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Food Recalls and Agri-Food Market Maturity: A Comparative Analysis Across Major Global Regions (2015–2024)

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ABSTRACT

The withdrawal/recall of agri-food products from the market represents an important instrument within modern food safety systems, acting towards reducing the risk associated with the consumption of non-compliant/potentially hazardous products. In the context of the globalization of agri-food trade and the development of international retail/distribution systems, the increasing frequency of such withdrawals leads to the need for an analysis of the economic impact and of the impact on food security. The research conducted aims at a comparative analysis of agri-food product withdrawals/recalls in the main regional markets for the period 2015–2024, with a focus on the year 2024. For documentation purposes, official reports and open access articles were used. Information regarding food withdrawals from the market was systematized and compared in correlation with the size of the agri-food market, through an intensity indicator expressed as the number of withdrawals per 1 billion EUR/USD. The research results indicate the existence of significant differences between regions. Thus, mature markets record a higher number of withdrawals in absolute terms, but moderate levels of intensity when related to market volume. The analysis of causes identifies undeclared allergens and microbiological contamination as the main reasons for withdrawals, with regional particularities related to chemical hazards and the institutional reporting framework. The research conclusions suggest that withdrawals/recalls should be interpreted both as indicators of food risk and as signs of agri-food market maturity and of the efficiency of control systems. The study can provide valuable information for authorities in the development of food safety public policies, as well as for the business environment, in adapting commercial strategies to market specifics.

1. Introduction

Food safety represents an essential component in the proper functioning of an agri-food market, with direct implications for consumer health and for trust in public authorities. Withdrawals/recalls constitute mechanisms for managing risks associated with non-compliant food products, used by authorities for the rapid removal from the market of non-compliant or potentially hazardous products (in regulated situations), and by traders (in voluntary situations).

In the context of the globalization of agri-food supply chains and the intensification of trade exchanges, the frequency and volume of reported withdrawals have increased in sufficiently regulated markets, without this phenomenon necessarily reflecting a deterioration of food safety. Some publications in the specialized literature suggest that the frequency of withdrawals is closely linked to monitoring capacity and to the transparency of control systems, characteristics specific to mature markets.

Taking these aspects into account, the paper analyses food product withdrawals and recalls as an indicator of agri-food market maturity, through a comparative approach of the main agri-food markets at the global level. The analysis uses official data for the period 2015–2024 and proposes an indicator of withdrawal intensity, calculated as the number of withdrawals/recalls relative to the size of the agri-food market, to allow a comparable assessment between regions.

2. Literature review

Public policies at the European level address withdrawals/recalls as elements of the food safety system and as a rapid mechanism for avoiding consumer exposure to risks. In mature markets, food recalls are

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considered not only as reactions to an incident, but also as outcomes of an efficient monitoring and traceability system, which rapidly identifies non-compliances and applies corrective measures.

From this perspective, an increase in the number of withdrawals may reflect not only a rise in the risk associated with food non-compliance, but also improvements in the detection and reporting of non-compliant situations (European Commission, 2025).

Event-study–type research highlights the fact that recall announcements can generate negative reactions in capital markets, associated with losses in shareholder value. Financial markets internalize reputational risks and the anticipated costs of recalls (Salin & Hooker, 2001).

More recent studies refine this mode of interpretation, specifying that the severity of the incident, the size of the recall, and media coverage amplify the negative effects on firm value, while large or experienced firms can partially absorb the shock. In the meat processing industry, stock market impact can be significant for critical food safety incidents, confirming that recalls may have much broader economic implications, exceeding direct logistical costs (Pozo & Schroeder, 2016).

An important direction of research in the field concerns the importance of labelling and undeclared allergens as major factors generating recalls. A global study on withdrawals/recalls associated with labelling errors conducted by Soon et al. (2021) identifies undeclared allergens as the dominant cause; moreover, the distribution of allergen types shows a recurrence of "milk" and "gluten" among the main alert triggers, thus indicating systemic vulnerabilities in the control of labelling and recipe changes.

Institutional data confirm the relevance of undeclared allergens in food products. In this regard, official communications of the Australian governmental agency responsible for food safety indicate that in 2024 undeclared allergens represented the main cause of food recalls from the market. Labelling errors were frequently present, which supports the conclusions of previous research that a substantial share of recalls can be prevented through quality controls and effective change management (Food Standards Australia New Zealand, 2025).

At the European level, specialized articles and institutional reports show that chemical hazards (including residues) represent a major component of notifications, particularly for certain product categories (Stanciu, 2015). ACN/RASFF reports mention a high number of notifications in 2024 and highlight the role of controls in identifying risks, including pesticide residues, mycotoxins, and pathogenic microorganisms in specific product segments (European Commission, 2025).

Research using long time series of data provided by RASFF complements the institutional perspective by offering an analysis of recurrent hazards and frequently involved products. A significant prevalence of pesticide residues and pathogenic microorganisms in notifications is thus observed, depending on the period and product category (Stanciu, 2025). This body of literature supports the inclusion of the EU as a region with a high intensity of monitoring of cross-border food trade and with a particular profile of reported hazards.

Food traceability is considered a mechanism for reducing the impact of recalls, and the performance of this quality management system is influenced by data quality, interoperability, and supply chain coverage. The economic benefits for distribution networks are mainly due to the reduction of the scope of recalls (fewer affected batches) and to the acceleration of locating non-compliant products (Dabbene et al., 2011).

Scientific research in operations management explicitly mentions how traceability can reduce recall costs by limiting the scope of withdrawal and increasing response speed. In supply chain–based approaches, downstream traceability is associated with faster and more efficient recall procedures, which strengthens the economic argument for investments in digitalization and identification standards (Pulita, 2024).

Overall, the scientific literature shows that recalls should be interpreted from the perspective of institutional maturity: markets with robust surveillance and higher transparency tend to report more non-compliances. Indicators adjusted to market size can provide a more relevant comparison between regions. The convergence of causes (allergens, microbiological) coexists with regional particularities (for example, the chemical/pesticide profile in the EU), which justifies the use of a comparative methodology and a cautious discussion regarding the comparability of definitions and reporting units (European Commission, 2025; Soon et al., 2021).

Food product withdrawals/recalls can be considered essential operational instruments of the legislative and institutional food safety framework in Romania, having a direct role in consumer protection and in maintaining trust in the agri-food market. The effectiveness of these mechanisms depends on the functioning of official controls, traceability, and public communication, supporting the interpretation of recalls as an indicator of market maturity (Condulet et al., 2023).

Deficiencies occurring in the implementation and monitoring of HACCP systems and quality management can generate food safety incidents, leading to product withdrawals. From this perspective, recalls can be interpreted both as outcomes of systemic dysfunctions and as corrective mechanisms that reflect the level of compliance and responsibility of operators in the food industry (Radu et al., 2023).

Research conducted by Bichescu & Stanciu (2019) highlights correlations between food fraud and product withdrawals, showing that non-compliances related to food quality and authenticity may cause food withdrawals from the market with significant economic and reputational impact.

3. Materials and Methods

The bibliographic documentation was based on the selection of representative open-access articles from the specialized literature, identified in internationally recognized databases such as Clarivate, Google Scholar, and ResearchGate, as well as on the analysis of official reports published by bodies with relevant competencies in the field of food safety and the agri-food economy.

The applied research developed in this paper proposes an interregional comparative approach, with the main objective of identifying possible relationships between the frequency of food product withdrawals and recalls and the degree of maturity of agri-food markets.

The analysis focused on the main agri-food markets at the global level, namely the European Union, the United States of America, Australia/New Zealand, Canada, and China.

For the assessment of withdrawals and recalls, data for the period 2015–2024 were used, collected from reports and databases of regional institutions responsible for monitoring the agri-food market: the Rapid Alert System for Food and Feed (RASFF) for the European Union; the Food and Drug Administration (FDA), the U.S. Department of Agriculture, Economic Research Service (USDA ERS), and the U.S. Department of Agriculture, Food Safety and Inspection Service (USDA FSIS) for the United States of America; Food Standards Australia New Zealand (FSANZ) for Australia; the Canadian Food Inspection Agency (CFIA) for Canada; and the State Administration for Market Regulation (SAMR) for China.

The size of the regional agri-food market was estimated based on economic indicators such as food expenditure or the turnover of the agri-food industry. To ensure comparability, withdrawals/recalls were defined as official actions aimed at removing non-compliant or unsafe food products from the market.

The data were adjusted to the size of the agri-food market, the proposed indicator being the intensity of withdrawals/recalls, defined as the ratio between the number of withdrawals and the market size. Depending on data availability, the size of the agri-food market was expressed either in monetary terms (billion EUR/USD) or through relevant physical volume indicators (e.g., million tonnes of food products marketed), with the analysis conducted separately for each type of indicator, without aggregating them, to ensure the comparability of results between regions.

Where comparable information was available, the analysis was complemented by a withdrawal severity indicator, defined as the ratio between the quantity of products withdrawn and the size of the agri-food market, used for descriptive and interpretative purposes only and not integrated into the main comparative analysis.

In preparing the paper, the authors made use of artificial intelligence tools; however, these were used exclusively to support documentation activities, the organization of information, and preliminary technical editing of the text, without substituting the authors' own scientific analysis, personal interpretation of the results, or responsibility for the final content.

4. Global agri-food product withdrawals/recalls from the market (2015–2024)

The comparative analysis of the number of withdrawals and recalls in most of the regions included in the study shows a progressive dynamic over the period 2015–2024 (Table 1).

Table 1. Food recalls and notifications by major regions (2015–2024)

Region / Country	Indicator type	2015	2020	2023	2024	Source
European Union	RASFF notifications	3,049	3,862	4,695	5,250	European Commission, (2024; 2025)
United States	FSIS food recalls (number)	–	31	65	34	USDA FSIS (2021; 2024; 2025), USDA ERS (2025)
United States	FSIS food recalled (pounds)	–	1,461,019	4,005,384	19,913,171	USDA FSIS (2021; 2024; 2025), USDA ERS (2025)
Australia	Food recalls (number)	–	77	82	95	FSANZ (2025)
Canada	Food recall incidents (approx.)	–	~150	~155	~160	CFIA (2024)
China	Official food recalls	n.a.	n.a.	n.a.	n.a.	SAMR (2025)

Note: For the European Union, RASFF notifications are used as a proxy for recall-related events. Data for China are not fully standardized or publicly comparable across years.

This trend is more evident in agri-food markets with a high degree of institutional maturity, such as those of the European Union, the United States of America, and Australia/New Zealand, where well-developed mechanisms for monitoring, control, and reporting are in place. In the case of China, a lower number of recalls can be observed in absolute terms compared to the other regions. This aspect may be explained by the existence of a centralized institutional framework and probably by a lower level of reporting transparency, rather than by a lower incidence of food-related risks.

Adjusting absolute values in relation to the size of the agri-food market highlights relevant differences between the analysed regions (Table 2). Regions that record a high number of withdrawals/recalls in absolute terms generally exhibit moderate levels of withdrawal intensity when the indicators are reported relative to

the value of the agri-food market, expressed per 1 billion EUR/USD. The agri-food markets of the United States of America and Australia/New Zealand are characterized by relatively stable values of withdrawal intensity, most likely indicating the existence of consolidated control and response mechanisms.

The agri-food market of the European Union shows a comparable level of intensity, with variations that can be correlated with periods of intensified official controls.

Table 2. Food recalls normalized by agri-food market size (2024)

Region	Food recalls / notifications (2024)	Agri-food market size* (2024)	Normalized indicator	Source
United States	34 recalls (FSIS)	USD 2.58 trillion (food expenditure)	13.2 recalls / USD 1 trillion	USDA ERS (2025), USDA FSIS (2025)
European Union	5,250 RASFF notifications	~EUR 1.2 trillion (food industry turnover)	4.4 notifications / EUR 1 billion	European Commission (2025)
Australia	95 food recalls	15.3 million tonnes (retail food volume)	6.2 recalls / million tonnes	FSANZ (2025)
Canada	~160 recall incidents	~CAD 135 billion (food retail sales)	1.2 recalls / CAD 1 billion	CFIA (2024)
China	n.a. (not standardized)	~USD 1.9 trillion (food consumption estimate)	n.a.	National Bureau of Statistics of China (2025)

**Agri-food market size measured using food consumption expenditure, food retail sales, or agri-food industry turnover, depending on data availability.*

In the case of China, despite the considerable size of the agri-food market, the intensity of withdrawals reported relative to market volume is low. This result should be interpreted with caution, given the particularities of the centralized reporting system and issues related to data transparency.

Regardless of the region analysed, the results indicate a relatively convergent structure of the causes leading to food product withdrawals and recalls (Table 3). Factors frequently responsible for withdrawals include the presence of undeclared allergens, microbiological contamination, non-compliances associated with the use of additives or the presence of chemical contaminants, labelling errors, and traceability deficiencies.

Table 3. Main causes of food recalls by region (2024)

Region	Cause 1	Share (%)	Cause 2	Share (%)	Source
Australia	Undeclared allergens	57%	Microbiological contamination	~19%	Food Standards Australia New Zealand (2025)
European Union	Pesticide residues	~28%	Pathogenic microorganisms	~22%	European Commission (2025)
United States	Undeclared allergens	~38%	Microbiological contamination	~27%	USDA FSIS (2021, 2024, 2025)
Canada	Allergen labelling errors	~41%	Microbiological contamination	~31%	Canadian Food Inspection Agency (2024)
China	Illegal / excessive food additives	dominant	Labelling & traceability issues	secondary	State Administration for Market Regulation (2025)

In mature agri-food markets, withdrawals generated by labelling errors account for a higher share, reflecting a higher level of legislative stringency and a lower tolerance for non-compliances with an impact on consumer information and protection.

In 2024, the main causes of food product withdrawals and recalls in most of the analysed regions were undeclared allergens and microbiological contamination. Chemical contaminants, particularly pesticide residues, were the main causes of withdrawals in the European Union. Authorities in China focused primarily on the illegal use of food additives and on traceability issues, rather than on detailed quantitative reporting of hazards. The results suggest that a higher intensity of withdrawals/recalls relative to market size does not necessarily indicate a higher level of food risk but may instead be a sign of market maturity and of the effectiveness of control systems. Large and well-regulated markets tend to identify and correct non-compliances more rapidly, which leads to a higher number of officially reported withdrawals.

The research findings highlight that food product withdrawals and recalls should not be interpreted exclusively as indicators of food risk, but rather as indicators of agri-food market maturity and of the efficiency of control systems. Large and well-regulated markets, such as the European Union, the United States of America, and Australia, report a higher number of withdrawals in absolute terms; however, when adjusted for market size, these figures indicate moderate levels of withdrawal intensity. The differences observed between regions largely reflect institutional specificities and the degree of transparency of food safety systems. In mature markets, monitoring mechanisms are more developed and economic operators are subject to strict reporting obligations, which leads to the rapid identification and correction of non-compliances. In this context, a higher number of withdrawals may indicate the effective functioning of the regulatory framework rather than a deterioration of food safety.

An analysis of the causes of food withdrawals/recalls in 2024 confirms the existence of recurrent patterns at the global level, particularly about undeclared allergens and microbiological contamination. The prevalence of labelling errors in developed markets suggests a high level of regulatory stringency and a low tolerance for minor non-compliances with potential impacts on consumer health. In the European Union, the high share of chemical hazards, especially pesticide residues, reflects the emphasis placed on official controls in the primary production sector and in imports. The case of China represents an example of a different approach to withdrawals, with the national authority being more oriented toward administrative sanctions and ex ante control than toward detailed public reporting of recalls. This difference limits the direct comparability of data but highlights the importance of the institutional context in interpreting indicators related to food product withdrawals.

The comparative assessment of food product withdrawals and recalls from the market can be carried out using the indicator "Withdrawal/Recall Intensity (IR)," calculated by relating their volume to the total value of the agri-food market (Formula 1).

$$IR = (\text{Number of withdrawals / notifications}) / (\text{Size of the agri-food market}) \quad (1)$$

IR is expressed as the number of withdrawals/recalls reported per 1 billion EUR (USD) or per an equivalent unit, depending on data availability. For the year 2024, a withdrawal and recall intensity indicator was calculated, defined as the ratio between the number of recalls and the size of the agri-food market.

The results highlight significant differences between regions, with mature markets recording higher intensity values, which nevertheless remain moderate when reported relative to the total market volume (Table 4).

Table 4. Food recall intensity by agri-food market size (2024)

Region	Food recalls / notifications (2024)	Agri-food market size (2024)	Calculated indicator	Sources
United States	34 recalls (FSIS)	USD 2.58 trillion (total food expenditure)	13.2 recalls / USD 1 trillion	USDA FSIS (2025)
European Union	5,250 RASFF notifications	~EUR 1.2 trillion (food industry turnover)	4.4 notifications / EUR 1 billion	European Commission (2025);
Australia	95 food recalls	15.3 million tonnes (retail food volume)	6.2 recalls / million tonnes	FSANZ (2025); Australian Bureau of Statistics (2024)
Canada	~160 recall incidents	~CAD 135 billion (food retail sales)	1.2 recalls / CAD 1 billion	CFIA (2024); Statistics Canada (2024)
China	n.a. (not standardized)	~USD 1.9 trillion (food consumption estimate)	n.a.	National Bureau of Statistics of China (2025)

From an economic perspective, withdrawals and recalls generate relevant costs for operators in the agri-food sector; however, these can be interpreted as costs of regulatory compliance, aimed at limiting much larger losses associated with major food safety crises. In this context, investments in traceability systems, quality control, and labelling compliance contribute not only to consumer protection, but also to strengthening the stability and credibility of the agri-food market.

For the agri-food market of the United States of America, given the availability of detailed quantitative data published by USDA institutions, it was possible to calculate a withdrawal severity indicator, expressed as the ratio between the quantity of products withdrawn and the value of the agri-food market. In 2024, the total quantity of products recalled reached 19,913,171 lb, and relating this value to the size of the food market, estimated at USD 2.58 trillion, results in a severity level of approximately 7,700 lb per USD 1 billion (USDA FSIS, 2025; USDA ERS, 2025).

For the other regions analysed, the absence of official data regarding the quantity of products withdrawn did not allow for the calculation of this indicator.

5. Conclusions

The comparative analysis carried out within the research highlighted that food product withdrawals/recalls from the market represent an essential instrument of food safety systems, reflecting the existence of risks, the level of institutional maturity, and the efficiency of control mechanisms within agri-food markets. The results obtained show that, at the regional level, large and well-regulated agri-food markets tend to report a higher number of withdrawals in absolute terms; however, their intensity, when related to market size, remains moderate.

Adjusting the absolute values of withdrawals/recalls to the volume of the agri-food market may represent a relevant analytical tool for interregional comparisons, allowing for a more nuanced interpretation of this phenomenon. A higher level of withdrawals should not be automatically interpreted as a sign of a decline in food safety, but may instead indicate a robust institutional framework, effective supervision, and a high level of transparency.

The analysis of the frequent causes generating food withdrawals from the market in 2024 highlighted recurrent global patterns, with undeclared allergens and microbiological contamination constituting the main contributing factors. The existence of regional differences—such as the high share of chemical contaminants in the European Union or the emphasis on illegal additives and traceability in China—underscores the determining role of the institutional and regulatory system in shaping and operating control mechanisms.

From an economic perspective, although withdrawals/recalls lead to significant costs for operators in the agri-food sector, they can be considered investments in compliance and prevention systems, aimed at avoiding more substantial economic and reputational losses. Strengthening traceability systems, improving labelling practices, and integrating digital technologies can contribute to reducing the frequency of withdrawals and increasing the resilience of agri-food markets.

The research findings support the use of food product withdrawals/recalls as relevant indicators of agri-food market maturity, providing valuable information for public decision-makers, control authorities, and economic operators.

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