

Crisis, Recovery, and Regional Asymmetries: A Firm-Level Financial Analysis of Italian Food and Beverage SMEs

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Abstract

This study investigates the financial impact of the COVID-19 pandemic on small and medium-sized enterprises (SMEs) in Italy's food and beverage processing sector. Drawing on firm-level panel data from the AIDA database, the analysis spans the period 2019–2022 and focuses on structural resilience and heterogeneity across firm sizes and regions. A sample of 1,600 SMEs was examined, segmented by workforce size and macro-geographical area. Key performance indicators - Return on Equity (ROE), Return on Investment (ROI), debt ratio, and EBITDA per employee - were analyzed to track changes before, during, and after the crisis. Findings reveal a substantial contraction in profitability in 2020, with ROE declining by 147% in the North, while Southern firms demonstrated relatively greater resilience. ROI dropped sharply across all areas, with incomplete recovery by 2022. Debt ratios exceeded 70% sector-wide during the crisis, underscoring high financial vulnerability. EBITDA rebounded after a 10% contraction, though rising labor costs - up 8.3% by 2022 - constrained operational efficiency. Supplementary analyses include a firm-level classification of performance evolution, a correlation matrix revealing moderate alignment between investment and profitability metrics, and a cluster analysis that distinguishes between typical SME trajectories, distressed micro-firms, and structurally distinct large enterprises. The results highlight asymmetrical recovery paths shaped by firm size and regional conditions.

Overall, the study underscores the importance of differentiated policy approaches tailored to the structural and territorial characteristics of the sector, to support long-term resilience and mitigate the effects of future systemic shocks.

Keywords: Food Industry; Beverage Industry, Small Medium Industries, post-pandemic recovery, Italy, COVID-19, resilience

Introduction

The food and beverage processing sector (FBP), as defined by the European Union, encompasses all industries involved in converting agricultural raw materials into consumable food and drink products. It holds a pivotal role in supporting food security, economic resilience, and the broader objectives of sustainable development across the EU. In the national context, the FBP sector contributes significantly to GDP - accounting for nearly one-quarter - and is widely recognized as a reliable source of employment and a cornerstone of the manufacturing industry.

Based on the last report of the *Food and Drink Europe* (available at www.fooddrinkurope.eu), in 2024 the sector in Italy, roughly 304,000 enterprises, employs approximately 4.7 million people: those numbers witness the leading positioning of this Italian sector within European manufacturing. Generating in 2024 €249 billion in added value, it is basically made of small and medium-sized enterprises (SMEs) counting for around 99% of all businesses within the sector, and deeply embedded in their local economies, contributing to social cohesion, employment but regional development too.

The sector reported consistent growth during the last years, driven by ongoing investments in modernization and technological innovation. Capital is primarily directed toward upgrading machinery, enhancing production facilities, and implementing agricultural infrastructure. Notably, renewable energy systems have emerged as a particularly dynamic area of investment, attracting increasing interest from both public and private actors.

While domestic demand for food and beverage products has shown a relatively stable progression over the years, the sector's international expansion has emerged as a critical engine of growth. Between 2015 and 2023, export revenues increased by an impressive 72.1%, underscoring the enhanced global competitiveness of Italian food and beverage producers. This expansion reflects the sector's growing ability to position its products successfully in foreign markets, supported by sustained improvements in quality, branding, and supply chain capabilities.

Revenue trends in the industry reveal two distinct phases. The pre-pandemic years were characterized by steady and incremental growth,

whereas the post-2020 period marked a clear inflection point, with accelerated gains. This surge not only signals a robust recovery but also indicates a strategic shift among firms toward innovation, internationalization, and diversification. Many enterprises reoriented their operational models in response to the pandemic by investing in digital tools, enhancing export logistics, and improving supply chain resilience.

This transformation is particularly evident among small and medium-sized enterprises (SMEs), many of which demonstrated rapid adaptability by implementing lean production techniques and targeting niche international markets. These combined efforts have strengthened the sector's reputation as a benchmark for resilience and adaptability in times of crisis.

As of 2022, Italy's food and beverage processing sector included 52,414 active firms employing nearly 468,000 workers, of whom 85% were salaried employees. Micro-enterprises (fewer than 10 employees) made up approximately 85% of the total number of firms and provided employment to 28.5% of the workforce. In contrast, large enterprises (250+ employees) accounted for less than 2% of all firms, according to data from the Italian National Institute of Statistics (ISTAT).

While the academic literature has widely explored the pandemic's impact on global food supply chains (e.g., Berardi, 2022; Nakat et al., 2021; Naseer et al., 2023; Vlachos, 2024), much of this work has focused on agricultural production or macro-level disruptions, with limited attention to the food processing segment. Recent studies (Rinaldi & Bottani, 2023; Barile et al., 2024; Timpanaro et al., 2024) have begun to address this gap by highlighting how supply chains and processing systems have responded to crises ranging from pandemics to geopolitical instability.

In the Italian context, the performance of food and beverage processing firms - particularly SMEs - relatively underexplored. This study aims to fill that gap by examining firm-level financial data for SMEs operating in the sector. Drawing on the hypothesis that SMEs possess greater operational flexibility and crisis-response agility than larger enterprises (Zutshi et al., 2021), the analysis investigates how these firms absorbed and recovered from the financial shocks of the COVID-19 pandemic, providing new insight into sectoral resilience and post-crisis adaptation.

Methods

This study draws upon financial data from a proprietary sample of 2,450 small and medium-sized enterprises (SMEs) operating within Italy's food and beverage processing sector. The sample was developed in partnership with the national association representing SMEs in Food and Beverage (www.unionalimentari.it). Data were sourced from the AIDA database and span the years 2019 through 2023, allowing for a comparative

analysis of pre-pandemic conditions, the peak of the COVID-19 crisis, and the initial recovery period. Due to the incomplete nature of the 2023 data at the time of analysis, the empirical investigation focuses on the 2019–2022 timeframe.

To capture sectoral diversity and regional disparities, the sample is disaggregated by both company size and geographic location. For analytical consistency, Italy's regions are grouped into three macro-areas:

- **North:** Aosta Valley, Piedmont, Liguria, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, and Emilia-Romagna
- **Center:** Tuscany, Umbria, Marche, and Lazio
- **South and Islands:** Abruzzo, Molise, Campania, Apulia, Basilicata, Sicily, and Sardinia

As shown in Table 1, micro-enterprises (fewer than five employees) make up roughly 55% of the total sample. Moreover, 58% of the firms are located in the South and Islands, with a particularly high concentration in Campania, Apulia, and Sicily. This distribution underscores the territorial importance of the sector and its deep-rooted presence in southern Italy's economic fabric.

Table 1. Final sample by employees and geographical location.

		<i>total Sample</i>	<i>Center</i>	<i>South + islands</i>	<i>North</i>
total		100%	15%	59%	27%
workforce	01 - 05	55%	61%	58%	45%
	giu-15	28%	28%	28%	29%
	16 - 50	13%	10%	11%	20%
	50	3%	1%	2%	6%

This study is driven by a central research question:

To what extent did the COVID-19 pandemic affect the financial health of small and medium-sized enterprises (SMEs)?

A secondary objective is to explore whether performance outcomes varied significantly across firm categories - specifically between small and medium-sized businesses - and across Italy's major geographical regions. In order to give evidence and answer the research question, the study unfolds in two principal stages to offer a comprehensive perspective on the sector. The first stage provides a descriptive analysis of key financial indicators over the period 2019–2022, segmented by firm size and macro-regional location (North, Center, and South & Islands). The indicators examined include:

- Return on Equity (ROE)
- Return on Investment (ROI)
- EBITDA

To enrich this assessment, labor dynamics - such as workforce size and growth - are also considered as integral measures of business resilience and development.

Statistical and econometric techniques were applied to detect underlying trends and resilience patterns over time. To improve data reliability and ensure the robustness of aggregate results, outlier values were excluded using the standard deviation method, generating a final set of 1600 companies of SME within the whole Italy. This approach aligns with analytical standards employed by Italian regional agencies (e.g., Unioncamere Lombardia), and was chosen over interquartile range filtering due to its ability to retain a broader portion of the sample while minimizing distortions.

It is worth noting that firms with over 50 employees showed some irregularities in the performance data. These deviations are likely linked to their limited representation in the sample, as they account for only 3% of the observed firms.

To deepen the analysis, we consider the Key performance indicators in exam for the two main years 2019 and 2022, thus we perform a three level analysis to identify which firms became stronger, weaker, or remained stable between 2019 and 2022 for each key performance indicator (EBITDA, ROE, ROI). At this end, we perform:

1. Cross-tabulated analysis by geographic area and firm size
2. Correlation Matrix (Pearson Coefficients)
3. Cluster analysis

Results

The findings related to each financial indicator are presented in the following sections, beginning with Return on Equity (ROE). The data clearly reflect the disruptive impact of 2020, a year marked by unprecedented economic stress, as evidenced by a sharp deterioration in ROE across all firm sizes and regional groupings. Table 2 presents average ROE values disaggregated by company size and geographical area, offering a clearer picture of the performance heterogeneity observed.

Following the initial shock, signs of recovery began to emerge in late 2020 and extended into 2021. However, this upward trend weakened considerably in 2022. The slowdown in recovery can be partially explained by a combination of external pressures - chief among them the escalating costs of raw materials and persistent instability in energy markets, both of which eroded firms' operational margins.

The most acute decline was recorded in Northern Italy, where ROE dropped by approximately 147% in 2020, pushing average profitability into negative territory. In contrast, firms located in Southern Italy, which

constitute the majority of the sample (55%), demonstrated relatively more stable performance. Despite macroeconomic headwinds, Southern firms were able to maintain a more favorable return on equity throughout the observed period.

Over the four-year span, the North–South performance gap in ROE remained relatively consistent, with both areas exhibiting similar trajectories in terms of direction, though not in magnitude. From a firm size perspective, the data reveal a differentiated response to the crisis: smaller enterprises were more acutely affected by the downturn, while larger firms displayed greater financial resilience, managing to absorb shocks more effectively and safeguard their profitability levels over time.

Table 2. ROE average by categories

ROE	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019	6,8	9,1	11,8	6,9	10,8	12,5	14,4
2020	-3,2	6,3	6,0	1,8	7,6	9,7	11,7
2021	6,3	8,2	11,9	8,6	12,3	12,2	12,1
2022	2,2	8,2	7,9	5,3	11,1	12,8	4,1

Table 3 presents the results for Return on Investment (ROI), revealing a general decline in investment efficiency across the sample during the 2019–2022 period. The overall trend indicates that ROI was among the financial indicators most adversely affected by the COVID-19 pandemic, with negative effects persisting well into the recovery phase.

From a territorial perspective, ROI dynamics closely mirror those observed for ROE, particularly in the North and South of Italy, including the island regions. The year 2020 marks a clear turning point, with firms across all regions experiencing a sharp deterioration in investment returns - largely attributable to halted production, disrupted supply chains, and shrinking domestic and international demand. A modest recovery began to take shape in 2021 and continued into 2022; however, the rebound proved insufficient to bring ROI back to its pre-pandemic levels. In some cases, the slight gains achieved in 2021 were eroded once again by 2022, underscoring the fragile and uneven nature of the recovery.

Particularly concerning is the pattern observed in Central Italy. While this area showed marginally positive ROI in 2019, it consistently underperformed in the following years. ROI values turned negative from 2020 onward, with a significant drop recorded in 2021. This sustained inefficiency may point to deeper structural weaknesses in the productive fabric of the Central regions, which appear to have struggled more than others in adapting to post-pandemic economic conditions.

These findings highlight the importance of spatial differentiation in assessing financial resilience and suggest the need for region-specific policy responses aimed at revitalizing investment productivity.

Table 3. ROI average

ROI	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019	3,8	1,4	4,6	3,5	4,0	4,8	5,9
2020	-0,3	-0,9	1,3	-1,5	1,6	3,5	5,0
2021	1,7	-2,2	2,5	-0,5	3,4	3,0	5,0
2022	1,0	-1,6	2,1	0,6	2,5	1,8	1,3

A disaggregated analysis of ROI by firm size yields valuable insights into the differential impact of the crisis and the varying trajectories of recovery. A clear pattern emerges: firm size is positively correlated with resilience to external shocks, particularly in terms of investment returns.

The sample can be broadly categorized into two segments. The first includes micro and small enterprises - those employing up to 15 people - which make up approximately 83% of the total dataset. These firms were the most severely affected by the downturn in 2020, suffering sharp declines in ROI as a result of limited financial buffers, constrained liquidity, and reduced operational flexibility. Nevertheless, many of these smaller entities exhibited a notable rebound in 2021, a trend that continued, albeit unevenly, into 2022. While micro-enterprises showed slower recovery, small firms regained positive ROI levels by the end of the observation period. However, even with signs of improvement, overall profitability for these groups remained modest in absolute terms.

In contrast, the second group - comprising firms with more than 15 employees (approximately 17% of the sample) - followed a different trajectory. These firms initially weathered the crisis more effectively, likely due to greater access to credit, diversified revenue streams, and more stable cost structures. Yet, over time, their ROI steadily declined, approaching critical thresholds in 2022. This downward trend raises concerns about diminishing returns on capital investments, and may indicate deeper issues related to operational rigidity or delayed adaptation strategies.

Table 4. Debt ratio variation

Debt ratio	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019-2020	1,0%	2,3%	0,0%	2,5%	-1,6%	-1,9%	-4,7%
2020-2021	0,0%	1,7%	0,5%	0,3%	-0,4%	1,8%	0,7%
2021-2022	1,6%	-3,7%	-0,5%	-1,7%	0,9%	-0,6%	2,2%
2019-2022	2,6%	0,3%	0,0%	1,1%	-1,1%	-0,7%	-1,8%

The analysis transitions in Table 4 to consider financial leverage, captured through the debt ratio - defined as the ratio of total liabilities to

shareholders' equity. This metric offers a dynamic view of each firm's reliance on external financing and highlights long-term structural dependencies that vary across firm size categories.

A low debt ratio typically signals strong financial health, as it reflects limited dependence on borrowed capital and greater internal funding capacity. In most financial analyses, a ratio between 25% and 50% is regarded as optimal. Exceeding this threshold may indicate increasing reliance on external financing, which can expose firms to higher risk, particularly during economic downturns.

In the case of the Italian food and beverage processing firms analyzed in this study, the data suggest a persistently high level of financial leverage throughout the 2019–2022 period. As shown in Table 5, debt ratios consistently exceeded 70% across nearly all firm categories and regions. The situation was especially critical in Central Italy, where average debt ratios peaked above 80% during the 2020–2021 period - coinciding with the height of the pandemic and related economic restrictions.

Despite heightened awareness during the crisis regarding financial vulnerability, no substantial reduction in leverage was observed in the short term. In fact, a combination of overlapping disruptions - ranging from supply chain instability to inflationary pressures - hindered many firms from regaining financial autonomy. Large enterprises initially demonstrated some capacity to deleverage in 2020, but this trend was partially reversed by 2022. In Northern Italy, debt levels increased gradually but remained comparatively balanced. Conversely, firms in the South and Islands displayed more stable ratios and, notably, outperformed the North in 2022 in terms of financial equilibrium.

From a firm size perspective, micro-enterprises showed the highest susceptibility to debt accumulation. A marked increase in leverage was observed in 2020, indicating a heavier reliance on external credit to absorb pandemic-related shocks. While moderate improvements were recorded in the two subsequent years, full financial recovery remained elusive. Medium and large firms showed comparatively greater stability, with a temporary decline in debt levels in 2020. However, this improvement was not sustained, as 2021 saw a rebound in leverage levels, effectively nullifying prior gains. A slight correction occurred again in 2022, but it did not signal a definitive trend toward consolidation.

The next section turns to EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization), an indicator that captures a firm's core operating performance. Initially analyzed as an average value per category, EBITDA variation is also assessed in per-employee terms to reflect operational efficiency and scale effects across firm sizes and regional clusters.

Average EBITDA declined significantly across all firm sizes and geographic areas in 2020, reflecting the widespread operational disruptions triggered by the pandemic. However, by 2021, a strong rebound was observed, with most firms regaining pre-crisis levels of core profitability. This positive trend continued into 2022, suggesting a phase of relative stabilization following the abrupt fluctuations of the previous years.

Table 5. EBITDA variation

EBITDA	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019-2020	-13,4%	-25,1%	-4,6%	-19,6%	-8,4%	-5,6%	-13,3%
2020-2021	18,8%	33,7%	15,1%	22,5%	23,2%	16,1%	17,0%
2021-2022	3,6%	9,5%	-10,7%	21,8%	3,4%	-4,3%	-18,4%
2019-2022	6,5%	9,6%	-2,0%	20,0%	16,7%	4,9%	-17,2%

The results for 2022 are particularly noteworthy. They indicate that the sector not only recovered from the immediate impact of the COVID-19 crisis but also began to realign itself with a more sustainable growth trajectory. Nevertheless, this recovery was shaped by a complex set of pressures. While firms intensified efforts to bridge the performance gap created in 2020, they were also navigating a highly inflationary environment. Rising energy and input costs, combined with increasing labor expenses, placed considerable strain on margins and tempered the momentum of EBITDA growth.

EBITDA trends are closely tied to labor market dynamics, which represent a crucial component of operational performance in the food and beverage processing sector. Between 2019 and 2022, national employment in the industry expanded by 23%, reflecting both the resilience of the sector and the intensification of production efforts during the recovery phase. Table 6 presents a detailed breakdown of employment growth by firm size category, offering further insight into how workforce expansion supported the resurgence of core business profitability across diverse enterprise types.

Table 6. workforce in the sample

workforce	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019	12.090	3.490	13.264	5.199	7.128	9.384	7.133
2020	12.595	3.695	13.940	5.206	7.062	9.876	8.086
2021	13.731	3.860	15.064	5.484	7.551	10.448	9.172
2022	14.914	4.028	15.563	5.788	7.768	11.153	9.796
% CHANGE 2019-2022	23,4%	15,4%	17,3%	11,3%	9%	18,9%	37,3%

Among Italy's macro-regions, Northern Italy recorded the highest employment growth in the food and beverage processing sector between 2019 and 2022, with a cumulative increase of 23.4%. This surge likely reflects both the greater concentration of firms in the North and their earlier and more effective access to post-pandemic support measures and recovery programs. The South and Islands, along with Central Italy, also experienced notable employment expansion, albeit at slightly lower rates. This pattern reinforces the broader narrative of resilience among small and medium-sized firms, even in regions historically marked by structural economic fragility.

A closer inspection reveals that Central Italy posted more modest employment gains relative to the other macro-areas. This is consistent with previous findings that pointed to weaker financial performance and higher levels of indebtedness among firms in that region - factors that may have limited their hiring capacity during the recovery phase.

From the perspective of firm size, the strongest employment growth was observed among large enterprises (those with more than 50 employees), which expanded their workforce by 37.3% over the same period. This underscores the significant role of large firms in driving national job recovery after the pandemic. Mid-sized enterprises (16–50 employees) also demonstrated steady employment gains, suggesting a robust growth capacity. In contrast, micro and small firms (1–15 employees), which constitute the majority of the sector, showed slower employment growth - averaging around 10%. Their more limited financial and operational flexibility likely constrained their ability to scale up hiring.

It is important to note that rising employment was accompanied by increasing labor costs, driven largely by inflationary pressures. Between 2019 and 2022, companies granted wage increases averaging 6.5% per year across the country. These escalating personnel expenses exerted downward pressure on EBITDA margins. To capture the combined effect of these developments, the following table reports EBITDA per employee, offering a clearer view of operational efficiency relative to workforce size during the recovery period.

Table 7. EBITDA per worker variation

EBITDA per worker	NORTH	CENTER	SOUTH+ISLANDS	1-5 employees	6-15 employees	16-50 employees	50+ employees
2019	25.521	16.573	21.176	10.680	18.300	20.671	24.569
2020	21.764	12.642	20.250	9.132	16.697	18.717	20.881
2021	25.259	17.106	22.980	11.571	19.865	20.686	22.422
2022	24.138	17.949	19.605	13.183	20.003	19.063	16.756

Table 7 reveals a steady upward trend in EBITDA per employee among smaller firms, particularly those with a workforce of 1 to 15 individuals. This trend suggests that micro and small enterprises, despite being more vulnerable to the initial economic shock, demonstrated notable adaptability and operational resilience in the recovery phase. Their leaner structures may have allowed for faster strategic adjustments and more flexible cost management, facilitating efficiency gains as demand rebounded.

In contrast, larger firms - especially those with over 50 employees - faced greater challenges in 2022. Their performance weakened relative to smaller enterprises, likely due to the rigidity of fixed cost structures, higher exposure to energy and wage inflation, and slower responsiveness to external volatility. These conditions may have eroded their operational margins, despite higher production capacity and broader market reach.

Regionally, Northern Italy continued to lead in terms of EBITDA performance, maintaining relatively strong efficiency levels throughout the period. However, signs of strain began to emerge in the South and Islands by 2022. Following an initially stable rebound, firms in these regions started to feel the cumulative effects of prolonged inflation and slower demand normalization.

To better understand firm-level resilience and vulnerability during the 2019–2022 period, firms were classified based on changes in key financial indicators: EBITDA, ROE, and ROI (table 8). Firms were categorized as *strengthened*, *weakened*, or *stable*, using a $\pm 10\%$ threshold to define meaningful performance shifts. The following section disaggregates these outcomes by macro-regional location and size class.

Table 8. Grouping Firms by indicator

	EBITDA	ROE	ROI
weakened	45,8%	53,0%	58,5%
strengthened	45,0%	42,1%	36,3%
stable	9,2%	4,9%	5,1%

The correlation matrix results (Table 9) revealed a strong relationship between EBITDA in 2019 and 2022 ($r = 0.80$), indicating operational consistency. Moderate correlations were found between ROI and ROE, particularly post-crisis, suggesting a growing alignment between investment and equity returns. Weak correlations between EBITDA and ROE underscore distinct structural dynamics.

As in the table 9, we fund a strong positive correlation (0.80) between EBITDA 2019 and EBITDA 2022, indicating high temporal consistency in operational performance; firms with high EBITDA in 2019 tended to maintain strong performance in 2022.

On the contrary, a moderate correlations exists between EBITDA and ROI (EBITDA 2019 vs ROI 2019: 0.17; EBITDA 2022 vs ROI 2022: 0.15).

This suggests that while profitability from core operations supports investment efficiency, the relationship is not particularly strong - likely due to external cost and capital structure variations.

Table 9. correlation matrix

	EBITDA 2019	EBITDA 2022	ROE 2019	ROE 2022	ROI 2019	ROI 2022
EBITDA 2019	1	0,80	0,07	0,03	0,17	0,08
EBITDA 2022	0,80	1	0,05	0,05	0,13	0,15
ROE 2019	0,07	0,05	1	0,07	0,30	0,10
ROE 2022	0,03	0,05	0,07	1	0,09	0,26
ROI 2019	0,17	0,13	0,30	0,09	1	0,37
ROI 2022	0,08	0,15	0,10	0,26	0,37	1

EBITDA and ROE have weak correlations throughout (max 0.07), indicating that EBITDA (an operational metric) and ROE (a shareholder return metric) may reflect different dimensions of firm performance - possibly due to variations in equity levels or financing structures. ROI and ROE show a moderate link in 2019 (0.30) and a higher correlation in 2022 (0.26): this suggests convergence between investment returns and equity returns post-COVID, possibly due to capital structure adjustments during recovery.

The cluster analysis applied K-means clustering to group firms based on their financial evolution (EBITDA, ROE, ROI) between 2019 and 2022 (table 10 and 11). Three distinct clusters were identified.

Cluster 0 (Majority Group) defines the “normal SME trajectory” (modest recovery in EBITDA, but sharply declining ROE and ROI, suggesting long-term fragility despite short-term operational recovery).

Includes a broad mix of firm sizes and all three regions; it is dominated by micro (1–5 employees) and small firms (6–15).

Likely represents firms with moderate to stable performance, as they dominate the data distribution. The cluster shows broad geographic and dimensional representation → potentially "baseline" performers.

Cluster 1 (Select Small Survivors) identifies outliers or distressed micro-firms, critical if you're exploring financial vulnerability or insolvency risk. It contains mostly very small firms (1–15 employees), but in small numbers. Could reflect firms with unusual performance paths, such as extreme volatility or unique recovery profiles.

Table 10. Cluster Distribution by Region

cluster	center	north	south+islands	total
0	12%	24%	64%	98%
1	0%	46%	54%	1%
2	6%	67%	28%	1%
total	12%	25%	63%	100%

Cluster 2 (Large Firms Only) isolates large firms with distinctly higher performance, both in absolute and relative terms. It contains exclusively large enterprises (>50 employees). The concentrated cluster suggests that larger firms followed distinct financial dynamics, separating them from the SME majority. Also, it may indicate either greater resilience or delayed impact, depending on performance trajectory.

Table 11. Cluster Financial Profiles

cluster	EBIDTA_2019	EBIDTA_2022	ROE_2019	ROE_2022	ROI_2019	ROI_2022
0	275477,9	290615,3	10,12	1,25	5,33	2,78
1	-205347	-8743,62	-781,18	-52,82	-13,01	-3,77
2	8485019	8721750	18,97	8,84	11,94	5,47

Micro and small enterprises demonstrated notable resilience and adaptive capacity, gradually increasing their workforce as market conditions stabilized. Their ability to recover employment levels reflects flexible organizational models and localized strategies that allowed them to respond effectively to evolving economic challenges. Meanwhile, large enterprises continued to act as key engines of job creation, leveraging their structural resources to support aggressive hiring, even in a context of cost inflation and market volatility.

In contrast, medium-sized firms displayed a more cautious approach to workforce expansion. Their hiring patterns suggest a heightened sensitivity to fluctuating input costs, financial constraints, and broader economic uncertainty. Positioned between the resource-rich large firms and the agile micro-enterprises, medium-sized companies may have faced more complex trade-offs in balancing growth opportunities with financial sustainability.

Overall, the table highlights the nuanced ways in which firms of different sizes and regions contributed to post-COVID labor market recovery, underscoring the importance of tailored support policies that account for structural and geographic disparities in the sector.

Discussion

The analysis highlights considerable heterogeneity in financial performance across both geographical regions and firm size categories within Italy's food and beverage processing sector. The economic shock of

2020 significantly impacted key financial indicators - most notably Return on Equity (ROE) and Return on Investment (ROI) - which reflect firms' profitability and investment efficiency, respectively.

ROE experienced a dramatic decline in 2020, particularly in Northern Italy, where average returns dropped by 147%, pushing many firms into negative profitability. Although some recovery occurred in 2021, this trend was uneven. Micro-enterprises (1–5 employees) displayed notable resilience, particularly in Southern Italy, where ROE returned to near pre-pandemic levels by 2022. In contrast, large firms (50+ employees), despite initially withstanding the shock more effectively, experienced a steady decline in returns in subsequent years.

ROI followed a similar trajectory. While most firms showed some improvement post-2020, only medium-sized enterprises (16–50 employees) maintained consistently positive ROI throughout the observed period. Central Italy emerged as the most vulnerable region, with ROI remaining negative for three consecutive years - suggesting deeper structural inefficiencies.

Debt ratio trends further expose systemic financial fragility. Average debt levels exceeded 70% across all firm groups, with Central Italy peaking above 80% during the crisis years of 2020–2021. Although Northern firms showed signs of deleveraging by 2022, the Center remained highly dependent on external capital. Smaller enterprises, while making some progress, continued to face significant financial strain.

EBITDA analysis provides additional insight into operational resilience. After a sharp contraction in 2020, EBITDA rebounded in 2021 and stabilized in 2022. However, this recovery was tempered by rising labor costs - averaging 6.5% between 2019 and 2022 and reaching 8.3% in 2022 - which eroded EBITDA per employee. Micro-enterprises showed encouraging gains in per-capita EBITDA, indicating greater cost agility, whereas larger firms recorded declines, likely due to inflexible cost structures and delayed adjustment to inflationary conditions.

Labor market trends offer further context. Between 2019 and 2023, sectoral employment expanded substantially. The most significant increases were observed in Southern regions (+25%) and among micro-enterprises (+24%). Large firms also played a major role in job creation, expanding their workforce by 38%. In contrast, medium-sized enterprises pursued more cautious hiring strategies, possibly constrained by narrower margins and higher risk sensitivity.

Taken together, these findings reveal a recovery landscape marked by asymmetrical trajectories. Micro-enterprises, though initially the most vulnerable, displayed substantial adaptive capacity. Larger firms, despite early stability, began to encounter operational and financial strain during the

later phases of recovery. These dynamics suggest that future policy must be structurally differentiated and geographically tailored to support long-term resilience and equitable growth across the sector.

Conclusions

This study assessed the mid-term financial impacts of the COVID-19 pandemic on small and medium-sized enterprises (SMEs) in Italy's food and beverage processing industry. Using firm-level panel data from 2019 to 2022 and applying descriptive statistics, Difference-in-Differences estimation, and exploratory techniques, the research identifies differentiated recovery paths across regions and firm sizes. While SMEs bore the brunt of the initial shock, many - especially micro-enterprises - showed significant recovery potential over time. Conversely, large firms, although more resilient in the early phase, experienced declines in investment efficiency and EBITDA per employee in the post-crisis years, likely due to structural inflexibility. Regionally, Southern Italy outperformed expectations in terms of profitability, while Central Italy exhibited persistent weaknesses, especially in ROI and debt levels. These findings have clear policy relevance. Recovery measures must account for the heterogeneous nature of the sector. Micro and small firms may benefit most from interventions that improve credit access, foster digital and process innovation, and alleviate labor cost pressures. Larger firms may require targeted support to enhance operational efficiency and mitigate rigid cost structures.

Future research should expand the time frame to include data beyond 2022 to capture the enduring effects of inflation, global uncertainty, and climate-related disruptions. Additionally, integrating qualitative evidence - such as managerial decision-making or governance responses - could enrich the understanding of organizational resilience in the agri-food system. Finally, to address a key limitation of this study - namely the limited representation of large enterprises (only 3% of the sample) - future work should incorporate a more balanced sample, enabling more robust comparisons and extending the generalizability of the findings.

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