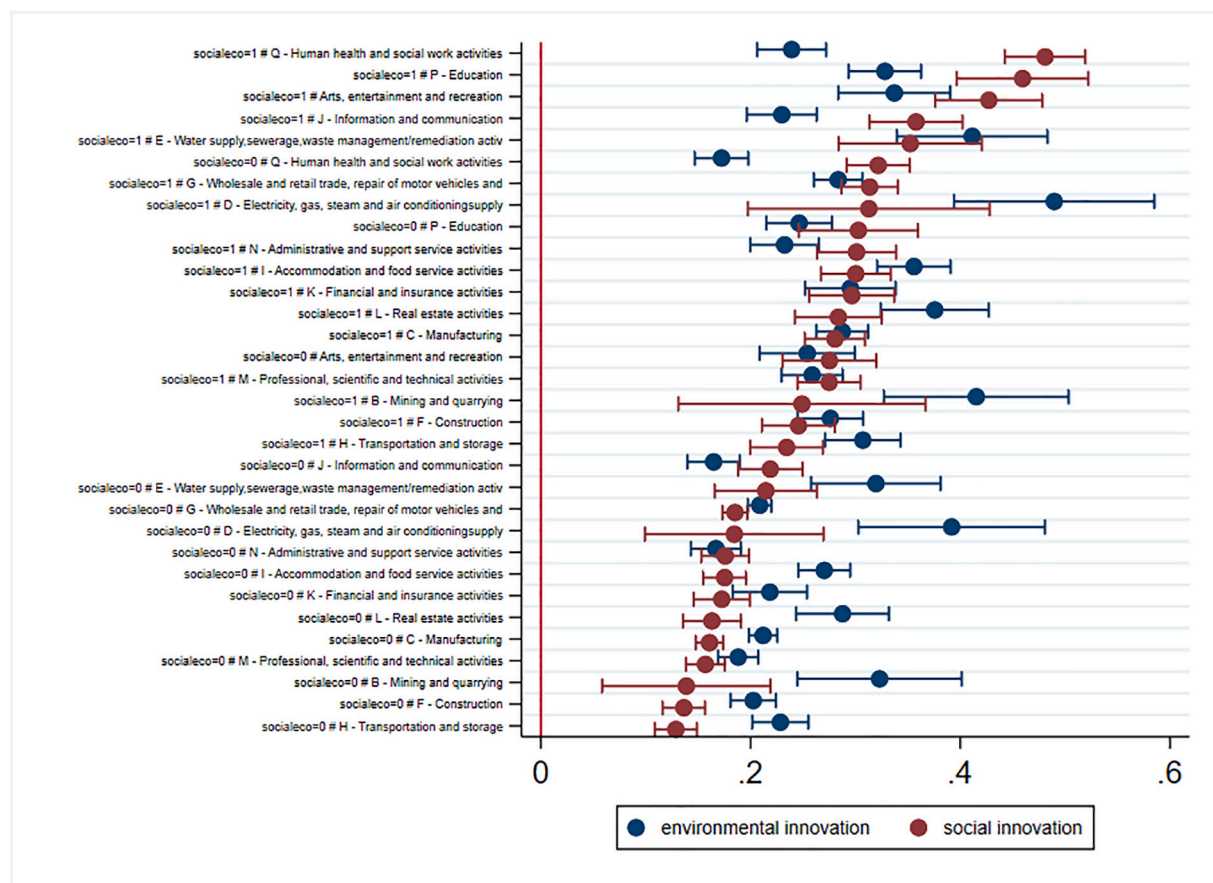


Fig. A.6.1. Predicted Probabilities for Environmental and Social Innovations depending on Social Economy status and nace main activity.

Note: 90 % level confidence interval reported. Ranking based on descending social innovation probabilities.

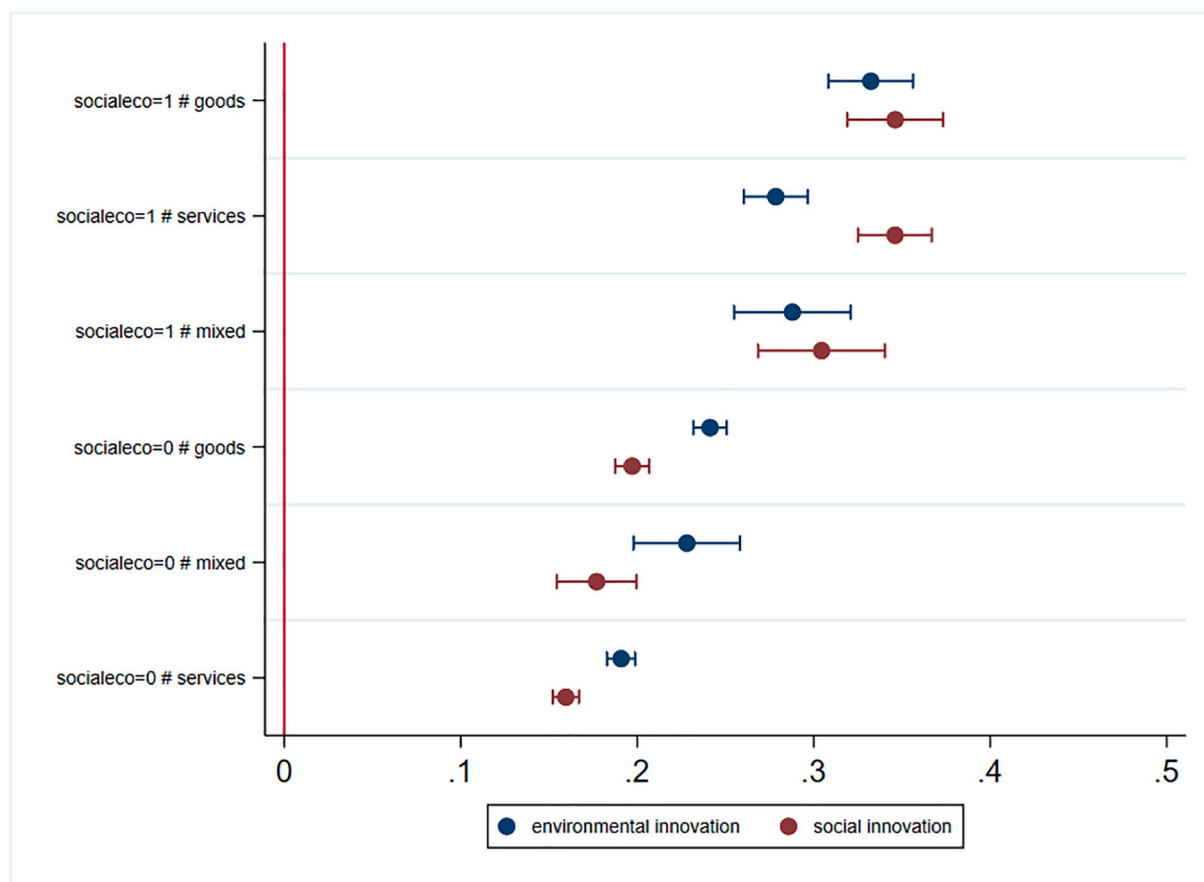


Fig. A.6.2. Predicted Probabilities for Environmental and Social Innovations depending on Social Economy and activities. Note: 90 % level confidence interval reported. Ranking based on descending social innovation probabilities.

A.7. Analysis of contextual effects

Table A.7.1

Linear-in-means models.

VARIABLES	Environmental Innovation		Social Innovation	
	2nd stage	1st stage	2nd stage	1st stage
Social Economy	0.0853*		0.309***	
	(0.0448)		(0.0433)	
Family Enterprise	0.154***		0.0333	
	(0.0279)		(0.0310)	
Providing Goods	0.0967*		0.217***	
	(0.0574)		(0.0633)	
Providing Services	0.0104		0.0857	
	(0.0586)		(0.0667)	
Member of a Cluster	0.278***		0.284***	
	(0.0307)		(0.0321)	
Age (log)	0.0156		−0.0543***	
	(0.0166)		(0.0178)	
Size (log)	0.0875***		0.0440***	
	(0.00780)		(0.00793)	
Located in a City	−0.00922		0.0565**	
	(0.0255)		(0.0266)	
No Exportation	−0.231***		−0.123***	
	(0.0283)		(0.0283)	
Nace				
B- Mining and quarrying	0.371**		−0.0926	
	(0.153)		(0.159)	
D - Electricity, gas, steam and air con	0.559***		0.113	
	(0.141)		(0.175)	
E - Water supply,sewerage,waste management	0.356***		0.234**	
	(0.110)		(0.113)	
F - Construction	−0.0384		−0.105*	
	(0.0486)		(0.0589)	
G - Wholesale and retail trade, repair	−0.00991		0.104***	

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Table A.7.1 (continued)

VARIABLES	Environmental Innovation		Social Innovation	
	2nd stage	1st stage	2nd stage	1st stage
H - Transportation and storage	(0.0399) 0.0580 (0.0577)		(0.0382) −0.153** (0.0690)	
I - Accommodation and food service activities	0.203*** (0.0639)		0.0555 (0.0621)	
J - Information and communication	−0.194** (0.0793)		0.229*** (0.0716)	
K - Financial and insurance activities	0.0227 (0.0920)		0.0557 (0.0885)	
L - Real estate activities	0.256*** (0.0762)		0.0286 (0.0803)	
M - Professional, scientific and techni	−0.0941* (0.0499)		−0.0171 (0.0564)	
N - Administrative and support service	−0.171*** (0.0617)		0.0642 (0.0638)	
P - Education	0.122 (0.0846)		0.488*** (0.0804)	
Q - Human health and social work activities	−0.159** (0.0707)		0.550*** (0.0679)	
Arts, entertainment and recreation	0.158* (0.0904)		0.419*** (0.0922)	
GDP (log)	0.00124 (0.0359)	−0.0618*** (1.95e-05)	0.0164 (0.0416)	0.0267*** (2.86e-05)
EPI (log)	0.0124 (0.208)	0.0208*** (3.08e-05)	−0.107 (0.238)	−0.236*** (5.26e-05)
mean(Social Economy)	−0.138 (0.444)	0.597*** (6.20e-05)	−0.0558 (0.407)	0.417*** (8.48e-05)
mean(Family Enterprise)	−0.177 (0.172)	0.197*** (3.57e-05)	0.409 (0.262)	0.476*** (4.80e-05)
mean(Providing Goods)	−0.253 (0.476)	0.203*** (0.000139)	−0.369 (0.537)	0.121*** (0.000219)
mean(Providing Services)	−0.404 (0.488)	0.547*** (0.000145)	−0.245 (0.593)	0.367*** (0.000222)
mean(Member of a Cluster)	−0.308** (0.156)	0.171*** (3.44e-05)	−0.241* (0.143)	0.0459*** (4.55e-05)
mean(Age (log))	−0.0525 (0.0865)	0.0671*** (1.68e-05)	−0.0425 (0.113)	0.0161*** (2.34e-05)
mean(Size (log))	−0.196 (0.153)	−0.0416*** (2.53e-05)	−0.119 (0.159)	0.0144*** (3.32e-05)
mean(Located in a City)	−0.120 (0.155)	0.0529*** (2.79e-05)	−0.0942 (0.172)	0.117*** (5.18e-05)
mean(No Exportation)	0.291 (0.195)	−0.0270*** (3.50e-05)	−0.102 (0.155)	0.0984*** (5.32e-05)
mean(environmental innovation)	3.996*** (0.415)		3.030*** (0.470)	
mean(social innovation)				
GII Variables				
P1: Institutions		0.000439*** (1.90e-06)		−0.00307*** (2.49e-06)
P2: Human capital and research		0.00191*** (1.00e-06)		−0.00198*** (1.43e-06)
P3: Infrastructure		−0.00147*** (1.90e-06)		0.00140*** (2.82e-06)
P4: Market sophistication		−0.00345*** (5.14e-07)		−0.00155*** (9.77e-07)
P5: Business sophistication		0.00265*** (1.75e-06)		0.00258*** (2.64e-06)
P6: Knowledge and technology outputs		−0.00333*** (1.28e-06)		−0.00309*** (1.86e-06)
P7 Creative outputs		0.00486*** (1.07e-06)		0.00414*** (1.31e-06)
Constant	−1.100 (1.020)	0.114*** (0.000112)	−0.646 (1.284)	0.527*** (0.000224)
Insig_1	−11.67*** (3.260)	−3.241*** (4.31e-07)	−9.080** (3.982)	−3.365*** (3.54e-07)
atanhrho_12	0.00393 (0.0224)		0.0335 (0.0222)	
Observations	15,665		15,665	

Note: Bootstrapped Standard errors in parentheses (200 replications).

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

Table A.7.2
Alternative specifications with effects at the sector-country level.

VARIABLES	All sample		Mixed Sectors	
	Envir.	Social	Envir.	Social
Social Economy	0.0998** (0.0425)	0.316*** (0.0417)	0.108** (0.0430)	0.316*** (0.0433)
Family Enterprise	0.146*** (0.0268)	0.0342 (0.0311)	0.156*** (0.0301)	0.0330 (0.0310)
Providing Goods	0.102* (0.0603)	0.192*** (0.0626)	0.0997 (0.0671)	0.214*** (0.0679)
Providing Services	0.0200 (0.0593)	0.0743 (0.0628)	0.0263 (0.0660)	0.0949 (0.0638)
Member of a Cluster	0.266*** (0.0337)	0.280*** (0.0352)	0.264*** (0.0358)	0.282*** (0.0352)
Age (log)	0.0131 (0.0152)	−0.0514*** (0.0172)	−0.00421 (0.0174)	−0.0561*** (0.0179)
Size (log)	0.0870*** (0.00940)	0.0392*** (0.00864)	0.0832*** (0.00973)	0.0379*** (0.00962)
Located in a City	−0.00424 (0.0262)	0.0478* (0.0257)	−0.0101 (0.0297)	0.0547* (0.0279)
No Exportation	−0.232*** (0.0290)	−0.124*** (0.0286)	−0.248*** (0.0296)	−0.116*** (0.0333)
GDP (log)	−0.000368 (0.0353)	0.205*** (0.0367)	−0.0890* (0.0463)	0.117*** (0.0409)
EPI (log)	0.386* (0.219)	−0.392 (0.239)	0.779*** (0.256)	−0.284 (0.234)
mean(Social Economy)	0.300** (0.122)	0.508*** (0.119)	0.515*** (0.159)	0.982*** (0.134)
mean(Family Enterprise)	0.829*** (0.117)	0.659*** (0.120)	0.671*** (0.124)	0.664*** (0.131)
mean(Providing Goods)	−0.340 (0.294)	0.0516 (0.277)	−0.748** (0.343)	−0.555* (0.308)
mean(Providing Services)	−0.726*** (0.281)	0.00988 (0.268)	−0.690** (0.333)	−0.627** (0.304)
mean(Member of a Cluster)	0.151 (0.107)	−0.201* (0.117)	0.399*** (0.115)	−0.0455 (0.128)
mean(Age (log))	−0.0439 (0.0563)	−0.0525 (0.0598)	−0.0899 (0.0661)	−0.175** (0.0723)
mean(Size (log))	−0.110*** (0.0268)	−0.249*** (0.0250)	−0.0270 (0.0351)	0.0822** (0.0338)
mean(Located in a City)	−0.240*** (0.0921)	0.265*** (0.0932)	−0.229** (0.0908)	0.566*** (0.104)
mean(No Exportation)	−0.0729 (0.0792)	0.132 (0.0837)	−0.0265 (0.0890)	0.0382 (0.0983)
Constant	−1.651** (0.743)	−0.793 (0.794)	−2.482*** (0.849)	−0.588 (0.812)
Insig_1	−2.294*** (0.104)	−1.834*** (0.0856)	−1.472*** (0.0810)	−1.496*** (0.0749)
atanhrho_1_12	0.720*** (0.0992)		0.650*** (0.100)	
atanhrho_12	0.443*** (0.0185)		0.446*** (0.0181)	
Observations	15,665		12,852	

Note: Bootstrapped Standard errors in parentheses (200 replications).

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

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