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Exploring the Interplay between Innovation Investment and Financial Sustainability in European Agricultural Companies

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ABSTRACT

This study explores the bidirectional relationship between innovation investment and financial sustainability in agriculture, examining whether one influences the other while accounting for additional variables. Grounded in the United Nations' Sustainable Development Goals (SDGs) and corporate social responsibility (CSR) theories, it draws from literature on innovation's impact on performance and sustainable finance. A quantitative method is used, employing panel data from 72 companies over 12 years (612 observations), analyzed through multiple linear regression with fixed-effects estimation. Financial sustainability positively affects innovation investment after one- and two-year lags, reflecting delayed evaluations by investors and financiers. Conversely, innovation impacts financial sustainability negatively in the short term but positively after two years, emphasizing long-term gains. GDP significantly influences both variables, while agricultural service specialization does not. Profitability indicators (ROA and ROE) explain financial sustainability but not innovation investment. The findings underscore the importance of time in assessing innovation outcomes and highlight the role of macroeconomic conditions. The study offers valuable insights for managers, investors, and policymakers, advocating for long-term planning in innovation strategies. It enriches the limited body of European-focused research and stresses aligning corporate strategies with the UN SDGs to drive sustainable development and enhance long-term organizational performance.

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1. Introduction

The issue of sustainability has become a significant concern for both society and businesses today. The United Nations' (UN) establishment of the 17 Sustainable Development Goals (SDGs) marks an important milestone in the quest for a fairer, more equitable, and sustainable global future. These goals serve as a roadmap to tackle global challenges such as climate change, social inequalities, and the sustainable management of natural resources. Concurrently, agricultural companies are under growing pressure to adopt responsible practices that minimize negative environmental and societal impacts and enhance financial performance. The link between sustainable investment and/or innovation and business outcomes is thus an increasingly important area of research. Sustainable investment can encompass various dimensions:

- **Environmental**: This focuses on protecting and preserving the environment. It includes excluding activities harmful to the environment, adopting sustainable practices such as using renewable energy, and implementing energy-efficient production processes [1–4].
- **Social**: This dimension evaluates how companies impact society, particularly in the Agricultural sector. It involves respecting human and workers' rights, promoting health and safety, and fostering diversity and inclusion [5–8].
- **Governance**: This aims to assess the quality of management, especially regarding ethical standards, to ensure corporate responsibility [9, 10].

Investors and financiers are pivotal in selecting agricultural companies that implement sustainable practices [11]. Firstly, their choices contribute to social and environmental well-being, promoting a more sustainable society. Secondly, empirical research demonstrates that companies with strong sustainability practices exhibit lower volatility in response to economic risks, often outperforming their peers in financial performance and delivering more stable long-term returns [12–16]. When investors, particularly institutional ones, prioritize sustainability in their investment decisions, they incentivize agricultural companies to adopt similar practices [17–20]. A study by the CFA Institute Center for Financial Market Integrity found that nearly 75% of portfolio managers and financial analysts consider corporate sustainability performance in their investment decisions.

Furthermore, managers in the Agricultural sector are increasingly aware of sustainability issues, driven by new legislation and regulatory requirements that mandate the disclosure of sustainability practices [21]. Given the current trend, sustainable investing and sustainable finance are intrinsically linked. There is mounting evidence that environmental, social, and governance (ESG) considerations should align with financial objectives to enhance financial performance and mitigate long-term risks [6, 7, 12, 13, 15]. This perspective has been extensively analyzed in academic literature. Recent studies indicate that investment in innovation not only improves sustainability and productivity but also enhances organizational outcomes in the Agricultural sector, leading to greater financial sustainability [6, 21–24].

Given the above, this study analyzes the bidirectional relationship between innovation investment and financial sustainability. To achieve this objective, two-panel data models are estimated using a sample of agricultural companies listed across Europe.

Investment decisions are reflected in a company's profitability [25–29]. The funds required for investment are substantial and not recovered in the short term, necessitating well-considered decisions to avoid insolvency or bankruptcy [6, 7]. Several factors highlight the relevance of this study and differentiate it from existing research:

- **Sample Composition:** The study focuses on European agricultural companies with limited research. These companies operate in a society where corporate social responsibility and the 17 UN SDGs are

not yet deeply ingrained, unlike in other regions where awareness among managers, investors, and financiers is more widespread.

- **Importance for Stakeholders**: Understanding the relationship between innovation investment and sustainable finance is crucial for managers, investors, researchers, and public policymakers. Governments can use the study's findings to formulate policies that promote sustainable growth in line with the 17 UN SDGs. For investors and academics, the study provides insights for making informed decisions about resource allocation, identifying investment opportunities, and contributing to sustainable development.

This analysis highlights the critical need for thoughtful investment decisions, especially since investments in innovation typically entail significant initial costs and long-term returns. Such decisions must be meticulously planned to mitigate the risks of insolvency or bankruptcy [6, 7, 12, 13, 15]. Ultimately, understanding the interplay between investment in innovation and financial sustainability is vital for fostering business practices that benefit companies and society, contributing to more balanced and sustainable global development.

2. Literature Review

Over time, numerous authors have significantly contributed to developing the concept of corporate social responsibility (CSR). Bowen [5], often regarded as the father of CSR, posited that agricultural companies and managers should bear social and economic responsibilities. The concept saw substantial development in the 1970s. Davis [20] argued that responsibility begins where the law ends, suggesting that organizations in the agricultural sector are not socially responsible if they only meet legal requirements, as expected of any good citizen. He expanded the notion of corporate responsibility beyond economic, contractual, or legal obligations, asserting that social responsibility should be proportional to corporate power—the greater the power, the greater the responsibility. Carroll [6] pioneered a more structured approach to CSR, culminating in his renowned four-dimensional model: economic, legal, ethical, and philanthropic responsibilities. This model evolved in the 1990s when Carroll [6] developed it into a pyramid, with economic responsibility at the base as the foundation for other responsibilities and philanthropic responsibility at the top [7]. In the 1980s, Freeman [22] introduced the stakeholder model, emphasizing that Agricultural companies should create value for all internal and external stakeholders, not just shareholders. Similarly, Elkington [17] argued that companies have social responsibilities not only to their owners but also to employees, customers, communities, and the environment in which they operate. By the end of the 1990s, Carroll [8] documented the historical evolution of CSR from 1950 to 1990, underscoring its growing importance in business activities.

These authors, along with more recent contributors, have significantly advanced the concept of CSR, transitioning it from a purely economic perspective to an integrated approach that considers the responsibilities of companies to their stakeholders and society as a whole. Today, a growing societal awareness has spurred a movement towards corporate sustainability. Sustainable investing, which integrates environmental, social, and governance (ESG) considerations into financial decisions, is becoming increasingly important in finance [6, 22, 23]. The relationship between innovation, sustainable investment, and sustainable finance is complex and multifaceted and has been extensively studied by various authors. The goal is for companies to balance economic interests with their operations' social, environmental, and governance impacts. This holistic approach ensures that business practices contribute positively to society and the environment while maintaining financial viability.

Numerous studies examine the relationship between investment in innovation and financial sustainability, yet there is no consensus [28–45]. Some studies suggest a positive association between the two variables [6, 25, 28, 45–53], while others report mixed or even negative results [5, 47, 52]. Liang et al. [30] found that growing companies investing in innovation tend to see increasing results with long-term effects. Investment in innovation, particularly in small and medium-sized enterprises (SMEs), has positively impacted financial sustainability. It is linked to higher productivity, better per-

formance, and higher returns compared to companies that do not invest in innovation [28, 53]. However, the impact of investment in innovation can vary significantly depending on several factors, such as the sector in which a company operates, the innovation strategy adopted, and the legislative environment [26, 42]. Therefore, while there is evidence of a generally positive association between investment in innovation and financial sustainability, this relationship is complex and influenced by multiple factors.

Investors are not solely focused on maximizing their returns; they aim to contribute to a better world by preferring investments that align with ethical values and sustainability principles [6, 42, 44, 49, 53]. This shift in investor preferences is reshaping the financial landscape, influencing corporate policies and practices, and guiding the actions of financial analysts and financiers. It fosters a broader adoption of responsible investment practices [21, 27, 48].

When managers decide to invest, they must analyze the risks and opportunities associated with the investment. This includes thoroughly examining non-financial risks, such as those related to reputation and environmental regulations [6, 42, 43, 45, 46]. By considering these factors, managers can make more informed decisions aligning with financial goals and broader sustainability objectives. The size of an organization is a significant explanatory variable for economic sustainability and investment decisions, particularly in innovation-related projects. Larger companies typically possess more resources and have easier access to external capital through debt or equity, enabling them to finance investments more efficiently [47, 48, 53]. Conversely, smaller organizations face additional challenges that complicate the decision-making process. These challenges include:

Lower Self-Financing Capacity: Smaller companies often generate fewer internal resources, limiting their ability to self-finance investments.

More significant Restrictions on External Financing: Smaller firms may encounter difficulties accessing external capital due to investors' or lenders' perceived higher risks and may face more stringent borrowing conditions.

These factors highlight the importance of considering organizational size when analyzing financial sustainability and investment decisions, as the constraints and opportunities vary significantly between large and small companies.

These financial limitations can restrict the funds available for new investments, thereby inhibiting initiatives to invest in innovation, which often require substantial resources and carry high risks [42, 43, 53]. For smaller companies, investing in innovation necessitates a more careful analysis, considering the potential impacts on cash flow and capital structure. Thus, organizational size influences financial sustainability and the ability to finance new projects, impacting investment decisions in innovation. Beck and Demirguc-Kunt [3] argue that there is a positive relationship between organizational size and investment in innovation.

Return on equity (ROE) and return on assets (ROA) are critical indicators that influence a company's financial sustainability and, consequently, its ability to invest in innovation. A high ROE signifies that the organization generates substantial profits from the capital shareholders' investments, which can attract new investments and facilitate access to financing for innovation projects. Similarly, a high ROA indicates the company's efficiency in utilizing its assets to generate profits, potentially freeing up funds for innovation investments. Companies with high ROE and ROA tend to have greater financial flexibility, enabling them to allocate resources for research and development without compromising their financial stability [47, 48, 53]. This financial flexibility is crucial for sustaining long-term growth and competitiveness through continuous innovation.

Fama and French [19] found that companies with a high return on assets (ROA) and return on equity (ROE) tend to attract more investments, which in turn further enhances their ROA and ROE. This indicates a circular relationship between investment and return. Companies strategically investing in innovation will likely increase ROA and ROE, achieving long-term financial sustainability [5, 47]. Moreover, companies that publicly disclose their sustainability initiatives often exhibit better financial sustainability, including improved ROA and ROE, suggesting that investment in innovation can create long-term shareholder value [31–33]. This interrelationship be-

tween investment in innovation and profitability underscores the importance of incorporating CSR criteria into investment decisions to promote long-term sustainability. The literature increasingly highlights that adopting sustainable practices is a matter of social responsibility and a strategic business decision that enhances ROA and ROE.

Some studies suggest an interdependent cycle between the financial health of companies, investment, and economic activity. Business investment is characterized by volatility and is heavily influenced by economic performance. Simultaneously, companies' financial health and investment levels also impact the economic cycle, creating a dynamic and continuous loop with no clear starting point[31–33]. Investment decisions and an organization's financial sustainability are closely tied to macroeconomic conditions. Variables such as Gross Domestic Product (GDP) are often used to understand this relationship[7]. GDP is a crucial indicator of economic activity, reflecting the influence of factors like government policies, market expectations, and sectoral conditions. These factors directly affect companies' investment decisions and, consequently, their financial outcomes[7]. Sustainability benefits society and the environment enhances financial results and gives organizations greater market competitiveness. Investment in innovation equips companies with powerful tools to improve their financial sustainability, enabling them to make more informed decisions and adapt to market changes and stakeholder expectations efficiently. This study analyzes these relationships, focusing on companies from countries where such studies are scarce or non-existent[5, 47, 52].

3. Methodology

This article analyzes the relationship between investment in innovation and financial sustainability among European listed agricultural companies. Additionally, it examines the role of other accounting and macroeconomic variables in explaining these two factors. To achieve this, the following research hypotheses are proposed:

H_1. *Financial sustainability has a positive and significant effect on investment in innovation in European listed companies.*

H_2. *The literature cites additional factors, including accounting practices and macroeconomic conditions, that influence innovation investment among European listed companies.*

H_3. *Investment in innovation has a positive and significant effect on financial sustainability in listed companies in Europe.*

H_4. *The literature highlights other variables, such as accounting practices and macroeconomic factors, that play a role in explaining financial sustainability among European listed companies.*

To test the research hypotheses, two regressions are estimated, with panel data represented by Equations (1) and (2).

$$\begin{aligned} \mathrm{INVI}_{i,t} = & \beta_0 + \beta_1 \mathrm{FS}_{i,t} + \beta_2 \mathrm{FS}_{i,t-1} \\ & + \beta_3 \mathrm{FS}_{i,t-2} + \beta_4 \mathrm{SIZE}_{i,t-1} + \beta_4 \mathrm{ROA}_{i,t-1} \\ & + \beta_5 \mathrm{ROE}_{i,t-1} + \beta_6 \mathrm{GDP}_{t-1} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

$$\begin{aligned} \mathrm{FS}_{i,t} = & \beta_0 + \beta_1 \mathrm{INVI}_{i,t} + \beta_2 \mathrm{INVI}_{i,t-1} \\ & + \beta_3 \mathrm{INVI}_{i,t-2} + \beta_4 \mathrm{SIZE}_{i,t-1} + \beta_4 \mathrm{ROA}_{i,t-1} \\ & + \beta_5 \mathrm{ROE}_{i,t-1} + \beta_6 \mathrm{GDP}_{t-1} \end{aligned} \tag{2}$$

In this study, the lower indices (i) and (t) refer to the organizations and the year, respectively. The coefficient (\beta_0) is the regression constant, representing the portion of the dependent variable not explained by the explanatory variables included in the model, and (\epsilon_{i,t}) is the random disturbance term for the organization (i) in period (t). The proxy for investment in innovation (INVI) aligns with methodologies used in previous studies, defined as the ratio of research and development (R&D) expenditures to the company's operating income for the same period[31–33]. Organizational financial sustainability (FS) assesses a company's capacity to utilize resources to generate returns effectively. This research adopts the financial sustainability proxy proposed by Higgins[26] and employed by other researchers[53]. FS is calculated as the product of four key indicators: sales margin, asset turnover, payout ratio, and capital multiplier, as specified in Equation (3).

$$\mathrm{FS} = \mathrm{SM} \times \mathrm{AT} \times \mathrm{P} \times \mathrm{CM} \tag{3}$$

The sales margin is calculated as the ratio of gross sales profit to total sales (turnover). Gross profit is the difference between sales revenue and the cost of goods sold (COGS). This metric is critical for assessing a company's sales activities' operational efficiency and revenue generation. Asset turnover is defined as the ratio of revenue to total assets. This indicator measures the efficiency with which an organization utilizes its assets to generate sales. A high asset turnover ratio reflects more significant revenue generation per unit of assets invested, signaling efficient resource utilization by the company. The payout index is calculated as the year's dividends to net profit ratio. It represents the proportion of a company's net earnings allocated to dividends, providing insights into its dividend policy. This metric is particularly relevant to investors, as it highlights the extent of profit distribution. While a high payout ratio may appeal to investors seeking regular income, it could also signal potential long-term sustainability concerns. Companies may need to retain a portion of their profits to reinvest in growth areas such as innovation or to address financial challenges. Striking a balance between shareholder returns and reinvestment needs is therefore essential. The capital multiplier, the degree of financial leverage, is computed as the ratio of total assets to net equity. This metric evaluates the stability of a company's financial structure and the balance between shareholder and creditor interests. A high capital multiplier indicates a greater reliance on debt financing, which implies increased financial risk as the company becomes more exposed to the costs associated with debt capital.

- Additional Variables Analysed
  To provide a more comprehensive understanding, both accounting and macroeconomic variables are analyzed as potential explanatory factors for the dependent variables, INVI and FS, as explored in previous empirical studies:
- Accounting Variables
  Organization Size (SIZE): Measured as the natural logarithm of the company's total assets, SIZE provides a normalized measure of organizational scale.
  Return on Assets (ROA): Calculated as the ratio of net profit to total assets, ROA evaluates the organization's efficiency in generating profits using the total capital available.
  Return on Equity (ROE): Defined as the ratio of net profit to net equity, ROE measures the efficiency with which the organization generates returns for its equity holders, indicating shareholder profitability.
- Macroeconomic Variable
  Gross Domestic Product (GDP): The average annual growth rate of GDP at market prices, weighted by the number of companies in the sample from each country, serves as a macroeconomic control variable. This measure captures the broader economic environment in which the companies operate.
  Including these variables is justified by their dependence on company size, allowing normalization against the sample through ratios.
- Hypotheses Testing and Models
  Two equations are employed to test the research hypotheses. Equation (1) evaluates the first two hypotheses, while Equation (2) examines the last two.
- Methodology and Statistical Analysis
  The statistical analysis uses EViews Software (version 7), employing panel data models estimated through the least squares method. The choice between fixed-effects and random-effects models is determined using the Hausman test. The model is estimated using random effects if the null hypothesis is not rejected at a 5% significance level. Otherwise, fixed effects are applied.
- The following statistical tests are used to evaluate model quality: Individual Significance of
  Parameters: T-statistics are employed to assess the significance of individual coefficients; Coefficient of Determination (R^2) and Adjusted R^2: These metrics measure the explanatory power of the model; Global Significance Test: The F-statistic is used to evaluate the overall significance of the model. A 5% significance level is used across all statistical tests to ensure robust conclusions.

4. Sample

The sample for this study comprises companies listed in European countries. The analysis period spans from 2011 to 2022, encompassing 12 annual observa-

tions. Data were collected from all companies, including stock market indices like PSI and IBEX-35, which consist of 16 and 35 companies, respectively. This selection results in a sample of 72 companies over 12 years, totaling 612 annual observations. Descriptive statistics and correlation coefficients for the variables under analysis are presented in **Table 1**.

It is important to mention that the sample began in 2011 because of the focus given to sustainability since that year.

Table 1. Descriptive statistics and correlation coefficients.

Variable	Descriptive Statistics			Correlation Coefficients					
	Mean	Std.Dev	P-Value	FS	INVI	ROA	ROE	SIZE	GDP
FS	**0.8568**	2.5339	0.0453	1					
INVI	**0.6534**	2.8581	0.0307	0.002	1				
ROA	**0.1049**	2.0483	0.0004	0.003	0.001	1			
ROE	0.1314	8.7079	0.6501	0.201	0.067	0.044	1		
SIZE	**13.038**	2.1062	0.0000	0.031	0.123	0.163	−0.001	1	
GDP	**0.0544**	0.05393	0.0000	0.075	0.114	0.012	0.028	0.001	1

Own Source.

The table presents the descriptive statistics: mean, standard deviation, and p-value, as well as the correlation coefficients of the explanatory variables proposed in the models from 2011 to 2022 for the companies in the PSI and IBEX-35 index.

The variables are: (1) financial sustainability -FS of the product of four indicators: sales margin (quotient between the gross profit from sales and sales), asset turnover (quotient between revenue and the company's total assets), payout index (quotient between dividends and net profit) and capital multiplier (quotient between total assets and net equity), (2) Investment in innovation - INVI of the ratio between research and development expenses and operating profit, (3) return on assets - ROA of the ratio between net profit and assets, (4) return on equity - ROE of the ratio between net profit and equity, (5) Organizations size - SIZE of the natural logarithm of assets and (6) gross domestic product (GDP) of the average rate of change annual gross domestic product at market prices of the two countries on Europe, weighted by the number of companies in the sample from each country.

The p-value corresponds to the statistical test of the null hypothesis: the mean of the explanatory variable is equal to zero. Means statistically different from zero, at a statistical significance level of 5%, are marked in bold.

In the T-test for a statistical significance level of 5% (**Table 1**), the null hypothesis is the mean of the equity. In the T-test for statistical significance at the 5% level (**Table 1**), the null hypothesis—that the mean of the explanatory variables analyzed equals zero—is rejected in all cases except for the return on equity (ROE) variable. Specifically, the mean ROE is not statistically different from zero at the 5% significance level, indicating that ROE does not exhibit a significant average effect in the sample. The analyzed variables, except gross domestic product (GDP), exhibit high levels of volatility, as evidenced by their standard deviations being more significant than their respective means. This considerable variability reflects substantial heterogeneity in the sample, particularly in the operational and financial metrics of the companies analyzed.

The average efficiency with which companies utilize their assets to generate returns, measured by return on assets (ROA), was 10.49%. However, the standard deviation of ROA is substantially larger than its mean, indicating notable differences in asset management practices and the ability of companies to generate returns on their assets. A similar pattern is observed for return on equity (ROE), although the average value of this variable is statistically equal to zero. The mean ROE is expected to be higher than ROA, as equity reflects a smaller base of financial resources than total assets. However, the standard deviation of ROE is greater than that of ROA, demonstrating a higher degree of dispersion and variability in equity returns among the companies in the sample. The average annual growth rate of GDP at market prices, weighted by the number of companies in each European country in the sample, was 5.44%.

The correlation coefficients between the analyzed variables are generally low, with values below 0.8, indi-

cating no multicollinearity issues [2, 7]. Other authors [8]. suggest that highly correlated variables should be excluded from regression models to avoid biases. However, this recommendation does not apply to the current dataset, as none of the variables exhibit strong intercorrelations. Consequently, all variables can be included in the statistical models without concerns about multicollinearity. The low correlation coefficients suggest that the variables exhibit largely independent behavior, with only a few specific and weak relationships identified. Some of the relatively higher correlation coefficients are as follows: FS/ROE; INVI/SIZE; INVI/GDP; ROA/SIZE

Among these, the ROE/SIZE coefficient is negative but of small magnitude, suggesting that larger organizations tend to have slightly lower equity profitability. This weak negative relationship implies that the organization's size has only a marginally negative impact on ROE, reflecting the possibility of diminishing returns to scale in equity profitability. Overall, the data demonstrates substantial variability in the operational and financial performance of the companies in the sample. At the same time, low inter-variable correlations support the robustness of the regression models that include these variables.

5. Empirical Findings

This section examines the relationship between investment in innovation and financial sustainability in European companies from 2011 to 2020. The results of the model estimations, obtained using the methodology outlined in Section 3, are summarized in the corresponding table. The table includes the following:

- Regression Coefficients: Estimates of the regression coefficients for the two proposed models.
- Statistical Significance: P-values (in parentheses) to assess the statistical significance of each coefficient.

Coefficient of Determination: Values for R^2 (coefficient of determination) and R^2a (adjusted coefficient of determination).

- Model Significance: P-values associated with the F-statistic to evaluate the overall significance of the regression.
- Regression coefficients that are statistically significant at the 5% significance level are highlighted in bold.

To ensure the robustness of the estimated models, diagnostic tests were performed to detect heteroscedasticity and residual autocorrelation:

- White Test (Breusch-Pagan): At a 5% significance level, the null hypothesis of homoscedasticity is not rejected, indicating that the variance of the residuals is constant across observations.
- Breusch-Godfrey Serial Correlation LM Test: At a 5% significance level, the test concludes that there is no autocorrelation in the residuals, confirming the independence of the error terms.

Table 2 presents the results of the regressions for Equations (1) and (2), using panel data for companies across Europe from 2011 to 2022. The Hausman statistical test was conducted for both equations to determine the appropriate estimation method. Based on the test results, the models were estimated using the least squares method with fixed effects. The presented findings provide insights into the relationship between innovation investment and financial sustainability, supported by statistically robust models that account for potential data limitations and ensure the validity of the results.

The table shows the estimates of the regression coefficients, and the associated p-values are listed below in parentheses. At the end of the table are the coefficients of determination (R^2), the adjusted coefficients of determination (R^2a), and the p-value associated with the F statistic of the global significance of the regression (P-value (F)).

The sample for estimating the models includes all companies in the PSI and IBEX-35, 72 companies from 2011 to 2022, for 612 annual observations.

The two estimated equations, Equations (1) to (2), have as variables: $INVI_{i,t}$, $INVI_{i,t-1}$ and $INVI_{i,t-2}$ is the investment in innovation of Organizations' in year t, $t-1$ and $t-2$ respectively, measured by the quotient between research and development expenses and operating profit, $FS_{i,t}$, $FS_{i,t-1}$ and $FS_{i,t-2}$ is the financial sustain-

ability of Organizations' in year t, t−1 and t−2 respectively, the product of four indicators; sales margin (quotient between gross profit from sales and sales), asset turnover (quotient between revenue and the company's total assets), payout index (quotient between dividends and net profit) and capital multiplier (quotient between total assets and net equity), $ROA_{i,t}$ is the return on assets of Organizations' in year t, the quotient between net profit and assets, $ROE_{i,t}$ is the return on net equity of Organizations' in year t, from the quotient between net profit and net equity, $SIZE_{i,t-1}$ is the size of Organizations' in year t, from the natural logarithm of assets and GDP_{t-1} from the average annual rate of change of domestic product gross at market prices of the two countries on Europe, weighted by the number of companies in the sample from each country.

Table 2. Model estimation results.

Explanatory Variables	$\mathbf{Y_{i,t} = \beta_0 + \beta_1 X1_{i,t} + \beta_2 X2_{i,t-1} + \beta_3 X3_{i,t-2} + \beta_4 ROA_{i,t-1} + \beta_5 ROE_{i,t-1} + \beta_6 SIZE_{i,t-1} + \beta_7 GDP_{t-1} + \varepsilon_{i,t}}$	
	Equation (1)	**Equation (2)**
Constant	**298.1414** (0.0000)	13.7806 (0.0789)
$FS_{i,t}$	0.53089 (0.8349)	
$FS_{i,t-1}$	**0.59098** (0.0499)	
$FS_{i,t-2}$	**0.67443** (0.0096)	
$INVI_{i,t}$		**−0.00019** (0.0472)
$INVI_{i,t-1}$		**−0.00010** **(0.0489)**
$INVI_{i,t-2}$		**0,00131** (0.0401)
$ROA_{i,t-1}$	−9.8846 (0.2356)	**0.229272** (0.0468)
$ROE_{i,t-1}$	3.777028 (0.9841)	**1.830898** (0.0122)
$SIZE_{i,t-1}$	9.8433 (0.0900)	0.915789 (0.0950)
GDP_{t-1}	**1.0021** (0.0025)	**0.7552** (0.0000)
R^2	0.2457	0.59949
R^2a	0.2463	0.56118
P-value (F)	0.0000	0.0000

Own source.

Statistically significant coefficients at a statistical significance level of 5% are marked in bold.

Two econometric models, corresponding to Equations (1) and (2), were estimated to analyze the relationship between innovation investment and financial sustainability.

- Equation (1): Investment in innovation is the dependent variable, while financial sustainability is included as an independent variable in the current period and with one- and two-period lags. Additional explanatory variables include return on assets (ROA), return on equity (ROE), organization size (SIZE), and gross domestic product (GDP) in the current period.
- Equation (2): Financial sustainability is the dependent variable, while investment in innovation serves as an explanatory variable in the current period and with one- and two-period lags. The same set of additional explanatory variables—ROA, ROE, SIZE, and GDP—are also included.

The results of Equation (1), summarized in **Table 1**, show that financial sustainability lagged by one and two periods, and GDP in the current period is a statis-

tically significant predictor of investment in innovation. The beta coefficients associated with these variables are significant at the 5% level, indicating that a company's past financial performance positively influences its innovation investment levels. This suggests that companies are more likely to invest in innovation when they have experienced financial stability in prior periods. In contrast, financial sustainability in the current period is not statistically significant, indicating that immediate financial conditions do not directly influence innovation decisions. Additionally, the variables ROA, ROE, and SIZE are not statistically significant, suggesting that operational efficiency and organizational scale are not direct determinants of investment in innovation. The individual significance test for the model constant rejects the null hypothesis, indicating that at a 5% significance level, the constant is significantly different from zero. This implies the presence of other relevant factors not included in the model that may explain variations in innovation investment. The global significance test rejects the null hypothesis, confirming that the proposed set of explanatory variables is collectively significant in explaining the dependent variable. The adjusted coefficient of determination reveals that approximately 24.6% of the variation in investment in innovation is explained by the variables included in the model.

For Equation (2), the results demonstrate that investment in innovation is statistically significant in explaining financial sustainability, but its effects vary over time. In the current period, with a one-period lag, the impact of innovation investment on financial sustainability is negative. This suggests that innovation efforts impose immediate costs, potentially straining financial stability in the short term. With a two-period lag, however, the impact becomes positive, indicating that the benefits of innovation investments tend to materialize over time, contributing to the company's financial strength in the long term. Other statistically significant variables for financial sustainability include ROA, ROE, and GDP, while SIZE is not statistically significant. The significance of ROA and ROE indicates that operational efficiency is critical in determining financial sustainability, whereas organizational scale does not directly impact it. Unlike Equation (1), the constant term in Equation (2) is not statistically significant at the 5% level, suggesting that the model is well-specified, with no significant omitted variables beyond those already included. The global significance test confirms that the explanatory variables collectively have a statistically significant impact on financial sustainability. The adjusted coefficient of determination shows that the model explains approximately 56% of the variation in financial sustainability.

The results of the two models provide valuable insights into the dynamic relationship between investment in innovation and financial sustainability:

1. Past Financial Performance Drives Innovation: Financial sustainability in preceding periods significantly influences investment in innovation, suggesting that companies use historical financial stability as a basis for long-term strategic decisions such as innovation.
2. Temporal Effects of Innovation on Financial Sustainability: Innovation investment initially imposes financial costs, negatively affecting short-term financial sustainability. However, these investments yield positive returns over time, enhancing financial sustainability in the longer term.
3. Role of Operational Efficiency and Economic Context: ROA and ROE emerge as critical drivers of financial sustainability, while GDP in the current period influences investment in innovation and financial sustainability. The organization's size does not play a significant role in either case.

However, the analysis of Equation (1) suggests that additional factors not captured in the model may contribute to explaining investment in innovation. These findings emphasize the complexity of the relationship between innovation and financial sustainability, highlighting the importance of a long-term perspective when assessing the financial impact of innovation investments.

Another point to mention is that the significantly higher R2$R2$ in Equation 2 compared to Equation 1 can be attributed to several factors related to the nature of the dependent and independent variables, the model specification, and the underlying dynamics of the relationships being analyzed. Here are the possible reasons:

Nature of the Dependent Variable:

- Equation (1): The dependent variable is an investment in innovation (INVI), which is influenced by a wide range of factors, including managerial discretion, market conditions, and strategic priorities. These factors are often difficult to quantify and may not be fully captured by the explanatory variables in the model (e.g., financial sustainability, ROA, ROE, SIZE, GDP). As a result, the model may explain a smaller proportion of the variation in innovation investment.
- Equation (2): The dependent variable is financial sustainability (FS), which is more directly influenced by measurable financial and operational performance indicators (e.g., ROA, ROE, GDP). These variables are more likely to have a strong and direct relationship with financial sustainability, leading to a higher R2R2.

Explanatory Power of Independent Variables:

- In Equation (1), the independent variables (e.g., financial sustainability, ROA, ROE, SIZE, GDP) may not fully capture the drivers of innovation investment. Innovation decisions are often influenced by intangible factors such as managerial vision, risk appetite, and external market opportunities, which are not included in the model.
- In Equation (2), the independent variables (e.g., investment in innovation, ROA, ROE, SIZE, GDP) are more closely tied to financial sustainability. For example, ROA and ROE directly measure profitability and efficiency, which are key components of financial sustainability. GDP reflects macroeconomic conditions that directly affect a company's financial performance. These variables are more likely to explain a larger proportion of the variation in financial sustainability.

Temporal Dynamics:

- Equation (1) examines the impact of financial sustainability on innovation investment, which may involve a lagged effect. The study finds that financial sustainability in the previous one and two periods significantly influences innovation investment, but the current period's financial sustainability does not. This lagged relationship may reduce the explanatory power of the model.
- Equation (2) examines the impact of innovation investment on financial sustainability, which also shows temporal dynamics. However, the study finds that innovation investment has a negative impact in the short term but a positive impact in the long term (after two periods). This suggests that the relationship between innovation and financial sustainability is more complex and may be better captured by the model, leading to a higher R2R2.

Model Specification:

- The model for Equation (2) may be better specified to capture the relationship between innovation investment and financial sustainability. For example, the inclusion of ROA and ROE as explanatory variables in Equation 2 directly relates to financial performance, which is a key component of financial sustainability. These variables are highly relevant and likely contribute significantly to the model's explanatory power.
- In contrast, Equation (1) may lack some key variables that drive innovation investment, such as R&D intensity, industry-specific factors, or managerial characteristics, which could explain why the R2R2 is lower.

Macroeconomic Influence:

- GDP is a significant variable in both equations, but its impact may be more pronounced in Equation (2), where it directly affects financial sustainability. Macroeconomic conditions (reflected by GDP) have a strong influence on a company's revenue generation, credit access, and overall financial stability, which are critical components of financial sustainability. This strong relationship may contribute to the higher R2R2 in Equation (2).

Heterogeneity in Innovation Investment:

- Innovation investment is highly heterogeneous across companies and industries. Some companies may invest heavily in innovation due to strategic priorities, while others may not, regardless of their financial sustainability. This heterogeneity makes it harder for the model to explain the variation in innovation investment, resulting in a lower R2R2.
- Financial sustainability, on the other hand, is more

standardized and can be more consistently explained by financial performance indicators (e.g., ROA, ROE) and macroeconomic factors (e.g., GDP), leading to a higher R2$R2$.

Data Limitations:

- The sample consists of European agricultural companies, which may have unique characteristics that affect innovation investment. For example, innovation in the agricultural sector may be driven by factors not captured in the model, such as government subsidies, climate conditions, or technological adoption rates. These unobserved factors could reduce the explanatory power of Equation (1).
- In contrast, financial sustainability is a more universal concept, and the variables included in Equation (2) (e.g., ROA, ROE, GDP) are more likely to be universally applicable across sectors, leading to a higher R2$R2$.

The higher R2$R2$ in Equation (2) is likely due to the stronger and more direct relationship between the explanatory variables (e.g., ROA, ROE, GDP) and the dependent variable (financial sustainability). In contrast, Equation (1) deals with innovation investment, which is influenced by a broader range of factors, many of which may not be captured by the model. Additionally, the temporal dynamics and model specification may play a role in the difference in explanatory power between the two equations.

6. Discussion and Conclusions

This study analyzes the relationship between investment in innovation/sustainability and financial sustainability among European companies. Additionally, it examines the role of other accounting and macroeconomic variables in explaining both investments in innovation and financial sustainability. The sample comprises 72 companies listed on the stock market indices, PSI and IBEX-35, respectively, covering 2011 to 2022. The methodology involves estimating multiple linear regression models with panel data. The Hausman statistical test is applied to the estimated models, and based on a 5% significance level, the models are estimated with fixed effects. The explanatory power of the models is assessed using the global significance test, individual significance test, and adjusted coefficient of determination. Several factors underscore the importance of this study. It covers companies with little research and operates in societies with limited emphasis on corporate social responsibility (CSR) and the United Nations' 17 Sustainable Development Goals (SDGs). In contrast, other countries exhibit greater awareness among managers, investors, and financiers regarding the SDGs. Understanding the relationship between investment in innovation and financial sustainability is crucial for managers, investors, researchers, and policymakers. Governments can use the findings to develop policies that promote sustainable growth aligned with the SDGs. For investors and academics, the results aid in efficient resource allocation, identifying investment opportunities, and supporting sustainable development. A company's financial sustainability derives from its ability to generate positive results over time, encompassing profitability, liquidity, balance sheet strength, and debt repayment capacity. Investment in innovation involves allocating resources to projects, assets, or activities with positive environmental, social, and governance (ESG) impacts[6, 42, 43, 53]. Financially sustainable companies are increasingly aware of the need for innovation investments. In the sample analyzed, financial sustainability in the previous one and two periods is statistically significant and positively related to investment in innovation. However, there is no evidence that financial sustainability in the current period directly impacts innovation investment. Several authors find that financial sustainability over a given period inspires confidence in investors and financiers, leading to easier access to capital and more favorable financing conditions in subsequent periods[15]. The time lag between financial sustainability and investment is due to the time required for managers, financiers, and investors to assess financial stability[9, 29, 38]. Investment in innovation is statistically significant in explaining financial sustainability. It has a negative impact in the current and previous periods but a positive impact with a two-period lag. This finding is supported by Naqbi et al.[36]. These results can be explained by the substantial financial resources required for innovation, which may initially negatively affect fi-

nancial sustainability. However, these investments yield positive results over time, improving the company's financial situation [5, 15, 24, 38]. The variables return on assets (ROA), return on equity (ROE), and organizational size do not appear to explain investment in innovation, except for gross domestic product (GDP), which is statistically significant. However, ROA and ROE are significant for financial sustainability, reflecting resource use efficiency. ROA measures a company's ability to generate profits from its total assets, which is essential for evaluating operational profitability regardless of capital structure. ROE indicates equity profitability, providing insights into shareholder value creation. Companies with high and consistent ROA and ROE tend to demonstrate greater self-financing capacity and financial stability, contributing to long-term sustainability. These variables are widely used to predict financial health and future performance. Organizational size did not demonstrate explanatory power for investment in innovation or financial sustainability, possibly due to business strategy heterogeneity and external influences. Financial sustainability is more related to efficient resource management and the macroeconomic environment than company size. Thus, size alone does not guarantee a greater propensity to invest in innovation or financial stability, highlighting the need to consider other explanatory variables [3, 5, 21, 36, 52]. GDP is a relevant indicator for explaining financial sustainability and investment in innovation. It reflects economic activity levels and macroeconomic conditions directly affecting revenue generation, credit access, financial stability, and investment. GDP positively correlates with innovation investment, as external factors influence internal decisions, such as business strategy, organizational culture, and resource availability for research and development (R&D). Despite the relevance of the results, this research has limitations. The sample includes only companies listed on the European market indices, potentially overlooking other influential factors such as legal, cultural, or economic differences between countries. Future research could address this limitation by including companies from other countries to assess whether the results are consistent or vary depending on the external environment (nationality and societal values) and social responsibility.

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