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Economics of the Fish Processing Industry: Applying the Beneish M-Score Model

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ABSTRACT

Financial statement manipulation has been a practice since the dawn of commerce, resulting in substantial financial losses that have a significant impact on the market. Various factors can lead to such behaviour, such as economic downturns or strong competitive pressures, which affect all sectors of the economy. One of these sectors, the frozen fish industry, stands out in Galicia (Spain) because of its importance due to its strategic location, with a large number of companies integrated into this commercial sector. One of these companies, Hiperxel S.L., was one of the best known for its development and size of business, but this did not prevent it from going bankrupt in 2023, an event that the Spanish Tax Agency considers to be the result of a multi-million-euro fraud. This study analyses the likelihood of fraud committed by this company through the Beneish model and shows index results that support this theory, as a Beneish M-score of 4.137 and -1.127 was obtained in 2019 and 2021, respectively, data that confirm the possible existence of financial statement manipulation before the collapse of Hiperxel S.L.

1. Introduction

Historically, financial fraud has created distrust among investors and stakeholders [1]. The seminal work of Smith [2] brought to light several shortcomings inherent in modern corporate structures. Building upon this, Roszkowska [3] observed the diminution of investor value as a consequence of financial detriments arising from fraudulent practices. The falsification of accounting data has a very negative impact not only on companies but also on all parties involved in them [4]. Based on a released report by the Association of Certified Fraud Examiners [5], between January 2022 and September 2023, fraud accounted for global losses of more than $3.1 trillion, with 1,921 recorded cases and a loss of 5% of company revenues annually, a situation that makes the detection of these practices a matter of great importance.

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In the case of Spain, between 2020 and 2021, there has been an increase in fraud as a result of the high precariousness of employment and the environment of uncertainty, a situation aggravated by the lack of both human and economic resources to combat this practice, which represents 29% of all types of fraud studied by the Spanish Association of Companies Against Fraud (AEECF) during this period (customer identity fraud, document fraud, and phishing/smishing attacks) [5]. Fraudulent activities require robust detection mechanisms.

A significant impact on accounting manipulation was also caused by the COVID-19 pandemic in Spain [6]. The poor economic performance resulting from the cessation of activities in non-priority sectors led to a scenario in which the predicted contraction of the Gross Domestic Product (GDP) and the increase in the unemployment rate [7] caused serious restrictions in obtaining financing and, consequently, an upward trend in the commission of accounting fraud, just as when the economic crisis of 2007-2008 broke out [8]. The health crisis, unexpected and demanding on corporate adaptation, has left a changing reality, forcing companies to concentrate all their efforts on recovering their business [9].

In terms of accounting fraud, there is still not much research that can serve as a guiding tool for managers and regulators [10]. Therefore, the search for new methodologies to detect whether a company is engaging in fraudulent practices is one of the most relevant research activities in accounting [11]. More recently, academic studies strongly call for using and developing artificial intelligence within accounting information systems, especially the Beneish model. Since earning manipulation involves intentional fraudulent acts, it is necessary to implement preventive measures to detect and deter such practices [12].

Accounting fraud occurs in all types of sectors. One of the most important sectors of the marine industry chain in Spain is the fish processing industry. In 2022, there were 578 companies in the fish processing industry in Spain, employing 26,324 people [13]. The sector has developed significantly since Spain joined the European Union in 1986, benefiting from European funding and tariff reductions. However, it faces challenges. These challenges include over-exploitation of natural resources, transition to more efficient and environmentally friendly production methods, and the increasing number of tons of imported canned products. A limited capacity for adaptation to change could represent a significant vulnerability for companies. Consequently, this vulnerability may create opportunities for fraudulent activities to arise.

Hiperxel S.L. is a major player in the fish processing industry. With more than thirty years in the market, this company held an important position in the market, a situation that would end in 2023 when it was declared bankrupt and accused of a crime of tax fraud. The results obtained in this study show a significant tendency of fraud by Hiperxel S.L., using abusive accounting techniques in the years prior to its closing, which is consistent with the fraud allegations made against it. By focusing on Hiperxel S.L., this article contributes to the understanding of financial fraud in the frozen fish sector and provides insights that can help regulators and managers detect and prevent such practices.

The main objective of this research is to analyze the specific case of the manipulation of the financial statements of Hiperxel S.L. In this way, it aims to detect indications of financial fraud and discuss the implications of the results for the frozen fish sector and the broader economic context. The methodology consists of applying the Beneish model to the financial data of Hiperxel S.L. from 2017 to 2021, comparing the results with control companies in the same sector. This approach helps to identify patterns and anomalies indicative of fraudulent activities.

The need to conduct this research stems from the increasing number of case studies on fraud detection. There are other case studies in academia on corporate fraud in Asia [14–17], Africa [18,19], America [20,21], Europe [22,23], and Spain [24–26].

Despite the growing academic interest in financial fraud detection, a notable gap in the literature exists regarding sectoral applications of fraud detection models, particularly in the fish processing sector, a vital but under-researched segment of the Spanish economy. The majority of extant research has centered on large publicly traded corporations in regions such as North America and Asia, thereby leaving small and medium-sized enterprises (SMEs) in southern Europe relatively unexamined. Additionally, the Beneish M-score model has seen minimal application in a retrospective manner to companies that have already experienced a collapse due to fraudulent practices, particularly in the context of legal proceedings. The present study addresses the aforementioned shortcomings by analyzing the case of Hiperxel S.L., a Galician company of relevance in the frozen fish sector that experienced bankruptcy in 2023, amidst allegations of improper financial practices. The present study aims to test the effectiveness of the Beneish model in the real context of an SME by comparing the financial indicators of Hiperxel with those of other companies belonging to the same sector. Furthermore, it contributes to the understanding of how post-pandemic economic pressures can influence fraudulent behavior. The objective of this study is to furnish regulators, auditors, and management with the tools necessary to identify indications of financial manipulation in analogous vulnerable sectors.

This study makes several fundamental contributions to the extant literature on financial fraud detection. Initially, the study implements Beneish's M-valuation model through a case study focusing on the domain of frozen fish processing in Spain. This area is characterized by a paucity of research, and the study offers empirical evidence that suggests potential financial manipulation. Secondly, the present case study focuses on Hiperxel S.L., a prominent Galician seafood industry company that was the subject of allegations of fraud and subsequently collapsed. The analysis provides a detailed perspective on how financial indicators can serve as signals prior to a company's declaration of bankruptcy, suggesting the possibility of anticipating fraudulent behavior. Thirdly, the study makes a comparison between Hiperxel's financial data and that of control companies in the same industry, thereby increasing the robustness of the conclusions drawn. The findings of this study have the capacity to furnish pertinent information to regulators, auditors, and management regarding the early warning signs of fraud. This could facilitate the optimization of detection and prevention strategies in related industries.

The structure of this paper is as follows: the first section presents a review of the literature on financial fraud and earnings management. The second section examines the frozen fish industry in Galicia and provides a detailed analysis of Hiperxel S.L. and its financial practices. The third section describes the methodology, including the model and its application. The fourth section presents and interprets the results. Finally, the conclusion summarizes the research results and their implications.

2. Case Study

2.1 The Fish Processing Industry

Spain is the European leader in the fish processing sector [27]. This success is partly due to the fact that this industry is one of the most innovative and technologically advanced within the agri-food chain in Spain [28].

An analysis of the profitability of 64 Galician fish canning companies for the period 2011-2018 shows that the financial structure of very large and large companies is stronger than that of medium and small companies [29]. Key financial indicators include ROE (Return on Equity), which shows a positive evolution with values above 10% from 2014, and ROA (Return on Assets), which also shows the best results in very large companies, with significant growth in 2015 [30]. In addition, very large companies show an acceptable ability to pay their short-term debts, with an improving trend in

recent years, although their solvency levels are low. Large companies have the highest EBIT margin in the sector, indicating higher profitability relative to sales.

Leading companies in the sector, such as Jealsa Rianxeira, Calvo and Frinsa, have adopted strategies of internationalization, private label production, commitment to technology and guaranteed supply of raw materials. These strategies are in line with the objectives of the strategic plans and have allowed large and very large companies such as Angulas Aguinaga SAU, Cabomar Congelados SA, Hiperxel SL and Pereira Productos del Mar SA to improve their economic and financial performance [31].

On the other hand, medium and small companies, such as Luis Solimeno e Hijos S.A., Ahumados Gimar SLU and Compesca SA, have shown a weaker performance compared to large and very large companies. Lack of direct access to raw materials and dependence on exports have negatively affected their profitability. However, some small companies have adopted differentiation strategies, producing gourmet products and using alternative distribution channels.

2.2 Hiperxel S.L.

Hiperxel S.L. was founded in 1988 in Galicia, Spain. In 2001, the company joined the Iberconsa S.L. group, a world leader in the capture and production of frozen southern shrimp and hake. Until around 2010, Hiperxel acquired a number of frozen food businesses. In this way, the company consolidated its position as one of the leaders of the frozen sector in Galicia, as it experienced a 5% growth and almost 50% of Galicians consumed its products [32]. In 2015, the investment fund Portobelo Capital acquired 55% of the Iberconsa S.L. group, becoming the parent company of Hiperxel S.L. At the time of this financial transaction, Hiperxel S.L. had a turnover of 19.5 million euros and 200 employees [33].

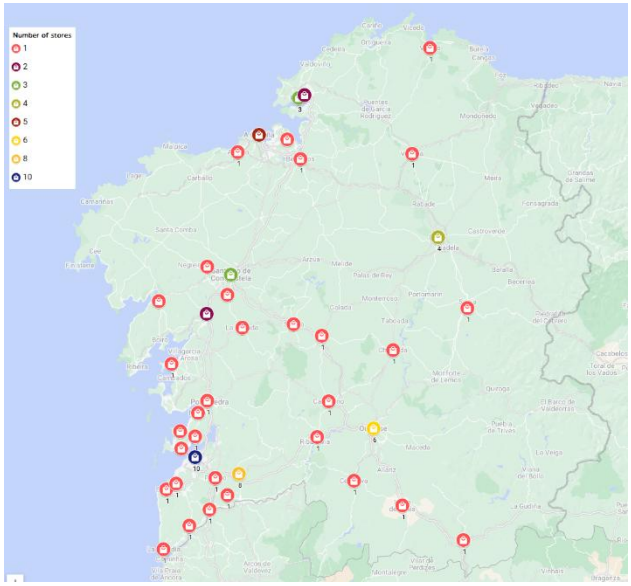

Fig. 1. Location of the Hiperxel S.L. branches in Galicia (Spain) in 2023 (Source: Authors' elaboration)

In 2021, one year after the COVID-19 pandemic, Madrid-based Vinova Investments acquired the parent company of Hiperxel S.L., Xeldist Congelados S.L.U., with the financial support of the Certior fund. At the time, Hiperxel S.L. was in a difficult economic situation, with revenues down to €25 million and annual losses of €1 million. At the end of 2022, the Casalnova company tried to improve Hiperxel's financial situation by advancing €1.5 million worth of merchandise for the Christmas campaign and committing to two other campaigns for 2023, with an additional injection of liquidity

from Resilience Partners and Certior [34]. Figure 1 illustrates the geographical distribution of Hiperxel S.L. branches in Galicia. This cartographic analysis demonstrates the company's extensive regional presence, underscoring its strategic importance in the local frozen food.

However, in 2023, Hiperxel was declared bankrupt. The declaration of bankruptcy was requested by Xeldist Congelados S.L.U., and the Commercial Court No. 3 of Pontevedra declared the bankruptcy. At that time, the number of stores in Galicia had increased from 74 to 102, although the bankruptcy prevented Hiperxel from meeting its outstanding payments [35]. This critical situation was due to the fall in families' purchasing power, the decline in consumption of frozen fish and seafood, and the difficulty in obtaining bank loans.

In the middle of 2023, Hiperxel S.L. was declared bankrupt. Figure 2 presents a timeline of the business activities of the managers of Hiperxel S.L. This chronology helps contextualize the sequence of corporate maneuvers and ownership changes that culminated in the alleged fraudulent activities under investigation. In 2023, the Ministry of Finance and Public Administration opened a fraud investigation based on the complaint filed by the Public Prosecutor's Office of Pontevedra in the Court of Marín against the managers of Xeldist Congelados S.L.U. This investigation was motivated by the suspicion that the managers (Novás and Villamizar) may have committed up to three crimes against the Public Treasury between 2017 and 2019. The complaint indicated the possibility that two legal entities and five natural persons had created a trading group to simulate operations that would give the public the impression of economic solvency, to obtain loans from large banking entities, with which they would have purchased a large quantity of fish from Norwegian companies.

However, a significant amount of these purchases was never paid to the suppliers, and the product was sold outside the company's registered accounts. The investigation by the Spanish Public Prosecutor's Office concluded that the company's managers defrauded €271,773 in 2017, €1.3 million in 2018 and €119,000 in 2019, amounts whose calculation exceeds the amount established for the constitution of a crime against the public treasury in Spain.

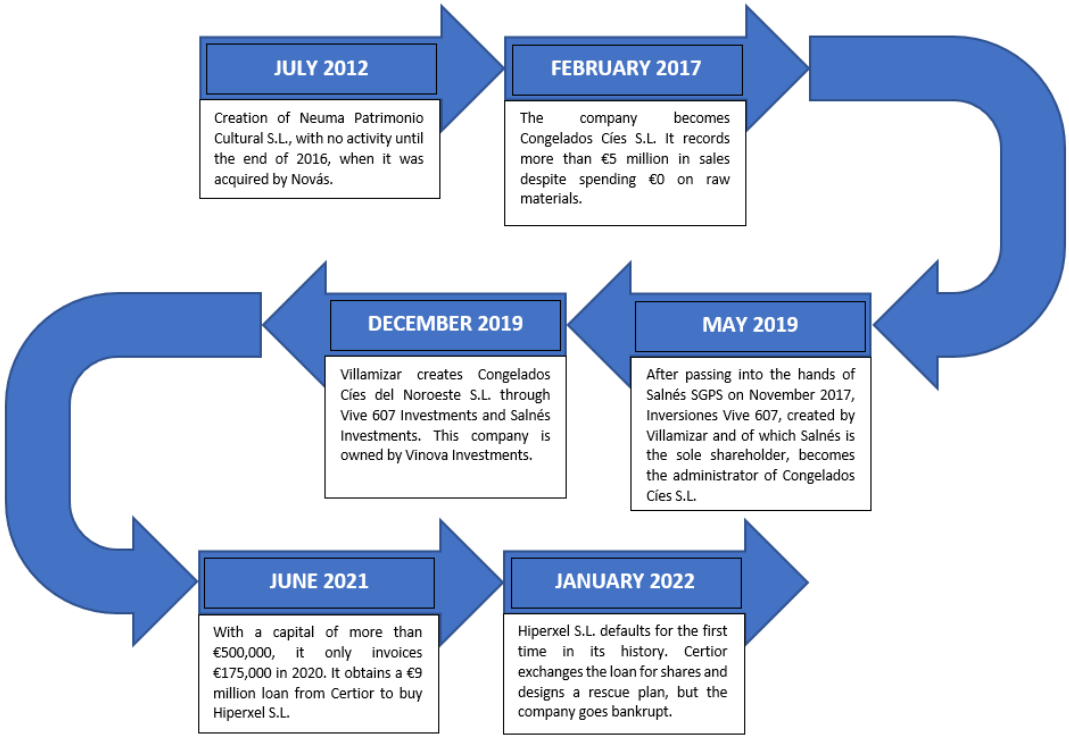

Fig. 2. Chronology of Hiperxel business from 2012 to 2022 (Source: Authors' elaboration)

In addition to the pending case in Spain, the Portuguese judiciary has requested a total of 30 years in prison for the managers of Hiperxel S.L. for massive tax fraud. The possible crime of Hiperxel S.L. would begin in 2012 with the creation of the company Neuma Patrimonio Cultural S.L., which was renamed Congelados Cíes S.L. in 2017. Although Congelados Cíes S.L. did not have any raw material costs, the company had a turnover of more than 5 million euros. The company was subsequently acquired by Portugal's Salnés SGPS and then by Inversiones Vive 607 S.L.

Despite Hiperxel S.L.'s pending legal cases in Spain and Portugal, businessman Manuel Cibeira, owner of the frozen food brand Alaskamar, acquired Hiperxel S.L. in 2023. This acquisition resulted in the reopening of more than 20 stores, between 25 and 30, in the Galician community and the creation of between 60 and 70 jobs in 2024.

3. Methodology

Earnings management is defined as the practice whereby managers intervene in the preparation of financial reports and the structuring of transactions to alter them and influence the results that depend on the reported financial statements. Over time, various methodologies have been developed to identify earnings management practices [36,37]. The issue gained prominence in the 1980s through academic studies that identified four categories to measure management: accruals (category I), earnings smoothing (category II), earnings forecasting (category III), and earnings conservatism (category IV). It is important to distinguish between discretionary and non-discretionary accruals. Non-discretionary accruals occur without accounting distortions, while discretionary accruals are added to complete the total accruals realized by the firm [38].

In the 21st century, academics have analyzed earnings management from different approaches. Non-discretionary accruals models used include the DeAngelo model, the Healy model, and the Jones model, both normal and simplified [39]. Another widely used model for studying earnings management is the multiple regression model, which predicts a company's results by analyzing multiple variables, although small differences in data sources can make this methodology somewhat imprecise [40].

Fraud is related to earnings management because both involve discretionary accrual management, which leads to the view that discretionary accrual management is outside GAAP (Generally Accepted Accounting Principles) even if it does not result in a material change or distortion in the financial statements [41]. Techniques to identify accounting manipulation have emerged in the 21st century, including models that focus on qualitative aspects related to managerial decision making [42].

Accounting manipulation or fraud is defined as when managers violate generally accepted accounting principles solely to present a favorable image of the company [43]. One of the most widely used methods for detecting corporate fraud is the M-score model. The M-score model identifies possible manipulations in companies that exhibit extreme levels of financial performance. Beneish conducted a study between 1987 and 1993 with a sample of 64 companies that falsified their accounts and compared them with 1,989 companies that met their financial obligations according to accounting principles (control companies) [44].

Although the fraudulent firms were clearly identified because they appeared in the media accused of manipulating their accounts or were subject to SEC (Securities and Exchange Commission) actions [45], the control firms could include undetected fraudulent firms, which would result in a significant bias in the M-score and make the study more conservative.

Recent studies have improved the Beneish model using logistic regression and genetic algorithms, improving its accuracy in predicting earnings manipulation [46]. In addition, the development of the

Beneish model through logit and probit analysis has shown significant differences in predictive accuracy, emphasizing environmental variables such as information asymmetry and product market competition [47].

This second Beneish model includes a total of eight variables, all of which are designed to detect changes in financial statements that may reflect manipulation of accounts and, therefore, the existence of fraud:

Daily Sales Receivables Index (DSRI): This ratio measures whether accounting changes in accounts payable are consistent with changes in sales. Recommended value: < 1.

$$DSRI = \frac{Receivables_t/Sales_t}{Receivables_{t-1}/Sales_{t-1}} \quad (1)$$

Gross Margin Index (GMI): Tests whether the difference between sales revenue and cost of goods sold, i.e. the gross margin, has deteriorated and therefore provides a negative view of the company's future. Recommended value: < 1.

$$GMI = \frac{(Sales_{t-1} - Cost\ of\ goods\ sold_{t-1})/Sales_{t-1}}{Sales_t - Cost\ of\ goods\ sold_t/Sales_t} \quad (2)$$

Asset Quality Index (AQI): Analyzes the risks arising from changes in the quality of the company's assets. Growth would imply a propensity to capitalize and defer costs. Recommended value: < 1.

$$AQI = \frac{1-(Current\ assets_t + PP\&E_t)/Total\ assets_t}{1-(Current\ assets_{t-1} + PP\&E_{t-1})/Total\ assets_{t-1}} \quad (3)$$

Sales Growth Index (SGI): Ratio of one year's sales to the previous year's sales. Although an increase in this ratio does not indicate fraud, companies experiencing rapid growth are considered more susceptible to accounting manipulation than others due to the pressure on management to meet established financial targets. Recommended value: < 1.

$$SGI = \frac{Sales_t}{Sales_{t-1}} \quad (4)$$

Depreciation Index (DEPI): This index tracks changes in the depreciation rate. An increase indicates efforts to reduce depreciation and thus increase profits. Recommended value: < 1.

$$DEPI = \frac{Depreciation_{t-1}/(Depreciation_{t-1} + PP\&E_{t-1})}{Depreciation_t/(Depreciation_t + PP\&E_t)} \quad (5)$$

Selling, General and Administrative Expense Index (SGAI): Ratio of selling, general and administrative expenses to sales. If this ratio rises excessively, it could indicate an unfavorable future for the company. Recommended value: < 1.

$$SGAI = \frac{Sales, general\ and\ admisnistrative\ \exp ense_t/Sales_t}{Sales, general\ and\ admisnistrative\ \exp ense_{t-1}/Sales_{t-1}} \quad (6)$$

Leverage Ratio (LVGI): The ratio of the company's total debt to its assets, both current and noncurrent. A high value indicates an incentive for managers to misrepresent the financial statements. Recommended value: < 1.

$$LVGI = \frac{(LTD_t + Current\ liabilities_t)/Total\ assets_t}{(LTD_{t-1} + Current\ liabilities_{t-1})/Total\ assets_{t-1}} \quad (7)$$

Total Accruals to Total Assets (TATA): This ratio estimates the level or degree to which earnings are cash based. The higher the positive accrual, the greater the likelihood of accounting manipulation. Recommended value: = 1.

$$TATA = \frac{\Delta Working\ capital - \Delta Cash - Depreciation_t}{Total\ assets_t} \quad (8)$$

Beneish (1999) used a weighted exogenous sample maximum likelihood probit (WESML) and an unweighted probit to evaluate the model. The results from the unweighted probit estimates were applied to this model:

WESML=-4.84+0.92*(DSRI)+0.528*(GMI)+0.404*(AQI)+0.892*(SGI)
+0.115*(DEPI)-0.172*(SGAI)+4.679*(TATA)-0.327*(LVGI) (9)

The application of the Beneish model to determine the degree of probability that the company Hiperxel, S.L. has committed fraud is shown below. Along with Hiperxel, S.L., four other companies in the same sector were also analyzed, which were considered as control companies in this study, since none of them was involved in any case of fraud. Finally, the results obtained from these companies were compared with those of Hiperxel S.L. The main financial data are presented in Table 1.

Table 1
Financial statements and ratios of Hiperxel S.L. and control companies for 2021. (Source: Authors' elaboration based on [48])

Financial statement/ratio	Hiperxel S.L.	Distribuciones Frionorte S.L.	Tiendas Aqualund S.L.	Quagga Inversiones S.L.	La Sirena Alimentación Congelada S.A.U.
Size (in thousand €)					
Total assets	13,312,076	47,345,278	2,576.113	1,339,717	72,870,819
Sales	25,113,019	72,486,728	6,211.127	5,626,538	194,382,381
Liquidity/laverage					
Working capital over total assets	-0.13	0.23	-0.17	0.06	-0.10
Current ratio	0.84	2.12	0.73	1.09	0.79
Total debt over total assets	0.54	0.38	0.81	0.58	0.53
Profitability/growth					
Return on assets	-8.13	11.88	2.02	11.03	-1.12
Sales growth	-0.45%	-1.23%	-4.66%	48.87%	19.03%

The period analyzed in this study is 2017-2021, since 2021 is the period in which the alleged fraud would have been committed in the accounts of Hiperxel, S.L. In the analysis, the data included in the balance sheet and the profit and loss account have been used, information thanks to which the Beneish model has been applied, a methodology also used in control companies with the aim of being able to make a comparison.

4. Results

The results obtained for all the companies covered by this study (Table 2 and Table 3) allow us to observe the trends towards the commission of fraud by each of them.

Table 2
Earnings manipulation predictive indicators of Hiperxel S.L. (Source: Authors' elaboration)

		2017	2018	2019	2020	2021
Hiperxel S.L.						
	Day's sales in receivables index (DSRI)	0.057	1.229	8.997	0.75	2.982
	Gross margin index (GMI)	1.022	0.919	1.039	1	0.958
	Asset quality index (AQI)	1.076	1.044	0.806	1.019	0.697
	Sales growth index (SGI)	0.986	1.031	1.053	1.191	0.995
	Depreciation index (DEPI)	0.956	0.938	1.072	0.873	0.888
	Sales, general and administrative expenses index (SGAI)	0.999	1.002	0.993	0.938	1.248
	Leverage index (LVGI)	0.989	0.93	1.098	0.912	1.246
	Total accruals to total assets (TATA)	0.094	0.066	-0.151	-0.294	-0.04
	Manipulation index	-2.877	-1.943	4.137	-3.881	-1.127

Table 3
Earnings manipulation predictive indicators of control companies (Source: Authors' elaboration)

		2017	2018	2019	2020	2021
Distribuciones Frionorte S.L.						
	Day's sales in receivables index (DSRI)	0.836	0.885	1.145	1.135	1.061
	Gross margin index (GMI)	0.986	0.932	0.99	0.923	0.96
	Asset quality index (AQI)	1.003	0.989	0.898	0.816	0.963
	Sales growth index (SGI)	1.089	1.08	1.034	1.24	0.988
	Depreciation index (DEPI)	0.913	1.011	0.992	0.952	0.892
	Sales, general and administrative expenses index (SGAI)	1.064	1.008	1.068	0.895	1.113
	Leverage index (LVGI)	0.979	0.913	1.046	1.015	0.92
	Total accruals to total assets (TATA)	-0.063	-0.074	-0.056	-0.15	-0.075
	Manipulation index	-2.868	-2.871	-2.652	-2.948	-2.829
Tiendas Aqualund S.L.		2017	2018	2019	2020	2021
	Day's sales in receivables index (DSRI)	1.088	0.744	1.414	0.589	0.73
	Gross margin index (GMI)	0.94	0.932	1.014	0.98	0.921
	Asset quality index (AQI)	0.856	1.228	0.932	0.772	0.926
	Sales growth index (SGI)	0.912	0.955	1.136	1.135	0.953
	Depreciation index (DEPI)	1.232	15.3	0.165	0.251	1.202
	Sales, general and administrative expenses index (SGAI)	1.054	1.072	0.975	1.019	1.098
	Leverage index (LVGI)	1.008	0.99	0.994	0.991	0.991
	Total accruals to total assets (TATA)	-0.039	0.012	-0.069	-0.175	-0.189
	Manipulation index	-2.735	-1.01	-2.411	-3.747	-3.716
Quagga Inversiones S.L.		2017	2018	2019	2020	2021
	Day's sales in receivables index (DSRI)	n.a	n.a	n.a	n.a.	0.421
	Gross margin index (GMI)	n.a	n.a	n.a	1.021	0.94
	Asset quality index (AQI)	n.a	n.a	n.a	3.232	0.86
	Sales growth index (SGI)	n.a	n.a	n.a	2.501	1.489
	Depreciation index (DEPI)	n.a	n.a	n.a	1.392	1.073
	Sales, general and administrative expenses index (SGAI)	n.a	n.a	n.a	1.143	0.955
	Leverage index (LVGI)	n.a	n.a	n.a	n.a.	0.758
	Total accruals to total assets (TATA)	n.a	n.a	-0.679	-0.483	-0.465
	Manipulation index	n.a	n.a	n.a	n.a.	-4.746

Table 3
Continued

La Sirena Alimentación Congelada S.A.U.		2017	2018	2019	2020	2021
	Day's sales in receivables index (DSRI)	0.632	1.14	0.714	1.84	0.718
	Gross margin index (GMI)	0.987	0.986	1.004	0.978	1.009
	Asset quality index (AQI)	0.955	0.929	0.938	0.814	0.867
	Sales growth index (SGI)	1.006	1.025	1.009	1.081	1.19
	Depreciation index (DEPI)	0.787	1.054	1.019	0.936	1.046
	Sales, general and administrative expenses index (SGAI)	1.049	1.035	1.075	0.923	0.906
	Leverage index (LVGI)	1.056	1.085	0.75	0.983	1.022
	Total accruals to total assets (TATA)	-0.259	-0.249	-0.428	-0.298	-0.284
	Manipulation index	-4.099	-3.557	-4.69	-3.103	-3.934

The analysis of the predictive indicators of earnings manipulation for Hiperxel S.L. reveals significant trends that suggest potential fraudulent activities. Firstly, the Days Sales in Receivables Index (DSRI) for Hiperxel S.L. shows values significantly above the threshold in 2018, 2019, and 2021, with the 2018 value being nearly nine times higher than the established limit. This suggests a high probability of fraud through fictitious increases in accounts receivable. Such a drastic increase in DSRI indicates that Hiperxel S.L. might be inflating its sales figures by recording revenue that has not yet been collected, thereby artificially boosting its financial performance. According to Anh & Da Hanh (2023), a high DSRI is a strong indicator of revenue manipulation, as companies may recognize revenue prematurely to meet financial targets.

Regarding the Gross Margin Index (GMI), Hiperxel S.L. presents indications of fraud in 2017, 2019, and 2020. The deterioration in gross margin during these years suggests that the company might be manipulating its cost of goods sold to present a more favorable financial position. A declining GMI can indicate that the company is overstating its revenues or understating its costs, which is a common tactic in earnings manipulation. Bansal et al. [36] emphasize that a declining GMI is often associated with aggressive accounting practices aimed at inflating profitability.

The Asset Quality Index (AQI) for Hiperxel S.L. shows suspicions of fraud in 2017, 2018, and 2020. This index indicates possible fraud through excessive capitalization of expenses, as non-current assets increased relative to fixed assets in these years. An increasing AQI suggests that the company might be capitalizing expenses that should be expensed, thereby inflating its asset base and improving its reported earnings. This behavior aligns with findings from Beneish [44], who noted that companies with high AQI values are more likely to engage in earnings manipulation by capitalizing costs that should be expensed.

The Sales Growth Index (SGI) indicates potential fraud in 2018, 2019, and 2020, showing an upward trend in this variable. This implies a growing propensity for accounting manipulation to falsify earnings. Rapid sales growth can be a red flag, especially if it is not accompanied by a corresponding increase in cash flow, suggesting that the reported sales might not be entirely genuine.

The Depreciation Index (DEPI) for Hiperxel S.L. suggests accounting falsification in 2018. This indicates a possible false increase in earnings by extending the useful life of assets to depreciate them at a slower rate. Manipulating depreciation can significantly impact reported earnings, as it reduces the expense recognized in the income statement, thereby inflating profits. According to Ramírez-Orellana et al. [49], companies often manipulate depreciation rates to manage earnings, making DEPI a critical indicator of potential fraud.

The Sales, General and Administrative Expenses Index (SGAI) for Hiperxel S.L. shows results above the threshold in 2018 and 2021, indicating possible accounting manipulation due to a lower level of

efficiency. High SGAI values suggest that the company might be understating its operating expenses to present a more favorable financial position. This aligns with findings from Mohammed et al. [50], who noted that companies with high SGAI values often manipulate expenses to improve their financial appearance.

The Leverage Index (LVGI) for Hiperxel S.L. shows signs of fraud in 2019 and 2021, indicating probable earnings manipulation to meet debt commitments. High leverage can pressure management to manipulate earnings to meet debt covenants and avoid default.

The Total Accruals to Total Assets (TATA) analysis reveals that Hiperxel S.L. shows a significant difference between earnings and cash flow, indicating a high probability of accounting manipulation. High accruals relative to total assets suggest that the company might be using aggressive accounting practices to inflate its earnings.

Finally, the Manipulation Index (M-score) calculation reflects that Hiperxel S.L. has a value above -1.78 in 2019 and 2021. The 2019 index is the highest among all calculated in this study, indicating a very high probability of fraud. This high M-score suggests that Hiperxel S.L. is likely engaging in earnings manipulation to present a more favorable financial position than is actually the case.

4. Discussion and conclusions

In this study, the existence of possible falsified financial statements by a major company in the frozen food sector, Hiperxel S.L., has been assessed. The calculations carried out for both the company suspected of fraud and the companies with which a comparison has been established have been carried out following the Beneish model. The examination of the accounts of Hiperxel S.L. using the Beneish method reveals the existence of a high probability that the company has committed fraud in its financial statements in the period under study. Specifically, the company shows signs of manipulation in all the variables of the model, although not for all the years studied. The indexes with the highest values for Hiperxel S.L. are the Day's sales in receivables index (DSRI), the Sales, general and administrative expenses index (SGAI), and the Leverage index (LVGI).

The Day's sales in receivables index (DSRI) is the one that has registered the highest values, covering the years 2018, 2019 and 2021. The first case is due to a difference in the account of clients pending collection between 2017 and 2018 of more than 25%, while for 2019 there was an increase of 847%, the difference between 2020 and 2021 being more than one million €, which represents a variation between both financial years of almost 200%, data that present a considerable difference compared to the variation in sales, which increased by 3% between 2017 and 2018 and more than 5% between 2018 and 2019, falling by 0.45% from 2020 to 2021. These differences in the account of clients pending collection, especially in 2019, reveal a very probable manipulation of the Day's sales in receivables index (DSRI) and, therefore, a clear propensity for fraud.

The second of the indices that most reveal the alleged alteration of the accounts of Hiperxel S.L. is the Sales, general and administrative expenses index (SGAI). The result obtained in this variable reflects an evident decrease in the level of efficiency of the company as a result of the increase in administrative expenses and also sales expenses, which increased from 2020 to 2021 by almost 25% compared to the decrease in sales, which reveals a propensity to falsify the financial statements according to the Beneish model.

The third variable to show greater signs of a possible commission of fraud is the Leverage index (LVGI). This variable reflects a very high level of leverage, which derives from a high increase in long-term debts, which grew by more than 1,400% between 2020 and 2021, with short-term debts growing by more than 70%. These percentages reveal high financial pressure, a detail that increases the propensity to commit fraud in order to meet debt obligations.

The fourth and last variable to present the highest fraud rates is the Total accruals to total assets (TATA), whose result, very far from the recommended limit, reveals a notable difference between the profits obtained in the financial year and the Cash Flow, which suggests a high probability of accounting manipulation since the greater the disparity, the greater the tendency to commit fraud, although it should be noted that the control companies also present a high difference between both accounts.

As for the M-score obtained, it shows a significant tendency to falsify the accounts of Hiperxel S.L., a fact motivated by the four indices mentioned above, which reveal signs of an aggressive practice of accounting alteration. This situation is consistent with the fraudulent situation in which the company is involved, whose financial statements would have been allegedly manipulated to defraud the Public Treasury, although it is important to highlight that in 2019, two years before the acquisition of the company by Vinova, there were already symptoms of fraud due to the fact that for said financial year an index of 4,137 was obtained, a result derived mainly from an increase in the account of clients receivable by 847%, which in monetary units constitutes an increase of more than half a million €, a figure that contrasts with that obtained the previous year, in which said account grew by less than €14,000, and above all with the amount contributed in 2017, a year in which customer debts fell by more than €840,000, that is, 1,667%.

It is worth mentioning the results obtained in the other indices, in which values were obtained that either did not show signs of possible fraud or the value reflected exceeded the limit by very little. Of these indices, the most notable is the Asset quality index (AQI), with a value for 2021 very far from the established limit, which indicates that of all the companies analyzed, Hiperxel S.L. is the one with the least tendency to capitalize expenses for this year, being also little prone to an artificial increase in profits at the cost of altering the depreciation of assets by lengthening their useful life or to an excess of capitalization of expenses for the last year studied, a situation that is far from previous financial years, in which it exceeded the limit with the exception of 2019. In addition to this, it is necessary to highlight the index shown by Tiendas Aqualund S.L. in 2018, the only year in which a control company shows signs of fraud, a situation derived from a decrease in depreciation of more than 1,260%.

Finally, it should be noted that this exploratory study is merely an approximation to determine the variables that may have effects on fraud and the alteration of financial statements. Furthermore, it should be noted that the nature of the data shown indicates that they should not be interpreted casually, despite the relationship that appears to exist between accounting manipulation and the variables used in this study. Finally, the companies analyzed in this article are not listed on the stock exchange, which makes the Beneish method not as reliable as in the case of the analysis of companies that are listed on the stock market.

Author Contributions

Conceptualization, R.F-G. and F.P-G.; methodology, R.F-G.; software, R.F-G.; validation, R.F-G., F.P-G. and P.C.P.; formal analysis, R.F-G.; investigation, R.F-G.; resources, R.F-G.; data curation, R.F-G.; writing—original draft preparation, R.F-G.; writing—review and editing, R.F-G.; visualization, R.F-G.; supervision, R.F-G.; project administration, R.F-G.; funding acquisition, F.P-G. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author, R.F-G., upon reasonable request.

Conflicts of Interest

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

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