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Subsidies and financial performance in the rural tourism sector

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ABSTRACT

In 2023, the World Tourism Organisation stated that rural tourism in member states faces the challenge of improving rural infrastructure, overcoming depopulation and seasonality, and enhancing competitiveness, while providing the necessary knowledge for rural development. Rural tourism receives international, national, and local subsidies, as it is an essential sector for sustainable development and the implementation of the SDGs of the 2030 Agenda. Moreover, it contributes to reducing rural depopulation and provides complementary income to the primary sector. This research assesses the sector's financial performance and the relationship between subsidies and said performance. The data used in the study were obtained from the SABI - Bureau van Dijk database and correspond to the period 2018–2022. A set of robust financial ratios was derived using compositional data analysis as representative indicators of the companies' financial performance. The importance of subsidies was examined through regression models. Although it is not uniform across all ratios, companies that received subsidies exceeding 25 % of their total

assets show higher turnover, a more tangible asset structure, and longer debt maturity. These factors support the sector's financial health and, in turn, firm survival.

KEYWORDS
CoDa, log-ratios, margin, turnover, leverage, ROE, SABI

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1. Introduction

Rural tourism was born in Spain in the middle of the last century, as an activity that supports the agricultural sector. At that time the government already aided this activity through the Ministry of Agriculture and the Ministry of Information and Tourism to avoid the depopulation of rural areas (Cànoves *et al*., 2004). Subsequently, with tourism planning, the autonomous communities have competences in tourism management, and specifically in the management of rural tourism, and this sector is growing at different rates throughout Spain.

The rural tourism sector receives international, national and local subsidies to ensure firm survival (Galluzzo, 2021), as it is an essential sector for sustainable development and the implementation of the Sustainable Development Goals (SDGs) of the 2030 Agenda (Barba Bayas & Morales Noriega, 2019). Furthermore, it helps to reduce rural depopulation and also helps the primary sector get better profitability (Cànoves *et al.,* 2004).

Subsidies to the sector have been present from 1962 to the present day, specifically from the "Vacaciones en casas de Labranza" (Spain) grants to the current Next Generation Funds of the European Union (EU), through various subsidies, such as the CAP (Common Agricultural Policy), LEADER (Liaison Entre Actions de Développement de l'Économie Rurale), INTERREG Europe (Programme for Interregional Cooperation) and PRODER (Operational Programme for the Development and Economic Diversification of Rural Areas in the Regions).

Since the beginning of the integration of the EU, the CAP, created in 1962, until the current CAP 2023-2027, continues to promote the agricultural and rural tourism sector, with subsidies derived from the EU policy. On the other hand, the LEADER programme created by the EU in 1989, provides subsidies from the European Agricultural Fund for Rural Development (EAFRD), to rehabilitate buildings and digitalise these businesses (Abellán, 2003), which are extended with subsidies from the European Regional Development Fund (ERDF) and the European Social Fund (ESF).

Regarding the INTERREG Europe programme of 1990, there are also EU subsidies to

reduce the differences between the regions of Europe, which go to local, regional and national governments throughout Europe. Since 2014, new cross-border cooperation programmes have appeared that help to promote sustainable tourism with sustainable economic development criteria, such as the INTERREG Euro-MED programmes, which encourage cooperation across the borders of the Mediterranean. Specifically, the INTERREG POCTEFA is a programme that promotes the sustainable development of the border territory between Spain, France and Andorra. The aim of the INTERREG SUDOE programme is to preserve the natural capital of south-west Europe and its adaptation to climate change, as well as to strengthen social cohesion and territorial and demographic balance.

From 1996 to 2006, the PRODER programme aims to develop the rural environment, by strengthening and diversifying its economy, maintaining the population, increasing the income and social welfare of the inhabitants, as well as preserving space and natural resources.

In short, all the grants highlight the strategic importance of the rural tourism sector and indicate that the subsidies granted contribute to the survival of firms in the sector.

The aim of this research is to assess the sector's financial performance and its relationship with subsidies. The research evaluates subsidies derived from public policies, used to reduce the “Spain of poverty” by means of rural tourism, in order to favour the primary sector and the GDP of the rural areas. Therefore, the study is relevant to assess the usefulness of public administration subsidies that support the rural tourism sector.

Conceptually, subsidies may affect firms through (i) investment additionality and balance-sheet reallocation toward non-current assets, (ii) maturity matching in financing long-lived investments, and (iii) the alleviation of financing constraints, with potentially ambiguous short-run effects on operating performance.

The article analyses the financial performance of the sector, according to the subsidies received, the size and age of the companies in the sample under study and various financial indicators. Performance is measured as the companies’ short-term solvency, debt maturity, margin, turnover, and asset tangibility using the Compositional Data (CoDa) methodology (Coenders & Arimany-Serrat, 2025a), to achieve statistically reliable results and to make better financial decisions possible.

Building on this conceptual framing, we state research questions and hypotheses for five CoDa log-ratio dimensions linking subsidy intensity to operating activity, profitability, short-term solvency, asset tangibility, and debt maturity. The empirical analysis estimates associations consistent (or not) with these expectations.

After the introduction, the literature review is presented, followed by the methodological part, in order to highlight the results obtained, and, finally, to discuss the research strengths and weaknesses and draw conclusions.

2. Theoretical framework

The theoretical framework of this study is based on the characterisation of the rural

tourism sector, followed by a detailed review of the academic literature on this sector of activity, with emphasis on official subsidies, the firms' financial health, and actions to exploit their potential and ensure their survival. It should be borne in mind that in the Spanish case, the rural tourism sector is growing, with differences according to the autonomous communities.

The theoretical framework and literature review argue for the need to support rural tourism, with different subsidies to address rehabilitation, digitisation and the fulfilment of environmental, social and governance (ESG) criteria according to established standards, for the continuity of a sector that promotes agriculture and the repopulation of rural areas.

2.1. Relevance of the rural tourism sector

The World Tourism Organisation (UNWTO) in 2023 asserts that the situation of rural tourism in member states has the challenge of improving the infrastructures of rural areas, to overcome rural depopulation, reduce seasonality, and improve the competitiveness of the rural sector, providing the necessary knowledge for rural development (Hitchins *et al.*, 2005).

Other important challenges for the rural tourism sector are focused on accessing funding to rehabilitate property and innovate in this sector, striving to conserve the natural resources of rural areas and advancing in digitisation (Chengcai *et al*., 2024; Wibisono *et al*., 2024). Therefore, it is a typology of tourism with potential to promote the SDGs. With regard to this boost, the UNWTO highlights the potential of rural tourism to contribute to SDG 8 (decent work and economic growth) and SDG 1 (no poverty). The indicators of rural tourism market penetration and frequency are growing by 2024 and the diversity of experiences in rural tourism makes it easier to receive visitors at different times of the year, attracting visitors to agricultural, cultural, gastronomic, and wine tourism activities, among others (Dudziak *et al.*, 2017; Vysochan *et al*., 2022; Wartini *et al*., 2022; Stanciu *et al*., 2023).

Rural tourism is a growing sector that affects the local population, local suppliers, local authorities and in general the whole geographical area where the rural tourism activity takes place, as it involves local development, preserves traditions, respects the environment, preserves agriculture and offers tourists an experience that provides well-being (Tu & Long, 2017; Van der Ploeg *et al*., 2017; Giaccio *et al*., 2018; Liu *et al*., 2020).

The development of rural tourism has become one of the main forces to promote rural reconstruction (Tu & Long, 2017; Shen *et al*., 2019). There are different types of rural tourism, such as ecotourism, nature tourism, adventure tourism, agro-tourism, gastronomic tourism and educational tourism, among others, and several studies point out the projection of these types of tourism (Dudziak *et al*., 2017; Siddiqui *et al*., 2021; Wartini *et al*., 2022; Vysochan *et al*., 2022; Stanciu *et al*., 2023).

It is therefore a growing sector, which benefits from official subsidies at international, European, national and local levels (Fotiadis *et al*., 2019; Fleischer & Felsenstein, 2000; Khatua & Panda, 2024). These official subsidies are of different types: those of the CAP,

for farmers; the subsidies of the LEADER programme, for small rural villages that rehabilitate rural tourism lodgings, while respecting the environment (Galluzzo, 2020), and the Next Generation EU subsidies for rural tourism to promote sustainability and modernise the sector, with more energy efficiency and circular economy in lodgings (e.g., installing solar photovoltaic panels in rural areas, waste management and reuse systems). Rural tourism has received various European, national and local public subsidies to revitalise rural areas, improve the environment and sustainable development, and prevent the depopulation of these areas by diversifying sources of income (Roberts *et al*., 2017; Calatayud Prats, 2021). Furthermore, rural tourism promotes the role of women, due to their empowerment and dynamism in the sector (Nicolas Martinez *et al*., 2021). In other words, rural tourism is characterised by its diversity, sustainability and ability to offer unique experiences in authentic and peaceful environments. It is a commitment to quality rather than quantity, and subsidies contribute positively to the development of less populated areas (Khatua & Panda, 2024).

It should be borne in mind that post-COVID-19 grants under the Next Generation EU programme have provided subsidies for digitisation and digital marketing, bringing customers and suppliers closer together, with greater knowledge of rural areas (Senyao & Ha, 2022). With subsidies, tourism destinations and their impact on rural areas have become more visible, as in the case of LEADER subsidies (Yubero & Garcia, 2019), although not all municipalities are equally visible (Soler Vayà & San-Martín González, 2023).

Depopulation and socio-demographic transformations in different rural territories (Spain, Italy and France) show that all municipalities have had at least one LEADER and/or PRODER project, but also that there are large inequalities in the number of projects carried out, and in their employment (Maroto Martos & Pinos Navarrete, 2019).

The survival of firms in the sector depends on the correct application and use of subsidies, as well as the digitisation and sustainability. It also involves analysing the sector at a financial level, using the CoDa methodology, in order to diagnose the financial health of the firms in the sector reliably, both from an accounting and a statistical perspective.

2.2. Subsidies received and success in rural tourism

Rural tourism has been the subject of growing interest in the strategy of economic diversification and territorial revitalization with diverse demographic and socioeconomic characteristics. Various studies agree in their assessment of public intervention, in the form of subsidies, investments, and specific programmes, which can act as catalysts for tourism development and the improvement of the living conditions of rural communities.

Internationally, research shows that subsidies provided to support rural tourism have a positive effect on rural incomes, contributing to consolidating the tourism sector as an alternative or complement to farming activity (Yang *et al.*, 2021). Furthermore, Khatua and Panda (2024) argue that subsidies can be key instruments for promoting sustainable tourism, if they comply with efficiency and sustainability criteria and maintain a balanced relationship between tourism development and environmental sustainability.

At the European level, the CAP and LEADER programmes have been expanded to contribute to rural tourism. According to the Network EUCAP (2023), advances in economic diversification have strengthened the resilience of tourism in rural areas, promoting initiatives linked to heritage, gastronomy, and cultural services. Increasingly, recent studies in the context of the EU (Castilho & Fuinhas, 2025) show that investment in tourism infrastructure and services can reduce poverty and territorial inequality, with variations between states and regions. Specifically, Ion and Petre (2024) show that the founding countries of the EU have the most developed rural tourism sector, with the most overnight stays in France, the most establishments in Italy, and the most employees in Germany. Bearing in mind that at the end of the 20th century, rural tourism was a key driver of these public LEADER initiatives, and all these initiatives have been considered successful, the funding has yielded mixed results. Specifically, in the Spanish case, there are studies that show that this funding focuses on factors such as investment concentration, accessibility to urban spaces, and natural resources in mountain areas that favour the sustainability of the tourism sector (Engelmo Moriche *et al.*, 2021), but there are also studies that highlight imbalances in the territories where this funding is implemented (Nieto Masot & Rios Rodríguez, 2020).

In the case of Catalonia, the academic literature evaluating the impact of the LEADER subsidies notes a significant increase in job creation in areas investing in rural tourism (Gras *et al.*, 2025). Furthermore, the Generalitat de Catalunya (Catalan Government) has promoted subsidy programmes for housing rehabilitation in rural and mountain areas, which have contributed to the professionalization and modernization of the sector (Generalitat de Catalunya, 2024). In the academic field, there is research that supports subsidies for rural regeneration, provided that cultural and natural capital is preserved (Colomina Wiegerinck, 2024). Thus, the development of rural tourism with government support generates new revenue for the sector and enables business development, especially in rural areas that are economically, geographically, and agriculturally developed (Li *et al.*, 2025).

Finally, it should be noted that local and provincial subsidies also play a relevant role in supporting rural tourism projects, especially in relation to the promotion of heritage and tourism infrastructure (Diputació de Girona, 2022). These interventions, together with European sources, create an ecosystem of public support that allows rural tourism to be strengthened in these areas, through the creation of jobs, which improve the tourist offer and the economic diversification of rural territories.

There are few studies of the profitability and solvency of firms in the rural tourism sector using accounting data (Saus-Sala *et al.*, 2021; 2023; 2024), the majority relying instead on questionnaire data. To the best of our knowledge, no study based on accounting data examines the impact of subsidies at company level in this sector.

2.3 Conceptual framework and theoretical expectations

Public subsidies in rural/farm tourism are typically intended to co-finance investments (e.g., renovation of the farm building, equipment, digitization) and to support business continuity and upgrading. This motivates a conceptual framework linking subsidy intensity to five dimensions of financial performance and structure: (i) operating activity (turnover), (ii) operating profitability (margin), (iii) short-term solvency, (iv) asset structure (tangibility), and (v) liability structure (debt maturity).

First, investment-oriented subsidies are expected to increase the relative weight of non-current (often tangible) assets, as subsidized projects translate into capital formation and balance-sheet reallocation toward long-lived assets. This channel is consistent with the *additionality* perspective in public support policies, which conceptualizes subsidies as instruments intended to stimulate incremental investment rather than merely replacing private funding (Winckler Andersen *et al.*, 2021).

Second, investment co-financing and maturity-matching considerations suggest that firms may finance long-lived investments with longer-maturity liabilities, increasing the relative weight of non-current liabilities. This logic aligns with standard *capital-structure frameworks* (pecking order and trade-off) and with the *debt-maturity* literature highlighting the link between asset structure and maturity choice (Myers, 1984; Myers & Majluf, 1984; Kraus & Litzenberger, 1973; Stohs & Mauer, 1996).

Third, effects on operating activity and profitability are *a priori* ambiguous. Quality upgrading and market access may raise revenues, while compliance and adjustment costs, additional fixed costs, and transition frictions may offset profitability gains, especially in the short run. A complementary lens is the *financing-constraints* literature: if subsidies relax liquidity/financing frictions, firms may invest and scale up, but performance effects may be heterogeneous across firms and time horizons (Fazzari *et al.*, 1988; Kaplan & Zingales, 1997).

Fourth, short-term solvency may also react ambiguously depending on whether subsidies translate into cash buffers and faster current-asset accumulation, or are accompanied by short-term payables and working-capital needs. Finally, from a *soft budget constraint* perspective, support can improve viability and stability without necessarily improving operating efficiency in the short run (Kornai, 1986).

Given limited firm-level accounting evidence in this niche setting, we use this conceptual framework to state *theory-informed expectations*, while maintaining an *associational interpretation* of the estimates.

Section 3.1 translates this framework into research questions and hypotheses, section 3.2. describes the data, and Sections 3.3. and 3.4 details the CoDa operationalization of the five dimensions.

3. Methods

3.1. Research questions and hypotheses

Guided by the framework, we address the following research questions:

RQ1 (Current-asset turnover / operating activity): Is subsidy intensity associated with operating activity, measured by the turnover dimension (as operationalized in Section 3.4)?

RQ2 (Margin / operating profitability): Is subsidy intensity associated with operating profitability, measured by the margin dimension (as operationalized in Section 3.4)?

RQ3 (Short-term solvency): Is subsidy intensity associated with short-term solvency (as operationalized in Section 3.4)?

RQ4 (Asset tangibility): Is subsidy intensity associated with asset structure (tangibility) (as operationalized in Section 3.4)?

RQ5 (Debt maturity): Is subsidy intensity associated with liability maturity structure (as operationalized in Section 3.4)?

Based on these research questions, we formulate the following hypotheses:

H1 (Turnover, non-directional): Subsidy intensity is associated with turnover, but the sign is a priori ambiguous.

H2 (Margin, non-directional): Subsidy intensity is associated with margin, with ambiguous sign.

H3 (Short-term solvency, non-directional): Subsidy intensity is associated with short-term solvency, with ambiguous sign.

H4 (Asset tangibility, directional): Subsidy intensity is positively associated with asset tangibility (higher relative weight of non-current assets versus current assets).

H5 (Debt maturity, directional): Subsidy intensity is positively associated with debt maturity (higher relative weight of non-current liabilities versus current liabilities).

3.2. Data

The data used in the study were obtained from the SABI - Bureau van Dijk database (accessible at https://sabi.bvdinfo.com/) and correspond to the financial years 2018-2022.

To select the Spanish companies that operate in the rural tourism sector we filtered the NACE codes: I55 - Accommodation or L68.2 - Renting and operating of own or leased real estate, having at the same time in the description of the company's activities the phrase "turismo rural", the Spanish translation of rural tourism, farm tourism and agrotourism. The search term was: (Phrase ("turismo rural")) AND (NACE(55,682)). The NACE I55 code includes: I55.1 - Hotels and similar accommodation; I55.2 - Holiday and other short-stay accommodation; I55.3 - Camping grounds, recreational vehicle parks and trailer parks; I55.9 - Other accommodation. The results were refined by removing inactive companies in 2022 (zero revenues, zero costs, or zero total assets. See Coenders & Arimany-Serrat, 2025b). After the filtering process, n = 348 companies were included in the study.

To compute the ratios of turnover, margin, short-term solvency, asset tangibility and debt maturity for the companies included in the study, we collected the following accounting figures: non-current assets, current assets, non-current liabilities, current liabilities, revenues, and costs. These data refer to 2022.

Given that this article focuses on the relevance of public policies, which turn into subsidies for the sector, we calculated the main explanatory variable as Level of subsidy = Subsidies received in the last five years over total assets. Apart from the subsidies received, as control variables, we have also collected the company age and the number of employees. 70 % of the companies had no subsidies. The firms with subsidies were categorized into two equal-sized groups (15 % of firms each) so as to maximize statistical power, which led to a subsidy threshold equal to 25 % of total assets to separate both categories. Subsidies refer to 2018-2022. The rest of the variables to 2022.

The explanatory and control variables were thus defined in the model as follows:

- level of subsidy: [>0 % to 25 % of assets], binary variable; level of subsidy [> 25 % of assets], binary variable. Reference category: no subsidy;
- company age: log-transformed strictly positive numeric variable in years (log(age));
- company size: log-transformed in number of employees: strictly positive numeric variable (log(size)).

As for the set of control variables included in the model, the decision not to include additional controls stems from the lack of available data. Accordingly, only age and size were included as control variables, due to the unavailability of other relevant information, such as destination quality or digitalization level.

3.3. A compositional data (CoDa) perspective on financial analysis

The CoDa methodology, which originated in the fields of geology and chemistry in the late 20th century to study the relative importance of components in a chemical analysis, has expanded into numerous scientific fields, including economics and management (Coenders & Arimany-Serrat, 2025b). However, its application to accounting ratios is relatively recent. Nevertheless, this is a natural field of application for CoDa, as the methodology is primarily associated with the study of relative magnitudes expressed as ratios. A composition is defined as an array of D strictly positive numbers, called *parts*, the ratios among which are of interest to the researcher (Egozcue & Pawlowsky-Glahn, 2019). It is worth noting that when financial ratios were first developed in the late 19th century (Horrigan, 1968), statistical analysis methods were still in their infancy, and these ratios were not designed for use in statistical analysis.

Accounting ratios are useful for assessing the financial and economic status of companies on an individual level. However, their use in statistical studies generates significant issues (Linares-Mustarós *et al.*, 2018). The construction of these ratios causes a loss of symmetry, which significantly distorts the results of financial diagnostics, especially in regression models (Coenders & Arimany-Serrat, 2025a).

Although asymmetry in accounting ratios has been identified as a problem for some time (Deakin, 1976; Lev & Sunder, 1979; Cowen & Hoffer, 1982; Frecka & Hopwood, 1983), it still has not received the necessary attention in accounting. This is concerning, given the serious consequences of their use.

The CoDa methodology addresses the aforementioned asymmetry issue (Linares-Mustarós *et al.*, 2022; Molas-Colomer *et al.*, 2024). This problem may cause other

significant issues, such as the appearance of extreme outliers (Lev & Sunder, 1979; Magrini, 2025), non-linearity of the relationships (Cowen & Hoffer, 1982; Carreras-Simó & Coenders, 2021), non-normality of the distributions (Deakin,1976; Durana *et al.*, 2025), and incoherence of results when numerator and denominator are swapped in ratios (Frecka & Hopwood, 1983; Molas *et al.*, 2024).

To correct these deficiencies, the alternative to the standard use of accounting ratios is the CoDa methodology. This methodology features a mathematical formalism that has been widely applied across numerous scientific fields (Aitchison, 1986; Pawlowsky-Glahn *et al.*, 2015). Bibliometric studies by Martinez-Garcia *et al.* (2023), as well as the reviews by Coenders *et al.* (2023a) and Greenacre *et al.* (2023), highlight its current relevance.

For example, CoDa analysis produces accounting ratios in the interval (–∞, +∞), values consistent with those expected of normally distributed variables (Linares-Mustarós *et al.*, 2018). Since the assumption of normality is necessary in linear regression studies, the log-ratios computed with the CoDa methodology allow for the creation of variables that meet this requirement. In contrast, traditional ratios, which are defined in the interval (0, +∞), make this assumption inappropriate and can lead to computing impossible (i.e., negative) predicted values (Coenders & Arimany-Serrat, 2025a).

Additionally, the log-ratios created with the CoDa approach do not exhibit the serious issues of outliers in the upper tail (Linares-Mustarós *et al.*, 2022). In linear regression models, the results obtained with classical accounting ratios also tend to vary if the numerator and denominator of the ratio are permuted. With CoDa log-ratios, this methodological issue is resolved (Linares-Mustarós *et al.*, 2022; Coenders *et al.*, 2023b). Moreover, the CoDa approach helps reduce non-linearity of the relationships (Carreras-Simó & Coenders, 2021), thus improving compliance with the linearity assumption, which is essential in any linear regression study and is not met by classical ratios.

Finally, it is possible to construct an acyclic and connected graph from the accounting figures to create the so-called pairwise log-ratios (plr), such that no multiple paths exist to reach the same accounting figures. In this way redundancy among ratios is avoided while preserving all the information in the accounting figures. This prevents the inclusion of ratios that could be derived from linear combinations of other ratios in the model (Creixans-Tenas *et al.*, 2019; Greenacre, 2019).

Since previous studies have shown significant differences when comparing results obtained with traditional accounting ratios and those calculated using the CoDa methodology (Linares-Mustarós *et al.*, 2018; Creixans-Tenas *et al.*, 2019; Carreras-Simó & Coenders, 2021; Arimany-Serrat *et al.*, 2022; Jofre-Campuzano & Coenders, 2022; Linares-Mustarós *et al.*, 2022; Coenders *et al.*, 2023b; Dao *et al.*, 2024; Molas-Colomer *et al.*, 2024; Escaramís & Arbussà, 2025; Coenders & Arimany-Serrat, 2025a; 2025b; Hernandez-Romero & Coenders, 2025), while no study has reported equivalence between the two approaches, and CoDa log-ratio transformations provide statistically more coherent and reliable results by overcoming the asymmetry and inconsistency problems inherent in traditional ratios, it can be concluded that analyses based on the CoDa methodology provide a higher degree of statistical validity and reliability than those using classical ratios.

3.4. Statistical analysis and software

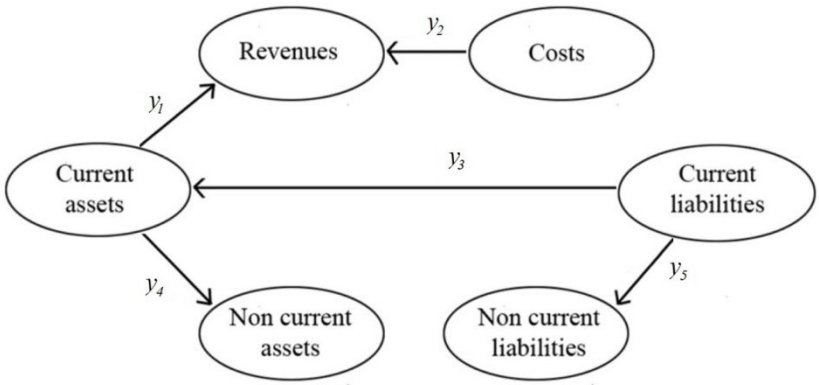
While CoDa offers various options for transforming ratios, such as additive log-ratios (alr), centred log-ratios (clr), pairwise log-ratios (plr), and isometric log-ratios (ilr), alr and clr are not interpretable in the accounting context. Coenders and Arimany-Serrat (2023) compare ilr and plr and conclude that there is little to choose between them apart from interpretational taste. In this study we have chosen to use plr (Creixans-Tenas *et al*., 2019; Greenacre, 2019; Mulet-Forteza *et al.*, 2024; Coenders & Arimany-Serrat, 2025a; 2025b). This choice is due to their resemblance to the result of applying a logarithm to certain classical ratios with only one accounting figure in the numerator and another in the denominator. This allows researchers to continue identifying with the ratios they are most familiar with, thereby avoiding resistance to a new accounting ratio paradigm. Table 1 shows the plr that will act as dependent variables in the model, and their conceptual correspondence with classical financial ratios and the dimensions of interest in the conceptual framework in Section 2.3.

Table 1. plr used as dependent variables in the model and their analogous classical ratios

Label	plr expression	Analogous classical ratio / dimension
y_1	log(revenues/current assets)	Current-asset turnover
y_2	log(revenues/costs)	Margin
y_3	log(current assets/current liabilities)	Short-term solvency
y_4	log(non-current assets/current assets)	Asset tangibility
y_5	log(non-current liabilities/current liabilities)	Debt maturity

From the previous definitions, the connected and acyclic graph shown in Figure 1 is obtained.

Figure 1. Connected acyclic graph defining the plr



Following Greenacre's (2019) construction principles, the arrows in the graph in Figure 1 indicate which variables are in the numerator (arrowhead) and which are in the denominator (arrow tail) of the CoDa ratios. This construction allows the formation of five plr as dependent variables. Since any element in the graph can be connected to another by a single path, it ensures the formation of a basis in a vector space, which in turn guarantees linear independence among the dependent variables and avoids data redundancy while capturing all relative information in the accounting figures.

In order to assess the relationship between subsidies and financial performance, we defined the following set of Ordinary Least Squares (OLS) regression models:

$y_i = \alpha + \beta_1$ subsidy [>0 % to 25 %] $+ \beta_2$ subsidy [>25 %] $+ \beta_3$ log(age) $+ \beta_4$ log(size) $+ \varepsilon_i$

For i = 1 to 5, a regression model is formulated for the corresponding plr, where ε_i is an independent, normal, and identically distributed error term. Subsidies refer to 2018-2022. The rest of the variables to 2022.

Both subsidy levels were operationalised as binary dummy variables, equal to 1 when the company belonged to the respective group and 0 otherwise. Age and size were included as control variables.

The log-ratio transformations were computed using CoDaPack 2.03.06 available at https://imae.udg.edu/codapack/ (Comas-Cufí & Thió-Henestrosa, 2011). The subsequent regression analyses were conducted in R 4.1.2 (R Core Team, 2021).

4. Results

Five OLS regression models were obtained, one for each plr included in the study. The coefficients in the models show the relationship of the explanatory variables with each plr connected to the financial performance of the companies. Table 2 shows the coefficients associated with each explanatory variable and model.

Table 2. Model coefficient estimates, standard errors and statistical significance for each plr

	y_1 Current-asset turn.			y_2 Margin			y_3 Short-term solv.		
	$\hat{\beta}$	SE	Sig.	$\hat{\beta}$	SE	Sig.	$\hat{\beta}$	SE	Sig.
Subsidy [>0 % to 25 %]	0.16	0.19		0.07	0.08		-0.33	0.35	
Subsidy [>25 %]	0.45	0.18	*	0.02	0.07		-0.45	0.33	
Log(age)	-0.06	0.10		0.03	0.04		-0.07	0.17	
Log(size)	0.41	0.08	***	0.01	0.03		0.01	0.15	
	y_4 Asset tangibility			y_5 Debt maturity					
	$\hat{\beta}$	SE	Sig.	$\hat{\beta}$	SE	Sig.			
Subsidy [>0 % to 25 %]	0.59	0.29	*	0.64	0.68				
Subsidy [>25 %]	0.98	0.27	***	1.54	0.65	*			
Log(age)	0.44	0.14	**	0.14	0.34				
Log(size)	-0.70	0.12	***	-0.22	0.29				

Sig: Significance codes: 0 *** <0.001 ** <0.01 * <0.05; SE: Standard error.

According to the OLS specification of the models and the CoDa transformation of the variables, the interpretation of the coefficients varies. In the case of the variables Subsidy [>0 % to 25 %] and Subsidy [>25 %] the regression model relates a dependent variable on a logarithmic scale (log-ratio) to a categorical variable. Previous research with

compositional regression of financial ratios has only dealt with statistical significance of the relationships, but effect sizes are also relevant. In this situation, to obtain and interpret the relationships in the natural scale of the classical (not log transformed) ratio, the coefficient must be exponentiated: exp ($\hat{\beta}$). On the other hand, in the case of variables age and size, the regression model relates a dependent variable on a logarithmic scale (log-ratio) with a quantitative variable also on a logarithmic scale. In this second situation, the value of the coefficient $\hat{\beta}$ can be interpreted, in its original scale, as an elasticity, indicating the percentage increase in the dependent variable associated to a one-point percentage increase in the independent variable.

Following the interpretation above, four key points can be inferred from the results in Table 2, implying a very strong relationship between subsidies and three of the plr:

- Receiving a subsidy higher than 25 % of the assets is associated to multiplying the value of the classical (not log transformed) current-asset turnover ratio (revenues / current assets) by 1.57 [exp(0.45)] (support for H1).
- Receiving subsidies has no relationship with the margin (revenues / costs) nor on the short-term solvency (current assets / current liabilities) ratios (no support for H2 and H3).
- All subsidy levels have a positive relationship with asset tangibility (non-current assets / current assets). Receiving a subsidy lower than 25 % of the assets multiplies the value of the ratio by 1.80 [exp(0.59)]. Receiving a higher subsidy multiplies the value of the ratio by 2.66 [exp(0.98)]. An increase in the relative weight of non-current assets is consistent with the fact that many subsidy programmes are intended for the improvement, rehabilitation and digitalisation of the rural properties (support for H4).
- Receiving a subsidy higher than 25 % of the assets implies multiplying the value of the debt maturity ratio (non-current liabilities / current liabilities) by 4.66 [exp(1.54)]. Companies co-financing the new investments with long-term loans and subsidies seem a reasonable explanation (support for H5).

With respect to the control variables:

- The control variables age and size act in opposite directions with respect to asset tangibility. A one percent increase in firm age is associated to raising the classical tangibility ratio by 0.44 % (i.e., multiplying it by 1.0044). A one percent increase in firm size is associated to reducing the ratio by 0.70 % (i.e., multiplying it by 0.9930).
- Company size has a positive relationship with current-asset turnover: a one percent increase in size is linked to multiplying the ratio by 1.0041.

5. Discussion

To ensure the validity of the models, the presence of outliers in both dependent and independent variables was evaluated. A boxplot analysis was used for this purpose. Additionally, diagnostic plots were reviewed: residuals vs. fitted values, normal Q-Q plots of the residuals, scale-location plots, and Cook's distances. The absence of patterns in the residuals vs. fitted plots confirmed that the residuals were randomly distributed. This supports the linearity assumption of the models. The normal Q-Q plots showed that

the residuals followed an approximately normal distribution. The scale-location plots did not indicate heteroscedasticity. Finally, the Cook's distances indicated that no observations had a disproportionate impact on any of the models. Overall, the results suggest that the models fit the data well and meet the fundamental assumptions necessary to ensure their validity. On the contrary, when replicating the analysis with classical financial ratios, all five regression models contained extreme outliers, either with Cook's distances above 0.5, standardized residuals above 8 in absolute value, or both. This had a dramatic impact on the models' results. Only the relationship between receiving a subsidy higher than 25 % and current-asset turnover (y_1) remained statistically significant at 5 %. Consequently, in this article the CoDa methodology once again performs better in this setting, in line with the literature on CoDa modelling of accounting ratios in regression studies and related research (Creixans-Tenas *et al*., 2019; Coenders & Arimany-Serrat, 2025a; Carreras-Simó & Coenders, 2021).

To the best of our knowledge, this is the first article relating subsidies to hard financial-statement data at company level in the rural tourism sector. It is also the first application of compositional regression on financial data showing how to numerically interpret regression coefficients in the original scale of classical ratios, as previous studies had only dealt with significance of the relationships.

The non-significant findings for profitability and short-term solvency may be explained by the fact that subsidies primarily affect the economic and financial structure of firms rather than their operational efficiency. This is reflected in improvements such as a greater proportion of non-current assets or longer-term debt, but not necessarily in profit margins. Moreover, there may be a temporal lag in their effects, as investments financed by subsidies require time to generate returns. In addition, the rural tourism sector is characterized by seasonality and limited demand, which slows the translation of structural improvements into economic results. Short-term solvency also depends on the management of current assets and liabilities, which responds more slowly. Therefore, this does not imply a lack of effectiveness of subsidies, but rather a different transmission channel, oriented more towards structural strengthening than immediate financial outcomes.

From this perspective, the concept of a soft budget constraint reflects that firms can finance investments without relying directly on immediate operational results. Subsidies exceeding 25% of total assets are associated with a higher proportion of non-current assets and longer-term debt, enabling a more solid and stable financial structure. This flexibility reduces the pressure on short-term profitability and prioritizes survival and territorial development over profit maximization, confirming that public policies function as a financial stabilization mechanism, mitigating the risks associated with seasonality in the rural tourism sector.

The first main limitation of this study is that the SABI database only applies to companies with a corporate structure, thus ruling out many of the smaller ones so common to the sector, run by individual entrepreneurs who are not required to present their financial statements to the Business Registry. Unfortunately, this limitation, which involves sample-selection bias and seriously affects the external validity of the results, is not easy to solve. There is a body of literature which uses surveys and qualitative interviews and includes firms of all sizes (Saus-Sala *et al.*, 2021), but the reliability of financial information is at best questionable.

The second main limitation is the inability to establish causal relationships. There is indeed potential endogeneity, as larger or more solvent firms may be able to invest more time and resources in applying for subsidies. There may also be regional heterogeneity. A panel-data design would be better at capturing dynamic causal effects. Panel-data models have been successfully applied on financial ratios using the CoDa methodology (Escaramís & Arbussà, 2025; Carreras-Simó & Coenders, 2021), as have structural equation models (Creixans-Tenas *et al.*, 2019).

The third main limitation is missing control variables, like region (called autonomous community in Spain), legal form (public and private limited companies, cooperatives), gender distribution of the workforce, or rural tourism sub-type (rural hotel, tourism farm, rural real estate agency).

Further research will include using a panel-data design with mixed models (Escaramís & Arbussà, 2025) including a wider range of control variables, a larger number of accounting figures and ratios indicating the cost structure, and separating subsidies by type.

6. Conclusions

As it was stated in the introduction, the aim of this research is to assess the sector's financial performance in relationship to subsidies derived from public policies. According to the results and using a robust construction of financial ratios, a level of subsidy higher than 25 % of the assets is associated with the financial stability of the companies, having a significant association with the turnover of assets, asset tangibility and debt maturity. On the contrary, subsidies did not show a significant relationship with the sector's profitability nor with its short-term solvency. Overall, the findings are consistent with the conceptual framework's balance-sheet channels (H4 and H5), and the activity hypothesis (H1), but do not yield statistically significant evidence for the margin and short-term-solvency hypotheses (H2–H3). This can be explained by the fact that rural tourism subsidies are aimed at non-financial objectives, such as territorial development, sustainability, and population retention, rather than profit maximization. Their effects are mainly reflected in the balance sheet, confirming H4 and H5 through an increase in the proportion of non-current assets and long-term debt, while also being associated with higher asset turnover (H1), thereby strengthening financial stability and firm survival. In contrast, no significant effect is observed on profit margins (H2) or short-term solvency (H3), indicating that subsidies do not immediately improve operational management, although they may cover structural weaknesses and prevent major deterioration rather than generate immediate profitability gains. Additionally, firms with lower financial performance may receive more subsidies, which could dilute the expected positive relationship.

The control variables included in the study (age and size of the company) had a marginal and inconclusive relationship with the financial performance. Although the importance of subsidies is not uniform in all the ratios studied, companies that have received a subsidy of more than 25 % show a more solid investment structure and a better debt maturity, a situation that can contribute to the long-term solvency of the sector, and subsequently to firm survival in the long term.

Policy recommendations regarding the public institutions would be to maintain the

subsidy programmes while not overburdening recipients with bureaucracy or additional requirements that may increase overhead costs and reduce profitability. Regarding firms in the sector themselves, margin has already been shown to be a critical variable in previous research on rural tourism unrelated to subsidies (Saus-Sala *et al.*, 2023; 2024), which implies paying attention to pricing and cost control, and not counting on subsidies as a substitute for good revenue and cost management.

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AUTHOR CONTRIBUTIONS

Conceptualization: MF-N and NA-S; methodology: SL-M; formal analysis: MC-P; data curation: MF-N and NA-S; writing - original draft: All; writing - review & editing: All.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

The curated data are available from the corresponding author upon reasonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI)

The authors used ChatGPT to improve the grammar and clarity of the manuscript. All scientific content of the article was developed entirely by the authors without the use of AI.

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