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RESEARCH ARTICLE

Financial performance of new circular economy companies in rural settings

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Abstract This study examines how rural conditions affect the establishment and performance of new circular economy (CE) companies—those that reduce, reuse, recycle, and recover materials in their processes—focusing on their longevity, financial performance, and distribution of economic value to stakeholders. We hypothesize that while rural conditions generally lead to fewer business establishments, the liability of rurality is less severe for CE companies than for others. We also anticipate that new CE companies will grow more slowly but achieve better performance, resulting in higher survival rates compared to those in other sectors. Our empirical analysis includes all CE companies established in Spain over the past decade. The results indicate that rural CE companies have higher survival rates than their urban counterparts, even after controlling for factors like subsidies and personnel costs. Although rural CE companies exhibit slower growth, they achieve greater profitability. Thus, the CE sector in rural areas demonstrates sustainability not only through its circular practices but also in financial terms, offering significant implications for investors seeking sustainable ventures.

Plain English Summary This study explores how demographic and geographic factors in rural areas affect the creation, survival, financial performance, and economic value distribution of circular economy (CE) companies. We found that rural CE companies tend to survive longer than their urban counterparts, partly because entrepreneurs in rural areas have fewer alternative opportunities. Although these rural companies may experience slower growth, they often achieve higher profitability, demonstrating sustainability both in their circular practices and financial outcomes. Analyzing data from CE companies in Spain, our findings highlight the resilience of rural entrepreneurs and reveal promising opportunities for investors interested in sustainable ventures. These insights have important implications for research, business practices, and policies aimed at promoting sustainable economic development in rural regions. Specifically, investors seeking sustainable businesses with a lower risk of failure should consider supporting rural CE companies.

Keywords Entrepreneurship · Circular economy · Survival · Stakeholders · Financial performance · Rural studies

JEL Classification M13 · M21 · L25 · L26

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1 Introduction

Embracing circular economy (CE) principles in rural communities offers a path to sustainable development, potentially benefiting diverse stakeholders (Marshall et al., 2023). However, establishing businesses in rural areas poses challenges due to their distance from urban centers, limited infrastructure, and talent retention difficulties (Glaeser & Gottlieb, 2009), which is often referred as the "liability of rurality" (Clausen, 2020). The growing prevalence of CE companies in rural areas has driven increased research interest, particularly as a result of their potentially positive environmental impact (Stahel, 2016). While research interest in this topic is substantial, the influence of rural conditions—including population size, density, aging demographics, neighborhood population, unemployment rate, infrastructure availability, business density, distance to urban centers, and the municipality's altitude and topographic slope—on the outcomes of new CE businesses remains unclear, particularly as regards stakeholders. Our study aims to investigate how rural conditions impact the establishment, longevity, financial performance, and distribution of economic value to stakeholders in new CE companies, compared to non-CE companies.

Kirchherr et al. (2017) examined 114 definitions of CE, concluding that it is an economic system that replaces the "end-of-life" concept with reducing, reusing, recycling, and recovering materials in production, distribution, and consumption processes. The CE explores circular business models, with innovative green startups driving sectoral change (Berger & Blanka, 2024). While the CE exhibits strong growth in job creation, these opportunities are primarily concentrated in metropolitan areas (Niang et al., 2024), despite their potential for rural development (Cherrington et al., 2024). Some countries are exploring ways to enhance their rural economies through the CE, as seen in initiatives like the Spanish Circular Economy Strategy (Alonso & Pozas, 2024) and India's National Mission on Bioeconomy (Mukherjee et al., 2023). The issue of rural depopulation—particularly as global rural population growth rates declined for the first time in 2021 (World Bank, 2023)—and the rise of the CE motivated us to investigate the factors influencing the establishment and performance of CE companies in rural areas. We hypothesize that rural conditions may hinder the establishment of CE companies, which may also exhibit slower growth, leading to lower overall economic value generation. However, this sustainable growth results in higher survival rates and increased profitability for such firms.

Extensive research has been conducted on the factors that explain the success of rural entrepreneurship, such as the behaviors of entrepreneurs (Güzel et al., 2021), sources of funding (Halkier & James, 2022), and the adoption of innovative strategies (Chege & Wang, 2020). Recent research has advanced our understanding of the distinctive characteristics and challenges faced by CE companies compared to non-CE counterparts, highlighting specific barriers, required skills, and strategies that define circular business models and differentiate them from traditional linear companies (Henry et al., 2020; Kirchherr et al., 2017; Suchek et al., 2022). Suchek et al.'s (2022) literature review highlighted the emerging and fragmented nature of research in this field, concluding that the CE offers a sustainable alternative to linear systems. Additionally, the heterogeneity of CE practices has led to the development of frameworks like the 9R model, which is widely accepted for assessing circularity. This model ranks circularity strategies as follows: refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover (Kirchherr et al., 2017). New CE companies often adopt strategies with higher circularity levels than incumbents, indicating their potential to contribute significantly to the CE transition (Henry et al., 2020).

Studies on new CE ventures remain limited, although they are rapidly growing (Borms et al., 2023a; Geissdoerfer et al., 2023; Henry et al., 2020; Kanda et al., 2024; Kasana et al., 2024; Lit et al., 2024; van Opstal & Borms, 2023; von Kolpinski et al., 2023). These studies reveal that new CE companies face unique barriers such as skill shortages, financial constraints, and scaling difficulties but also benefit from enhanced resilience and strategic flexibility. Compared to non-CE companies, CE firms often encounter more complex challenges in terms of supply chain management, stakeholder engagement, and market acceptance. However, they possess distinct advantages in regard to innovation potential, sustainability performance, and alignment with growing consumer and regulatory demands for circular solutions (Perramon et al., 2024). Notably, the literature has yet to address the specific challenges and

opportunities associated with rural settings for new CE companies, thus underscoring the novelty of our study.

With regard to the relationship between adopting CE practices and financial performance, existing literature identifies a positive association (Ghisellini et al., 2016). This positive relationship is attributed to several factors, including enhanced brand reputation (Blasi et al., 2021; Mazzucchelli et al., 2022), improved operational efficiencies (Agan et al., 2013; Rexhäuser & Rammer, 2014), cost savings through reduced dependence on natural resources (Kwarteng et al., 2022), and benefits from tax incentives (McDowall et al., 2017).

Our study makes three contributions. First, we extend the current literature by not only examining how rural liability affects the establishment, longevity, and financial performance of new CE companies but also by analyzing the impact on various stakeholders. The stakeholder management approach (Freeman, 1998) is particularly promising in rural contexts, where social and environmental considerations are often interconnected (Musinguzi et al., 2023). The actions of CE companies impact the entire ecosystem, affecting various stakeholders (Govindan & Hasanagic, 2018). By calculating the economic value generated by a CE company and the distribution of this value among the stakeholders, we align our research with the principles outlined by the Global Reporting Initiative (GRI, 2016), providing a more comprehensive understanding of CE company performance and its broader societal impact.

Our second contribution derives from the consideration that, beyond population size and density, rurality is a multifaceted concept (Clausen, 2020). Thus, we look beyond the traditional indicators of rurality by incorporating geodemographic measures such as municipality altitude, topographic slope, business density, infrastructure availability, distance to urban centers, unemployment rate, population decline, neighborhood population, and aging. Our study contributes to the field by precisely identifying the relative importance of these rurality-associated factors, offering a comprehensive understanding of rural business contexts.

Third, to isolate the effect of rurality on CE companies, we incorporate established firm-level controls (size, financial strength, industry affiliation, and foundation date) and two novel explanatory variables particularly relevant to rural entrepreneurship: subsidies and labor costs. By addressing these factors, our study yields robust findings that enrich the theoretical framework that has been built upon economic theories like agglomeration (Marshall, 1890; Rosenthal & Strange, 2004), entrepreneurial opportunity (McMullen et al., 2007), organizational ecology (Hannan & Freeman, 1977), and resource dependence (Pfeffer & Salancik, 1978).

The following section provides a comprehensive literature review and our hypotheses. We then present the empirical study, which encompasses all companies in the CE sector established in Spain over a period of 10 years. Finally, we discuss our findings and draw conclusions from our research.

2 Review of the literature and formulation of hypotheses

2.1 Challenges in establishing CE companies in rural areas

Demographic and geographic factors are critical considerations for businesses when making location decisions (Shields, 2005). Rural areas are often remote from urban centers, which hinders infrastructure development. The CE faces numerous adoption barriers (Govindan & Hasanagic, 2018), and these disproportionately impact already fragile rural supply chains. Early theories of firm location choice emphasized proximity to raw materials or consumers (Isard, 1949). Social networks, a major factor for entrepreneurs, are influenced by geography, as people primarily interact with other people who are nearby (Sorenson, 2018). CE companies, particularly those requiring specialized infrastructures for transportation logistics, waste management, and recycling, may face challenges due to deficiencies in rural settings. Furthermore, rural areas often grapple with environmental restrictions, and these significantly impact business entry. However, while rural areas often encounter challenges that can hinder business entry, Brandão and Santos (2022) argued that CE and bioeconomy practices have the potential to transform these challenges into opportunities. Their research, utilizing surveys, interviews, and case studies, highlights how innovation in products and partnerships can generate new economic opportunities and foster collaboration,

thereby improving local business dynamics and aligning with broader environmental goals.

The demographics of rural areas are often characterized by a combination of low population size, low population density, and an aging demographic, all of which can hinder infrastructure development. Being located in a sparsely populated area with limited infrastructure is an obstacle to starting any type of business (Huiban, 2011). CE entrepreneurs may be deterred from establishing companies in areas with low market demand. In contrast, cities provide significant advantages for business creation, including better matching of resources, increased opportunities for sharing, and enhanced learning (Duranton & Puga, 2004). Agglomeration economics suggests that the concentration of firms in urban areas fosters increased productivity and innovation (Marshall, 1890). All of this may explain why companies tend to cluster naturally in cities.

While entrepreneurs offering tech solutions can be place-indifferent (Khurana & Dutta, 2024), many CE companies depend strongly on local resources to function effectively. The limited availability of resources can increase dependence on a few key suppliers in a rural area. This dependence can make businesses vulnerable to disruption, price fluctuations, and uncertainties associated with accessing essential resources, further deterring new business establishments. This is consistent with the theory of resource dependence (Pfeffer & Salancik, 1978), which emphasizes the critical importance of external resources for companies, such as financing, technology, materials, labor, and relationships with customers and suppliers. An urban area has a larger consumer base, easier access to new technologies, a more specialized labor market, closer proximity to suppliers, and better transportation, telecommunications, and energy infrastructure. These factors would justify a lower rate of business creation in rural areas.

Based on Stinchcombe's (1965) imprinting theory, Clausen (2020) developed the concept of the liability of rurality. As a result of limited access to up-to-date social technology, new enterprises in rural areas face challenges in accessing financial resources, establishing connections with universities, and benefiting from community dynamism. These factors, associated with the imprint at the founding of CE companies that emerge in rural areas, may discourage aspiring entrepreneurs. CE companies often require significant investment and long-term commitment to sustainable practices and may be particularly susceptible to path-dependent inertia in challenging rural contexts. This highlights the potential for a vicious cycle: Rural locations hinder initial development, exacerbating the challenges of accessing the resources and networks necessary for sustained growth and innovation, and thus discouraging aspiring entrepreneurs from establishing CE companies in such areas.

Despite the aforementioned factors, certain studies have shown that proximity to urban centers does not always have a positive impact on business creation. Lavesson (2018) stated that it is opportunity-driven firms that benefit from urban proximity, while distance from urban centers favors necessity-driven firms. Additionally, while it is clear that companies in sectors such as technology benefit from economies of scale by being located in cities, other sectors, such as the agricultural sector, have special characteristics that require the resources offered by nature, and this sometimes makes their location in a rural environment essential. Similar observations can be made for the CE sector, which includes many companies that focus on the management of natural resources. In addition, CE businesses in rural areas might benefit from reduced competition for operational resources such as secondary raw materials or recyclable waste.

Some specific factors may help make rural conditions less disadvantageous for CE companies than for other sectors, potentially encouraging the establishment of CE entrepreneurs. These factors include enhanced access to critical natural resources available only in rural areas, alignment with sustainability practices valued by rural communities, and local production that meets the increasing demand for sustainable products. In fact, some CE companies can only be established in rural areas, particularly those related to the primary sector, such as regenerative agriculture, permaculture, composting and organic waste management, and bioenergy production. Additionally, rural locations may offer specific advantages over urban settings in areas like agro-industries and material recycling. This may explain why the liability of rurality might be less severe for CE companies than for others, potentially making rural areas more attractive to CE entrepreneurs than to those in non-CE sectors.

Thus, we propose the first hypothesis:

H1. Rural conditions—including population size, density, aging demographics, neighborhood population, unemployment rate, infrastructure availability, business density, distance to urban centers, and the municipality's altitude and topographic slope—discourage business establishment, with this effect being weaker for CE companies than for non-CE companies.

2.2 Rural location and new CE firm survival

The geodemographic factors that favor urban entrepreneurship do not necessarily support its success (Stuart & Sorenson, 2003). While high agglomeration offers economies of scale, learning opportunities, investor attraction, and proximity to the market, excessive competition can have a detrimental effect on survival, as explained by the ecological organization theory (Hannan & Freeman, 1977). In rural areas, competition among businesses, including CE companies, is often lower than in urban areas. The challenges they initially face serve as a protective barrier against new competitors, creating a competitive advantage. With fewer competitors vying for resources and customers, CE companies in rural areas may experience less pressure and enjoy higher profit margins, thus increasing their chances of survival.

According to Borms et al., (2023a, 2023b), organizations with higher circularity scores demonstrate greater resilience and stability, both during crises and in normal times. Their study further found that combining multiple circular strategies can maximize the effectiveness of these practices in strengthening resilience. Using data from manufacturing firms in an emerging market, de Sousa Jabbour et al. (2023) found that adopting CE business models directly enhances organizational resilience. Circular business models can enhance the resilience of nascent CE companies, particularly in rural or resource-constrained environments (Perramon et al., 2024). The authors identified a positive correlation between the adoption of circular business models and increased organizational resilience, suggesting that circularity enhances firms' adaptability to challenges. Their research demonstrated that this transition fosters both internal and external adaptability, facilitating business transformation and sustainability, and potentially conferring a competitive advantage during economic or environmental uncertainties. Significantly, internal factors such as material reuse, reduction, and recycling exert more influence than external factors like regulatory incentives.

Furthermore, the lower labor costs in rural areas (Strotmann, 2007) can be advantageous for CE companies, which may require labor-intensive processes for recycling, waste management, and sustainable manufacturing (Stahel, 2016). Lower labor costs can contribute to reduced operational expenses, enhancing the viability of CE ventures in rural areas. This observation further supports a positive relationship between rural location and survival.

Moreover, subsidies and tax incentives offered by public administrations in rural areas to address depopulation can have a positive impact on the survival of rural businesses. This connection is supported by research highlighting a positive relationship between subsidies and firm survival (Srhoj et al., 2021). In particular, governments and local authorities often implement policies to foster CE initiatives in rural regions in order to achieve various objectives, such as stimulating economic development, creating employment opportunities, and addressing environmental challenges (Medaglia et al., 2024). By leveraging these subsidies and incentives, CE companies in rural areas can access additional financial support and resources, thus potentially bolstering their survival prospects.

The strong support and close-knit relationships within rural communities also contribute to their resilience (Shields, 2005). Rural communities tend to foster strong social bonds and close-knit relationships among their residents. This sense of community support can be invaluable for new CE companies, as it provides access to local networks, resources, and collaborative opportunities. Community backing can also enhance the visibility and acceptance of CE initiatives, facilitating market penetration and long-term sustainability.

The theory of entrepreneurial opportunity (McMullen et al., 2007) also provides insights into how rural areas promote the survival of businesses. It suggests that in rural areas entrepreneurs face lower opportunity costs, which increases the likelihood of business survival (Huiban, 2011). Limited availability of alternative options, such as stable employment or the ability to launch other ventures in rural areas, may incentivize CE entrepreneurs to dedicate their efforts

and resources toward sustaining their businesses. Consequently, challenges such as inadequate infrastructure, low population density, aging, the scarcity of businesses, and long distances to populated areas make it difficult for entrepreneurs to find employment alternatives. Thus, worse location conditions lead to higher survival rates.

There is a consistent positive association between establishment in a rural area and firm survival (Huiban, 2011; van Leuven et al., 2023), although exceptions exist (Stearns et al., 1995). This is attributed to the strong support within rural communities (Shields, 2005), the typically low levels of local competition (Pe'er & Keil, 2013), and the lack of alternative options for entrepreneurs in case of failure (Huiban, 2011; McMullen et al., 2007). Furthermore, potentially favorable founding conditions, including government subsidies and lower labor costs, might contribute to the success of rural CE entrepreneurship. Several studies have found higher survival rates in rural companies than in urban ones (Huiban, 2011; van Leuven et al., 2023). However, there are conflicting findings from other studies. Basile et al. (2017) found that an agglomeration of related companies positively affects the survival of manufacturing firms by facilitating the generation and dissemination of new knowledge, but large cities can pose challenges. These challenges, commonly known as "urban disamenities," encompass factors such as congestion, which substantially increases commute times and negatively affects the overall quality of life in urban areas (Glaeser & Gottlieb, 2008). Stearns et al. (1995) also reported that some service sector companies following a niche strategy have a higher survival probability when located in an urban area.

Based on the above, our second hypothesis is that:

H2. Rural conditions are positively associated with survival in new CE companies. New CE firms established in rural areas exhibit higher survival rates than non-CE companies.

2.3 Rural location and new CE firm financial performance

The relationship between being located in a rural area and financial performance is not well established (Andersson et al., 2023; Phillipson et al., 2019). In fact, "financial performance" is an ambiguous term that includes aspects such as growth, profitability, and financial strength. The creation of economic value and its distribution to stakeholders is also part of performance evaluation (GRI, 2016). Focusing on growth, agglomeration economies theories suggest that the concentration of economic activity and human capital in cities promotes knowledge exchange, thereby potentially enhancing business growth (Rosenthal & Strange, 2004). CE companies located in urban centers benefit from access to a diverse pool of talent, research institutions, industry networks, and a large number of customers, which facilitates market expansion. This concentration of resources enhances the growth of urban CE companies through improved efficiency, collaboration, and market penetration. Imperfect financial markets create a double challenge for rural ventures: limited access to investment capital due to dependence on self-generated cash flow, compounded by lower revenue potential in smaller markets (Andersson et al., 2023).

New CE companies often lack essential specialized skills such as logistics, R&D, and technology for circular business models and prefer financial incentives, like subsidies, over educational support, highlighting their unique policy needs (Borms et al., 2023a). Challenges include high technology dependence, low credibility, limited resources, and inadequate institutional support (Lit et al., 2024); diseconomies of scale, limited time for a robust value proposition, and a predominantly linear industry structure (van Opstal & Borms, 2023); internal barriers such as risk aversion and a lack of circular business modeling skills (von Kolpinski et al., 2023); and unique issues like outdated value chains, material access problems, and high logistical costs, influenced by local conditions and business development stages (Kasana et al., 2024). New CE companies need tailored strategies for scalability, including commercial, phased, and synced approaches (Han et al., 2023). Balancing profitability with system-level impacts and integrating sustainability into growth strategies is often more complex for CE companies than for non-CE firms.

The challenges faced by circular new CE ventures are influenced by the type of business model, industry sector, institutional context, and liabilities of newness, with particular difficulties in scaling due to limited resources and legitimacy hindering strategic partnerships (Kanda et al., 2024). The

challenges faced by circular new CE ventures are influenced by the type of business model, industry sector, institutional context, and liabilities of newness. These challenges are especially pronounced when it comes to scaling, due to limited resources and the need to establish legitimacy, which can hinder strategic partnerships (Kanda et al., 2024). Startups in the circular economy are often driven by market and financial factors, but they also face significant barriers, such as legal and value chain challenges, which can impact their ability to innovate and grow (Geissdoerfer et al., 2023).

Adopting CE practices can enhance a company's financial performance through various factors (Ghisellini et al., 2016). Specifically, waste treatment and recycling improve a company's image among stakeholders, which in turn provides a competitive advantage and boosts financial performance (Mazzucchelli et al., 2022). These authors found that brand reputation mediates the relationship between CE practices and firm performance, with stronger reputations leading to higher profitability and market success. Blasi et al. (2021), using data from Italian manufacturing SMEs, examined the impact of intensively promoting CE practices on profitability and found that these companies can increase profitability by effectively signaling their circular economy initiatives to the market.

CE activities also have the potential to improve firm performance by enhancing operational efficiency (Agan et al., 2013). However, it is innovations that enhance resource efficiency—such as reducing material or energy use per unit of output—and that positively impact firm profitability, while innovations not focused on resource efficiency contribute less significantly to profitability (Rexhäuser & Rammer, 2014). CE practices can reduce costs by minimizing resource use, thereby improving financial performance (Mazzucchelli et al., 2022). Kwarteng et al. (2022) also noted that reducing dependence on natural resources strengthens firms' financial performance, but they emphasized that organizational culture plays a moderating role in reinforcing this positive relationship, highlighting the importance of considering political, social, and institutional factors. Companies implementing CE practices may benefit from tax incentives and favorable policies from stakeholders and governments, potentially improving their financial performance (McDowall et al., 2017).

Early growth is associated with survival and success in newly established firms (Coad et al., 2020). However, rapid early growth tends to be nonsustainable, often leading to significant losses in subsequent periods (Choi et al., 2017). This can be attributed to financial difficulties arising from rapid growth, rising costs, difficulties in hiring staff, and compromised decision-making (Coad et al., 2020). In contrast, slow and steady growth is more sustainable, requiring fewer resources and creating less of a strain on cash flow. While explosive growth offers short-term profit opportunities, it also carries a higher risk.

The liability of rurality implies that there are challenges in achieving growth in rural areas (Clausen, 2020). However, these challenges can lead to steady and consolidated growth over the long term. This slow but sustained growth allows rural CE companies to invest in long-term strategies and cultivate strong relationships with local communities. Furthermore, new firms often face the liability of newness (Stinchcombe, 1965), experiencing challenges due to their lack of experience and established routines. This lack of experience can become manifest in difficulties with managing rapid growth, resulting in increased costs and low profitability. Therefore, CE companies located in rural areas may not experience significant revenue growth or rapid expansion but, instead, tend to have sustained growth that leads to long-term profits. Thus, geodemographic constraints in rural areas may lead to slower growth for CE companies, somewhat mitigating the liability of newness. Additionally, the lower competition in rural areas can result in higher margins and profits, unlike the situation in major cities where a good business idea is quickly replicated.

The economic value generated in a given year is derived from multiple revenue sources and subsequently distributed among stakeholders (GRI, 2016). Limited market access and slower growth in rural areas likely hinder value creation and distribution for rural CE companies compared to urban ones. Additionally, rural areas may lack the infrastructure and resources necessary for large-scale economic development, further constraining economic value creation in these areas. As a result, a smaller allocation is anticipated for distribution among stakeholders, leading to decreased personnel expenses, lower tax payments to the government, and reduced interest expenses for financial institutions.

While urban areas offer advantages in terms of knowledge exchange and market access, rural areas present advantages for CE companies. These include lower competition, more subsidies, and lower labor costs. Rural CE companies can leverage these advantages to achieve competitive pricing, lower operational expenses, and higher profit margins, contributing to their profitability. Urban companies, on the other hand, might face profit erosion due to the negative externalities associated with larger cities, such as congestion costs, pollution, labor agglomeration, and high living expenses (Dijkstra et al., 2013). Phillipson et al. (2019) found that rural firms in England were more likely than their urban counterparts to report profits.

Taking the above into consideration, we propose the following hypotheses:

H3a. Rural conditions are negatively associated with growth, economic value creation, and economic value distribution to stakeholders in new CE companies. New CE firms in rural areas show lower rates in these aspects than non-CE companies.

H3b. Rural conditions are positively associated with profitability in new CE companies. New CE firms established in rural areas exhibit higher profitability than non-CE companies.

3 Empirical study

3.1 Sample and data

We utilized the SABI financial database, distributed by Moody's Analytics, to obtain annual financial statements for 236,486 companies established in Spain between 2008 and 2017. Five years of data were collected for each company, extending to 2021 for those established in 2017. CE subsectors were identified using National Classification of Economic Activities (NACE) codes (Eurostat, 2017), in line with previous studies (Bianchi & Cordella, 2023; Geerken et al., 2019; Llorente-González & Vence, 2020). This sectoral approach was chosen for its official source (Eurostat) and enhanced cross-country replicability. We identified 10,205 companies in the CE sector. To categorize CE subsectors, we introduced a categorical variable (SECTOR) and five dummy variables representing manufacturing (MANUF), supply (SUPPLY), trade (TRADE), administrative and rental (ADMIN), and other activities (OTHER). Table 1 presents the NACE codes and variables used in our analysis.

For hypothesis 1, business entry was measured using the ratio of new CE companies in a municipality to the total population of that municipality (BE). We employed two dependent variables for measuring survival: SURV is a dummy variable indicating whether the firm survived to year 5, and TIME is a continuous variable representing the number of days the firm survived after its creation. Financial performance was measured using two indicators: a dummy variable (PROFIT) indicating profit generation in the company's fifth year and the return on assets (ROA) for the same period. We also calculated measures of growth, including the increases in assets (ΔTA), sales (ΔSALES), and profit (ΔEBIT) from year 1 to year 5. As regards stakeholders, we focused on the value added in the fifth year (VA) and its distribution (McLeay, 1983). We considered personnel expenses for employees (PE), taxes paid to the government (TAX), interest expenses paid to financial institutions (IE), and the remaining value for the company and its shareholders (OTH). We addressed the issue of the non-normal distribution of most financial variables, which violates the assumptions of certain statistical methods, by calculating their logarithms.

The independent variables included data related to the municipality in which the company was headquartered. The first block consists of demographic data obtained from the National Institute of Statistics (INE). In terms of the classification of an area as rural or urban, we used several criteria. The first criterion is based on the population of the municipality in which the company was headquartered at the time of its foundation (POP). According to Eurostat (2024), a city is a local administrative unit where the majority of the population lives in an urban center with at least 50,000 inhabitants. Therefore, a dummy variable takes the value 1 if the company is headquartered in a municipality with fewer than 50,000 inhabitants (SMALL). The second criterion considers population density (DENS), with a threshold of 300 inhabitants per km^2, considered by Eurostat to be an intermediate-density zone. Thus, a dummy variable takes the value 1 if the company is headquartered in a municipality with a density of fewer than 300 inhabitants per

Table 1 Variables used: acronyms and definitions

Dependent variables	
BE	Business entry = number of new circular economy companies in a municipality to the total population of that municipality
SURV	A dummy variable that equals 1 for surviving companies in year 5 and 0 for failed companies
TIME	The company's survival time since its founding
PROFIT	A dummy variable that equals 1 for companies with positive profit in year 5 and 0 otherwise
ROA	Return on assets
ΔTA	Total assets growth rate
ΔSALES	Sales growth rate
ΔEBIT	Earnings before interest and taxes growth rate
VA	Value added = Profit before tax + Employee cost + Depreciation + Interest expense
PE	Personnel expenses
TAX	Taxes
IE	Interest expense
OTH	Dividends and company retentions
Independent variables	
CIRCULAR	A dummy variable that equals 1 if the company operates within the CE sector and 0 otherwise
POP	Population of the municipality in which the company's headquarters are located
SMALL	A dummy variable that equals 1 if POP < 50,000 inhabitants and 0 otherwise
DENS	Population density of the municipality in which the company's headquarters are located
LOWDENS	A dummy variable that equals 1 if DENS < 300 inhabitants per km^2 and 0 otherwise
POPCHANGE	Population change of the municipality in which the company's headquarters are located since 2000
DECLINED	A dummy variable that equals 1 if POPCHANGE < 0 and 0 otherwise
AGE	Average age of the population in the municipality where the company's headquarters are located
AGED	A dummy variable that assigns a 1 if AGE < 42 years and a 0 otherwise
UR	Unemployment rate of the municipality in which the company's headquarters are located
UNEMPLOYED	A dummy variable that equals 1 if UR > 10% and 0 otherwise
BD	Number of companies in the province divided by population of the province
DEPRIVED	A dummy variable that equals 1 if BD < 65 companies and 0 otherwise
POP50KM	Number of inhabitants in 50 km around the municipality
ISOLATED	A dummy variable that equals 1 if POP50000 < 500,000 inhabitants and 0 otherwise
DISTCAP	Distance in a straight line to the capital of the province
REMOTE1	A dummy variable that equals 1 if DISTCAP > 50 km and 0 otherwise
DIST50000	Closest distance to a municipality with more than 50,000 inhabitants
REMOTE2	A dummy variable that equals 1 if DIST50000 > 50 km and 0 otherwise
INFRA50	Number of bus, train, light rail, and subway stops within a 50-km radius of the municipality
LOWINFRA	A dummy variable that equals 1 if INFRA50 > 500 transportation infrastructures and 0 otherwise
ALTITUDE	The altitude of the municipality above sea level
HIGHLAND	A dummy variable that equals 1 if ALTITUDE > 616 m and 0 otherwise
SLOPE	The average topographic slope of the entire municipality
STEEP	A dummy variable that equals 1 if SLOPE > 13.5 grades and 0 otherwise
EXTREME	A dummy variable that equals 1 if POP + DENS + POPCHANGE + AGE + UR + BD + POP50000 + DISTCAP + DIST50000 + INFRA50 + ALTITUDE + SLOPE > 5 and 0 otherwise

Table 1 (continued)

URBANTYPE	DISPERSED = 0, VILLAGE = 1, RURALCLUS = 2, URBSEMI = 3, URBDENSE = 4, URBCENTER = 5, OTHER = 6 DISPERSED: municipality with a population density below 300 inhabitants per km^2 and a population below 500 VILLAGE: municipality with a population density below 300 inhabitants per km^2 and a population between 500 and 5000 RURALCLUS: municipality with a population density between 300 and 1500 inhabitants per km^2 and a population between 500 and 5000 URBSEMI: municipality with a population density between 300 and 1500 inhabitants per km^2 and a population between 5000 and 50,000 URBDENSE: municipality with a population density of at least 1500 inhabitants per km^2 and a population between 5000 and 50,000 URBCENTER: municipality with a population density of at least 1500 inhabitants per km^2 and a population of at least 50,000 URBOTHER: municipality that does not fit in the previous categories
Control variables	
TA	Total assets
ZSCORE	The score obtained when applying the Altman model (Altman et al., 2019)
PE/S	Staff cost ratio = Personnel expense to sales
SUB	A dummy variable that equals 1 for companies that received a subsidy and 0 otherwise
ETR	Effective tax rate = Total tax expenses by earnings before taxes
STARTED	Year in which the company started operations (2008 = 1; 2009 = 2; 2010 = 3; 2011 = 4; 2012 = 5; 2013 = 6; 2014 = 7; 2015 = 8; 2016 = 9; 2017 = 10)
SECTOR	MANUF = 1; SUPPLY = 2; TRADE = 3; ADMIN = 4; OTHER = 5 MANUF: manufacturing companies Metal repair (3311), machinery repair (3312), electronics repair (3313), electrical repair (3314), marine maintenance (3315), aviation maintenance (3316), transport maintenance (3317), and other general repair (3319) SUPPLY: water supply, sanitation, waste management, and decontamination activities companies Water services (3600), sewer systems (3700), non-hazardous waste collection (3811), hazardous waste collection (3812), non-hazardous waste treatment (3821), hazardous waste treatment (3822), wreck dismantling (3831), materials recovery (3832), and waste remediation (3900) TRADE: wholesale and retail trade and repair of motor vehicles and motorcycles companies Vehicle repair (4520), parts/accessories vehicle wholesale (4531), parts/accessories vehicle retail (4532), scrap wholesale (4677), and secondhand retail (4779) ADMIN: administrative activities and auxiliary services companies, particularly rental and leasing Car rental (7711), truck rental (7712), sports rental (7721), video rental (7722), household rental (7729), agricultural rental (7731), construction rental (7732), office rental (7733), water rental (7734), air rental (7735), and other rental (7739) OTHER: other circular economy companies Computer repair (9512), communication repair (9521), electronic repair (9522), appliance repair (9523), footwear repair (9524), furniture repair (9525), jewelry repair (9529), and other goods repair (9529)

km^2 (LOWDENS). To capture different municipality types, we created a categorical variable (URBANTYPE) and seven dummy variables (DISPERSED, VILLAGE, RURALCLUS, URBSEMI, URBDENSE, URBCENTER, URBOTHER) based on defined criteria (see Table 1).

In addition to population size and density, population change is relevant. POPCHANGE measures the rate of change in the population from the year 2000. DECLINED is a dummy variable indicating whether the company is headquartered in a municipality whose population declined after 2000. Rural areas often experience population aging. AGE represents the average age of the population, and AGED is a dummy variable indicating whether the company was created in a municipality with an average age exceeding 42 years (the Spanish average in the period). UR represents the unemployment rate in the company's municipality, while UNEMPLOYED indicates whether the company was established in a

municipality with an unemployment rate exceeding 10% (the upper quartile of the sample during the analyzed period). Business density (BD) was calculated as the number of companies in the province divided by its population. DEPRIVED indicates whether the company was established in a province with fewer than 65 companies per 1000 inhabitants, which is the lower quartile of the sample.

A municipality can be small and have a low population density but be located near a large city. The variable POP50KM captures the number of inhabitants within a 50-km radius and was obtained from the Global Human Settlement Layer (GHSL, 2015) database, created by the European Commission. ISOLATED is a dummy variable that takes the value 1 for a company created in a municipality with fewer than 500,000 inhabitants within a 50-km radius. The straight-line distance to the provincial capital (DISTCAP) and the shortest distance to a municipality with over 50,000 inhabitants (DIST50000) were calculated. A dummy variable takes the value 1 if the company is headquartered in a municipality that is more than 50 km away from the provincial capital (REMOTE1). Another dummy variable is assigned a value of 1 if the company's headquarters are more than 50 km away from a municipality with a population of over 50,000 inhabitants (REMOTE2).

Infrastructure has a significant impact on the establishment and viability of businesses (Audretsch et al., 2015; van Leuven et al., 2023). All bus stops, train stations, tram stops, and metro stations within a 50-km radius of the municipality were accounted for using Open Street Map (INFRA50). A dummy variable is assigned a value of 1 if the company is headquartered in a municipality that has fewer than 500 train, subway, or bus stops within a 50-km radius (LOWINFRA). The physical environment can influence population distribution and infrastructure development, indirectly affecting business creation and success. To measure this, the municipality's altitude above sea level (ALTITUDE) and the average topographical slope of the entire municipal area (SLOPE) were used. The data on topographical slope were obtained from Zúñiga-Antón et al. (2022). A dummy variable is assigned a value of 1 if the company is headquartered in a municipality that is more than 616 m above sea level (HIGHLAND). Another dummy variable is assigned a value of 1 if the company is headquartered in a municipality with an average slope exceeding 13.5 degrees (STEEP). These thresholds were taken from the upper quartile of the sample. Finally, we created a dummy variable (EXTREME) by summing the results of all the dummy variables for each municipality and assigning a value of 1 if the municipality scores more than five points. This threshold was chosen using the upper quartile of the sample.

Control variables are essential to understanding rural CE location choices and mitigating confounding effects. The size of a company, measured by total assets (TA), typically has a positive association with survival, reflecting the principle of "survival of the fittest" (Coad, 2007). Financial strength (ZSCORE) also increases the likelihood of survival (Fuertes-Callén et al., 2022) and was measured following the methodology of Altman et al. (2019). Considering the comparatively lower labor costs in rural areas (Dijkstra et al., 2013), it is important to control for this factor to assess whether survival and performance are driven by cost. Labor cost was measured using the ratio of personnel expenses to sales (PE/S). The variable ETR measures the effective tax rate to control for differences in tax burdens between locations.

Rural location might be driven by subsidy availability, necessitating control for subsidies due to their potential positive impact on new business outcomes (Karhunen & Huovari, 2015; Li et al., 2019). The variable SUB indicates whether the company received subsidies at its creation. Additionally, the control variables include the company's foundation date (STARTED) because starting a business during a crisis negatively affects its survival (Cefis et al., 2022).

The categorical variable SECTOR identifies the specific CE subsector in which each company operates. Table 2 shows the distribution of new CE companies across various subsectors (SECTOR) and by municipality size (SMALL). Over half of the companies fall into wholesale and retail trade, including the repair of motor vehicles (TRADE). The sample is quite well balanced between rural and non-rural areas. The table presents Eurostat's (2022) classification of circularity levels by NACE subsector, which aligns with the 9R framework (Kirchherr et al., 2017). The most circular subsectors are those engaged in administrative activities and auxiliary services (ADMIN), which operate at the R1 level (rethink). Manufacturing companies (MANUF) are positioned at the R4 (repair) and R5 (refurbish) levels. The least circular

Table 2 Sample distribution of new CE companies by subsector and across rural and non-rural areas. Rural areas are defined as municipalities with fewer than 50,000 inhabitants (SMALL). Table 1 lists NACE code definitions

Subsector	NACE code	Circularity level	Total CE firms		Rural CE firms		Non-rural CE firms	
			Num	%	Num	%	Num	%
MANUF	*3311, 3312, 3313, 3314, 3315, 3316, 3317, 3319*	R4, R5	**1752**	**17.17**	**929**	**18.23**	**823**	**16.11**
SUPPLY			**670**	**6.57**	**368**	**1.22**	**302**	**1.08**
	3600		117	1.15	62	0.59	55	0.61
	3700	R8, R9	61	0.6	30	2.06	31	1.45
	3811, 3812	R8, R9	179	1.75	105	1.30	74	1.00
	3821, 3822	R8, R9	117	1.15	66	1.33	51	1.02
	3831, 3832	R8, R9	120	1.18	68	0.73	52	0.76
	3900	R4	76	0.74	37	7.22	39	5.91
TRADE			**5477**	**53.67**	**2819**	**37.61**	**2658**	**33.11**
	4520	R4, R5	3608	35.36	1916	9.60	1692	10.25
	4531, 4532		1013	9.93	489	7.14	524	6.38
	4677	R8, R9	690	6.76	364	0.98	326	2.27
	4779	R3	166	1.63	50	55.33	116	52.02
ADMIN			**1727**	**16.92**	**794**	**4.51**	**933**	**5.40**
	7711, 7712	R1	506	4.96	230	1.57	276	1.84
	7721, 7722, 7729	R1	174	1.71	80	9.50	94	11.02
	7731, 7732, 7733, 7734, 7735, 7739	R1	1047	10.26	484	15.58	563	18.26
OTHER			**579**	**5.67**	**185**	**1.28**	**394**	**2.66**
	9511, 9512	R4, R5, R6	201	1.97	65	2.36	136	5.05
	9521, 9522, 9523, 9524, 9525, 9529	R4, R5, R6	378	3.7	120	3.63	258	7.71
TOTAL			**10,205**	**100**	**5095**	**100**	**5110**	**100**

Circularity levels: R0 (refuse); R1 (rethink); R2 (reduce); R3 (reuse); R4 (repair); R5 (refurbish); R6 (remanufacture); R7 (repurpose); R8 (recycle); R9 (recover)

NACE codes are presented in italics. Bold values indicate the total number and percentage of companies in each subsector

are companies in the water supply, sanitation, waste management, and decontamination sectors (SUPPLY), which are at the R8 (recycle) and R9 (recover) levels. As for retail (TRADE), there is variation: Retail sale of second-hand goods in stores reaches the R3 level (reuse), maintenance and repair of motor vehicles fall at the R4 (repair) and R5 (refurbish) levels, while the least circular is the wholesale of waste and scrap, at the R8 (recycle) and R9 (recover) levels.

3.2 Regression analysis of geodemographic factors on business entry

We employed rank-based methods for our analyses because of the presence of significant skewness in many variables. This approach is particularly useful for addressing potential non-linear relationships (Barron et al., 2002). Table 3 presents the Spearman's correlation coefficients for the variables discussed earlier. The findings reveal positive correlations among the geographic and demographic variables. Negative correlations were observed between most variables associated with rural liabilities and business entry (BE). Correlation coefficients between most rural liabilities and survival time (TIME) were positive and statistically significant, but low.

Table 4 presents the results of a rank regression with business entry (BE) as the dependent variable and the geodemographic variables as independent variables. This analysis was conducted separately for samples of CE companies and non-CE companies. It compares the outcomes of the RE model (GLS), which considers individual specific effects, with those of the pooled (OLS) model, which combines

Table 3 Spearman's correlation coefficients between variables considered in this study, for CE companies. Total observations: 8680

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
BE(1)	1																		
TIME(2)	.01	1																	
POP(3)	.19***	−.07***	1																
DENS(4)	.17***	−.08***	.74***	1															
POP-CHANGE(5)	−.09***	.02	−.09***	−.07***	1														
AGE(6)	−.10***	.07***	−.17***	−.09***	.26***	1													
UR(7)	−.03***	−.03***	.11***	−.03***	−.01	−.23***	1												
DEPRIVED(8)	.14***	−.01	.14***	.37***	−.17***	.05***	−.54***	1											
ISOLATE(9)	.11***	−.07***	.34***	.55***	−.21***	−.26***	−.17***	.5***	1										
DISTCAP(10)	−.14***	.04***	−.64***	−.59***	−.01	−.01	.04***	−.06***	−.25***	1									
DIST50000(11)	−.18***	.05***	−.79***	−.7***	.04***	.04***	−.07***	−.14***	−.38***	.73***	1								
INFRA50(12)	.10***	−.07***	.32***	.56***	−.18***	−.13***	−.25***	.59***	.91***	−.26***	−.36***	1							
ALTITUDE(13)	.02	.05***	−.14***	−.24***	.04***	.06***	−.23***	.07***	.02	.13***	.16***	.08***	1						
SLOPE(14)	−.13***	.01	−.12***	−.17***	.08***	.21***	−.08***	.04***	−.2***	.19***	.14***	−.03***	−.15***	1					
EXTREME(15)	−.23***	.06***	−.54***	−.68***	.27***	.30***	.22***	−.57***	−.69***	.42***	.57***	−.65***	.19***	.19***	1				
TA(16)	.04***	.19***	−.02	−.01	−.01	−.00	−.1***	.06***	−.02	.01	.02	−.01	.02**	.03**	−.01	1			
SUB(17)	−.01	.03***	−.02	−.03***	.05***	.05***	−.00	−.03**	−.06***	−.00	.02	−.05***	.02**	.03***	.05***	.09***	1		
ETR(18)	−.01	.15***	−.07***	−.08***	.02	.02**	−.02**	−.01	−.06***	.06***	.06***	−.08***	.00	−.01	.04***	.19***	−.01	1	
PE/S(19)	.02**	−.02	.01	.01	−.02	.02**	.01	.00	.00	−.00	−.03**	−.00	−.02**	.01	−.01	−.04***	.04***	−.19***	1
ZSCORE(20)	−.02**	.13***	−.04***	−.03***	.02	.03***	−.01	−.01	−.03***	.02	.03***	−.05***	−.03***	−.01	.03***	−.01	−.01	.45***	−.23***

Significant at the 5% level, * significant at the 1% level

Table 4 Rank regression model with business entry (BE) as the dependent variable and geographic and demographic variables as independent variables. Number of municipalities: 8132. Total observations (10 years): 81,320

Variables	Circular economy				Non-circular economy			
	RE model (GLS)		Pooled (OLS)		RE model (GLS)		Pooled (OLS)	
	Coef	*z*-test	Coef	*t*-test	Coef	*z*-test	Coef	*t*-test
POP	.270	27.68***	.272	59.02***	.790	69.27***	.797	109.01***
DENS	.036	3.19***	.035	8.31***	.029	2.23**	.026	3.04***
POPCHANGE	− .009	− 1.47	− .008	− 2.72***	.068	8.64***	.090	17.58***
AGE	− .044	− 6.71***	− .048	− 13.90***	− .025	− 3.25***	− .022	− 4.52***
UR	− .004	− 0.95	− .003	− 0.01	− .019	− 3.30***	− .036	− 8.09***
BD	.029	5.72***	.045	12.69***	.084	12.97***	.095	2.33**
DISTCAP	− .059	− 7.63***	− .061	− 15.00***	− .072	− 7.97***	− .068	− 11.98***
DIST50000	− .049	− 4.90***	− .051	− 9.31***	− .022	− 1.91*	− .027	− 3.52***
INFRA50	.055	3.92***	.045	5.49***	.016	0.95	− .002	− 0.20
ALTITUDE	.019	2.61***	.022	5.44***	− .004	− 0.49	− .000	− 0.04
SLOPE	− .038	− 7.07***	− .040	− 13.74***	− .061	− 9.23***	− .064	− 15.70***
Intercept	125.82	1.25	121.34	2.22**	− 729.7	− 6.18***	− 776.42	− 10.23***
chi2/F (p value)	3908.80 (0.000)		567.86 (0.000)		22,119.01 (0.000)		7536.41 (0.000)	
R-squared	.148		.149		.408		.409	

*Significant at the 10% level, **significant at the 5% level, ***Significant at the 1% level

all observations without such considerations. The findings reveal negative relationships between rural liability and business entry (BE). Therefore, the data support hypothesis 1, suggesting that being located in a rural area hinders the establishment of CE companies. The regression model for CE business entry using geodemographic variables shows substantially lower explanatory power (R-squared = 0.15) than that for non-CE companies (R-squared = 0.41), indicating a weaker relationship between rural liability and CE establishment decisions.

3.3 Survival analysis

We utilized propensity score matching (PSM) to construct a control group, pairing rural companies with non-rural counterparts sharing similar founding conditions, to isolate the impact of location on business outcomes. In PSM, the first step involves estimating the propensity score, which represents the probability of a firm being located in a rural area, using a logistic regression model. This model incorporates variables reflecting firm characteristics relevant to rural location receptivity, such as subsidies, labor costs, firm size, financial strength, industry, and foundation date. Subsequently, nearest-neighbor matching is employed to create a control group of non-rural firms with similar propensity scores to the treated group (rural firms), ensuring balance in observable characteristics that might confound the relationship between location and outcomes. The Average Treatment on the Treated (ATT) is then calculated to estimate the causal impact of rural location on firm survival and performance. Formally, the ATT is defined as:

$$\mathrm{ATT} = E\left[Y_{1i} - Y_{0i} | T_i = 1\right],$$

where Y_{1i} and Y_{0i} represent the potential outcomes (survival and performance) for firm i under the treatment (rural location) and control (non-rural location) conditions, respectively. $\mathrm{T_i}$ is a binary treatment indicator, equal to 1 if the firm is located in a rural area when it is founded. This study adopts a cross-sectional design, where the treatment and control variables are based on the year of the firm's foundation, while outcome variables are measured 5 years after that foundation.

Table 5 presents the results of 20 logistic regression models with as many dummy dependent variables related to rurality for CE companies. The objective is to account for the propensity of CE companies

Table 5 Logistic regression results for CE companies. Number of observations: 8681

	Model1 SMALL	Model 2 LOWDENS	Model 2 DECLINED	Model 4 AGED	Model 5 UNEMPLOYED	Model 6 DEPRIVED	Model 7 ISOLATED	Model 8 REMOTE1	Model 9 REMOTE2	Model 10 LOWINFRA
lnTA	−0.033**	−0.045***	−0.017	0.012	−0.094***	−0.039***	−0.005	−0.000	0.025	−0.023
SUB	0.315	0.422**	1.023***	1.147***	0.113	0.049	0.709***	−0.012	0.262	0.561***
ETR	0.872***	1.011***	0.348	0.417***	0.009	0.237	0.769***	0.618***	0.224	0.956***
PE/S	−0.149***	−0.113**	−0.129	0.022	−0.015	−0.103**	−0.145**	−0.063	−0.083	−0.133
ZSCORE	−0.007	−0.016	0.013	−0.009	0.011	0.004	0.001	0.008	0.018	0.004
Constant	0.436**	−0.409	−2.23***	−1.308***	−1.632***	−1.521***	−1.869***	−2.290***	−3.120***	−1.696***
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Started	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	−5949.04	−5463.63	−2786.51	−5305.80	−4793.08	−4924.49	−4162.62	−3249.84	−2552.28	−4171.26
LR chi2 (*p* value)	135.13 (0.000)	116.03 (0.000)	111.66 (0.000)	1393.32 (0.000)	621.39 (0.000)	501.28 (0.000)	139.45 (0.000)	109.80 (0.000)	101.42 (0.000)	167.08 (0.000)
Pseudo *R*2	.011	.011	0.014	.075	.078	.042	.009	.009	.011	.008
	Model 11 HIGHLAND	Model 12 STEEP	Model 13 EXTREME	Model 14 DISPERSED	Model 15 VILLAGE	Model 16 RURALCLUS	Model 17 URBSEMI	Model 18 URBDENSE	Model 19 URBCENTER	Model 20 URBOTHER
lnTA	0.032	0.015	−0.024	0.070	−0.007	0.028	−0.006	0.019	0.059***	−0.051***
SUB	−0.081	−0.030	0.622***	0.989	0.081	–	0.169	−0.677	−0.472**	0.342
ETR	−0.035	−0.844***	0.948***	2.046***	0.725**	1.805***	0.177	−0.510	−1.096***	0.440**
PE/S	−0.094	0.015	−0.192***	−0.976	−0.149	0.405**	−0.060	−0.199	0.098	0.008
ZSCORE	−0.032***	0.002	−0.004	−0.061	−0.022	0.054	0.000	0.016	0.017	−0.010
Constant	−1.339***	−1.516***	−2.291	−6.941***	−2.156***	−6.102***	−1.427	−2.889***	−1.370	−0.133
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Started	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	−5350.34	−4241.99	−3905.24	−311.15	−2387.57	−431.88	−3851.45	−1688.39	−5229.60	−5790.75
LR chi2	117.92 (0.000)	99.95 (0.000)	288.69 (0.000)	33.99 (0.000)	47.84 (0.000)	24.45 (0.115)	19.70 (0.345)	22.28 (0.108)	113.72 (0.000)	68.93 (0.000)
Pseudo *R*2	.012	.006	.017	.052	.010	.028	.003	.007	.011	.006

**Significant at the 5% level, ***significant at the 1% level

to be located in rural areas. In short, companies located in rural areas tend to be smaller in size, a higher percentage of them receive subsidies, and they have a higher effective tax rate and lower personnel expenses as a percentage of sales, on average. The composite indicator of financial strength, ZSCORE, did not yield statistically significant results.

Table 6 presents the results of PSM analysis examining the impact of rural location on company survival in year 5, while accounting for factors influencing the propensity to locate in a rural area. The table displays 20 models, each representing a dummy variable for a specific rural typology. The overall findings indicate a significant positive association between rural location and survival for CE companies. Specifically, variables such as small population (SMALL), low population density (LOWDENS), aging (AGED), isolated location (ISOLATED), remoteness from provincial capital (REMOTE1), remoteness from municipalities with over 50,000 inhabitants (REMOTE2), and poor infrastructure (LOWINFRA) show statistically significant associations with survival. The composite variable for extreme rurality (EXTREME) also exhibits statistically significant positive associations with survival, suggesting that firms in challenging locations might have higher survival rates. However, there is no association between survival and population decline (DECLINED), high unemployment rate (UNEMPLOYED), low business density (DEPRIVED), high altitude (HIGHLAND), or steep slope (STEEP). Being located in a demographic desert (DISPERSED) or a village (VILLAGE) is positively associated with survival, while being located in an urban center (URBCENTER) is negatively associated. The survival of companies is not significantly associated with other types of settlements.

We conducted additional analyses by categorizing CE subsectors according to the NACE classification (Eurostat, 2017) because the CE sector is heterogeneous, encompassing diverse activities. The results in Table 6 highlight notable differences among the groups. Rural and urban-based TRADE sector companies, representing over half of our CE sample, exhibited statistically significant differences in survival rates. For the MANUF, SUPPLY, ADMIN, and OTHER subsectors, our results showed no significant differences. A covariate balance diagnostic was used to assess the reduction in confounding factor differences between the treatment and control groups after matching. The differences in means disappeared, indicating a reduction in biases. For reasons of space, these results are not presented.

Survival analysis was conducted using the Cox regression model on both the unmatched and the PSM-matched samples. The 20 models—one for each rural variable—use two dependent variables: survival time (TIME) and a binary survival indicator for the company (SURV). Table 7 presents the results. The findings reveal statistically significant positive effects for several factors for CE companies, including being located in a municipality with a population size below 50,000 (SMALL), in an area with low population density (LOWDENS), in a region with an aging population (AGED), in an isolated location (ISOLATED), in an area distant from the provincial capital (REMOTE1) or from municipalities with over 50,000 inhabitants (REMOTE2), in a region with low infrastructure levels (LOWINFRA), in a municipality with extreme rurality (EXTREME), and in a demographic desert (DISPERSED) or a village (VILLAGE). Conversely, statistically significant negative effects on company survival are observed for being located in an urban center (URBCENTER).

Table 8 presents a study that clarifies the distinctions between companies in the CE sector and those in the linear sector. Instead of using the rural/urban company variable as the treatment variable, we employed a dichotomous variable (CIRCULAR) to indicate whether a company operates within the CE sector. We defined 20 subsamples, each representing a specific rural typology (e.g., SMALL, LOWDENS). The outcomes of the treatment effect analysis were the binary survival indicator for the company (SURV) and survival time (TIME). All ATT values for survival (SURV) were statistically significant, confirming that new CE firms established in rural areas exhibit higher survival rates than non-CE companies. Therefore, the data support hypothesis 2, indicating that being established in a rural area is positively associated with the survival of a new company in the CE sector. Additionally, when the outcome variable was TIME, the analysis revealed statistically significant positive effects of being a CE company on survival in rural areas characterized by low population density, isolation, an aging population, unemployment, low infrastructure levels, and limited business dynamism. Under extreme rural conditions, CE companies survive longer than non-CE ones.

Table 6 Treatment-effects estimation using propensity score matching for CE companies and by subsector. Treatment model: logit. ATT: average treatment effects on the treated group using PSM caliper. Num. control/treated: number of matched observations in the control and treated groups. Definition of the treatment variables in Table 1. Total obs. column displays the total number of observations and the number of individuals that fall outside the range of common values shared between the treatment and control groups

Outcome: SURV	Circular economy				MANUF ($n=1752$)		SUPPLY ($n=670$)		TRADE ($n=5477$)		ADMIN ($n=1727$)		OTHER ($n=579$)	
Variables	ATT	*t*-stat	Num. treated	Total obs	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat
SMALL	.043	3.18***	4392	8681 (6 off)	.072	2.34**	.093	1.58	.043	4.04***	.054	1.59	.148	2.43**
LOWDENS	.054	3.72***	2888	8681 (17 off)	.000	0.00	.041	0.69	.067	5.87***	.075	1.98	.166	2.25**
DECLINED	−.010	−0.45	870	8681 (18 off)	−.014	−0.25	−.121	−1.04	.026	1.48	.000	0.00	−.073	−0.85
AGED	.052	3.44***	3243	8681 (7 off)	.018	0.54	.076	1.21	.059	4.97***	.043	1.12	.021	0.31
UNEMPLOYED	−.007	−0.45	2486	8681 (11 off)	.027	0.73	−.024	−0.34	.006	0.54	.021	0.48	.068	1.01
DEPRIVED	.018	1.31	4443	8681 (2 off)	.002	0.08	−.042	−0.71	.025	2.25**	−.010	−0.28	.091	1.61
ISOLATED	.066	3.82***	1634	8680 (4 off)	.012	0.29	.033	0.48	.053	3.97***	−.256	−0.60	.022	0.31
REMOTE1	.051	2.49**	1089	8681 (5 off)	.046	0.91	.016	0.20	.053	3.23***	.009	0.19	.155	1.49
REMOTE2	.068	2.82***	762	8681 (24 off)	−.036	−0.59	−.045	−0.54	.074	3.70***	.011	0.21	.171	1.59
LOWINFRA	.048	2.76***	1640	8680 (10 off)	.048	1.13	.127	1.80	.058	4.26***	.037	0.83	.022	0.29
HIGHLAND	.002	0.10	2740	8681 (2 off)	−.026	−0.73	−.088	−1.43	.031	2.73***	.041	1.00	−.060	−1.01
STEEP	.021	1.44	1681	8681 (21 off)	−.018	−0.47	.011	0.15	−.009	−0.70	−.046	−1.10	.045	0.58
EXTREME	.057	3.20***	1486	8680 (57 off)	−.050	−0.43	−.027	−0.38	.068	4.64***	.120	2.48**	.092	1.07
DISPERSED	.185	2.23**	54	8681 (213 off)	.000	0.00	−.250	−1.00	.056	0.68	.083	0.43	.250	1.00
VILLAGE	.058	2.29**	691	8681 (47 off)	−.007	−0.13	−.065	−0.68	.081	3.79***	.098	1.44	.086	0.58
RURALCLUS	.026	0.35	78	8681 (553 off)	.100	0.61	.000	0.00	−.025	−0.40	−.125	−1.00	.500	1.00
URBSEMI	.018	0.94	1416	8681 (9 off)	.017	0.43	.075	0.92	.032	2.07**	−.009	−0.20	−.073	−0.87
URBDENSE	−.028	−0.84	426	8681 (25 off)	.022	0.34	−.143	−1.12	−.061	−2.26**	−.094	−1.03	.125	0.93
URBCENTER	−.057	−3.83***	2585	8681 (12 off)	−.025	−0.74	.000	0.00	−.026	−2.26**	.002	0.06	−.087	−1.60
URBOTHER	.020	1.45	3431	8681 (15 off)	−.013	−0.41	.011	0.19	.028	2.65***	.011	0.31	−.061	−1.03

**Significant at the 5% level; ***significant at the 1% level

Table 7 Cox regression estimators using the total sample (unmatched) and the matched sample applying the PSM caliper method for CE companies. Dependent variables: TIME and SURV. Control variables: LnTA, SUB, ETR, PE/S, ZSCORE, INDUSTRY, STARTED. The *z*-statistics are calculated using the bootstrap method, with firm as the clustering variable. LR chi2: likelihood ratio chi-squared statistic

Treatment variables	Circular economy							
	Unmatched				Matched PSM1:1			
	Coef	*z*-stat	LR chi2	*N*. obs	Coef	*z*-stat	LR chi2	*N*. obs
SMALL	−.147	−4.53***	455.27***	8681	−.185	−4.12***	271.51***	4644
LOWDENS	−.218	−5.70***	467.71***	8681	−.225	−4.37***	216.52***	4163
DECLINED	−.047	−0.81	441.25***	8681	.028	0.40	119.53***	3209
AGED	−.215	−5.93***	466.53***	8681	−.169	−3.16***	222.66***	3945
UNEMPLOYED	.109	2.56**	446.90***	8681	.067	1.18	177.72***	3503
DEPRIVED	−.004	−0.09	442.69***	8681	.022	0.38	237.49***	3617
ISOLATED	−.237	−5.36***	460.45***	8680	−.252	−3.74***	194.26***	2834
REMOTE1	−.162	−2.58***	447.88***	8681	−.149	−1.90	104.50***	2001
REMOTE2	−.185	−2.91***	447.36***	8681	−.258	−3.28***	89.73***	1447
LOWINFRA	−.202	−4.35***	455.04***	8680	−.195	−2.71***	146.62***	2856
HIGHLAND	−.063	−1.48	442.99***	8681	−.048	−1.11	175.10***	4075
STEEP	.056	1.18	442.09***	8681	.035	0.60	160.80***	2882
EXTREME	−.284	−5.89***	466.69***	8680	−.263	−3.41***	130.99***	2625
DISPERSED	−.617	−1.65	444.95***	8681	−.973	−2.00**	33.94***	108
VILLAGE	−.213	−2.75***	448.76***	8681	−.256	−2.68***	86.50***	1311
RURALCLUSTER	−.063	−0.28	440.82***	8681	−.175	−0.44	32.70**	155
URBSEMI	−.023	−0.45	440.92***	8681	−.041	−0.68	131.32***	2547
URBDENSE	.505	2.63***	446.51***	8681	.134	1.15	55.55***	831
URBCENTER	.154	4.37***	454.53***	8681	.164	3.49***	179.64***	3958
URBOTHER	−.093	−2.31**	446.34***	8681	−.046	−0.78	226.59***	4508
Control variables	Yes				Yes			

**Significant at the 5% level, ***significant at the 1% level

Therefore, the data support hypothesis 2, indicating that being established in a rural area is positively associated with the survival of a new company in the CE sector. Additionally, new CE companies in rural areas exhibit higher survival rates than non-CE companies.

3.4 Analysis of financial performance

Table 9 presents the results for the impact of being located in a rural area on financial performance for CE companies, while accounting for factors influencing the propensity to be located in such an area (subsidies, labor costs, firm size, financial strength, industry, and foundation date). The analysis considered economic profitability (ROA), profit in the fifth year (PROFIT), and changes in total assets (ΔTA), sales (ΔSALES), and operating income (ΔEBIT). Overall, CE companies established in rural municipalities showed lower growth rates in terms of size and sales, but no differences in profit growth. They exhibited lower levels of value-added creation (VA) and lower personnel expenses (PE) than their urban counterparts. No significant effects were observed for tax payments (TAX), financial expenses (IE), and the value for other stakeholders (OTH). A covariate balance test was conducted, finding that the differences in means disappeared, and a reduction in biases was observed.

Table 10 shows differences in firm growth and financial performance variables between CE and non-CE companies in rural areas. The treatment variable was a dichotomous CE/non-CE indicator used to distinguish between companies that belong

Table 8 Treatment-effects estimation using propensity score matching for rural companies. Treatment variable CIRCULAR. ATT: average treatment effects on the treated using PSM caliper. Cox regression estimators using the matched sample applying the PSM caliper method. Dependent variables: TIME and SURV. Control variables: LnTA, SUB, ETR, PE/S, ZSCORE, INDUSTRY, STARTED. The *z*-statistics were calculated using the bootstrap method, with firm as the clustering variable. LR chi2: likelihood ratio chi-squared statistic. Definition of rurality variables in Table 1

Subsamples	Matched PSM 1:1 outcome: SURV			Cox regression matched PSM1:1 outcome: TIME			
	ATT	*t*-stat	Num. treated	Coef	*z*-stat	LR chi2	Num. Obs
SMALL	.043	5.55***	1193	−.129	−1.34	87.42***	1596
LOWDENS	.043	4.72***	3602	−.167	−3.36***	263.11***	5516
DECLINED	0.39	4.91***	1136	−.113	−1.27	119.13***	1653
AGED	.025	2.66***	4041	−.193	−4.47***	333.38***	6164
UNEMPLOYED	.048	5.44***	3126	−.147	−3.01***	218.17***	4689
DEPRIVED	.025	2.38**	5578	−.126	−3.31***	375.74***	8454
ISOLATED	.038	4.54***	2059	−.183	−2.70***	147.45***	3126
REMOTE1	.042	5.38***	1365	−.155	−1.89	112.58***	2063
REMOTE2	.046	6.01***	963	−.108	−1.08	79.09***	1437
LOWINFRA	.043	5.17***	2063	−.253	−3.85***	202.62***	3135
HIGHLAND	.029	3.23***	3449	−.186	−3.86***	254.27***	5216
STEEP	.047	5.70***	2122	.000	0.02	170.38***	3188
EXTREME	.043	5.34***	1721	−.154	−2.02**	96.75***	2578
DISPERSED	.052	7.04***	70	−.151	−0.30	21.93	97
VILLAGE	.039	5.10***	912	−.386	−3.80***	92.27***	1323
RURALCLUS	.038	5.14***	100	−.024	−0.08	20.06	149
URBSEMI	.051	6.38***	1773	−.126	−1.83	150.27***	2674
URBDENSE	.029	3.90***	499	−.078	−0.68	63.40***	809
URBCENTER	.044	5.08***	3223	−.081	−1.68	184.78***	4857
URBOTHER	.034	3.59***	4221	−.143	−3.28***	342.66***	6590

**Significant at the 5% level; ***significant at the 1% level

to the CE sector and those that do not. The results showed slower growth and superior financial performance for CE companies established in rural areas than for non-CE ones. Despite their slower growth, it is noteworthy that CE companies ultimately generate greater economic value than non-CE firms. However, it should be noted that most ATT values were not statistically significant, which limits the extent to which definitive conclusions can be drawn from these findings.

The data support hypothesis 3a: Rural conditions negatively correlate with growth, economic value creation, and value distribution to stakeholders in nascent CE companies. These firms in rural areas underperform non-CE counterparts in terms of growth. CE enterprises in rural municipalities exhibited higher profitability by the fifth year, with a greater proportion achieving profitability, suggesting slower but more stable growth. This higher profitability of rural CE firms compared to non-CE entities also supports hypothesis 3b.

4 Discussion

Global rural population growth rates experienced a decline for the first time in 2021 (World Bank, 2023). Many countries are grappling with the serious issue of rural depopulation, and promoting rural entrepreneurship may seem like a solution to the problem. Regrettably, our results confirm that even for a sector such as the CE in which entrepreneurs may be inclined to settle in rural areas, it is a major challenge to do so. The factors associated with rurality, as identified by Clausen (2020), deter the establishment of CE businesses, thereby confirming the liability of rurality and supporting theories of urban agglomeration (Rosenthal & Strange, 2004). However, our findings suggest that CE companies experience a less pronounced liability of rurality than their non-CE counterparts. In fact, the degree of fit of the regression model that explains business entry based on geodemographic variables is much lower in the sample of CE companies (R-squared = 0.15) than in the sample of other companies (R-squared = 0.41). Rural

Table 9 Treatment-effects estimation using propensity score matching for CE companies. Control variables: LnTA, SUB, ETR, PE/S, ZSCORE, INDUSTRY, STARTED. Treatment model: logit. ATT: average treatment effects on the treated using PSM caliper. Definition of the treatment variables in Table 1

Outcomes	ΔTA		ΔSALES		ΔEBIT		PROFIT		ROA		VA		PE		TAX		IE		OTH	
Treatment variables	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat
SMALL	−.051	−0.46	−.224	−1.39	.140	0.74	.035	2.16**	.015	1.48	−.107	−2.08**	−.113	−2.49**	−.155	−1.90	−.07	−0.78	.011	0.16
LOWDENS	−.607	−2.19**	−.508	−2.96***	.331	1.60	.057	3.35***	.025	2.33**	−.122	−2.25**	−.207	−4.42***	−.141	−1.61	.051	0.39	−.160	−2.16**
DECLINED	−.269	−1.23	−.267	−0.99	−.219	−0.64	−.005	−0.18	.004	0.24	−.094	−1.13	−.167	−2.69***	−.122	−0.85	.054	0.26	−.161	−1.48
AGED	−.544	−3.67***	−.264	−1.46	−.225	−1.04	.008	0.46	.236	2.15**	−.147	−2.64***	−.174	−3.40***	.344	2.25**	−.117	−1.26	−.138	−1.78
UNEMPLOYED	.313	1.97**	.173	0.88	.050	0.21	.052	2.70***	.013	1.07	.099	1.63	.081	1.53	.166	1.08	.069	0.65	.009	0.12
DEPRIVED	.255	1.67	.039	0.20	.697	3.09***	.047	2.53**	.026	2.34**	−.011	−0.19	−.057	−1.11	.012	0.08	−.154	−1.54	.075	0.97
ISOLATED	−.389	−2.34**	.561	−2.76***	.367	1.46	.007	0.36	.001	0.11	−.308	−4.78***	−.353	−6.34***	.367	2.18**	−.255	−2.22**	−.066	−0.78
REMOTE1	−.370	−1.94	−.786	−3.19***	−.213	−0.72	.011	0.47	−.006	−0.41	−.178	−2.49**	−.213	−3.07***	−.131	−0.66	−.306	−2.25**	−.096	−0.96
REMOTE2	−.667	−2.85***	−.403	−1.46	−.437	−1.29	.023	0.80	.000	0.02	−.243	−2.65***	−.178	−2.22**	.199	0.85	−.317	−2.00**	−.083	−0.70
LOWINFRA	−.229	−1.39	−.309	−1.52	−.056	−0.22	.039	1.89	.016	1.28	−.276	−4.32***	−.274	−4.66***	.294	1.74	−.211	−1.90	−.145	−1.69
HIGHLAND	−.010	−0.07	−.049	−0.28	−.010	−0.05	−.025	−1.38	−.034	−3.10***	−.009	−0.17	−.006	−0.13	−.114	−0.80	−.042	−0.44	.011	0.14
STEEP	−.216	−1.28	−.408	−1.92	.516	2.02**	−.012	−0.58	−.016	−1.25	−.056	−0.86	−.048	−0.84	−.076	−0.46	.006	0.05	−.063	−0.67
EXTREME	−.478	−2.74***	−.552	−2.64***	−.098	−0.38	.013	0.64	.006	0.48	−.260	−3.98***	−.289	−4.81***	.403	2.28**	−.098	−0.85	−.095	−1.13
DISPERSED	−.645	−0.86	−1.451	−1.72	.295	0.26	−.067	−0.72	−.037	−0.79	−.159	−0.44	−.332	−1.16	−.162	−0.19	−.138	−0.23	.058	0.13
VILLAGE	−.042	−0.18	.070	0.23	.018	0.05	.061	2.05**	.012	0.75	−.039	−0.46	−.019	−0.24	.589	2.40**	.012	0.07	.158	1.31
RURAL-CLUS	−1.426	−2.07**	−.110	−0.14	1.049	1.14	.054	0.63	.029	0.62	−.146	−0.56	−.119	−0.62	.088	0.12	−.815	−1.67	−.016	−0.05
URBSEMI	.054	0.29	−.026	−0.12	.148	0.55	.007	0.32	.008	0.62	.031	0.44	−.031	−0.53	−.111	−0.62	.139	1.20	.021	0.22
URBDENSE	−.483	−1.58	−.348	−0.96	−.252	−0.50	−.015	−0.37	−.007	−0.28	−.139	−1.11	−.011	−0.09	−.342	−1.07	.022	0.11	−.216	−1.31
URB-CENTER	.207	1.37	.321	1.71	−.275	−1.26	−.051	−2.70***	−.028	−2.38**	.171	2.93***	.196	3.73***	−.333	−2.31**	.191	1.88	.146	1.87
URBOTHER	−.142	1.06	−.322	−1.93	.124	0.62	.036	2.14**	.025	2.44**	−.096	−1.88	−.135	−2.92***	.179	1.35	−.077	−0.82	−.145	−2.04**

**Significant at the 5% level, ***significant at the 1% level

Table 10 Treatment-effects estimation using propensity score matching for rural companies. Treatment variable: CIRCULAR. Control variables: LnTA, SUB, ETR, PE/S, ZSCORE, INDUSTRY, STARTED. Treatment model: logit. ATT: average treatment effects on the treated using PSM caliper. Definition of rurality variables in Table 1

Outcomes	ΔTA		ΔSALES		ΔEBIT		PROFIT		ROA		VA		PE		TAX		IE		OTH	
Subsamples	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat	ATT	*t*-stat
SMALL	−.051	−2.28**	−.518	−2.95***	1.267	0.90	.031	2.61***	.006	0.95	.098	2.55**	.135	1.70	−.007	−0.12	.017	0.27	−.027	−0.55
LOWDENS	−.352	−1.29	−.437	−2.07**	−.997	−0.68	.0101	0.72	.020	2.16**	.066	1.41	.056	1.31	−.007	−0.11	−.164	−2.06**	−.032	−0.55
DECLINED	−.165	−0.35	−.498	−1.34	−2.67	−0.85	.034	1.23	.004	0.27	.128	1.10	.042	0.55	−.034	−0.25	−.075	−0.51	−.078	−0.70
AGED	−.621	−2.53**	−.359	−1.79	.766	0.52	.035	2.54**	.018	2.30**	.0168	3.42***	.087	2.19**	.076	1.10	−.068	−0.92	.037	0.64
UNEM-PLOYED	−.672	−1.93	−.788	−3.14***	.084	0.49	.016	0.96	−.004	−0.41	.165	3.17***	.096	2.00**	−.011	−1.49	−.099	−1.13	−.022	−0.33
DEPRIVED	−.050	−0.21	−.236	−1.32	.733	0.53	.020	1.69	.012	1.61	.062	1.56	.031	0.90	−.053	−0.88	−.029	−0.45	−.017	−0.35
ISOLATED	−.499	−1.39	−.473	−1.78	4.81	2.48**	.033	1.75	.011	0.94	.146	2.33**	.027	0.48	.069	0.74	−.018	−0.17	.001	0.01
REMOTE1	−.110	−0.27	−.213	−0.67	−.222	−0.11	.028	1.16	.006	0.39	.125	1.29	.046	0.65	−.096	−0.81	−.199	−1.51	.099	1.02
REMOTE2	−.337	−0.65	−.513	−1.36	2.47	0.74	.046	1.60	−.000	−0.02	.101	1.10	−.057	−0.67	.027	0.20	−.024	−0.15	.042	0.37
LOWINFRA	−.196	−0.59	−.468	−1.77	−1.69	−0.89	.026	1.36	−.006	−0.64	.074	1.21	.048	0.84	.023	0.25	−.193	−1.84	.097	1.24
HIGHLAND	−.669	−2.04**	−.628	−2.69***	1.81	1.05	.006	0.41	−.007	−0.72	.052	0.88	.111	2.38**	−.106	−1.30	−.229	−2.58***	−.105	−1.53
STEEP	−.449	−1.30	−1.05	−3.61***	1.52	0.74	−.004	−0.21	−.027	−2.14**	.056	0.84	−.036	−0.59	−.162	−1.50	−.069	−0.63	−.056	−0.64
EXTREME	−.601	−1.52	−.439	−1.51	−.863	0.38	.006	0.32	.002	0.13	.010	0.16	.006	0.10	.098	0.99	−.0163	−1.46	−.126	−1.50
DISPERSED	−.214	−0.18	−1.28	−1.05	−8.12	−1.26	.080	0.76	.033	0.57	−.048	−0.13	.535	1.56	−.303	−0.67	−.762	−1.62	.243	0.64
VILLAGE	.283	0.50	.990	2.3***	−2.64	−0.77	.050	1.76	.005	0.38	.056	0.63	.142	1.68	.012	0.09	−.019	−0.12	.169	1.52
RURAL-CLUS	−1.81	−1.97**	−.593	−0.48	−1.73	−0.14	.033	0.38	.087	1.69	−.407	−1.41	−.399	−1.74	−.197	−0.49	−.446	−0.79	−.248	−0.70
URBSEMI	−.136	−0.34	−.208	−0.67	.957	0.33	.017	0.80	.020	1.49	.180	2.63***	.034	0.58	.010	0.10	.048	0.43	.066	0.74
URBDENSE	−1.13	−2.07**	−.482	−0.87	−1.96	−0.52	.027	0.68	.016	0.66	.056	0.48	−.083	−0.71	−.137	−0.68	−.017	−0.08	−.274	−1.51
URB-CENTER	−.555	−1.62	−.296	−1.17	.145	0.08	.022	1.32	.002	0.14	.161	2.78***	.095	1.81	−.115	−1.25	−.004	−0.05	.092	1.18
URBOTHER	−.266	−1.00	−.567	−2.90***	1.79	1.27	.009	0.70	.008	1.02	.070	1.59	.052	1.30	.008	0.12	−.188	−2.52**	.015	0.27

**Significant at the 5% level; ***significant at the 1% level

conditions, such as remoteness, low population density, and aging demographics, are less significant in explaining business entry for CE companies than for non-CE ones.

One explanation can be derived from the theory of resource dependence (Pfeffer & Salancik, 1978), which emphasizes the importance of external resources such as inputs, capital, production factors, and human resources. CE sector companies often have a greater reliance on the natural resources available in rural environments, which compensates for deficiencies in other resources such as qualified human capital, which is essential for high-tech sector companies. In contrast, CE companies may not require employees to be so highly qualified and may prioritize cost-effective personnel, as found outside urban conglomerates.

Our study reveals that CE companies in rural areas have higher survival rates than their urban counterparts, aligning with prior research (Perramon et al., 2024) and findings across other sectors (Huiban, 2011; van Leuven et al., 2023). Perramon et al. (2024) concluded that adopting circular business models enhances organizational resilience. However, while their study relied on manager surveys, ours utilizes financial data to compare survival rates between CE and linear companies, offering a complementary perspective. Theoretical arguments suggest that rural location indicators, associated with the liability of rurality, affect CE ventures differently than traditional linear enterprises in terms of natural resource access, community attitudes toward sustainability, and logistical advantages. Existing literature supports this perspective, highlighting the unique challenges and opportunities rural settings present for CE initiatives (Alonso & Pozas, 2024; Cherrington et al., 2024; Mukherjee et al., 2023).

Significant differences in survival were observed for all geodemographic variables except municipality slope, population variation, and business density. Although firm size positively influences survival (Fuertes-Callén et al., 2022), rural companies tend to be smaller. Financial strength did not significantly differ between rural and urban companies at the time they were founded. However, rural companies benefit from higher subsidies, which provide vital financial resources during critical periods (Karhunen & Huovari, 2015) and give positive signals to the market, partners, and funders (Li et al., 2019). Although rural companies receive more subsidies than urban ones, the effective tax rate remains higher. Public aid mainly appears through subsidies, but this does not translate into lower tax payments. Furthermore, the presence of low labor costs, which can be attributed to factors such as the higher cost of living in urban areas (Dijkstra et al., 2013), reinforces the competitive advantage of rural areas. Notably, the positive relationship between rural location and survival persisted even when controlling for these factors. Therefore, the higher survival rates of CE enterprises in rural areas cannot be attributed solely to subsidies, personnel costs, and founding conditions. There must be other causes.

Two categories of explanatory causes can be identified: the internal characteristics of the entrepreneur and external circumstances. In terms of internal characteristics, rural entrepreneurs may exhibit greater resilience because they regularly face unique challenges such as limited resources and geographic isolation (Shields, 2005). Strong social capital in rural communities, compared to urban areas, gives rural firms resilience against challenges (Brewton et al., 2010). In regard to external circumstances, the scarcity of economic opportunities in rural areas results in lower opportunity costs for entrepreneurs (Huiban, 2011). The limited alternative options in the event of bankruptcy influence entrepreneurs' decision-making, as suggested by the entrepreneurial opportunity theory (McMullen et al., 2007), providing an incentive to resist. Our study seems to confirm that stronger geodemographic constraints against finding alternative ventures lead to lower opportunity costs for entrepreneurs and subsequently higher survival rates.

Our subsectoral analysis revealed that companies in wholesale, retail trade, and motor vehicle repair—representing over half of our CE sample—exhibited statistically significant differences in survival rates. However, no significant differences were observed in the remaining subsectors. In rural areas, CE companies within this subsector may have more affordable and abundant access to materials like second-hand vehicles or used parts, due to lower competition and reduced operational costs compared to urban areas. This may be the case for the trade of scrap and spare parts, where operating costs could be lower and competition less intense in rural settings, potentially facilitating business survival. Rural areas may also

develop a specialization in certain types of repairs or parts trade due to specific local demand or the absence of alternatives. This specialized niche could strengthen the competitive position of these businesses in rural areas.

We found that CE sector companies created in rural areas grow at a slower pace than urban ones and, consequently, create less economic value. However, their growth is more solid, and they even achieve higher profitability within 5 years of their foundation. This fact can be explained by the relationship between early rapid growth and a lack of growth persistence (Choi et al., 2017). Companies with high early growth may face financial problems, increase their costs, take greater risks, and worsen the quality of their decisions (Coad et al., 2020). In contrast, CE companies thriving in rural environments can be likened to trees that grow in challenging conditions, developing deep roots to survive in difficult terrain. Consequently, these companies adopt sustainable growth practices that may be slower but enable them to withstand market fluctuations better and that enhance their long-term prospects. The slower growth observed in rural CE companies might also be explained by the liability of newness (Stinchcombe, 1965). This concept suggests that young firms face financial difficulties during a rapid expansion. By growing more slowly, rural CE companies may reduce these challenges, potentially contributing to their higher profitability. We can conclude that the liability of rurality highlighted by Clausen (2020) primarily affects business creation rather than its survival or performance. In fact, one could argue for the "advantage of rurality" in the CE case. The theoretical implications of our work can contribute to establishing the foundations of a theory of rural resilience, characterized by increased subsidies, lower personnel costs, reduced risk-taking, heightened resilience among rural entrepreneurs in the face of adversity, and limited alternatives to bankruptcy.

Current research on the location of businesses in rural areas primarily focuses on their survival and financial performance (Basile et al., 2017; Huiban, 2011; Lavesson, 2018; Stearns et al., 1995; van Leuven et al., 2023). In addition to these aspects, our study contributes by examining the impact of rural location on stakeholders. Overall, our analysis reveals that CE companies located in rural areas generate less economic value and have lower personnel costs than CE companies located in urban areas. The main cause of the former can be attributed to their lower growth rates. As for the latter, the rural business sector is characterized by a lower personnel expense ratio, which refers to the ratio of personnel expenses to sales, potentially due to the relatively lower wages in rural areas. Nevertheless, rural CE companies, despite experiencing slower growth, ultimately generate greater economic value than rural non-CE companies. However, the lack of statistical significance in most ATT values limits the robustness of these conclusions.

4.1 Practical implications

The findings of this study have significant implications for entrepreneurs, venture capital investors, and public administrators. Entrepreneurship plays a vital role in fostering sustainable development in rural communities (Johnstone & Lionais, 2004). For entrepreneurs in the sector, understanding the factors that determine survival is decisive, as it enhances their chances of success. Venture capital investors stand to benefit from the knowledge that geographic and demographic constraints contribute to the resilience of rural entrepreneurs, leading to higher survival rates and fostering long-term financial performance through a focus on sustainable growth rather than abrupt expansion. In the case of public administrators, we found a positive correlation between entrepreneurship subsidies and both survival and sustainable growth (i.e., lower growth but with higher profits). This fact underscores the value of subsidies as a solution to address rural depopulation challenges. Public administrators can leverage these findings to design targeted policies and initiatives that promote entrepreneurship in rural areas, supporting economic growth, job creation, and the overall well-being of rural communities. One of the CE subsectors that adapt best to rural conditions is the wholesale, retail trade, and repair of motor vehicles.

4.2 Limitations of the study and future lines of research

The strength of our analysis lies in the comprehensive financial data collected from all CE sector companies established in Spain over 10 years. However, non-financial information was not available. In Spain,

all companies must submit annual accounts to the Spanish Commercial Registry, following a standardized accounting plan. While microenterprises provide simplified accounts, all relevant items for our study (e.g., sales, assets, profit, and personnel expenses) were included. This standardization ensures comparability of financial ratios across firm sizes, thus reducing sampling bias concerns. Additionally, the SABI database retains information on companies even after bankruptcy, mitigating survival bias—a common issue in entrepreneurship studies (Johnson et al., 2006). Additionally, potential headquarter bias warrants consideration (Hjaltadóttir et al., 2020). This bias could lead to skewed comparisons between cities, in which headquarters tend to be concentrated, and rural regions. However, as the majority of our sample comprises microenterprises with single establishments, the anticipated bias is likely to be minimal. Future research could benefit from expanding the scope to include other sectors and countries, as well as incorporating non-financial information, such as data on entrepreneurs.

Recent literature on circularity metrics highlights the diverse range of measures and the need for standardization (Shevchenko et al., 2024). We used the NACE classification (Eurostat, 2017) to identify CE sector companies, but this approach has limitations (Reich et al., 2023). NACE codes, while aiding reproducibility, may overlook CE companies engaged in higher R-strategies like refurbishing, repairing, and reusing, which do not fit neatly within sectoral classifications. Alternative methodologies have been proposed (Reich et al., 2023; Sileryte et al., 2022). For instance, Henry et al. (2020) categorized 128 companies into five distinct circular business models: design-based, waste-based, platform-based, service-based, and nature-based. Although our sample includes 10,205 companies, it lacks details on specific business models or circularity strategies, meaning some CE companies might not be captured by NACE codes. Future research should explore alternative methods and criteria to fully capture CE activities and examine the relationship between circularity and firm survival and performance.

Legal forms of businesses may differ significantly between rural and urban settings, potentially with a higher prevalence of cooperatives in rural areas and more private limited firms in urban areas. While our study did not analyze the legal form of businesses, there has been much debate on whether the legal form of cooperatives affects resilience, with results varying depending on the context. For instance, cooperatives demonstrated greater resilience during the COVID-19 crisis (Billiet et al., 2021). Future research could explore the impact of business legal forms on resilience, sustainability practices, access to finance, and economic outcomes across rural and urban contexts. Such investigations could enhance the understanding of business ecosystem dynamics in diverse geographical settings and offer policymakers valuable insights into supporting business development, particularly in the context of CE initiatives.

5 Conclusions

This study explored the impact of rural location on business entry, survival, financial performance, and stakeholder returns within the CE sector. The study analyzed a sample of 10,205 CE companies established in Spain between 2008 and 2017 using 5 years of accounting data, covering the period up to 2021. We analyzed various demographic and geographic variables associated with rural conditions, including population size, density, population variation, unemployment rate, surrounding population, distance to urban centers, aging, business density, infrastructure, municipality altitude, and topographic slope.

We found that while rural conditions hinder business establishment, their impact is less significant for CE companies than for non-CE firms. However, rural conditions also limit entrepreneurs' alternatives in case of failure, leading to lower bankruptcy rates in rural than in urban areas. We found that new CE companies, particularly in wholesale, retail trade, and motor vehicle repair, show higher survival rates than non-CE companies. This relationship holds true even when controlling for founding conditions, such as subsidies and personnel costs. Furthermore, although CE ventures in rural areas experience slower growth than their urban counterparts and generate less economic value for their stakeholders, their growth can be considered more stable as it is characterized by higher profitability. This pattern of slow but sustainable growth, leading to better long-term financial performance and increased survival rates, has been noted in other contexts (Choi et al., 2017; Coad et al., 2020). The slower growth of these companies could

be attributed to their focus on sustainable practices, which often prioritize long-term stability over rapid expansion. Thus, nascent CE firms in rural areas demonstrate sustainability through both their circular activities and financial performance. Rural CE companies may benefit doubly from the resilience associated with rural entrepreneurs (Huiban, 2011; Shields, 2005) and the inherent resilience of circular companies (Perramon et al., 2024).

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Data Availability Data available upon request.

Declarations

Conflict of interest The authors have no conflict of interest to declare.

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