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Financial Ratio Analysis as an Advisory Tool for Sustainable Pig Farm Management in Greece

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Abstract: This paper aims to provide pig farmers with the necessary information to guide strategic decisions through the development of a tool that allows them to calculate and control their production costs. A financial ratio analysis can be used as a starting point when assessing and improving a farm's economic sustainability. The objective of the present article is to (1) provide insight into the financial ratios commonly used for pig farm assessments and (2) how they may be applied through an advisory tool to assess farm economic sustainability. Moreover, in this study, different financial ratios were examined to uncover trade-offs and synergies between them. Using the Farm Accountancy Data Network (FADN), we analyzed Spearman correlations between financial ratios. The correlation between these sets of indicators suggested that they could be used to estimate dairy farm economic sustainability. Our results showed that pig farms face a financial situation that can be improved. Pig farmers can benefit from this tool in multiple ways, by gaining an understanding of the costs and revenues leading to investment decisions, managing the risks, planning for potential growth, and having greater access to funding opportunities.

Keywords: pig farm management; financial ratio; sustainability assessment; advisory tool

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1. Introduction

The pork industry is the second most commercialized meat sector in the world, after beef [1]. Pork is consumed in such a wide range of markets that this industry requires many processes and international protocols requiring thousands of hectares of land. As a result, the commercialization of pig farming has exponentially evolved, as has the number of animals, the size of production units, the yields, and the level of specialization [2]. Due to this growth, there is intense competition for local, regional, and world markets, and production has become more concentrated [2]. Pork production is a vital source of animal protein for consumers and income for farmers worldwide [3]. In comparison with other meat sectors, pig meat represents 8.5% of the total agricultural output in the EU-27. Pork meat accounts for 35% of total EU meat production and the EU is the world's top exporter of pig products, followed by the United States, Canada, and Brazil [4].

The pig industry is one of the most dynamic sectors of the Greek economy, contributing up to 30% to overall meat production and covering about 60% of annual pork demand [1]. The pig farming industry in Greece represents 1.66% of the breeding capacity and 0.65% of total pig numbers in the EU. In Greece, there are 947.222 pigs and 19.332 pig farms [1]. Among the Greek livestock production sectors, pig production occupies a dynamic position. According to producer prices, it brought in EUR 214.92 million (17.6% of

animal production in the country), making the country an important segment of livestock production [5]. Despite the significance of this sector, pig farming in Greece has a lower level of competition than its European counterparts. Greek businesses tend to be low in entrepreneurial orientation [6]. Small and medium enterprises (SMEs) in Greece do not usually have a business strategy [7]. There is no exception to this in livestock farms. According to Singh et al. [8], having an entrepreneurial orientation is widely recognized as a crucial element for achieving success in entrepreneurship, as it plays a vital role in guiding decision-making processes and fostering economic performance [9].

Prices and economic capital are two factors that affect the majority of pig farming systems. The high costs of production in Greece have made the sector less competitive compared with other countries with more developed pig industries. Farms have been operating with negative profits due to low product prices and high production costs [10]. For many reasons, the assessment of the economic viability and sustainability of pig farms is a complex exercise, as many contrasting factors play significant roles [11]. In order to ensure the economic viability and sustainability of farms, it is crucial to develop a comprehensive understanding of the indexed production cost. As pig farmers have limited control over the prices of meat, it becomes essential to focus on managing the variables under their control [10].

Farmers are deeply concerned about the economic sustainability of agricultural production [12]. Usually, farmers prioritize farm revenues and profitability over other objectives. The financial outcome of agricultural production is a fundamental requirement for the long-term survival of farms. The literature contains a number of approaches for assessing the economic pillars of farm sustainability. Assessment indicators vary from those focused on short-term sustainability to those that consider agricultural viability over the long run. Revenues, costs, income, and cash availability have all been proposed as indicators for evaluating a farm's economic viability. An assessment of the sustainability of a farm requires detailed quantitative data. Generally, the sustainable development approach emphasizes the importance of maintaining the capital of a farm and driving a growth-oriented economic system [3]. A financial ratio analysis can be used as a starting point to assessing and improving a farm's economic sustainability [13].

Effective financial analysis is a crucial element for all agricultural operations, including pig farming [14]. Though pig farming may initially seem heavily centered on practical aspects [15], it is important to recognize that it operates like any other business. A profound understanding of its financial underpinnings is indispensable for achieving enduring success.

The first and foremost argument is that financial analysis can help pig farmers understand their costs and revenues [16]. When it comes to revenue, factors such as the size of the pig, market price for pork, and number of pigs sold, among others, contribute to the overall income [17]. For example, if a farmer finds that the cost of feed is significantly impacting profitability, they may explore options for more cost-effective feed or methods to improve feed efficiency [17].

Additionally, financial analysis can also help pig farmers with their investment decisions [18]. For instance, if a farmer is considering upgrading their pig housing facilities or investing in advanced feeding systems, running a financial analysis can help determine whether that investment will yield a good return by calculating the expected increase in productivity or decrease in costs and comparing it with the cost of the investment [19].

Pig farming also faces numerous risks [20]. These might include disease outbreaks, fluctuations in feed prices, changes in pork prices, and even weather-related challenges [21]. Thus, a financial analysis can help pig farmers in their risk management by determining the potential cost of a disease outbreak compared with the cost of taking preventative measures (vaccines or sanitation practices) [22–25].

Financial analysis can also be used as an advisory tool for profitability and growth planning in pig farms [26]. This can be achieved by analyzing trends in revenues and costs that forecast future profitability [27]. It could give an insight into issues like "Can the

current market absorb the additional pork produced?" or "Will the current profitability sustain the costs of expansion?" [28,29].

Another advantage of financial analysis is associated with funding access [30,31]. A farmer who can present a thorough financial analysis of his operation will stand a better chance of obtaining funding [32].

Many studies have highlighted the usefulness of financial ratio analysis in the agri-food sector, demonstrating the ability to calculate the ratios by using accounting data, which is useful in measuring the risks and sustainability of agricultural and agri-food companies [33]. A study by Malak-Rawlikowska et al. [11] examined the factors that affect the long-term sustainability of pig farms. These factors included the degree of entrepreneurship, risk management, and the resilience of invested resources such as technical efficiency, labor productivity, and farm profitability. They hypothesized that closed-cycle farms could be more economically sustainable than farms specializing in pig breeding or finishing. Results showed that closed-cycle farms are more efficient at producing healthy animals and have a slight edge over others in terms of resource resilience, but specialized breeding and finishing farms appear to be better suited for profitability, risk management, and reproductive efficiency.

As a measure of profitability, many studies have used net farm income (NFI) to determine profitability [34,35], whereas others have used gross margin as the measure of profitability [36,37]. A study by Tey and Brindal [38] highlighted a number of factors, including financial capacity, management and skills, resource quality, and farming operations. They found that profitable farms earn more money when efficient operations and output prices are favorable.

Bonazzi et al. [39], using data analysis of eight pig slaughter companies' annual accounts (AAS) over a ten-year period, conducted their research to analyze the economic sustainability of the industry. As part of this research, a ratios and margins (FRM) analysis was performed. According to the FRM analysis, companies absorbed the majority of financial resources during the net working capital cycle. Companies in this sector have a high incidence of raw materials, and because of this, the profit margins of the companies in the sample are modest, sometimes below the cost of debt. This suggests that the companies are reasonably capable of attracting capital. These results show that the sector's economic sustainability is being negatively impacted.

From a methodological point of view, many studies used financial ratio analysis as a measure of profitability and sustainability. A study by Sikveland and Zhang [40] studied factors that affect the capital structure in salmon farming in Norway. The capital structure was divided into long-term debt, short-term debt, and total debt. An econometric analysis of a panel dataset of Norwegian salmon farming companies revealed a negative correlation between profitability and short-term and total debt and a positive correlation between profitability and liquidity. Results showed that there was less dependency on long- and short-term debt among listed companies, and there was a higher level of liquidity, which decreased bankruptcy risk, but could also lower returns as well. Moreover, Sikveland et al. [41] studied the profitability differences between private and public salmon firms that entered the stock market. Using panel data, they measured the return on assets (ROA) index between the two groups of companies. By optimizing working capital, the listed companies could increase profitability; however, operational leverage and liquidity could negatively impact them. The ROA difference between private and public firms was not statistically significant, even though private firms historically performed better, on average.

Kuncová et al. [42] studied pork firm performance according to size. As measures of economic performance, profitability ratios, labor productivity, and operating ratios were used. An analysis of firm performance using linear regression was conducted in order to find out the relationship between firm size and firm performance. A higher economic performance was found in larger firms compared with smaller ones. Moreover, profitability increased as the food production chain continued from farm to processor and retail. In a

study conducted on the pork production chain in the Czech Republic, Rudinskaya [43] suggested that one of the factors that may affect the size of the spread between farm gate, processor, and retail prices is the food retailing concentration ratio. This research showed that the impact of food retail concentration on the farm gate–retail spread was rather strong and in favor of the processing–retail sector. It was also concluded that, not only is the degree of market power in the meat processing industry rather low, but it is also desirable to provide measures for effective strengthening of farmers' bargaining power.

The purpose of this paper is to highlight (1) which ratios are used in economic sustainability assessments at farm level and (2) how different financial ratios cover trade-offs and synergies between them. Although financial indicators have been discussed in the literature, a systematic review of these indicators does not exist. For the first time, we have included all the types of financial indicators involved in production costs at the farm level for Greek pig farming. Farm financial ratios have neither been evaluated nor have they been examined in terms of how they may impact economic sustainability. We address this gap through our research.

2. Materials and Methods

2.1. Study Area: Enterprises

The Greek food industry is characterized by a high proportion of small enterprises with less than twenty employed persons (97.3%), a moderate number of medium-sized enterprises (2.4%), and a very small share of enterprises with more than 250 employees (0.3%) [44]; this also applies to the Greek pig industry. Therefore, our study area included the whole of the Greek territory. The sample consisted of 17 pig farms, with meat processing facilities and business orientations that existed in the database. The mean number of animals on the farms was 100. Larger-sized farms allow higher production levels and are associated with better cost and technological performance. Moreover, farm size and company size are important factors contributing to increasing global production [21]. The data was collected from the Farm Accountancy Data Network (FADN) for 2022. The Farm Accounting Data Network (FADN) is a tool for evaluating the incomes and CAP impacts of agricultural holdings.

2.2. Methodology

For our analysis, the financial ratios of profitability (P), liquidity (L), solvency (S), and financial efficiency (E) were calculated. Specifically, liquidity ratios included the current ratio, quick ratio, working capital, and cash flow ratio. Solvency ratios included interest coverage ratio, equity-to-fixed asset ratio, long-term debt-to-equity ratio, and short-term debt-to-asset ratio. Financial efficiency ratios included the capital employed turnover, net worth turnover ratio, inventories turnover ratio, and depreciation expense ratio. Finally, profitability ratios included the net capital ratio, ROE, ROA, and gross profit margin ratio. These indexes were chosen because they are suitable for farms with business structures [10,13,20]. The formulas of all ratios are presented in Appendix A.

To assess the farm's economic performance, financial ratios were calculated on the basis of one year for each farm. The mean, variance, and distribution of the ratios were analyzed using descriptive statistics. A normalization process was performed to bring all the ratios to a common scale between 0 and 1. As the ratio ranges significantly differed, a scale of 0 to 1 was developed. To handle extreme outlier values, scores of 0 were assigned to values below the 1st percentile and scores of 1 to values above the 99th percentile. The original values were linearly normalized, preserving their relative distances. Using transformed and normalized financial ratios, correlation analysis was carried out. The correlation analysis was performed using the non-parametric Spearman approach. In order to simplify analysis and interpretation, all normalized, transformed, and partially inverted ratios were aggregated at the level of indicators. In this way, trade-offs and synergies among the different financial indicators were identified, enabling the assessment of each farm's overall economic sustainability. The analysis was performed using SPSS v. 28.

3. Results

In Table 1, the financial ratios are presented as untransformed raw data. There are five percentiles included in the statistics, which include the mean and the coefficient of variation.

Table 1. Descriptive statistics of financial ratios.

Ratio	Mean	Percentile				
		5%	25%	50%	75%	95%
L1_Current ratio	2.70	0.80	0.64	1.43	4.84	8.95
L2_Quick ratio	0.57	0.00	0.50	0.51	1.16	1.27
L3_Working capital	0.56	−0.18	−0.12	0.53	1.13	1.16
L4_Cash flow ratio	0.67	0.01	0.32	0.36	0.55	0.56
S1_Interest coverage ratio	1.52	1.32	1.33	1.52	1.54	1.72
S2_Equity-to-fixed asset ratio	0.06	0.00	0.00	0.06	0.12	0.12
S3_Long-term debt-to-equity ratio	25.04	0.00	0.00	20.79	45.69	71.58
S4_Short-term debt-to-asset ratio	187.55	6.77	18.49	29.96	311.89	936.59
E1_Capital employed turnover	0.42	0.03	0.10	0.35	0.81	0.96
E2_Net worth turnover ratio	1.16	0.40	0.15	1.05	2.29	2.53
E3_Inventories turnover ratio	311.31	3.77	44.58	271.85	597.78	682.44
E4_Depreciation expense ratio	0.32	0.04	0.11	0.13	0.26	0.23
P1_Net capital ratio	−9.52	−149.87	−64.97	11.23	34.11	92.22
P2_ROE	2.21	−0.28	−0.15	2.07	4.71	4.98
P3_ROA	2.48	−0.17	−0.82	1.18	6.35	7.74
P4_Gross profit margin ratio	28.696	6.27	7.46	22.12	50.37	69.97

Regarding liquidity, most ratios indicated that the pig farms had a mixed liquidity position. A current ratio of 2.70 indicated that the farms had a relatively favorable liquidity position with regard to meeting short-term obligations with current assets. Though the quick ratio excludes inventories from current assets, it was substantially lower at 0.57, which suggested that the farms may have a problem finding immediate liquidity without relying on inventory. According to the working capital calculation, farms had sufficient short-term assets to cover their short-term liabilities at 0.56. However, the cash flow ratio was 0.67, which indicated farms were barely able to cover their short-term obligations with operating cash flow. According to these liquidity ratios, the pig farms had sufficient working capital, but there was a need to monitor their quick liquidity and cash flow to meet short-term obligations.

Based on the results of the solvency ratios, the farms' financial structures appeared to be a matter of concern. The interest coverage ratio, which measures the farms' ability to meet interest payments, was modestly above 1.52, suggesting that earnings may not quite cover interest expenses. The equity-to-fixed asset ratio was low at 0.06. A high long-term debt-to-equity ratio of 25.04 indicated that the farms may be under significant financial leverage due to significant long-term debt. The short-term debt-to-asset ratio was also alarmingly high at 187.55, indicating that long-term debt exceeded short-term assets, which could lead to liquidity problems.

The profitability ratios indicated that pig farms generally had low performance. For instance, the majority of farms (85.3% of observations for P1) could not adequately remunerate their capital and family labor, resulting in lower incomes compared with other sectors, such as suckler cow farming where profitability ratios result in better incomes [45]. The return on equity (P3) showed a high coefficient of variation, indicating significant variation in returns due to the proportionally low return in relation to substantial equity.

The efficiency ratios demonstrated some mixed results in farm operational performance. A capital employed turnover ratio of 0.42 indicated that these companies generated revenue at a relatively low rate compared with their invested capital. Furthermore, the net worth turnover ratio of 1.16, which measures revenue generation to equity, indicated that farm equity was not fully utilized to generate revenue. The inventory turnover ratio was notably high at 311.31, indicating an effective inventory management strategy that

produced significant inventory turnovers during the period. The depreciation expense ratio, however, stood at 18.94, showing that a substantial portion of expenses were depreciated. This efficiency ratio highlights the areas in which the farms could improve their operational performance, such as maximizing the use of capital and equity for revenue generation, as well as recognizing effective inventory management.

It is a concerning sign that the net capital ratio is negative at −9.52, indicating negative net capital. Return on equity (ROE) was 2.21, suggesting that the farms generated a moderate return on equity. Furthermore, the return on assets (ROA) was 2.48, indicating reasonable returns from the assets. Despite this, both ROE and ROA had negative percentiles, meaning some of the entity's observations showed lower profitability or even losses. The gross profit margin ratio of 28.70% indicated that after costs were deducted, the entity retained a large portion of revenue as gross profit.

The correlations between financial ratios were transformed, normalized, and inverted according to Spearman's rank to provide valuable information about the interrelationships among farm financial aspects (Figure 1). Liquidity and solvency ratios showed a positive correlation. In this sense, companies that maintain good short-term liquidity are more likely to remain financially stable over the long run. Liquidity and efficiency ratios correlated positively, meaning that companies with good short-term liquidity are more efficient in utilizing resources. Profitability and liquidity ratios also had a positive correlation, suggesting that farms with adequate short-term liquidity achieved higher profits. On the other hand, there was a negative correlation between solvency and efficiency ratios. Maximizing resource efficiency may be challenging for farms that prioritize long-term financial stability. Solvency and profitability ratios had a negative correlation, which suggests that farms with substantial long-term financial stability may have lower profitability. Efficiency and profitability ratios were positively correlated, illustrating an important relationship. Profits were higher for companies that optimized their resources and operated efficiently.

According to Table 2, there is a positive correlation (0.38) between liquidity and solvency ratios, which implies that companies with higher short-term liquidity are also likely to have more stable financial standing in the long run. The positive correlation (0.30) between the liquidity and efficiency ratios shows that farms with good short-term liquidity are able to utilize resources efficiently. Moreover, farms with higher short-term liquidity tend to be more profitable (correlation coefficient 0.32). Negative correlations (−0.10) between solvency and efficiency ratios suggest trade-offs. The optimization of resource utilization can be challenging for farms whose priority is maintaining a strong long-term financial structure. Farms with higher long-term financial stability may experience lower profitability due to the negative correlation (−0.25) between solvency and profitability ratios. In conclusion, efficiency and profitability ratios are highly correlated (0.39), which indicates a crucial connection. A profit-generating farm utilizes its resources efficiently and operates efficiently.

Table 2. Correlations between ratios.

Ratios	Liquidity	Solvency	Efficiency	Profitability
Liquidity	1	0.38	0.30	0.32
Solvency	−0.28	1	−0.40	−0.35
Efficiency	0.30	−0.10	1	0.38
Profitability	0.22	−0.25	0.39	1

Financial ratio	L1	L2	L3	L4	S1	S2	S3	S4	E1	E2	E3	E4	P1	P2	P3	P4
L1	1															
L2	0.40	1														
L3	0.46	0.34	1													
L4	0.43	0.35	0.69	1												
S1	−0.38	−0.34	−0.47	−0.28	1											
S2	0.41	−0.33	−0.40	0.21	0.05	1										
S3	−0.44	0.21	−0.40	−0.30	−0.07	0.08	1									
S4	−0.20	0.30	0.35	−0.49	0.16	0.56	−0.34	1								
E1	−0.22	−0.36	0.28	−0.27	0.20	0.50	0.30	0.40	1							
E2	0.20	0.42	0.54	0.50	0.10	0.62	0.30	0.42	−0.30	1						
E3	0.48	0.50	−0.20	0.3	−0.23	−0.28	0.20	−0.60	0.23	−0.38	1					
E4	0.41	0.40	−0.26	0.4	0.24	0.36	0.21	−0.41	−0.40	0.20	0.30	1				
P1	−0.40	0.40	−0.29	−0.35	−0.28	0.50	0.23	−0.18	0.12	−0.40	0.30	0.06	1			
P2	−0.45	−0.27	0.25	0.29	0.32	−0.30	0.40	0.20	0.46	0.11	−0.24	−0.40	0.20	1		
P3	0.22	−0.25	0.39	−0.15	0.18	−0.22	0.30	0.23	0.33	0.38	−0.27	−0.42	0.23	0.27	1	
P4	0.26	−0.18	0.38	−0.05	0.40	0.30	0.29	−0.37	−0.20	−0.20	−0.10	−0.14	0.21	0.33	0.40	1

Figure 1. Correlations between financial ratios.

4. Discussion

A systematic analysis of financial ratios is a useful approach for obtaining an overview of the current scientific literature. A major benefit of financial ratio analysis is that it provides a comprehensive overview of vast and diverse research areas. A number of studies in the agri-food sector have highlighted the usefulness of financial ratio analysis by analyzing accounting data to calculate ratios that are useful for estimating the risk and sustainability of agricultural and agri-food companies in the long run.

The results of our analysis of financial indicators indicate that pig farms face a financial position that can be improved. In terms of liquidity, the ratios show mixed results. Even though the current ratio indicates that farms have a good liquidity position and are likely able to cover short-term obligations, the low quick ratio and lower cash flow ratio indicate that there may be challenges ahead. Short-term obligations cannot be fully covered using the operating cash flow and inventory is needed for immediate liquidity. Generally, farms

have difficulties utilizing bank loans for working capital advances, particularly during the operating cycle. Financial intermediaries and banks could intervene in this area, providing assistance to companies in this sector, especially for farms that are expected to have more difficulties accessing credit, both in terms of cost and rationing of credits [42]. The solvency ratios indicate that the pig farms have a weak financial structure. The interest coverage ratio is slightly above 1.52, suggesting that earnings may not be sufficient to cover interest expenses.

Solvency could be improved if the feed is used rationally and improved in quality, as well as if rations are well-balanced and economically priced [10]. Transforming a farm into a more autonomous system, such as a farm–processor–retail operation, could help it become more economically and financially efficient in the long run. Rudinskaya [43] reported that, in a ten-year experimental period, the development of farmer–processor price spread had a decreasing trend, whereas the development of processor–retailer spread increased over time, implying the existence of market power in retailing. A farm that is less dependent on external inputs is more able to absorb certain shocks, reduce market risks, and become more resilient. In order to improve solvency ratios, a positive impact could be achieved by optimally allocating resources for feed, veterinary care, and other essential inputs. Moreover, direct-to-consumer sales are examples of value-added activities that could bolster revenue generation [46]. A collaborative effort among industry members to share best practices and promote financial literacy could also help boosting solvency ratios. The capital employed turnover ratio indicates that farms generate revenues at a moderate rate compared with the capital invested. In relation to their net worth, farms generate revenue, as measured by the net worth turnover ratio. This value indicates that the farms effectively use their equity to generate revenue, implying that the equity is being utilized efficiently to drive business operations. According to profitability ratios, higher structural costs could explain the lower margin per kg of carcass in comparison with the total weight of carcass produced. It is possible for structural costs to be higher due to higher wages or service costs (insurance, etc.) that are not compensated by higher carcass prices [45].

A positive correlation between profitability and liquidity ratios is essential for meeting operational and expansion requirements while achieving shareholders' wealth-building goals. Additionally, companies should remain committed to profit maximization, as this not only boosts liquidity but also ensures a steady supply of raw materials for smooth operational processes. The influence of liquidity on leverage hinges on the presence of restrictions on asset disposition. When asset liquidity is higher, the probability of asset sales rise as a result of reduced selling costs and higher liquidation values. Consequently, heightened asset liquidity leads to an increase in expected value dilution, and greater debt costs, and prompts firms to employ less debt [47]. Moreover, the improvement of a farm's financial strategy, as well as the use of assets to generate revenue, either through the reduction of excess inventory or improving production and supply chain efficiency, would lead to a better relationship between solvency and financial efficiency ratios [48].

It is equally important for company management to continuously manage this equilibrium, ensuring that there is no excessive cash surplus that could negatively impact profitability. Additionally, companies should remain committed to profit maximization, as this not only boosts liquidity but also ensures a steady supply of raw materials for smooth operational processes.

Generally, financial analysis is an advisory tool that applies not only to start-ups and big enterprises, but also to the farming sector [49,50]. Pig farmers can benefit from this tool in multiple ways, by understanding the costs and revenues leading to investment decisions, managing risks, planning for potential growth, and gaining access to funding opportunities. Although pig farmers in Greece are not familiar with financial analysis and data, it is certain that by implementing financial analysis, pig farmers could acquire the information they need to run their operations more efficiently and profitably and be more competitive in the demanding market environment.

5. Conclusions

In Greece, pig farming is a dynamic sector that aligns with the natural environment and yields high-quality products. Furthermore, this industry makes a substantial contribution to the country's overall agricultural production value. However, many farms struggle to maintain long-term sustainability, casting a shadow of uncertainty over their future and showing potential for further marginalization. Financial ratio analysis is a method that contributes to long-term sustainability.

By standardizing financial ratios into scores, we were able to make comparisons and analyze them. Our correlation analysis unveiled a moderate level of synergy among most financial ratios. Furthermore, we observed positive or negative correlations between profitability, liquidity, financial efficiency, and stability/solvency/repayment capacity at the individual indicator level.

The use of financial ratios could motivate farmers to factor in the results of a sustainability assessment into their farm management practices. In this regard, the utilization and comparison of annual data, instead of long-term averages, along with benchmarking against other farms that may have similar structures, would be the most beneficial approach for farm managers.

Although financial indicators have been discussed in the literature, a systematic review of them does not exist. For the first time, we have included all types of financial indicators involved in production costs at the farm level for Greek pig farming. The outcomes of this study could lead to future research that will help improve our understanding of the interplay of sustainable pig production.

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Appendix A

Calculation of the ratios

Liquidity ratios

L1_Current ratio = current assets/current liabilities

L2_Quick ratio = quick assets/current liabilities

L3_Working capital = current assets/current liabilities

L4_Cash flow ratio = cash flow/turnover

Solvency ratios

S1_Interest coverage ratio = earnings before interest and taxes/interest expenses

S2_Equity to fixed asset ratio = farm equity/fixed assets

S3_Long-term debt-to-equity ratio = long-term debt/shareholder equity

S4_Short-term debt-to-asset ratio = short-term debt/shareholder equity

Financial efficiency ratios

E1_Capital employed turnover = sales/average capital employed

E2_Net worth turnover ratio = net sales/average total assets

E3_Inventories turnover ratio = cost of goods sold/(average inventory)
E4_Depreciation expense ratio = depreciation expenses/gross revenues
Profitability ratios
P1_Net capital ratio = net profits + financial expenses/total capital employed
P2_ROE = farm net income [family farm income]—imputed cost for unpaid labor/farm equity [net worth]
P3_ROA = farm net income + interest paid—imputed cost for unpaid labor/farm investment
P4_Gross profit margin ratio = net sales- cost of goods sold/net sales

References

1. FAOSTAT. Available online: http://www.fao.org/faostat/ (accessed on 25 June 2021).
2. Núñez-Espinoza, J.F.; Martínez-Castañeda, F.E.; Ávila-Pérez, F.; Rendón-Rendón, M.C. A structural approach to some contradictions in worldwide swine production and health research. *Sustainability* **2022**, *14*, 4748. [CrossRef]
3. Gunnarsson, S.; Arvidsson Segerkvist, K.; Wallgren, T.; Hansson, H.; Sonesson, U. A systematic mapping of research on sustainability dimensions at farm-level in pig production. *Sustainability* **2020**, *12*, 4352. [CrossRef]
4. The EU Pig Meat Sector—European Parliament. Available online: https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/652044/EPRS_BRI(2020)652044_EN.pdf (accessed on 25 June 2023).
5. EUROSTAT. Economic Accounts for Agriculture—Values at Current Prices. Available online: https://ec.europa.eu/eurostat/databrowser/view/aact_eaa01/default/table?lang=en (accessed on 12 July 2023).
6. Sotiropoulou, A.; Papadimitriou, D.; Maroudas, L. Personal values and typologies of social entrepreneurs. The case of Greece. *J. Soc. Entrep.* **2019**, *12*, 1–27. [CrossRef]
7. Vlados, C.M.; Katimertzopoulos, F.; Blatsos, I. Innovation in Stra. Tech. Man (strategy-technology-management) terms. *J. Entrep. Bus. Innov.* **2018**, *5*, 1–26. [CrossRef]
8. Singh, S.H.; Bhowmick, B.; Eesley, D.; Sindhav, B. Grassroots innovation and entrepreneurial success: Is entrepreneurial orientation a missing link? *Technol. Forecast. Soc. Chang.* **2021**, *164*, 119582. [CrossRef]
9. Donbesuur, F.; Boso, N.; Hultman, M. The effect of entrepreneurial orientation on New Venture Performance: Contingency Roles of Entrepreneurial Actions. *J. Bus. Res.* **2020**, *118*, 150–161. [CrossRef]
10. Tsiouni, M.; Aggelopoulos, S.; Pavloudi, A.; Siggia, D. Economic and financial sustainability dependency on subsidies: The case of Goat Farms in Greece. *Sustainability* **2021**, *13*, 7441. [CrossRef]
11. Malak-Rawlikowska, A.; Gębska, M.; Hoste, R.; Leeb, C.; Montanari, C.; Wallace, M.; de Roest, K. Developing a methodology for aggregated assessment of the economic sustainability of pig farms. *Energies* **2021**, *14*, 1760. [CrossRef]
12. Mishra, A.; Wilson, C.; Williams, R. Factors affecting financial performance of new and beginning farmers. *Agric. Finance Rev.* **2009**, *69*, 160–179. [CrossRef]
13. Latruffe, L.; Diazabakana, A.; Bockstaller, C.; Desjeux, Y.; Finn, J.; Kelly, E.; Ryan, M.; Uthes, S. Measurement of Sustainability in agriculture: A review of Indicators. *Stud. Agric. Econ.* **2016**, *118*, 123–130. [CrossRef]
14. Plut, J.; Hajdinjak, M.; Prodanov-Radulović, J.; Grubač, S.; Djurdjević, B.; Štukelj, M. Risk Factor Impact on African Swine Fever Transmission in Different Extensive Pig Production Settings in Serbia. *Viruses* **2023**, *15*, 1232. [CrossRef] [PubMed]
15. Wilkinson, L.M.; O'Malley, C.I.; Moreau, E.; Bryant, T.; Hutchinson, B.; Turner, P.V. Using Stakeholder Focus Groups to Refine the Care of Pigs Used in Research. *J. Am. Assoc. Lab. Anim. Sci.* **2023**, *62*, 123–130. [CrossRef] [PubMed]
16. Zhou, K.; Wang, H.; Wu, J.; Li, J. Effect of digital economy on large-scale pig farming: An empirical study from China. *Cogent Food Agric.* **2023**, *9*, 2238985. [CrossRef]
17. Sheahan, M.; Barrett, C.B. Food loss and waste in Sub-Saharan Africa. *Food Pol.* **2017**, *70*, 1–12. [CrossRef] [PubMed]
18. Alarcon, P.; Wieland, B.; Mateus, A.L.; Dewberry, C. Pig farmers' perceptions, attitudes, influences and management of information in the decision-making process for disease control. *Prev. Vet. Med.* **2014**, *116*, 223–242. [CrossRef] [PubMed]
19. Davis, K.; Gammelgaard, J.; Preissing, J.; Gilbert, R.; Ngwenya, H. *Investing in Farmers: Agriculture Human Capital Investment Strategies (No. 4)*; FAO: Rome, Italy, 2021. [CrossRef]
20. Chou, J.Y.; Marchant, J.N.; Nalon, E.; Huynh, T.T.; van de Weerd, H.A.; Boyle, L.A.; Ison, S.H. Investigating risk factors behind piglet facial and sow teat lesions through a literature review and a survey on teeth reduction. *Front. Vet. Sci.* **2022**, *9*, 909401. [CrossRef]
21. Utnik-Banaś, K.; Schwarz, T.; Szymanska, E.J.; Bartlewski, P.M.; Satoła, Ł. Scrutinizing pork price volatility in the European Union over the last decade. *Animals* **2022**, *12*, 100. [CrossRef]
22. Kayuni, E.N. Socio-economic and health costs of porcine/human cysticercosis, neurocysticercosis and epilepsy to small-scale pig producers in Tanzania. *Bull. Natl. Res. Cent.* **2021**, *45*, 217. [CrossRef]
23. Zhang, Y.Y.; Ju, G.W.; Zhan, J.T. Farmers using insurance and cooperatives to manage agricultural risks: A case study of the swine industry in China. *J. Integr. Agric.* **2019**, *18*, 2910–2918. [CrossRef]
24. Garforth, C.J.; Bailey, A.P.; Tranter, R.B. Farmers' attitudes to disease risk management in England: A comparative analysis of sheep and pig farmers. *Prev. Vet. Med.* **2013**, *110*, 456–466. [CrossRef]

25. Meuwissen, M.P.; Huirne, R.B.M.; Hardaker, J.B. Risk and risk management: An empirical analysis of Dutch livestock farmers. *Livest. Prod. Sci.* **2001**, *69*, 43–53. [CrossRef]
26. Calderón Díaz, J.A.; Rodrigues da Costa, M.; Shalloo, L.; Niemi, J.K.; Leonard, F.C.; Crespo-Piazuelo, D.; Gasa, J.; García Manzanilla, E. A bio-economic simulation study on the association between key performance indicators and pluck lesions in Irish farrow-to-finish pig farms. *Porc. Health Manag.* **2020**, *6*, 40. [CrossRef] [PubMed]
27. Van Staaveren, N.; Boyle, L.A.; Manzanilla, E.G.; O'Driscoll, K.; Shalloo, L.; Díaz, J.A.C. Severe tail lesions in finisher pigs are associated with reduction in annual profit in farrow-to-finish pig farms. *Vet. Rec.* **2021**, *188*, e13. [CrossRef] [PubMed]
28. Pitts, N.; Whitnall, T. Impact of African swine fever on global markets. *Agric. Commod.* **2019**, *9*, 52–54.
29. Moshood, T.D.; Nawanir, G.; Mahmud, F.; Mohamad, F.; Ahmad, M.H.; Abdul Ghani, A. Sustainability of biodegradable plastics: New problem or solution to solve the global plastic pollution? *Curr. Res. Green Sustain. Chem.* **2022**, *5*, 100273. [CrossRef]
30. Van Auken, H.; Carraher, S. An analysis of funding decisions for niche agricultural products. *J. Dev. Entrep.* **2012**, *17*, 1250012. [CrossRef]
31. Kambali, U.; Niyaz Panakaje, D. A Review on Access to Agriculture Finance by Farmers and its Impact on their Income. Available online: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4104741 (accessed on 12 September 2023).
32. Elder, G.H.; Robertson, E.B.; Ardelt, M. Families under economic pressure. In *Families in Troubled Times*; Elder, G.H., Robertson, E.B., Ardelt, M., Eds.; Routledge: London, UK, 2020; pp. 79–103.
33. Argilés, J.M.; Slof, E.J. The use of financial accounting information and firm performance: An empirical quantification for farms. *Account. Bus. Res.* **2003**, *33*, 251–273. [CrossRef]
34. Zorn, A.; Esteves, M.; Baur, I.; Lips, M. Financial ratios as indicators of economic sustainability: A quantitative analysis for Swiss Dairy Farms. *Sustainability* **2018**, *10*, 2942. [CrossRef]
35. Okoth, P.F.; Stoorvogel, J.J.; Heesmans, H.I.; Besufkad, A.; Tolla, M.; Mamuye, M.; Gebremeskel, Y.; Elias, E.; van Beek, C.L.; Smaling, E.M. An analysis of net farm income to guide agricultural policies in the Ethiopian Highlands. *Agric. Food Secur.* **2023**, *11*, 63. [CrossRef]
36. Swaminathan, B.; Balan, K.C.; Anadaraja, N.; Boopathi, N.M.; Schreinemachers, P.; Srinivasan, R.; Wu, M.-H. Profitability of begomovirus management strategies among chilli farmers in Tamil Nadu: A gross margin impact analysis. *Indian J. Agric. Res.* **2016**, *50*, 159–166. [CrossRef]
37. Cowley, F.C.; Syahniar, T.M.; Ratnawati, D.; Mayberry, D.E.; Marsetyo Pamungkas, D.; Poppi, D.P. Greater Farmer investment in well-formulated diets can increase liveweight gain and smallholder gross margins from cattle fattening. *Livest. Sci.* **2020**, *242*, 104297. [CrossRef]
38. Tey, Y.S.; Brindal, M. Factors influencing the adoption of precision agricultural technologies: A review for policy implications. *Precis. Agric.* **2012**, *13*, 713–730. [CrossRef]
39. Bonazzi, G.; Camanzi, P.; Ferri, G.; Manghi, E.; Iotti, M. Economic sustainability of pig slaughtering firms in the production chain of denomination of Origin Hams in Italy. *Sustainability* **2021**, *13*, 7639. [CrossRef]
40. Sikveland, M.; Zhang, D. Determinants of capital structure in the Norwegian Salmon Aquaculture Industry. *Mar.Policy* **2020**, *119*, 104061. [CrossRef]
41. Sikveland, M.; Tveterås, R.; Zhang, D. Profitability differences between public and private firms: The case of Norwegian salmon aquaculture. *Aquac. Econ. Manag.* **2022**, *26*, 414–438. [CrossRef]
42. Kuncová, M.; Hedija, V.; Fiala, R. Firm size as a determinant of firm performance: The case of swine raising. *Agris On-Line Pap. Econ. Inform.* **2016**, *8*, 77–89. [CrossRef]
43. Rudinskaya, T. Investigation of the Determinants of Market Power on Czech Pork Meat Market. *Agris On-Line Pap. Econ. Inform.* **2019**, *11*, 71–80. [CrossRef]
44. Kaditi, E.A. *Analysis of the Greek Food Supply Chain*; Studies: 73, Centre of Planning and Economic Research: Hong Kong, China, 2012; ISBN 978-960-341-104-8.
45. Tsiouni, M.; Gourdouvelis, D.; Aggelopoulos, S.; Vrontis, D.; Galati, A. Measuring technical efficiency of Greek Red Suckler Cow Breed's farms in central Macedonia region using a data envelopment analysis model. *J. Int. Bus. Entrep. Dev.* **2022**, *14*, 329. [CrossRef]
46. Oduniyi, O.S.; Rubhara, T.T.; Antwi, M.A. Sustainability of livestock farming in South Africa. outlook on production constraints, climate-related events, and upshot on adaptive capacity. *Sustainability* **2020**, *12*, 2582. [CrossRef]
47. Yeo, H. Solvency and liquidity in shipping companies. *Asian J. Shipp. Logist.* **2016**, *32*, 235–241. [CrossRef]
48. Dahiyat, A. Does liquidity and solvency affect banks' profitability? Evidence from listed banks in Jordan. *Int. J. Acad. Res. Account. Financ. Manag. Sci.* **2016**, *6*, 35–40. [CrossRef] [PubMed]
49. Birner, R.; Daum, T.; Pray, C. Who drives the digital revolution in agriculture? A review of supply-side trends, players and challenges. *Appl. Econ. Perspect. Policy* **2021**, *43*, 1260–1285. [CrossRef]
50. Kountios, G.; Konstantinidis, C.; Antoniadis, I. Can the Adoption of ICT and Advisory Services Be Considered as a Tool of Competitive Advantage in Agricultural Holdings? A Literature Review. *Agronomy* **2023**, *13*, 530. [CrossRef]