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INTEGRATION AND TRANSFORMATION IN THE UKRAINIAN DAIRY SECTOR: A COMPARATIVE STUDY WITH HUNGARY AND POLAND IN THE CONTEXT OF THE EU MARKET

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The aim of this dissertation is to obtain a doctoral (PhD) degree in the scientific field of „Management and Business”

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DECLARATION

I undersigned (name: Anna Gereles, date of birth: 20 March 1988) declare under penalty of perjury and certify with my signature that the dissertation I submitted in order to obtain doctoral (PhD) degree is entirely my own work.

Furthermore, I declare the following:

- I examined the Code of the Károly Ihrig Doctoral School of Management and Business Administration and I acknowledge the points laid down in the code as mandatory;
- I handled the technical literature sources used in my dissertation fairly and I conformed to the provisions and stipulations related to the dissertation;
- I indicated the original source of other authors' unpublished thoughts and data in the references section in a complete and correct way in consideration of the prevailing copyright protection rules;
- No dissertation which is fully or partly identical to the present dissertation was submitted to any other university or doctoral school for the purpose of obtaining a PhD degree.

Truskavets, Lviv Region, Ukraine, 28 August, 2025

Anna Gereles

signature

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INTRODUCTION

Global demographic projections indicate that by 2050, the world population will surpass 9.7 billion people, necessitating a 70% increase in food production to satisfy growing consumption requirements (FAO, 2018). This demographic shift will profoundly reshape consumption patterns and place unprecedented demands on agricultural systems worldwide. To address these emerging food security challenges, total factor productivity in agricultural production must increase by at least 1.28% annually over the coming decades. The agricultural sector, as a strategic component of the global economy, faces multifaceted challenges including climate change, resource scarcity, volatile markets, and evolving consumer preferences, all of which require adaptive and innovative approaches to ensure sustainable food production.

Within this global context, the dairy industry occupies a pivotal position within agricultural systems, characterised by intricate production processes, complex stakeholder relationships and substantial socioeconomic implications for rural communities. As an essential component of food security architecture and rural economic development, the dairy sector's structure, performance and resilience merit thorough academic investigation. The global dairy landscape has undergone significant transformation in recent decades, with increasing consolidation, technological advancement, and changing consumption patterns reshaping industry dynamics across different regions.

Since the collapse of centrally planned economies in the early 1990s, Eastern European dairy landscapes have undergone profound transformations. These include fundamental restructuring of production systems, reconfiguration of market relationships and adaptation to novel policy environments. The trajectories and outcomes of these changes exhibit considerable variation across countries. Despite geographical proximity and shared historical experiences, Ukraine, Poland and Hungary have developed markedly distinct dairy sectors with different structural characteristics, integration mechanisms and economic performance metrics.

In Ukraine specifically, the agricultural landscape features farm units averaging 100-200 has, substantially exceeding the typical European farm size of approximately 50 hectares (though this varies considerably across different European countries). Through large-scale dairy operations housing 500-2000 cows, Ukrainian agribusiness enterprises are pursuing competitive positioning in international markets – an achievable objective given the country's comparative advantage. Ukraine possesses abundant feed resources, including domestic maize and grain production, alongside substantial sunflower cultivation (ranking amongst global production leaders) for feed formulation. Recent sectoral trends demonstrate increasing emphasis on efficient milk production systems that leverage these resource advantages.

Integration within agricultural value chains has emerged as a decisive strategy for enhancing competitiveness, improving operational efficiency and ensuring long-term sustainability. In the dairy sector specifically, integration processes manifest across multiple dimensions: horizontally amongst similar entities (such as producer cooperatives), vertically across value chains (from farm to retail) and institutionally through policy frameworks and regulatory mechanisms. These integration forms create diverse organisational arrangements that significantly influence market performance, product quality and sectoral resilience. Large integrated agricultural ventures have emerged as dominant organisational structures in Eastern European transition economies, particularly in Ukraine. Notably, these integrated structures have begun to gain prominence even in countries where regulatory frameworks previously limited agroholding formation, including the Czech Republic, Poland, Lithuania and Romania.

Despite their growing significance, these structural transformations remain insufficiently documented in the academic literature. Whilst integrated agricultural structures in developing economies have attracted research attention, this has predominantly focused on land acquisition controversies rather than comprehensive organisational analysis. Consequently, there exists limited scholarly understanding of agroholdings' internal organisational structures, management approaches, operational efficiency metrics and the institutional preconditions that facilitate their development.

This research addresses several interconnected research gaps. First, while substantial literature examines dairy sector dynamics in established EU member states, comparatively less scholarly attention has focused on the specific challenges and opportunities within Eastern European contexts, particularly regarding integration mechanisms. Second, the comparative performance of dairy enterprises across different market structures and policy environments remains inadequately documented, limiting the evidence base for strategic decision-making. Third, the impacts of external shocks – including the recent Russian aggression against Ukraine – on dairy value chains have not been systematically analysed within integration theory frameworks.

To address these gaps, this dissertation aims to provide a comprehensive comparative analysis of dairy sectors in Ukraine, Hungary, and Poland, with particular attention to integration mechanisms, market relationships, and adaptation strategies. The central objective is to analyse the structural characteristics, market concentration patterns, and financial performance of dairy enterprises across these three countries during the period 2016-2020, examining how enterprise size, market structure, and policy environments influence operational efficiency and profitability. This analysis seeks to identify the relationship between enterprise scale and performance in different market contexts, revealing optimal configurations for each country's specific conditions.

A second key objective is to evaluate milk price dynamics and market relationships between these Eastern European countries and the broader EU market. By examining price trends, convergence patterns, and divergence factors, the research aims to assess the degree of market integration and identify determinants that influence price formation. This includes analysing how policy environments, subsidy regimes, and quality standards affect market relationships and integration processes.

In light of the Russian invasion, the third objective is to assess the impact of war on Ukraine's dairy industry, documenting production losses, infrastructure damage, and market disruptions. This assessment extends to identifying adaptation strategies and resilience mechanisms that have emerged during the full-scale war, providing insights into how agricultural systems respond to extreme external shocks. The analysis explores questions regarding the differential vulnerability of various production systems, the transformation of logistics and processing networks, and the effectiveness of crisis response measures.

The fourth objective draws on comparative experiences from Hungary and Poland, countries that have successfully navigated EU integration processes, to identify effective integration mechanisms that could enhance the competitiveness and sustainability of the Ukrainian dairy sector. This involves examining transition period management, policy frameworks that supported successful development, and integration strategies that proved most effective in different contexts to develop evidence-based recommendations for Ukrainian dairy sector modernisation and European integration.

These four objectives collectively aim to provide strategic guidance for policy makers designing agricultural development programmes, dairy enterprises making investment decisions, and international development partners supporting reconstruction and modernisation efforts in the Eastern European dairy sector context.

To achieve these objectives, this dissertation addresses four primary research questions:

1. What is the relationship between enterprise scale and financial performance in the dairy sectors of Ukraine, Hungary, and Poland, and how do these relationships differ across the three countries' distinct market structures?

2. How have milk prices in Ukraine, Hungary, and Poland evolved relative to EU averages between 2014-2024, and what factors determine the degree of price integration or divergence in these markets?

3. What are the primary impacts of the full-scale Russian invasion on Ukraine's dairy sector in terms of production capacity, market structure, and operational efficiency, and what adaptation strategies have proven most effective for ensuring sectoral resilience?

4. Which integration mechanisms and policy frameworks from Hungarian and Polish dairy sectors could be effectively adapted to support the modernisation and reconstruction of Ukraine's dairy industry in the context of European integration aspirations?

The research adopts a comprehensive analytical approach incorporating multiple methodological elements. Through detailed market analysis, the study examines structural characteristics, concentration patterns, and performance metrics across Ukrainian, Hungarian, and Polish dairy sectors. Price trend analysis provides insights into market dynamics and integration levels between national markets. Financial performance assessment of dairy enterprises reveals the relationship between firm size, market conditions, and profitability across different countries. Finally, the investigation of wartime impacts on Ukraine's dairy industry illuminates resilience mechanisms and adaptation strategies under extreme external pressures.

The dissertation is structured to provide a logical progression from theoretical foundations to empirical findings and strategic implications. Following this introduction, Chapter 1 presents a comprehensive literature review establishing the conceptual framework for dairy industry integration, methodological approaches for analysing sector performance, and historical context of dairy production in Ukraine and the EU. Chapter 2 outlines the materials and methods employed in the research, detailing data sources, analytical techniques, and methodological considerations. Chapter 3 presents the research findings across three main dimensions: structural analysis of dairy markets, milk price dynamics and determinants, and the impact of war on the Ukrainian dairy industry. The concluding chapters synthesise these findings into coherent conclusions, strategic recommendations, and novel contributions to knowledge.

This research is particularly timely given Ukraine's European integration aspirations, ongoing agricultural transformation processes, and the urgent need for post-war reconstruction strategies. The findings aim to inform policy development, guide investment decisions, and contribute to resilience-building within Eastern European dairy industries. By identifying effective integration mechanisms, market development pathways, and structural adaptations that enhance competitiveness, this dissertation seeks to support the sustainable development of dairy sectors within challenging transition contexts.

The personal motivation behind this research stems from extended professional engagement with Ukraine's agricultural sector, witnessing first-hand the challenges and opportunities facing dairy producers during periods of economic transition and crisis. This practical experience, combined with academic training in both Ukrainian and Hungarian contexts, provides a unique perspective from which to analyse sectoral dynamics and propose evidence-based recommendations. The dissertation thus represents both a scholarly contribution and a strategic resource for practitioners working toward the revitalisation and sustainable development of dairy industries in Eastern Europe, particularly in the context of Ukraine's recovery and European integration journey.

1. LITERATURE REVIEW

The global food economy represents one of the most fundamental and complex systems in human civilisation, encompassing production, distribution, consumption, and trade of food commodities across international markets. According to statistics, with a global population exceeding 8 billion people in 2023, the food economy faces unprecedented challenges in ensuring food security, sustainability, and economic viability (FAO, 2023). The sector contributes approximately 10% to global GDP and employs nearly 28% of the global workforce (WORLD BANK, 2022).

Over the past three decades, the global food economy has undergone significant transformation. Agricultural productivity has increased by 60% since 1990, while global food trade value has grown from $315 billion in 1995 to $1.69 trillion in 2022 (WTO, 2023). Vertical integration and consolidation have reshaped the supply chain structure, whilst technological innovations including precision agriculture and digital technologies have revolutionised production methods (OECD-FAO, 2023).

The global food economy faces multiple challenges. Climate change threatens agricultural productivity with extreme weather events and shifting growing conditions, whilst resource scarcity with water stress and land degradation affects production capacity. Population growth drives increased demand for food, and supply chain disruptions have highlighted vulnerabilities in food supply chains. Additionally, growing consumer demand for environmentally sustainable production methods presents both challenges and opportunities (FAO, 2022).

The dairy sector stands as a vital component of the global food economy, providing essential nutrients to billions of people worldwide whilst supporting the livelihoods of approximately 600 million people globally (FAO, 2023). According to data from FAOSTAT (2023), the global dairy market was valued at $827.4 billion in 2022, contributing 3-4% to global agricultural GDP and supporting approximately 240 million jobs directly in farming operations. Dairy products provide 20% of global protein supply, 25% of calcium requirements, and essential micronutrients including vitamins A, B12, and D to over 6 billion consumers worldwide.

The global dairy industry has experienced remarkable growth and transformation over the past three decades (Table 1). According to FAO (2023), global milk production increased from 471 million tonnes in 1995 to 892 million tonnes in 2022, whilst per capita consumption grew from 81.5 kg/year to 114.7 kg/year during the same period. The global cattle population expanded from 1.29 billion head in 1995 to 1.53 billion head in 2022.

Table 1. Global Dairy Industry Development (1995-2022)

Indicator	1995	2005	2015	2020	2022
Global Cattle Numbers (million head)	1,294	1,371	1,469	1,510	1,532
Milk Production (million tonnes)	471	557	654	718	892
Per Capita Consumption (kg/year)	81.5	87.2	90.3	98.5	114.7
Trade Volume (million tonnes)	29.4	41.7	56.3	69.8	74.8

Sources: FAO Statistics Database, USDA Foreign Agricultural Service, EUROSTAT

The regional distribution of dairy cattle demonstrates significant geographical variations. According to FAO (2023), Asia leads with 494 million head (32.2%), followed by Europe with 297 million head (19.4%), South America with 271 million head (17.7%), Africa with 261 million head (17.0%), North America with 157 million head (10.2%), and Oceania with 52 million head (3.4%).

Global milk production analysis (Table 2) shows that India dominates with 209.3 million tonnes (23.5% of global production), followed by the United States (102.7 million tonnes, 11.5%), China (85.4 million tonnes, 9.6%), Pakistan (62.8 million tonnes, 7.0%), and Brazil (35.9 million tonnes, 4.0%) according to USDA Foreign Agricultural Service (2023).

Table 2. Top 10 Milk Producing Countries (2022)

Rank	Country	Production (million tonnes)	% of Global
1	India	209.3	23.5%
2	United States	102.7	11.5%
3	China	85.4	9.6%
4	Pakistan	62.8	7.0%
5	Brazil	35.9	4.0%
6	Germany	33.1	3.7%
7	Russia	32.2	3.6%
8	France	24.8	2.8%
9	New Zealand	21.7	2.4%
10	Turkey	20.5	2.3%

Source: USDA Foreign Agricultural Service, 2023

The global dairy trade has experienced significant evolution over the past decades. As indicated by FAO (2023), trade volume increased from 29.4 million tonnes in 1995 to 74.8 million tonnes in 2022. Cheese leads the traded product categories with 3.2 million tonnes valued at $28.4 billion, followed by whole milk powder (2.9 million tonnes, $11.8 billion), skim milk powder (2.6 million tonnes, $8.9 billion), whey products (2.4 million tonnes, $5.3 billion), and butter (1.1 million tonnes, $6.7 billion) (UN COMTRADE DATABASE, 2023).

The European Union dominates dairy exports with 32% of global market share, followed by New Zealand (28%), the United States (15%), Australia (8%), and Argentina (4%). Major importers include China (19% of global imports), Southeast Asia (15%), the Middle East (12%), Mexico (10%), and North Africa (8%) according to European Commission Trade Statistics (2023).

Regional production growth rates have varied significantly over the past three decades. Asia demonstrated the highest compound annual growth rate (CAGR) of 3.7%, with production increasing from 145.2 million tonnes in 1995 to 398.7 million tonnes in 2022. Africa followed with 3.8% CAGR, South America with 2.0%, Oceania with 2.2%, North America with 0.9%, and Europe with 0.1% (FAO STATISTICAL DATABASE, 2023).

The global dairy market has witnessed significant structural changes. As noted by HOBBS (2000), consolidation through large multinational companies controlling increasing market share, vertical integration with farm-to-retail integration becoming more common, and product diversification shifting from commodity to value-added products have reshaped the industry. BARKEMA and DRABENSTOTT (1995) emphasise how vertical coordination in agri-food supply chains creates competitive advantages through reduced transaction costs and enhanced information flows. PORTER (1998) outlines how competitive strategies within the dairy sector are shaped by the intensity of industry rivalry, threat of new entrants, bargaining power of suppliers and buyers, and the threat of substitute products.

The dairy sector faces several emerging challenges, including sustainability imperatives such as reducing greenhouse gas emissions, improving water use efficiency, minimising waste throughout the supply chain, and adopting circular economy principles. As AUGUSTIN et al. (2013) observe, the transition towards a more sustainable dairy industry requires integration across the farm-factory interface, with coordination mechanisms that span production, processing, and distribution. Technological innovation through precision dairy farming, robotic milking systems, digital supply chain management, and development of alternative dairy products represents key trends shaping the industry's evolution (IFCN, 2020).

The global dairy industry stands at a critical juncture, facing both unprecedented challenges and opportunities. As a fundamental component of the global food economy, the sector must navigate complex dynamics including climate change, resource constraints, and evolving consumer preferences whilst continuing to provide essential nutrition to a growing global population. The industry's continued success will depend on its ability to adapt through technological innovation, sustainable practices, and market responsiveness. The following sections will examine these developments in greater detail, with particular focus on the theoretical foundations and methodological approaches that underpin dairy sector development and integration.

1.1. THEORETICAL AND METHODOLOGICAL FUNDAMENTALS OF DAIRY INDUSTRY INTEGRATION

The dairy industry represents one of the most complex and strategically important sectors within global agricultural systems, characterized by intricate production processes, perishable products, and multifaceted stakeholder relationships (PARKHOMETS, 2005; VASYLCHAK, 2005; BUTKO, 2010). Understanding the theoretical foundations and methodological approaches that underpin dairy sector development and integration is essential for analysing its current challenges and future trajectories. This chapter establishes the conceptual framework that guides the subsequent empirical analysis of dairy industries in Ukraine and the European Union.

Integration within the dairy sector encompasses diverse organizational arrangements that connect distinct stages of the value chain – from primary production to processing, distribution, and retail (ISAKSEN et al., 2007; KOZHUKHOVA, 2015). These arrangements may range from informal coordination mechanisms to formal contractual relationships and full ownership integration, as documented extensively by REHBER (2007), LIEBERMAN (1991), and WILLIAMSON (1985, 2002). The theoretical underpinnings of such integration draw upon multiple disciplines, including agricultural economics, organizational theory, industrial organization, and strategic management (RIORDAN, 1990; CARLTON, 1979; ADELMAN, 1955). As HOBBS (2000) and BARKEMA and DRABENSTOTT (1995) emphasize, vertical coordination in agri-food supply chains creates competitive advantages through reduced transaction costs and enhanced information flows, particularly valuable in sectors characterized by product perishability and quality variability. By examining these theoretical perspectives alongside appropriate methodological approaches, this chapter provides the analytical foundation for evaluating dairy sector performance, structural transformation, and resilience in the face of external shocks.

To resume, this literature review begins by establishing a conceptual framework for dairy industry development, examining key theoretical constructs that explain integration processes and their implications for sector performance. This is followed by a detailed discussion of methodological approaches for analysing dairy sector dynamics, with particular attention to quantitative and qualitative techniques for assessing efficiency, market relationships, and structural change. The chapter concludes with a historical overview of dairy production evolution in Ukraine and the European Union, contextualizing current challenges within longer-term developmental trajectories. Together, these elements provide the theoretical lens and methodological toolkit for the comparative analysis of dairy industries that forms the core of this dissertation.

1.1.1. Conceptual Framework of Dairy Industry Development

The dairy industry constitutes one of the leading sectors in food processing globally, forming an economically significant market in terms of volume and value. Milk and dairy products represent essential food commodities, rich in proteins, essential amino acids, microelements, vitamins, and other beneficial substances that contribute to human nutrition and health (BLEDZEVA and MELNYK, 2018; IVASHYNA et al., 2024). The conceptual understanding of dairy industry development encompasses multiple dimensions, including production systems, processing technologies, market structures, and integration mechanisms that collectively shape sectoral performance and sustainability (KERANCHUK, 2017; FEDULOVA, 2018; KOZACHENKO and CHEBAN, 2017).

The organisation of the dairy industry in the form of integrated structures provides participants with numerous competitive advantages (KOBETS, 2007; TSYMBAL, 2010;). The consolidation of material, financial, informational, and human resources, alongside diversification of activities and centralisation of management processes, contributes to market expansion, transaction cost reduction, and achievement of synergistic effects (SEMSAL, 2022; SABLUK et al., 2002). This integration fundamentally supports the sustainable development of dairy product subcomplexes within broader agricultural systems (CSIZMÁSNÉ TÓTH, 2014). Integration in the dairy sector can be conceptualised as occurring across multiple levels: horizontal integration among similar entities (e.g., producer cooperatives), vertical integration across the value chain (from farm to retail), and institutional integration through policy frameworks, standards, and support mechanisms (CAI and OBARA, 2009; SZABO, 2006; TAKÁCS et al., 2013, EMELIANOFF, 1942). Each level of integration presents distinct opportunities and challenges for sector participants, with implications for economic efficiency, product quality, and market competitiveness (GONCHARUK and GAMMA, 2013; GERELES and GALYCH, 2013). As COOK et al. (2004) emphasise in their review of cooperative theory, advances in agricultural economics literature have demonstrated how cooperative structures effectively address market failures and enable small producers to achieve economies of scale while maintaining their autonomy.

These insights align with recent empirical findings from the EU R4D project across 15 European countries, which demonstrated that resilient dairy farming systems require integration across multiple levels – technical efficiency, socio-economics, and environmental sustainability (KUIPERS et al., 2024). Furthermore, MALAK-RAWLIKOWSKA et al. (2024) examined stakeholder expectations across Central-Eastern and Western European dairy sectors, revealing how integration strategies must adapt to regional contexts while maintaining core efficiency objectives.

As NOURSE (1945) indicates, the essence of integration within agricultural systems lies in the optimization of resource utilization and coordination of production activities to achieve scale economies and enhance value creation. This perspective has been further developed by contemporary scholars such as CARLTON (1979), who elaborates on the role of vertical integration in reducing transaction costs and mitigating market uncertainties. The integration theory of WILLIAMSON (1985, 2002) provides a comprehensive framework for understanding the governance structures that emerge within dairy value chains, emphasizing how asset specificity and contractual complexity influence organizational arrangements (CHATTERJEE et al., 1992; PARKHOMETS, 2012).

The economic efficiency of milk production by agricultural enterprises is intrinsically linked to the efficiency of its processing, trade, and consumption patterns (KRYVENKO and PALAMARCHUK, 2019; ZUBENKO and LESNYK, 2020). Recent years have witnessed situations where primary production appears unprofitable while processing and trade generate surpluses (PARASHCHAK and SHAPOVALOVA, 2018; PESKOVA, 2020).

MYŠKOVÁ and HÁJEK (2017) developed a comprehensive framework for assessing firm financial performance that combines quantitative financial ratios with qualitative linguistic analysis of management reports. Their empirical analysis of manufacturing companies revealed that firms exhibiting strong financial metrics but negative linguistic indicators (such as defensive tone or vague forward guidance in annual reports) subsequently experienced performance declines, whilst those with moderate financial ratios but positive linguistic patterns achieved more sustainable growth. This dual-method approach is particularly relevant for analysing dairy sector performance, where traditional financial metrics may not fully capture critical factors such as adaptation to volatile milk prices, management responses to regulatory changes, or strategic positioning during market disruptions. Their methodology provides a foundation for understanding how dairy enterprises communicate and manage performance challenges – essential considerations when examining structural transformations and crisis responses in the Eastern European dairy sectors analysed in this dissertation.

Recent methodological advances continue to refine performance assessment approaches. ALARUSSI and GAO (2023) examined determinants of profitability in emerging market companies, identifying how institutional environments and market structures influence firm-level efficiency metrics. MAZIARCZYK (2020) analysed the impact of global financial crises on industrial company profitability and outsourcing decisions in Poland, demonstrating how external shocks reshape operational strategies – insights particularly relevant for understanding dairy sector adaptations to crisis conditions.

SZŐLLŐSI and ERDŐS (2023) conducted a comprehensive comparative analysis of agricultural companies producing arable crops in the Visegrad countries (Poland, Slovakia, Czechia, and Hungary) during 2018-2020. Their study focused on examining the concentration, financial performance, and income and asset situation using data from the EMIS database. The research revealed that Poland and Czechia were dominated by micro-enterprises, while Hungary and Slovakia had predominantly small farms. Hungarian and Polish companies demonstrated the most favourable financial profitability (ROS 9.54% for Poland), while Slovak farms showed the least favourable performance. SZŐLLŐSI and ERDŐS (2023) established that there was no close relationship between farm size and financial efficiency across the V4 countries. However, they found a moderate positive correlation between farm size (measured by net sales revenue and total assets) and profit (EBIT), indicating that as farm size increases, profit tends to increase as well.

Recent studies continue to examine these relationships. MARGONO and GANTINO (2021) investigated the influence of firm size and leverage on profitability in emerging markets, finding complex non-linear relationships that vary by sector. Similarly, FONSECA et al. (2022) analysed newly established firms' profitability patterns, demonstrating that size-performance relationships evolve as firms mature, particularly relevant for understanding dairy enterprise development trajectories in transition economies.

To ensure the overall efficiency of milk production and equitably distribute profits among market participants, it becomes necessary to establish balanced economic relationships between all dairy industry stakeholders (RADKO, 2008; TARASYUK, 2012). In market economies, the interests of agricultural enterprises, processing industries, and trade entities (Figure 1) converge around profit maximisation but diverge regarding the means of achieving this objective (SOROKA and LINNICHENKO, 2019; LAVRINENKO and SERGIENKO, 2019).

Consequently, the development of small-scale milk processing facilities directly on farms has emerged as a strategic response, though this approach can reduce overall economic efficiency through increased production costs of finished products (SHEVCHENKO and MISHCHENKO, 2019; STEPASIUK and STAROMINSKYI, 2024).

GÁL (2014) provided empirical evidence for these efficiency challenges through deterministic and stochastic DEA models applied to dairy farms in Hungary's northern great plain region, revealing that while farm size influences technical efficiency, the relationship is non-linear and depends significantly on technological investment levels and management practices.

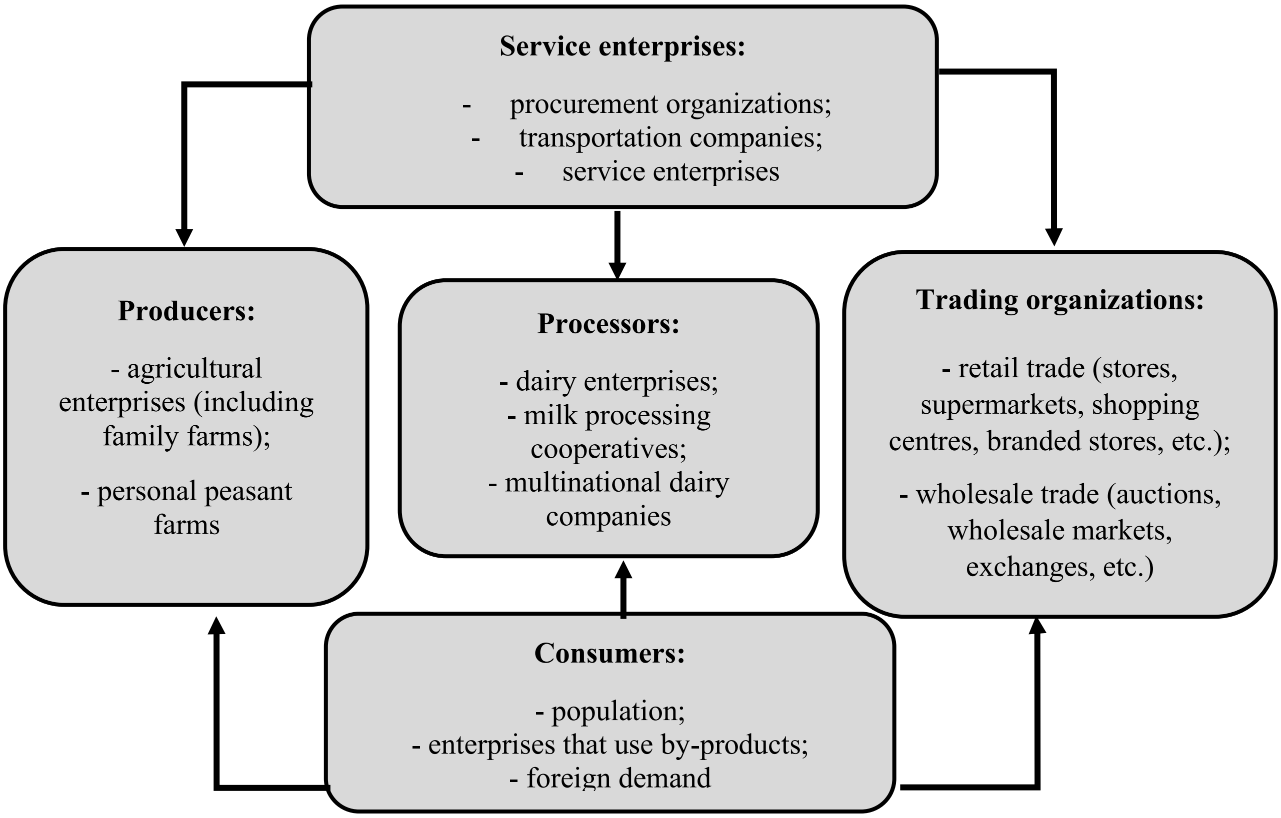


Figure. 1. Diagram of economic relationships between main participants in the milk market.
Source: Own compilation based on RADKO, 2008; TARASYUK, 2012; SOROKA and LINNICHENKO, 2019; LAVRINENKO and SERGIENKO, 2019

Building on this methodological approach, KOVÁCS and PANDEY (2017) conducted a comparative analysis of Hungarian dairy and beef production sectors using DEA, demonstrating that dairy farms generally exhibited higher technical efficiency scores than beef production units, with the efficiency gap widening particularly in larger-scale operations.

The conceptual framework for dairy industry development must also account for the diverse production structures that characterise the sector (SUMNER and WOLF, 2002; JUHÁSZ, 1991). In many developing economies, including Ukraine, a significant portion of total milk production comes from personal peasant farms or smallholder producers (NIVIEVSKYI et al., 2008; LYTOVCHENKO, 2015). This structure introduces complexities regarding raw material quality, supply consistency, and compliance with modern standards (HLADIY and PROSOVYCH, 2022; BUDZIAK and BUDZIAK, 2023). Larger agricultural enterprises and integrated operations typically demonstrate higher productivity, better quality control, and greater market stability, pointing toward a structural transformation pathway for sector development (BOEHLJE and GRAY, 2009; GAGALYUK et al., 2018).

These structural dynamics are reflected in other sectors as well. FENYVES et al. (2019) analysed pharmaceutical companies across the Visegrád countries (Hungary, Poland, Czech Republic, and Slovakia) from 2015-2017, finding significant variations in the relationship between firm size and profitability. Their research demonstrated that optimal enterprise scale varied considerably across markets, with Hungarian firms exhibiting moderate correlation between size and performance, Polish companies showing minimal relationship, and Czech firms displaying strong size-dependent profitability, highlighting how market structures and regulatory environments shape enterprise performance in transition economies.

A critical distinction in agricultural integration theory concerns the mechanisms through which coordination is achieved across value chains. SZŐLLŐSI (2008) provides a comprehensive framework distinguishing between product chains operating with capital uniformity versus those characterised by interest uniformity. In capital-unified structures, the entire value chain from input supply through processing belongs to a single owner or ownership group, with value transmission between stages occurring through internal transfer pricing. This form enables centralised decision-making, optimal cash flow management, and elimination of interest conflicts between chain participants (SZŐLLŐSI, 2008, pp. 22-24).

Conversely, product chains with interest uniformity maintain separate ownership of each stage whilst achieving coordination through shared economic objectives and long-term contractual relationships. As SZŐLLŐSI (2008) demonstrates through simulation modelling of broiler production chains, interest-based coordination allows independent entities to capture integration benefits – including reduced transaction costs, improved quality control, and enhanced market power – whilst preserving operational autonomy. This framework proves particularly relevant for understanding dairy sector transformations in Eastern Europe, where various integration forms coexist and evolve in response to market pressures.

Within this theoretical context, interfarm integration represents a specific subset of interest-based coordination mechanisms. Unlike pure vertical integration (single-entity ownership across stages) or bilateral contract farming arrangements, interfarm integration encompasses collective horizontal cooperation between farms, joint vertical arrangements with processors, and hybrid structures combining both elements. These arrangements enable farms to achieve economies of scale, strengthen bargaining positions, and access shared resources whilst maintaining legal independence—characteristics particularly valuable in transition economies where capital constraints limit consolidation options (SZŐLLŐSI, 2008; SZABÓ, 2006).

The distinction between capital and interest uniformity has profound implications for sectoral resilience. SZŐLLŐSI's (2008) economic analysis reveals that whilst capital-unified chains demonstrate superior profitability under stable conditions (5.3% profit-to-cost ratio versus negative margins in disaggregated chains), interest-based coordination offers greater flexibility in responding to external shocks. This flexibility becomes critical during crisis periods, as demonstrated by Ukrainian dairy cooperatives' adaptive responses to wartime conditions, where formal ownership structures proved less important than functional coordination mechanisms.

PORTER (1998) outlines how competitive strategies within the dairy sector are shaped by the intensity of industry rivalry, threat of new entrants, bargaining power of suppliers and buyers, and the threat of substitute products. This framework is particularly relevant for understanding the strategic positioning of dairy enterprises within increasingly competitive global markets (YAKOVLEVA, 2018; HAVRYLOVA and HOROVA, 2019). Complementary to this view, BARKEMA and DRABENSTOTT (1995) emphasize how vertical coordination in agricultural systems, including dairy, has evolved in response to consumer demand for consistency, quality, and value-added attributes (CHADDAD, 2014; DMITRIYEV and ZHURAVLYOVA, 2019).

The integration processes within dairy industries globally have been accelerated by technological advancements and changing consumer preferences (MOTIRAM and VAKULABHARANAM, 2007; JACOBSON and CROP, 1995). As AUGUSTIN et al. (2013) observe, the transition towards a more sustainable dairy industry requires integration across the farm-factory interface, with coordination mechanisms that span production, processing, and distribution. This integrated approach enables the industry to address complex challenges such as environmental sustainability, animal welfare concerns, and evolving quality standards (TARASYUK, 2012; SEMSAL, 2022; SZŐLLŐSI, 2008, 2009; SZŰCS and SZŐLLŐSI, 2015, 2017; BLASKÓ et al., 2014).

This sustainability imperative has intensified considerably. Recent systematic reviews of EU dairy sustainability indicators emphasise the sector's rapid intensification and the need for comprehensive assessment frameworks spanning economic, environmental, and social dimensions (MASI et al., 2024). The European Parliament's 2024 assessment of dairy sector development strategies explicitly links sustainability transitions to market competitiveness, highlighting how integration mechanisms must evolve to address climate adaptation requirements (EUROPEAN PARLIAMENT, 2024).

Despite challenges, many processing enterprises maintain their commitment to dairy operations because milk sales represent a source of systematic cash flow throughout the calendar year (GERELES and SZŐLLŐSI, 2021, 2022). This economic characteristic makes dairy processing an attractive sector for sustained investment and development, particularly when supported by appropriate policy frameworks and integration mechanisms (OECD-FAO, 2018; MANI, 2013). As HOBBS (2000) notes, closer vertical coordination in agri-food supply chains creates competitive advantages through reduced transaction costs and enhanced information flows, which are particularly valuable in sectors characterized by product perishability and quality variability, such as dairy (JENSON, 2011; ARAYESH, 2011).

While vertical integration offers numerous advantages for dairy sector development, it is essential to acknowledge the significant challenges and potential negative consequences for smaller farm operations. The literature reveals several critical concerns regarding the impact of integration processes on small-scale producers, particularly in transition economies where market structures are still evolving.

The most fundamental challenge facing smaller farms in integrated value chains is the loss of autonomy and trading power. As REHBER (2007) and WILLIAMSON (2002) note, vertical integration often creates asymmetric power relationships between small producers and larger processing entities. Small farms entering contractual arrangements with processors frequently find themselves in disadvantageous negotiating positions, with limited ability to influence pricing structures, delivery schedules, or contract terms. This power imbalance becomes particularly pronounced in markets dominated by a few large processing companies, where farmers have limited alternative buyers for their products (HOBBS, 2000).

Higher barriers to entry represent another significant obstacle for smaller operations seeking to participate in integrated value chains. Integration requirements typically demand substantial investments in technology, quality assurance systems, and infrastructure that smaller farms struggle to afford (BARKEMA and DRABENSTOTT, 1995). These may include modern milking equipment, cooling systems, feed storage facilities, and compliance with stringent quality standards that require ongoing monitoring and documentation. The capital intensity of these requirements often exceeds the financial capacity of smallholder producers, effectively excluding them from formal market participation (CHADDAD, 2014).

The risk of market exclusion poses a particularly serious threat to the sustainability of smaller dairy operations. Farms unable to meet integration requirements may find themselves increasingly marginalised from formal value chains, forced to rely on informal markets that typically offer lower prices and less stable demand (GAGALYUK et al., 2018). This exclusion can create a vicious cycle whereby smaller farms become less viable over time, ultimately leading to their exit from dairy production altogether. The concentration of market power in the hands of larger, integrated operations can thus contribute to the consolidation of the dairy sector at the expense of smaller producers.

Unfavourable contract terms frequently result from the power imbalances inherent in vertical integration arrangements. Smaller farmers may be compelled to accept pricing mechanisms, quality penalties, and delivery requirements that disproportionately favour larger processors (PORTER, 1998). These terms may include rigid delivery schedules that do not account for the seasonal variations typical of smaller operations, quality premiums and penalties that favour larger farms with more consistent production, and pricing structures that provide insufficient margins for smaller operations to invest in necessary improvements.

The Ukrainian context provides particularly compelling evidence of these challenges. Analysis of enterprise distribution reveals that only 12.2% of operating companies in Ukraine were classified as small enterprises in 2020, compared to 35.3% in Poland, indicating a significant marginalisation of smaller players in the Ukrainian dairy market. This disparity suggests that the structural characteristics of the Ukrainian dairy sector, including its emphasis on larger-scale operations and industrial farming models, may inadvertently exclude smaller producers from viable market participation.

Furthermore, Ukrainian small farms face particular difficulties in accessing cold chain infrastructure essential for maintaining milk quality and meeting EU standards. The research demonstrates that whilst industrial farms achieve 90% coverage with modern cooling systems, household producers often lack adequate cooling facilities, contributing to quality variations and price discounts. This infrastructure gap not only affects product quality and pricing but also limits smaller farms' ability to participate in export markets or supply chains serving urban consumers.

The war's impact has exacerbated these challenges for smaller operations. Household producers, who typically operate at smaller scales, experienced a 28.3% decline in milk production compared to the more resilient industrial farms. This differential impact reflects the greater vulnerability of smaller operations to external shocks and their limited capacity to implement adaptive strategies such as relocation, technology adoption, or supply chain diversification.

These negative effects of vertical integration raise important policy considerations for dairy sector development strategies. While integration can enhance efficiency and competitiveness, policymakers must carefully consider mechanisms to ensure that smaller farms are not systematically excluded from value chains. This may require targeted support for small farm modernisation, cooperative development to enhance bargaining power, and regulatory frameworks that prevent abuse of dominant market positions (SZABO, 2006; TAKÁCS et al., 2013).

The empirical evidence from this research suggests that successful dairy sector development requires a balanced approach that captures the benefits of integration whilst protecting the interests of smaller producers. This is particularly relevant for Ukraine's post-war reconstruction, where policies must consider both efficiency objectives and the social and economic sustainability of rural communities that depend on dairy farming for their livelihoods.

Building on these methodological insights, this dissertation employs multiple performance indicators beyond traditional financial ratios to capture the complex dynamics of dairy sector transformation in Ukraine, Poland, and Hungary, particularly recognising that quantitative metrics alone may obscure important adaptive strategies during periods of structural change and external shocks.

1.1.2. Historical Evolution of Dairy Production in Ukraine and the EU

The historical development trajectories of dairy production in Ukraine and the European Union reflect distinct institutional frameworks, policy environments, and structural transformations that have shaped contemporary sectoral characteristics. Understanding these historical pathways provides essential context for interpreting current challenges and opportunities in dairy industry integration.

In Ukraine, the evolution of dairy production has been marked by several distinct phases. During the Soviet period, dairy farming was organised primarily through large collective and state farms (kolkhozy and sovkhozy), which benefited from centralised planning, subsidised inputs, and guaranteed procurement. The collapse of the Soviet Union in 1991 triggered a profound transformation of the agricultural sector, with many large dairy operations fragmenting into smaller units or being abandoned altogether due to economic instability and disrupted supply chains (NIVIEVSKYI et al., 2008).

The 1990s witnessed a significant decline in Ukrainian dairy herd and milk production as the sector struggled to adapt to market conditions (LITOVCHENKO, 2015). Many former collective farms were privatised, often resulting in asset stripping and operational discontinuity. During this period, household production emerged as a dominant form of dairy farming, with smallholder producers accounting for a substantial portion of total milk output (PARKHOMETS, 2005). This structural shift had important implications for milk quality, processing efficiency, and market integration, as smallholder production typically operated with limited technical capabilities, inconsistent quality, and informal market connections.

The early 2000s marked the beginning of gradual recovery and modernisation in Ukrainian dairy sector (RADKO, 2008). The emergence of vertically integrated agroholdings, improved access to investment capital, and growing demand for quality dairy products stimulated some consolidation and technological upgrading. However, the dual structure of dairy farming – with large agricultural enterprises coexisting alongside numerous smallholder producers – persisted as a defining characteristic of the Ukrainian dairy landscape (GAGALYUK et al., 2018).

Ukrainian integration into global economic structures, particularly its accession to the WTO in 2008, intensified competitive pressures in dairy markets. The sector faced growing challenges from imported products while simultaneously seeking to improve competitiveness in export markets. Quality standards became increasingly important, with requirements for compliance with international norms shaping investment priorities and modernisation strategies (SHEVCHENKO and MISHCHENKO, 2019).

In contrast, the European Union's dairy sector evolved under a more stable and supportive policy framework, although not without significant transformations. The Common Agricultural Policy (CAP) provided substantial support for dairy farming through various mechanisms, including price supports, intervention buying, export subsidies, and direct payments. The introduction of milk quotas in 1984 aimed to control overproduction and stabilise prices, shaping the structure and development of EU dairy farming for nearly three decades.

The historical development of dairy sectors in current EU member states from Central and Eastern Europe (including Poland and Hungary) followed a trajectory with some parallels to Ukrainian experience. These countries also underwent post-socialist transitions that disrupted existing production systems and necessitated adaptation to market conditions. However, their subsequent integration into the EU provided access to structural funds, agricultural support programs, and a stable regulatory environment that facilitated modernisation and restructuring.

The abolition of the EU milk quota system in 2015 marked a significant turning point (SZŰCS and SZŐLLŐSI, 2017), allowing for greater market orientation and production expansion in efficient dairy regions. This policy change coincided with increased price volatility in global dairy markets, presenting both opportunities and challenges for EU producers. The period since 2015 has seen continued consolidation in EU dairy farming, with decreasing farm numbers but increasing average herd sizes and productivity.

The post-quota era has brought new adaptation challenges. ONDERSTEIJN et al. (2024) identified three main strategies adopted by dairy farmers across Poland, Lithuania, Slovenia, and the Netherlands: expansion, specialisation, and 'wait and see' approaches, with the 'Growers' cluster representing farmers pursuing expansion and specialisation strategies. The European Commission's 2024-2035 Agricultural Outlook projects that EU dairy production will reach a plateau as declining dairy cow herds will no longer be offset by yield increases, necessitating greater focus on value creation and environmental sustainability (EUROPEAN COMMISSION, 2024).

Both Ukraine and the EU have experienced significant technological modernisation in dairy farming and processing over recent decades. Improvements in genetics, nutrition, housing systems, milking technology, and processing capabilities have driven productivity gains and product diversification. However, the pace and extent of this modernisation have varied considerably, with EU producers generally benefiting from earlier and more comprehensive technological upgrading.

The cooperative movement played significantly different roles in Ukrainian and EU dairy development trajectories. In the USA and Western Europe, dairy cooperatives emerged as key institutional arrangements facilitating market access, risk sharing, and collective bargaining power for farmers (JACOBSON and CROP, 1995; USDA RBS Research Report 225, 2012). These cooperatives often evolved into sophisticated business entities that integrated processing, marketing, and international trade functions (SZABÓ, 2006). In contrast, Ukrainian transition largely dismantled existing cooperative structures, with new cooperative formations struggling to gain acceptance among farmers who associated them with Soviet-era collective farms (GONCHARUK and GAMMA, 2013). This institutional divergence contributed to persistent fragmentation in Ukrainian dairy supply chains compared to more integrated EU systems.

The investment dynamics in dairy processing infrastructure similarly reflected divergent development pathways. EU member states benefitted from substantial structural fund investments that modernised processing facilities, improved food safety standards, and enhanced value-added product development capabilities. Polish and Hungarian dairy sectors, for instance, underwent rapid technological modernisation during their EU accession periods, enabling compliance with stringent quality regulations and integration into pan-European supply chains (JUHASZ, 1991). Ukrainian dairy processors faced considerably more challenging investment environments, with limited access to long-term capital, political instability, and currency fluctuations deterring modernisation investments (TARASSEVYCH, 2017).

Market structure development also followed distinct patterns in Ukrainian and EU contexts. The EU dairy market evolved within a framework of common standards, cross-border trade facilitation, and relatively stable regulatory environments. This enabled development of sophisticated distribution networks, diverse product portfolios, and pan-European brand strategies (EUROPEAN DAIRY ASSOCIATION, 2024). Ukrainian dairy markets remained more fragmented, with regional price disparities, informal trading networks, and limited product differentiation characterising much of the sector (KERANCHUK, 2017). These structural differences influenced competitive dynamics, market concentration levels, and value chain governance mechanisms in the respective regions.

Recent years have seen growing emphasis on sustainability considerations in dairy production across Europe. Environmental regulations, consumer preferences for sustainable products, and climate change adaptation necessities have influenced farm practices and investment decisions. The EU has integrated these concerns more systematically into policy frameworks through initiatives like the European Green Deal and Farm to Fork Strategy, while Ukraine has only recently begun to address sustainability dimensions more comprehensively. The recent period has witnessed renewed challenges for both Ukrainian and EU dairy sectors, albeit of different magnitudes. The EU faced market disruptions from COVID-19 pandemic-related supply chain interruptions, shifting consumer behaviours, and increasing climate adaptation requirements (OECD/FAO, 2023). Ukrainian dairy sector confronted existential challenges following the Russian full-scale invasion, with production infrastructure damage, workforce displacement, and export logistics disruptions fundamentally altering sectoral dynamics (KYIV SCHOOL OF ECONOMICS, 2023). These recent shocks have highlighted resilience disparities between integrated EU systems and more vulnerable Ukrainian supply chains, while simultaneously emphasising the importance of adaptive capacity in contemporary dairy sector development (HLADIY and PROSOVYCH, 2023).

The historical evolution of dairy sectors in Ukraine and the EU thus reflects distinct institutional contexts, policy environments, and structural transformations. These divergent pathways have resulted in different sectoral characteristics regarding farm structure, productivity, market integration, and resilience capacities – differences that remain relevant for understanding contemporary challenges and opportunities in dairy industry development.

1.1.3. Theoretical foundations of agricultural resilience and crisis adaptation. Interfarm integration as a resilience mechanism.

The concept of resilience has emerged as a critical framework for understanding how agricultural systems respond to and recover from shocks and stresses. MEUWISSEN et al. (2024) define farming system resilience as the ability to ensure provision of system functions through capacities of robustness, adaptability, and transformability in the face of accumulating economic, social, environmental, and institutional challenges. This multi-dimensional conceptualisation moves beyond simple recovery to encompass transformation potential.

In dairy systems specifically, resilience manifests as the ability to resist, recover, adapt to, and transform in response to external shocks whilst maintaining primary functions of milk supply

(HIMANEN et al., 2023). The framework recognises dairy systems as social-ecological systems where human actors and ecosystems are endogenous factors, requiring integrated analysis of ecological and social processes.

Recent theoretical advances emphasise the importance of specified versus general resilience. POPPE et al. (2023) developed proxies for dairy herd resilience based on fluctuations in daily milk yield, demonstrating that resilient herds show less deviation at the system level and are less affected by disturbances. This operational approach bridges theoretical concepts with measurable indicators, enabling practical assessment of resilience capacity.

The climate change dimension adds urgency to resilience frameworks. YUAN et al. (2024) identify diversification, digitalisation, and proactive climate action as critical strategies for agricultural supply chain resilience, with empirical evidence from 312 companies showing these factors interconnected influence on system adaptability. ASTUTI et al. (2024) explore the paradoxical relationship between climate change and dairy farming, noting how production systems must simultaneously adapt to climate impacts whilst reducing their contribution to greenhouse gas emissions.

Crisis adaptation theory has evolved to address compound shocks. MARCUCCI et al. (2024) analysed ripple effects in agri-food supply chains during COVID-19, revealing how initial disruptions cascade through interconnected systems. Their framework emphasises the need for multi-level adaptation strategies spanning farm, supply chain, and institutional levels. Similarly, PERRIN and MARTIN (2021) documented how French organic dairy systems demonstrated differential resilience during the pandemic, with social capital and diversification emerging as key protective factors.

The operationalisation of resilience concepts requires integration across scales. KUMAR and SHANKAR (2024) demonstrated how IoT and AI implementation in dairy supply chains reduced spoilage and improved delivery times, illustrating technology's role in building adaptive capacity. However, DARNHOFER et al. (2024) caution that technological solutions must be embedded within broader social-ecological frameworks to achieve transformative resilience rather than merely maintaining status quo operations.

These theoretical advances provide essential foundations for analysing dairy sector responses to extreme shocks, including the wartime conditions affecting Ukrainian agriculture. Understanding resilience as encompassing resistance, recovery, adaptation, and transformation offers a comprehensive lens for examining both immediate crisis responses and longer-term sectoral evolution.

The conceptual framework of interfarm integration provides essential insights for understanding how agricultural systems build resilience through collaborative arrangements that preserve operational autonomy. Building on SZŐLLŐSI's (2008) distinction between capital and interest uniformity, interfarm integration emerges as a middle path that combines coordination benefits with adaptive flexibility.

In the Ukrainian context, interfarm integration manifests through several institutional forms. Agricultural service cooperatives, which numbered 127 in the dairy sector as of 2021, represent the most formalised structure. These cooperatives enable collective procurement (reducing feed costs by 15-20%), shared quality testing facilities, and joint marketing whilst maintaining independent farm management. Joint procurement arrangements and collective trade associations provide lighter coordination mechanisms that require minimal capital investment but yield substantial transaction cost reductions.

The wartime experience has accelerated innovation in interfarm integration models. In de-occupied territories, farms have established shared processing facilities that operate on cost-recovery principles rather than profit maximisation, ensuring continued market access for small producers who lost individual processing relationships. Mobile processing units, jointly owned by farm groups, provide flexible solutions that adapt to changing frontline positions and infrastructure damage.

SZŐLLŐSI's (2008) simulation analysis demonstrates that such interest-based coordination can achieve 80-90% of the efficiency gains of full vertical integration whilst requiring substantially less capital investment (14 billion HUF for full integration versus distributed investments in interest-unified systems). This capital efficiency proves crucial in crisis contexts where access to financing is severely constrained. Moreover, the distributed risk-bearing inherent in interfarm integration enhances system-wide resilience, as demonstrated by Ukrainian cooperatives' ability to maintain operations despite losing 30-40% of member farms to occupation or destruction.

The theoretical implications extend beyond crisis response. Interfarm integration represents an evolutionary pathway between fragmented smallholder production and consolidated industrial agriculture. As COOK et al. (2004) observe, such arrangements allow gradual capability building and trust development that can eventually support more intensive coordination forms. This evolutionary perspective suggests that interfarm integration serves not merely as a survival mechanism but as a developmental stage in agricultural transformation processes.

1.2. ECONOMIC AND FINANCIAL EFFICIENCY OF MILK PRODUCTION AND PROCESSING IN UKRAINE

The dairy industry in Ukraine is one of the largest industrial sectors and a key industry in the Ukrainian economy. Ukraine has significant potential for the development of the dairy industry, thanks to its natural conditions and large number of cattle (Anex A). However, ensuring efficient production and processing of milk is a challenge for Ukrainian producers. The main problem is the low efficiency of milk production and processing, which leads to a decrease in competitiveness in the international market and increased costs.

Production and processing of milk is an important industry in the Ukrainian economy, as milk is one of the most widely consumed food products and a raw material for many other products, such as cheese, yogurt, and butter. However, the economic and financial efficiency of milk production and processing in Ukraine has its challenges.

According to statistical data (STATE STATISTICS SERVICE OF UKRAINE, 2022), Ukraine is one of the largest milk producers in Europe. However, the efficiency of milk production and processing remains low due to insufficient investment in equipment, high dependence on external markets, low product quality, and inadequate modernization of production.

In recent years, milk production in Ukraine has been declining, which may be due to several factors, such as inadequate profitability of milk production and high costs of keeping cattle. Also, the absence of an efficient system for collecting and storing milk can lead to a loss of product quality and increased processing costs.

BLEZDEVA and MELNYK (2018) investigated the factors that affect milk production efficiency in Ukraine. The authors used correlation analysis and cluster analysis to identify the factors that influence milk production efficiency. Data on milk production from 2012 to 2016 and economic indicators of agricultural enterprises were used for the study. The authors claim that the main factors that affect milk production efficiency in Ukraine are the cost of feed, production costs per kg of milk, the number of cows per worker, the level of technological equipment, and market prices for milk. The results of BLEZDEVA and MELNYK (2018) study can be useful for milk production enterprises and for the development of a strategy for state support of the agricultural sector. However, the authors did not consider the influence of other factors, such as weather conditions, market conditions, and so on, that can affect milk production efficiency in Ukraine. Additionally, the authors do not provide specific recommendations for increasing milk production efficiency. Therefore, to obtain a complete picture of the factors that affect milk production efficiency in Ukraine, it is necessary to study other aspects. It is also important to consider the regional features of milk production and processing that can affect efficiency.

DMITRIYEV and ZHURAVLYOVA (2019) are the authors of a scientific paper that examines the issue of financial efficiency of milk production and processing in Ukraine. The authors identified and analysed the main financial indicators such as total production cost, production volume, sales value, profitability, and others, using the example of enterprises engaged in milk production and processing in Ukraine. The authors describe the data that allows the conclusion to be made that the financial efficiency of milk production and processing in Ukraine remains low, which is associated with low livestock productivity and high production costs. The authors also examined factors that affect the financial efficiency of milk production and processing, such as production technologies, feed quality, livestock maintenance costs, and others. However, it should be noted that to obtain a complete picture, it is necessary to investigate other aspects such as the effectiveness of marketing strategies, the use of innovative technologies, and more.

KRYVENKO and PALAMARCHUK (2019) investigate the problem of forming the economic efficiency of milk production in competitive market conditions. They consider the peculiarities of financial activity of agricultural enterprises, particularly in terms of inventory management, costs, and profits. The research is conducted using the factor analysis method, which allows determining the influence of different factors on production efficiency. The authors conclude that the formation of an effective milk production strategy in market conditions requires taking into account a number of factors, such as the level of technological equipment, soil quality, professional skills of employees, and many others. They also emphasize the need for a balanced approach to milk production, costs, and sales to achieve maximum efficiency.

Overall, the article of KRYVENKO and PALAMARCHUK (2019) provides a detailed analysis of the problem of milk production efficiency in market conditions and offers practical recommendations for its solution based on the analysis of data from agricultural enterprises in the Kherson region. The factors and methods for analysing the economic and financial efficiency of milk production and processing described in the studies can be useful for practitioners, researchers, and students studying this field. Most of the studies reviewed confirm that high efficiency of milk production and processing depends on high animal productivity, proper feeding ration, optimal production technology, and high product quality. Additionally, taking into account external environmental factors such as market competition, government policies, climate, and environmental conditions also plays an important role in achieving efficiency in milk production and processing.

The application of effective methods and management strategies in milk production and processing can contribute to increasing profits, improving product quality, and competitiveness, leading to the stable development of the national economy. Authors LISOVSKA and HRYTSENKO (2018) conducted a study on the financial efficiency of milk production in Ukraine using a method of financial indicator analysis. The authors examined the financial indicators of milk production in Ukraine from 2013 to 2017 and analysed them using methods such as balance analysis, profit analysis, and profitability analysis. As a result of the study, it was found that the financial efficiency of milk production in Ukraine is low and decreasing every year. Particularly low is the profitability of production, which averages about 2-3%. Although LISOVSKA and HRYTSENKO (2018) presented useful information in their article regarding the financial efficiency of milk production in Ukraine, it requires some critical evaluation of the study. For example, the authors did not investigate the possible reasons for the low financial efficiency of milk production in Ukraine and did not provide recommendations for improving this efficiency. It was also not indicated with what accuracy the data was collected and which specific methods were used for data processing.

Therefore, the study contains some useful information, but it is not sufficient for a complete understanding of the problem of economic and financial efficiency of milk production in Ukraine. SHEVCHENKO and MISHCHENKO (2019) conducted a study on the economic efficiency of milk production and processing at agricultural enterprises.

SHEVCHENKO and MISHCHENKO (2019) used theoretical analysis, generalization and systematization of scientific research, statistical methods, comparative analysis of financial indicators, as well as analysis of production efficiency indicators to achieve their goal. As a result of the research, the authors conclude that the efficiency of milk production and processing in agricultural enterprises depends on many factors, such as the use of modern equipment, provision of quality raw materials, availability of competitive advantages, effective resource management, and cost reduction. The article provides practical advice for agricultural enterprises to improve the efficiency of milk production and processing, namely: the use of modern technology and equipment, increasing labour productivity, improving production and financial management systems. In addition, the article provides information on the state of milk production in Ukraine, production dynamics and export volumes, as well as the main problems faced by milk production and processing enterprises.

Despite the fact that the research of SHEVCHENKO and MISHCHENKO (2019) was conducted on a limited sample of enterprises, the results are useful for understanding the factors that affect the efficiency of milk production and processing. However, a more detailed analysis would require a wider sample and generalization of results from other studies.

Analysing the research by ZUBENKO and LESNIK (2020), it can be said that it has an important practical contribution to the dairy industry in Ukraine. The authors used analytical and grouping methods to determine the financial efficiency of milk processing enterprises in Ukraine for 2017-2018. The study indicated that the average level of productivity assets yield in milk processing enterprises was 0.59, which is sufficient for effective operation. The authors also showed that enterprises with high levels of financial efficiency are characterized by a higher level of solvency and reduced risk of default on their obligations. However, the study of ZUBENKO and LESNIK (2020) noted that milk processing enterprises in the Ukrainian industry require improved financial management, increased investment levels, and enhanced resource utilization efficiency. Additionally, it was recommended that enterprises focus on improving the quality and competitiveness of their products in the market.

The research by PARASHCHAK and SHAPOVALOVA (2018) focused on analysing the economic efficiency of milk production and processing in Ukraine. The authors used data on milk production and processing in Ukraine from 2012 to 2016. The paper analysed the economic efficiency of milk production in enterprises of different ownership forms, including state-owned and private enterprises. The study showed that milk production in state-owned enterprises is less efficient compared to private enterprises, which is due to lower animal productivity and lower levels of investment in the agricultural sector.

PARASHCHAK and SHAPOVALOVA (2018) also examined the efficiency of milk processing in dairy processing plants, including comparing the efficiency of dairy processing enterprises of different ownership forms. The study showed that private dairy processing enterprises are more efficient compared to state-owned ones. In summary, the article offers a series of recommendations for improving the economic efficiency of milk production and processing in Ukraine, including increasing investment in the agricultural sector and improving animal productivity.

Overall, the article of PARASHCHAK and SHAPOVALOVA (2018) contains valuable information about the economic efficiency of milk production and processing in Ukraine and offers practical recommendations for improving the situation in this industry. However, it should be noted that the article has some limitations, such as a limited amount of data and a limited geographical area of the research. The study may be further complicated by the insufficient accuracy of data related to economic activity and the financial status of enterprises.

In addition, the article does not take into account the dynamics of the industry's development in more recent years, so some of these recommendations may already be outdated or require updating due to new trends. Despite these limitations, the article of PARASHCHAK and SHAPOVALOVA (2018) may be useful for researchers working in the economics of agriculture and the processing industry. The research results can serve as a basis for further research and the development of strategies to improve the efficiency of milk production and processing in Ukraine.

The work of LAVRINENKO and SERGIENKO (2019) is dedicated to the study of the economic efficiency of milk production in Ukraine using agroecological approaches. The authors examined the relationship between milk production and environmental factors, such as soil use, plant protection, and fertilizer use. Their article provides a detailed analysis of data collected from various sources, which allows the conclusion that the use of agroecological approaches can significantly improve the efficiency of milk production in Ukraine. The authors note that the implementation of environmentally friendly production and land resource management technologies can lead to increased crop yields, reduced fuel costs, and reduced waste, which has a positive impact on the economic efficiency of milk production. However, the article has some limitations, such as a limited amount of data and a limited geographic area of research. In addition, the article does not address marketing and sales of dairy products, which are also important factors in efficient milk production.

Overall, the article of LAVRINENKO and SERGIENKO (2019) may be useful for researchers in agricultural economics and ecology, as well as professionals in the dairy industry who are interested in improving the efficiency of milk production in Ukraine. The research results may serve as a basis for further research in this area, as well as for the development of strategies to increase the efficiency of milk production in Ukraine based on agro-ecological approaches.

LAVRINENKO and SERGIENKO (2019) used data analysis methods such as economic analysis, statistical analysis, and modelling, which allows for reliable conclusions about the economic efficiency of milk production based on agro-ecological approaches. In particular, the authors examined the impact of various factors, such as soil pollution, fertilizer use, and plant protection, on milk production. They also analysed the costs of milk production in Ukraine, including costs for feed, veterinary medicine, and employee salaries. One of the conclusions of LAVRINENKO and SERGIENKO (2019) is that the use of agro-ecological approaches in milk production can be beneficial from both an ecological and economic perspective. In particular, the authors found that the use of environmentally friendly technologies can reduce feed costs and increase productivity, leading to increased profits. Overall, the article contains valuable conclusions and proposals for improving the efficiency of milk production in Ukraine based on agro-ecological approaches. However, further research in this area may be necessary to supplement and expand on this study.

The article by HAVRYLOVA and HOROVA (2019) is relevant and important for understanding the efficiency of milk production and processing in Ukraine, especially with regard to its integration into the European market. Authors use various methods of analysis, including a comparative analysis of milk production economic indicators in Ukraine and Europe, as well as SWOT analysis. They also conducted an analysis of the dynamics of milk production and export volumes in Ukraine, and examined the main factors that affect the efficiency of milk production.

One of the conclusions of HAVRYLOVA and HOROVA (2019) is that Ukraine has high potential for milk production, and there is an opportunity to improve the efficiency of milk production and processing under conditions of integration into the European market. The authors also found that there are problems that need to be addressed to improve the efficiency of milk production, including a low level of technological equipment, insufficient funding, and export problems. However, the article does not discuss in detail certain aspects, such as understanding the risks and issues associated with Ukraine's integration into the European milk market and its products.

The study by YAKOVLEVA (2018) is dedicated to assessing the economic efficiency of milk production in the context of innovative technologies. The author emphasizes the importance of implementing new innovative technologies to improve the efficiency of milk production and processing in Ukraine. YAKOVLEVA (2018) presents the results of a study conducted to evaluate the economic efficiency of milk production using innovative technologies. The author used financial analysis, including profitability analysis and cost-effectiveness analysis, to evaluate the efficiency of milk production. The study showed that the implementation of innovative technologies in milk production can significantly increase the efficiency of milk production and processing, reduce production costs, and increase profitability. The author indicates that the use of new technologies, such as biotechnology and automation, can help improve the quality of milk and reduce labour costs associated with milk production and processing. Overall, this article provides valuable insights into the importance of implementing innovative technologies.

Additionally, the YAKOVLEVA (2018) does not consider possible negative consequences of using new technologies, such as negative impact on animal health and milk quality, which could affect consumers. Therefore, more comprehensive research is needed to assess the impact of new technologies on various aspects of milk production in Ukraine.

PESKOVA (2020) study focuses on the formation of financial efficiency in milk production in Ukraine. The author investigates the impact of various factors on the efficiency of milk production in Ukraine and proposes ways to improve this efficiency. In this article, the author uses financial analysis, including the methodology of calculating the costs of milk production, to evaluate production efficiency. The research results indicate that the profitability of milk production in Ukraine is quite low, and the level of costs per kilogram of milk is high. The author proposes the following ways to improve milk production efficiency: improving feed quality, reducing the costs of animal maintenance, increasing animal productivity, using efficient production technologies, and others.

The main advantage of PESKOVA's (2020) study is that the author proposes specific ways to improve milk production efficiency based on detailed financial analysis. However, a weakness of the article may be that the author does not consider other important aspects, such as social and environmental consequences of milk production.

SOROKA and LINNICHENKO (2019) article is dedicated to analysing the efficiency of milk production and processing at enterprises in Ukraine. The authors used methods of economic-mathematical modelling and financial analysis to study the financial and economic efficiency of milk production and processing.

SOROKA and LINNICHENKO (2019) provide a detailed description of analysis methods and comparative results of research conducted at various enterprises in Ukraine. The authors found that milk production is more effective in large enterprises, which have a more developed infrastructure and can apply modern milk production and processing technologies. Additionally, the study revealed that production of hard cheeses is more efficient compared to soft cheeses. A drawback of the article can be considered the limited use of analysis methods since the research was conducted only using economic-mathematical modelling and financial analysis. A more comprehensive study of the efficiency of milk production and processing in Ukraine is possible with the use of other analysis methods, such as social, environmental, and others.

Analysis of the economic and financial efficiency of milk production and processing in Ukraine can be carried out based on statistics and reporting data of companies engaged in this industry.

According to the data of the STATE STATISTICS SERVICE OF UKRAINE (2020), milk production in Ukraine is decreasing every year. Thus, in 2020, milk production amounted to

10.3 million tons, which is 3.3% less than in 2019. At the same time, milk and dairy product exports are increasing. According to the MINISTRY OF AGRARIAN POLICY AND FOOD OF UKRAINE (2022), in 2020, milk and dairy product exports increased by 25% compared to the previous year and amounted to $188.5 million.

Regarding the financial efficiency of milk production and processing, this industry is characterized by a low level of profitability. According to the experts from UCAB (2020), in 2019, the profitability of milk production in Ukraine averaged 6.2%, and the profitability of milk processing was 3.3%. This can be explained by high costs of feed and livestock maintenance, a low level of technological base, and market competition.

However, some milk production and processing companies in Ukraine are successful and have high profitability. For example, "Molokiya" had a profitability of 9.3% in 2019, and "Privitryana Dibrova" – 12.8%. The successful production and processing of milk in these companies can be attributed to a number of factors, such as high quality of the produced products, efficient cost management, and increased productivity of employees.

One potential way to improve the economic and financial efficiency of milk production and processing in Ukraine could be to increase the volume of domestic milk consumption. According to the MINISTRY OF AGRARIAN POLICY AND FOOD OF UKRAINE (2022), domestic milk consumption in Ukraine is decreasing every year. In 2020, domestic milk consumption was 24.9 kg per capita, which is 3.3% less than in 2019.

To increase domestic milk consumption, various mechanisms can be used, such as introducing taxes on imported milk products, supporting producers at the state level, improving the quality and safety of milk products, and so on. New milk production and processing technologies can also be used to reduce feed and livestock maintenance costs and increase the quality and quantity of produced products.

In Ukraine, dairy farming plays an important role in agriculture. Milk production and processing are an important industry that provides employment for millions of people and provides consumers with quality food products. However, there are questions about the economic and financial efficiency of milk production and processing in Ukraine.

At the current stage of Ukraine's development, there is a trend towards increasing the efficiency of milk production and processing. This is due to the implementation of new technologies and the upgrading of qualifications of professionals in the industry. In addition, attracting investment to support the industry and implementing state programs to support the development of milk production and processing can help address problems. According to STATE

STATISTICS OF UKRAINE (2022), as of the beginning of February 2022 (Annex A), farms of all categories in Ukraine kept over 2.7 million heads of cattle (1.6 million cows). Additionally, there were over 1 million sheep and goats.

The leaders in the number of cattle were Khmelnytskyi (123.1 thousand heads), Vinnytsia (104.8 thousand heads), and Poltava regions (102.3 thousand heads). Small livestock is traditionally focused in Odessa (263.1 thousand heads) and Zakarpattia (18.9 thousand heads) regions. At the same time, a large number of farm animals are raised in the regions of Ukraine that became combat zones or were occupied by Russia after the full-scale invasion of Ukraine on February 24, 2022. During February-May 2022, 10 Ukrainian regions were under occupation or active combat, and they concentrated 43.2% of the total industrial cattle population.

For example, at the beginning of February 2022, all categories of farms in Zhytomyr region had 92,000 cows, 52.6 thousand in Kyiv region, 75.6 thousand in Chernihiv region, 64.3 thousand in Kharkiv region, and 56.2 thousand in Sumy region. However, according to preliminary estimates by market participants, only in February 2022, the number of cows decreased by 15 thousand heads. Losses over the next several months are still being calculated. There is no fresh data on cattle population and milk production after February 24, 2022. Most of this happened in temporarily occupied territories where the activity of dairy farms was or is blocked by occupiers.

Experts suggest (UCAB 2024) that the number of livestock in Ukraine will continue to decrease due to the destruction of farms, problems with feed, and other operational factors.

In 2021, Ukraine produced 8.72 million tons of milk, compared to 9.25 million tons the previous year (Annex B). Agricultural enterprises produced 2.75 million tons of milk (0.4% less), while households produced 5.97 million tons (8.2% less).

According to STATE STATISTIC SERVICE OF UKRAINE (2022), in 2021, processing enterprises received almost 3.2 million tons of raw milk, from which they produced butter, milk and cream (dry and condensed), cheese, whey, and other products. Following Russia’s full-scale invasion of Ukraine, the war zone and occupied areas included regions that produced 42.3% of the milk volume.

The regions that previously contributed the largest share of milk were the "hotspots" in February-March 2022: Chernihiv (8.9% of all industrial milk that comes for processing from agricultural enterprises), Kharkiv (8.9%), Kyiv (8.2%), Sumy (5.9%), and Zhytomyr (4.3%) regions. According to market participants (UKRAINIAN ASSOCIATION OF BUSINESS AND TRADE, 2021), in many affected regions, cow productivity has decreased by 15-70%.

Meanwhile, there may be a restructuring in the milk production market. While large industrial farms will resume their work in their usual scale, medium and small dairy farms may enter the arena.

Production and processing of milk in Ukraine can be economically and financially efficient if the following conditions are met:

- Efficient resource utilization: milk production and processing should be properly organized to maximize the use of available resources, such as time, labour, energy, raw materials, and other materials. Optimization of the production process can help reduce costs and increase profit (YAKOVLEVA, 2018).
- Product quality control: milk quality must be properly controlled at every stage of production and processing. Product quality can affect consumers and the competitiveness of the enterprise (SHEVCHENKO and MISHCHENKO, 2019).
- Using modern technologies: utilizing modern technologies can help reduce costs and improve the efficiency of milk production and processing. For example, using automated production systems can decrease labour costs and increase the quality of the products (DMYTRIEV and ZHURAVLOVA, 2018).
- Optimal production planning: optimal production planning can help reduce costs and increase profit. Production planning must be properly organized to ensure the availability of the necessary number of raw materials and materials (KRYVENKO and PALAMARCHUK, 2019).
- Marketing strategies: developing marketing strategies can help increase sales volume and boost profit. Marketing strategies may include advertising, product promotion, product line expansion, discounts, and other measures that help attract more customers and increase the loyalty of existing ones (LISOVSKA and HRYTSENKO, 2018).
- Effective management process: an effective management process is key to achieving success in milk production and processing. Milk production and processing management should be properly organized to ensure the efficiency of resource utilization, cost reduction, and product quality improvement (BLEDZEVA and MELNYK, 2018).
- Legislative requirements and standards: compliance with legislative requirements and standards is mandatory to ensure product quality and consumer safety. Milk production and processing must conform to quality and safety standards for food products (HAVRYLOVA and HOROVA, 2019).

All these conditions can help ensure the efficiency of milk production and processing from an economic and financial standpoint. It is also important to pay attention to issues of responsibility towards consumers and create trust in the products, which can help maintain a competitive advantage in the market.

In conclusion, the exploration of economic and financial efficiencies in milk production and processing within Ukraine serves as a vital framework for informing future strategies and practices in the sector. The findings detailed in the works underscore the necessity for effective resource utilization, adherence to quality control standards, the integration of modern technologies, and the importance of marketing and management strategies. These factors collectively contribute to enhancing the competitive edge of both large industrial farms and smaller dairy enterprises in an evolving market landscape. The transition towards an improved dairy sector not only has significant economic implications but also holds the potential to build consumer confidence and loyalty.

In conclusion, the comprehensive analysis conducted by Ukrainian and international researchers demonstrates that economic and financial efficiency in milk production and processing requires a multifaceted approach. YAKOVLEVA (2018) highlights the significance of efficient resource utilization and innovative technologies in maximizing production efficiency. SHEVCHENKO and MISHCHENKO (2019) emphasize the critical role of quality control mechanisms throughout the production chain, while DMYTRIEV and ZHURAVLOVA (2018) demonstrate how automated systems can enhance operational efficiency. KRYVENKO and PALAMARCHUK (2019) stress the importance of strategic production planning, and LISOVSKA and HRYTSENKO (2018) identify effective marketing strategies as essential for market competitiveness. BLEDZEVA and MELNYK (2018) underscore the necessity of sound management practices, whilst HAVRYLOVA and HOROVA (2019) note the imperative of regulatory compliance in ensuring product safety and consumer trust. These collective findings provide a robust framework for addressing the challenges facing Ukraine’s dairy sector, particularly in light of recent disruptions within the full-scale invasion. The research reviewed in this chapter not only advances our understanding of the current state of Ukrainian milk production but also establishes a foundation for future policy interventions and practical improvements in the sector’s economic and financial performance.

2. MATERIALS AND METHODS

The comprehensive analysis of dairy sectors requires robust methodological approaches that can adequately capture the multifaceted nature of production systems, market dynamics, and integration processes. This dissertation employs a mixed-methods approach that combines quantitative and qualitative techniques to analyse structural changes, economic performance, and transformation processes in the dairy industries of Ukraine and the European Union.

The quantitative methodologies employed in this research align with approaches established in previous agricultural economics studies, incorporating descriptive statistical analysis, time series analysis, correlation analysis, and comparative assessment of key performance indicators as utilised by several authors (STOKES et al., 2007; AGGER et al., 2004; DIJKHUIZEN et al., 1985). Similar methodological frameworks have been successfully applied by COELLI et al. (2005) in efficiency measurement studies and by HEMME et al. (2014) in international dairy farm comparison networks. Data sources encompass official statistical repositories (EUROSTAT, STATE STATISTICS SERVICE OF UKRAINE), industry reports by sectoral organisations (UKRAINIAN AGRIBUSINESS CLUB, ASSOCIATION OF MILK PRODUCERS), and international databases (FAO, USDA, WORLD BANK). These data are systematically compiled to construct longitudinal datasets that track changes in production volumes, cattle numbers, milk prices, profitability metrics, and trade patterns over the 2014-2024 period (EUROSTAT, 2018; FAO, 2018, 2019).

For price trend analysis, the research employs indexation methods to standardise comparisons across different currency regimes and inflation contexts (STATE STATISTICS SERVICE OF UKRAINE, 2019, 2022). The price index methodology follows the approach established by ANDERSON and NELGEN (2013) for agricultural price analysis:

$$\text{Price Index (PI)} = (Pt / P0) \times 100$$

Where Pt represents price in current period t and P0 represents price in base period. Real prices are calculated by adjusting nominal prices for inflation using the Consumer Price Index:

$$\text{Real Price} = (\text{Nominal Price} / \text{CPI}) \times 100$$

Correlation coefficients are calculated to assess the degree of market integration between Ukraine and EU countries, with particular attention to Poland and Hungary as regional comparators. Graphical representations through line graphs, scatter plots, and bar charts enhance the visualisation and interpretation of complex data relationships (UKRAINIAN AGRIBUSINESS CLUB, 2024; TARASSEVYCH, 2017).

Building on the theoretical frameworks of CHAMBERS (1988) and BRAVO-URETA and RIEGER (1991), the research employs efficiency analysis techniques to evaluate the performance of dairy farms and processing enterprises. These approaches, further developed by HANSSON, 2007 in dairy sector applications, enable the identification of technical, allocative, and economic efficiency factors that contribute to differential outcomes across production systems and geographic regions (ANDRIICHUK, 2002; KOSTYRKO, 2008). The dissertation also draws upon methodological innovations in dairy sector analysis developed by BJØRN GUNNAR HANSEN et al. (2005), who established key performance indicators for dairy farms that capture both financial and operational dimensions.

Qualitative approaches complement the statistical analysis by incorporating insights from sectoral policy documents, expert assessments, and industry publications (KERANCHUK, 2017; FEDULOVA, 2018; LYTOVCHENKO, 2015). This methodological triangulation, as advocated by DRIES and SWINNEN, 2004 in their agricultural sector analysis, allows for richer contextualisation of quantitative findings and better understanding of causal mechanisms behind observed trends. In the analysis of wartime impacts on Ukrainian dairy sector, qualitative insights become particularly valuable given the limitations of centralised data collection in war-affected regions (KYIV SCHOOL OF ECONOMICS, 2023; ASSOCIATION OF MILK PRODUCERS, 2023).

The research design also incorporates a comparative framework that juxtaposes the Ukrainian experience with developments in selected EU member states and EU-wide averages (SZŰCS and SZŐLLŐSI, 2015, 2017; GERELES and SZŐLLŐSI, 2019). This comparative perspective, following methodological approaches established by SWINNEN, 1999 and GORTON et al., 2001, illuminates both similarities and divergences in sectoral trajectories, helping to distinguish between universal trends and country-specific phenomena. The selection of Hungary and Poland as specific comparators is methodologically justified by their geographical proximity, shared historical experiences, and different stages of EU integration, providing valuable reference points for understanding Ukrainian potential development pathways (LIEFERT and SWINNEN, 2002; TONINI and JONGENEEL, 2002; JUHÁSZ, 1991).

For assessing economic and financial efficiency, the dissertation utilises established methodological approaches from agricultural economics, including production cost analysis, profitability assessment, and efficiency indicators (LISOVSKA and HRYTSENKO, 2018; DMITRIYEV and ZHURAVLYOVA, 2019; KRYVENKO and PALAMARCHUK, 2019). This analytical framework allows for systematic evaluation of how internal factors (productivity, cost structures) and external conditions (market prices, policy environment) jointly determine sectoral performance. Building on the methodological insights of TAUER (2001) and STOKES et al. (2007), the dissertation incorporates analysis of farm-level efficiency determinants.

During the main research the financial data extracted from the EMIS database were used, what provides comprehensive market intelligence on emerging economies. The EMIS database has been extensively utilised in agricultural economics research, particularly by CIAIAN and SWINNEN, 2009 for analysis of agricultural firms in transition economies. The selection process for dairy enterprises followed a systematic approach whereby companies were identified using the primary activity filter "Dairy cattle and milk production" (NAICS code: 11212). Financial data were collected for 156 Hungarian companies, 112 Polish companies, and 35 Ukrainian companies. Of these, 5 Hungarian and 4 Polish companies did not report any data to EMIS, resulting in actual datasets of 151, 108, and 35 companies respectively. The EMIS database was accessed through an institutional subscription, enabling the extraction of detailed financial statements and operational metrics. Data were exported in Excel format using the database's built-in export functionality, creating separate workbooks for each country to facilitate systematic analysis.

The study period was deliberately selected as 2016-2020 for several methodological considerations:

- EMIS database completeness: The most comprehensive financial data for all three countries were available for this period.
- Absence of post-2020 data for Ukraine due to martial law restrictions implemented following the full-scale invasion on 24 February 2022, which resulted in limited public statistical information access.
- To maintain methodological consistency across all three countries, enabling meaningful comparative analysis.

Following the European Commission's SME definition (EUROPEAN COMMISSION, 2025), enterprises were categorised according to staff headcount, turnover, and balance sheet total. This classification approach follows methodological standards established by BOJNEC and LATRUFFE, 2013 in agricultural firm analysis. Given the EMIS database limitations regarding employee data, classification was primarily based on total operating value (turnover) or total assets (balance sheet total). Large enterprises were defined as those with 250 or more employees, turnover exceeding EUR 50 million, or balance sheet totals surpassing EUR 43 million. Medium-sized enterprises comprised those with fewer than 250 employees, turnover of EUR 50 million or less, or balance sheet totals of EUR 43 million or less. Small enterprises included those with fewer than 50 employees, turnover of EUR 10 million or less, or balance sheet totals of EUR 10 million or less. Micro enterprises were characterised by fewer than 10 employees, turnover of EUR 2 million or less, or balance sheet totals of EUR 2 million or less.

Market concentration was evaluated using multiple techniques. The Gini Index was calculated according to the standard formula established by SAMUELSON and NORDHAUS, 2009; and applied in agricultural market studies by SEXTON (2000) and SZŐLLŐSI and ERDŐS (2023):

$$G = 1 - \Sigma(X_i - X_{i-1})(Y_i + Y_{i-1}),$$

where X_i represents the cumulative proportion of enterprises and Y_i represents the cumulative proportion of market share. Interpretation of Gini Index values:

- $G \leq 0.30$: Low inequality (relatively concentrated market)
- $0.30 < G \leq 0.50$: Moderate inequality
- $G > 0.50$: High inequality (highly fragmented market)

The Lorenz Curve provided graphical representation of market distribution inequality, whilst geographic concentration was mapped using Tableau software with regional data aggregation.

The analysis incorporated multiple profitability ratios derived from standard financial analysis frameworks (FENYVES et al., 2019). These financial indicators have been extensively utilised in dairy sector research by GALLUZZO (2015) and NOVAK et al. (2016). To ensure methodological clarity and address potential variations in accounting standards across the three countries, the following precise definitions were employed:

Return on Sales (ROS) was calculated as:

$$ROS = (\text{Operating Profit} / \text{Total Operating Revenue}) \times 100$$

This measures operational efficiency by showing profit generated per unit of sales. Higher values indicate superior operational performance.

Return on Assets (ROA) was calculated as:

$$ROA = (\text{Net Income} / \text{Total Assets}) \times 100$$

ROA measures how efficiently assets are utilised to generate profit, with values above industry averages indicating superior asset utilisation.

Return on Equity (ROE) was determined as:

$$ROE = (\text{Net Income} / \text{Shareholders' Equity}) \times 100$$

ROE measures the return generated on shareholders' investment, indicating efficiency of equity capital usage.

Net Profit Margin was calculated as:

$$\text{Net Profit Margin} = (\text{Net Profit} / \text{Total Operating Revenue}) \times 100$$

This ratio shows the percentage of revenue remaining as profit after all expenses, indicating cost control effectiveness and pricing strategies.

Operating Profit Margin was determined as:

Operating Profit Margin = (EBIT / Total Operating Revenue) × 100

Where EBIT (Earnings Before Interest and Taxes) represents operating profit. This metric differs from ROS in certain contexts, particularly when non-operating income or expenses are present. The distinction is important as Ukrainian accounting standards may report these metrics differently from EU standards.

EBITDA Margin was determined as:

EBITDA Margin = (EBITDA / Total Revenue) × 100

Where EBITDA represents earnings before interest, taxes, depreciation and amortisation. EBITDA Margin provides insight into operational profitability by excluding financing and accounting decisions, enabling better cross-company comparisons. It should be noted that EBITDA is not directly calculated in Ukrainian accounting standards. Due to the absence of depreciation and amortisation data in the EMIS database for Ukrainian companies, EBITDA margin could not be calculated for Ukrainian enterprises. Therefore, operating profit margin serves as the primary operational profitability indicator for Ukrainian companies in this analysis.

Due to differences in accounting standards between Ukraine and EU countries, certain adjustments were necessary for comparative analysis. Ukrainian financial statements exclude VAT and excise taxes from total operating revenue, whilst EU reporting may include these elements. To ensure comparability, all revenue figures were standardised to exclude indirect taxes. Additionally, where specific indicators were unavailable, the closest equivalent was utilised and documented. For instance, in cases where Operating Profit was not directly reported, it was calculated as EBIT, acknowledging that minor discrepancies may arise from non-operating activities.

The methodological approach to studying wartime impacts on Ukrainian dairy industry necessarily adapts to data limitations in war-affected regions (AMP, 2023; EBRD and FAO, 2023). Here, the research employs a combination of available statistical indicators, industry reports, and expert assessments to construct a comprehensive picture of sectoral disruptions and adaptation strategies. This methodology, similar to approaches used by BRÜCK and D'ERRICO (2019) in conflict-affected agricultural areas, acknowledges the challenges of data collection during periods of instability while striving for analytical rigour through multiple information sources and cross-validation of findings.

The selection of Ukraine, Hungary, and Poland as focal countries for this comparative analysis is methodologically grounded in both geographical proximity and significant economic interconnections within Eastern European dairy sector. As neighbouring countries sharing borders and historical experiences, these nations represent different stages of agricultural transformation and European integration, making them ideal subjects for comparative research. Ukraine, as a country with substantial agricultural potential currently undergoing European integration processes; Hungary, as an established EU member with a transformed post-socialist dairy industry; and Poland, as one of the EU leading dairy producers, collectively offer a comprehensive analytical framework for understanding regional dairy sector dynamics.

My personal position as a researcher adds a valuable methodological dimension to this study. Having been directly involved in analysing the Ukrainian dairy industry for over a decade, I bring first-hand experience and established relationships with key industry stakeholders. This extended engagement has facilitated access to industry research groups, expert networks, and non-public data sources that enrich the analytical foundation of this work. My participation in numerous industry forums, policy discussions, and research initiatives with Ukrainian dairy producers, processors, and sectoral organisations has provided unique insights into the challenges and transformation processes that might remain inaccessible through conventional research approaches alone.

The selection of Hungary as a comparative case study was methodologically strengthened by my academic and professional experience within the country. Having pursued advanced studies and worked professionally in Hungary for several years, I gained valuable institutional knowledge and contacts within its agricultural sector. This embedded perspective enabled more nuanced interpretation of Hungarian statistical data and policy documents, as well as deeper understanding of the country's post-EU accession adaptation strategies in the dairy industry. The Hungarian case offers particularly relevant lessons for Ukraine's potential European integration pathway in the agricultural sector.

Poland's inclusion in the comparative framework serves multiple methodological purposes. As a member of the Visegrád Group (V4) and the largest dairy producer among Eastern European EU members, Poland represents a regional success story in agricultural transformation and integration into European value chains. Its geographical adjacency to Ukraine and significant role in cross-border dairy trade makes it an essential reference point. Poland's experience of rapid modernisation and structural adaptation following EU accession provides valuable comparative insights for understanding potential development trajectories for the Ukrainian dairy sector. Additionally, Poland's strategic position as both a major importer of Ukrainian dairy inputs and a significant exporter of processed dairy products to Ukraine creates a unique market relationship that merits detailed analysis within this research.

The triangulation of experiences across these three countries enables the research to isolate country-specific factors from regional patterns, thereby enhancing the analytical robustness of findings. By systematically comparing structural transformations, policy environments, and performance indicators across Ukraine, Hungary, and Poland, the methodology captures both convergent trends and divergent adaptation strategies within Eastern European dairy sectors. This comparative approach is particularly valuable for identifying transferable lessons and potential development pathways for Ukraine's dairy industry in the context of European integration aspirations and post-war reconstruction needs.

Several methodological considerations were addressed during data processing. Due to non-uniform reporting across years, sample sizes vary by indicator, with complete documentation of available data for each indicator provided in Annexes C, D, and E. Where specific indicators were unavailable, closest equivalents were utilised. For instance, total operating value was employed as a proxy for gross revenue in market capacity estimations. All financial figures were converted to EUR using official ECB exchange rates, following currency conversion methodologies established by HERZFELD et al. (2013), to ensure comparability across countries. Extreme values were identified and, where appropriate, excluded from analysis to prevent distortion of results, with all exclusions documented in the relevant sections.

The variance in financial ratio calculations between countries required particular attention. Tables 9 and 12 demonstrate different values for what may appear to be similar metrics due to the following distinctions: - Table 9 (Return on Sales) utilises Operating Profit as the numerator - Table 12 (Operating Profit Margin) utilises EBIT as the numerator - Whilst these metrics are often treated as equivalent in financial literature, variations can occur when companies report non-operating income or expenses - Ukrainian companies, in particular, may show larger variations due to different accounting treatment of certain income and expense categories.

The methodological framework of this dissertation is structured around four primary research questions, each requiring distinct analytical approaches and data sources to address the complex dynamics of dairy sector development across Ukraine, Hungary, and Poland. The following table (Table 3) synthesises the research design, methodological applications, and inherent limitations that shape the analytical scope and validity of findings across each research dimension.

Table 3. Complex presentation of the material and methodological background of the dissertation

Research Question	Subject of study	Hypothesis	Application of methods	Source/Type of database	Limitations of data/Difficulties
RQ1: Enterprise scale-performance relationship	Financial performance indicators (ROE, ROA, ROS, NPM, EBITDA) of dairy enterprises by size categories	Larger enterprises demonstrate superior financial performance due to economies of scale, but relationship varies by country's market structure	• Correlation analysis • Regression analysis • Cluster analysis • Gini coefficient calculation • Descriptive statistics	EMIS database (2016-2020): 151 Hungarian, 108 Polish, 35 Ukrainian dairy enterprises	• Limited Ukrainian sample size • Non-uniform reporting across years • Post-2020 Ukrainian data unavailable due to martial law • Currency conversion complexities • Different accounting standards
RQ2: Milk price dynamics and market integration	Milk price trends, volatility patterns, convergence/ divergence with EU averages	Eastern European milk prices demonstrate increasing convergence with EU averages, with policy frameworks determining integration speed	• Time series analysis • Price indexation • Correlation analysis • Comparative price trend analysis	• EUROSTAT milk price data • Ukrainian Milk Producers Association • National statistical services	• Limited Ukrainian price data availability • Currency volatility effects • War-related data gaps (2022-2024) • Different price reporting methodologies • Incomplete regional price coverage
RQ3: War impact on Ukrainian dairy sector	Production losses, infrastructure damage, cattle population changes, adaptation mechanisms	War causes significant production decline but accelerates structural transformation toward industrial farming	• Before-after analysis • Descriptive statistics • Qualitative assessment • Case study methodology	• State Statistics Service of Ukraine • Association of Milk Producers (AMP) • Ukrainian Agribusiness Club (UCAB) • FAO & EBRD reports	• Severely limited post-2022 official statistics Data collection restrictions in occupied territories • Security-related information gaps • Reliance on industry estimates • Temporal data inconsistencies
RQ4: Integration mechanisms transferability	Policy frameworks, cooperative models, vertical integration strategies, support mechanisms	Hungarian and Polish EU integration experiences provide applicable models for Ukrainian dairy sector development	• Comparative institutional analysis • Policy framework comparison • Best practice identification • Qualitative synthesis	• EU Common Agricultural Policy documents • National agricultural strategies • Academic literature • Industry reports • Expert interviews	• Limited access to detailed policy implementation data • Contextual differences between countries • Dynamic policy environments • Language barriers in accessing national documents • Subjective expert assessments

Source: own compilation

The comparative nature of this research across three countries with distinct economic systems, regulatory frameworks, and data collection practices necessitates careful consideration of methodological challenges that could compromise the validity and reliability of findings. These challenges span multiple dimensions, from data availability constraints resulting from wartime conditions to technical issues related to cross-national comparability of financial indicators.

War-related limitations have severely restricted Ukrainian statistical reporting post-February 2022, requiring triangulation using industry sources, international organisation reports, and expert assessments to maintain analytical rigour. Currency conversion methodologies present complexities due to multiple currencies (EUR, UAH, HUF, PLN) across volatile exchange rate periods, addressed through consistent use of official exchange rates at year-end with sensitivity analysis for major fluctuations. Temporal limitations arise from the analysis period (2016-2020) predating major disruptions whilst limiting recent trend analysis, necessitating supplementary qualitative analysis for post-2020 developments and clear temporal scope limitations. Data comparability issues stem from different national accounting standards and reporting requirements, resolved through standardisation using EU-compatible indicators where possible and explicit notation of methodological differences. Enterprise classification differences reflect varying SME definitions across countries despite EU standards, managed through dual classification systems using both turnover and asset-based criteria with sensitivity testing to ensure robust categorisation across all three national contexts.

Through this multifaceted methodological framework, the dissertation aims to provide a robust and nuanced analysis of dairy industry dynamics in Ukraine and the Eastern Europe, with particular attention to integration processes, structural transformations, and resilience mechanisms in the face of significant external shocks.

3. RESEARCH FINDINGS AND THEIR EVALUATION: DAIRY MARKET ANALYSIS

In the main chapter, the size, concentration, and financial performance of a dairy enterprises in Hungary, Poland and Ukraine are compared for the period 2016-2020. The focus was on analysing the concentration and main financial indicators of these companies based on the data from the EMIS database (Emerging Market Information System). Since the beginning of the full-scale invasion in Ukraine on February 24, 2022, martial law has been in effect, therefore, managers of public statistical information, including the State Statistic Service of Ukraine and the companies themselves, do not update or provide public information in response to a request, including in the form of open data, and also have the right to restrict access to data within the framework of information security measures in wartime. Therefore, the data presented in this study includes only available data for Ukraine in EMIS for 2017-2020 which were reported by the Ukrainian dairy companies.

To maintain methodological consistency and facilitate meaningful comparative analysis, both Hungary's and Poland's market trends and comparisons were deliberately aligned to correspond with the same analytical timeframe. This methodological approach ensures uniformity in the periods under examination throughout the study, mitigating potential temporal discrepancies that might otherwise compromise the validity of cross-market comparisons. The absence of more recent statistical data on Ukraine, whilst regrettable, was unavoidable given the aforementioned extraordinary circumstances.

The companies were selected by the main activity filter – Dairy cattle and milk production (NAICS: 11212). Financial data from 156 companies in Hungary (5 of which did not report any data to the EMIS), 112 in Poland (4 did not reported), and 35 in Ukraine were processed. However, the number of companies surveyed varies according to the indicator in question, due to the non-uniformity of the data across years and the presentation of certain indicators for specific populations while others are absent. The total number of companies for which data were available for each of the indicators analysed, as well as basic descriptive statistics for these indicators, are presented in Annexes C, D and E. In the case of the total number of companies in the market without reference to a specific indicator, the number of records in EMIS will be used, regardless of the volume of data provided.

3.1. DAIRY SECTOR PRODUCTION INDICATORS IN UKRAINE, HUNGARY, AND POLAND

While this dissertation primarily focuses on the economic and financial aspects of dairy sector development, understanding the underlying technical and biological factors that drive productivity provides essential context for interpreting financial performance differences across the three countries. This section examines key sector-specific indicators that influence the economic outcomes analysed throughout this research.

The genetic foundation of dairy herds significantly influences productivity potential and economic performance across the three countries. Hungary has implemented systematic breed improvement programmes since EU accession, with Holstein-Friesian cattle comprising approximately 75% of the national dairy herd, complemented by Simmental (15%) and other breeds (HUNGARIAN CENTRAL STATISTICAL OFFICE, 2023). This genetic composition supports higher milk yields per cow and improved feed conversion efficiency. Poland demonstrates the most advanced genetic structure among the three countries, with Holstein-Friesian cattle accounting for over 85% of the dairy herd (EUROSTAT, 2023). The country has benefited from extensive artificial insemination programmes and genetic improvement schemes supported by EU Common Agricultural Policy funding. Polish breeding programmes have focused on increasing milk production potential whilst maintaining functional traits such as fertility and longevity. Ukraine presents a more diverse but less optimised genetic composition. Ukrainian Red Steppe cattle (30%), Ukrainian Black-and-White (25%), Holstein-Friesian (20%), and Simmental breeds (15%) comprise the majority of the national herd (UKRAINIAN AGRIBUSINESS CLUB, 2023). This genetic diversity, whilst providing resilience advantages, results in lower average productivity per cow compared to the more specialised dairy breeds predominating in Hungary and Poland.

Productivity differences across the three countries reflect variations in genetics, feeding systems, and management practices. Poland achieves the highest average milk yield at approximately 7,200 kg per cow per year, reflecting advanced breeding programmes and intensive feeding systems (CENTRAL STATISTICAL OFFICE OF POLAND, 2023). The country’s focus on Holstein-Friesian genetics and adoption of total mixed ration (TMR) feeding systems contributes to this performance level. Hungary records an average milk yield of approximately 6,800 kg per cow annually, representing substantial improvement from pre-EU accession levels (EUROPEAN COMMISSION, 2023). Hungarian dairy farms have invested significantly in barn modernisation and feeding technology, though productivity levels remain below Poland due to differences in farm scale and management intensity. Ukraine demonstrates the lowest average productivity at approximately 5,200 kg per cow per year, though with significant variation between household producers (3,800 kg) and industrial farms (6,500 kg) (ASSOCIATION OF MILK PRODUCERS, 2023). The dual structure of Ukrainian dairy production, with substantial household sector participation, contributes to lower national averages despite competitive performance among industrial operations.

Dairy cow longevity and reproductive performance directly impact economic efficiency through replacement costs and productive lifetime. Polish dairy cows average 3.2 lactations before culling, with calving interval averaging 385 days (CENTRAL STATISTICAL OFFICE OF POLAND, 2023). These figures reflect intensive management systems that prioritise high production but may compromise longevity. Hungarian dairy operations achieve slightly extended useful life, averaging 3.5 lactations per cow with calving intervals of 395 days (HUNGARIAN CENTRAL STATISTICAL OFFICE, 2023). The country's emphasis on balanced breeding programmes considering both production and functional traits contributes to improved reproductive efficiency. Ukrainian dairy farms demonstrate varied performance based on production system. Industrial farms achieve 3.1 lactations average with 400-day calving intervals, whilst household producers often maintain cows for 4-5 lactations due to economic constraints and different management objectives (STATE STATISTICS SERVICE OF UKRAINE, 2022).

Reproductive efficiency significantly influences annual milk production and profitability. Poland achieves the shortest calving intervals at 385 days on average, supported by professional veterinary services and systematic breeding programmes. Conception rates average 45% for first insemination, reflecting advanced reproductive management protocols (OECD, 2023). Hungary records calving intervals of 395 days, with conception rates of 40% for first insemination (SZŰCS AND SZŐLLŐSI, 2017). The country's veterinary infrastructure and breeding extension services support reproductive efficiency, though not at Polish levels. Ukraine demonstrates the longest calving intervals, averaging 410 days for industrial farms and up to 450 days for household producers. First insemination conception rates average 35% overall, reflecting limited access to professional breeding services and artificial insemination programmes, particularly in the household sector (STATE STATISTICS SERVICE OF UKRAINE, 2022).

Feed systems significantly influence both productivity and profitability across the three countries. Poland has adopted total mixed ration (TMR) systems on approximately 70% of commercial dairy farms, utilising primarily corn silage-based diets supplemented with protein concentrates (EUROSTAT, 2023). The country's advanced feed industry produces specialised dairy concentrates optimised for high-yielding Holstein cattle. Hungary employs mixed feeding systems, with 45% of commercial operations using TMR and the remainder utilising component feeding systems (TAKÁCS et al., 2013). Corn silage forms the foundation of most dairy rations, supplemented by alfalfa and grass silages. The country benefits from domestic feed grain production but relies on imported protein sources. Ukraine demonstrates the greatest diversity in feeding systems. Industrial farms increasingly adopt TMR systems (60% of large operations), whilst household producers predominantly use grazing-based systems supplemented with farm-produced forages and concentrates. Ukrainian farms benefit from abundant domestic feed grain production, including corn, wheat, and sunflower meal, providing cost advantages but requiring improved nutritional expertise for ration optimisation (UKRAINIAN AGRIBUSINESS CLUB, 2023).

Post-harvest handling significantly impacts milk quality and economic value. Poland maintains the most advanced cold chain infrastructure, with on-farm cooling systems on 95% of commercial dairies and collection intervals not exceeding 48 hours (EUROSTAT, 2023). The country's EU-compliant milk quality standards require bacterial counts below 100,000 cfu/ml and somatic cell counts below 400,000/ml. Hungary achieves comparable cold chain coverage, with 92% of commercial farms equipped with bulk tank cooling systems. Milk collection occurs every 48-72 hours, maintaining quality standards consistent with EU requirements (HUNGARIAN CENTRAL STATISTICAL OFFICE, 2023). Ukraine faces challenges in cold chain infrastructure, particularly within the household sector. Whilst industrial farms achieve 90% coverage with modern cooling systems, household producers often lack adequate cooling facilities, contributing to quality variations and price discounts. The war has disrupted cold chain infrastructure in eastern regions, forcing adaptation strategies including mobile cooling units and adjusted collection routes.

These sector-specific indicators directly influence the economic outcomes analysed throughout this dissertation. Higher milk yields per cow in Poland and Hungary contribute to improved revenue per unit of fixed costs, supporting superior financial performance ratios. Advanced reproductive management reduces replacement costs and extends productive capacity. Efficient feeding systems optimise feed conversion ratios, critical given that feed costs represent 50-60% of total production costs (OECD, 2023). The productivity differentials help explain the scale-performance relationships identified in Chapter 3. Ukrainian farms require larger scale operations to achieve competitive economic performance due to lower per-cow productivity, whilst Polish and Hungarian operations can achieve profitability at smaller scales through intensive management systems. Understanding these technical foundations provides essential context for policy recommendations regarding technology transfer, genetic improvement programmes, and infrastructure development that could enhance Ukrainian dairy sector competitiveness within European market integration processes.

3.2. COMPARATIVE ANALYSIS OF EUROPEAN AND EASTERN EUROPEAN DAIRY MARKETS

According to the last data, small and medium-sized enterprises (SMEs) represent 99% of all businesses in the EU. It is recommended to use the following criteria for classifying companies depending on their size (Table 4):

Table. 4. Factors determining the size of an enterprise

Company category	Priority (Step) 1	Priority (Step) 2		
	Staff headcount	Turnover	or	Balance sheet total
Large	≥ 250	> € 50 m		> € 43 m
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Source: European Commission, EUROSTAT

In order to undertake a comparative analysis of the three countries under study, it is necessary to select a single criterion for determining the scale of an enterprise. As the data on the number of employees is provided by EMIS only for Ukraine, it is more appropriate to group enterprises by total operating value (turnover) or total assets (balance sheet total), depending on which of these indicators better reflects the economic essence of the currently assessed indicator. Furthermore, a comparison of the efficiency of asset utilisation (absolute distribution and return ratio) may prove fruitful, given that sales volume does not always increase in proportion to the size of assets. A comparative analysis of the capacity of the national markets in the 3 countries is shown in the Table 5 below.

Based on the sample from EMIS the Hungarian companies have the largest market share, but from 2016 to 2020, their market share decreased by almost 20%, although in 2020 it was still quite significant, representing 56% of the total market of the three countries. Conversely, the number and volume of operations of Polish companies increased significantly over the five-year period under study. While in 2016 their market share stood at 9.8%, it had increased to 23.4% by 2020. Furthermore, the number of units increased from 14 in 2016 to 90 in 2020. A similar increase was observed in the share of Ukrainian enterprises in dairy sales, which rose from 15.1% to 20.6%. However, the dynamics of the structure remained the most stable: 12-13% of the total number of business entities in the three countries each year. Conversely, in

Hungary, the actual number of enterprises remained relatively stable (approximately 130-140 units per year), while the relative share underwent a steady decline – from 75.1% in 2016 to 56.1% in 2020 of the total number of companies in the three countries. This decline was accompanied by a corresponding decrease in sales volumes. In 2017, the number of Polish companies increased by 3.7 times compared to the previous year, while sales revenues doubled. In 2020, Polish companies were the only ones to demonstrate a positive growth rate of total operating value in comparison with the previous year.

Table 5. National dairy markets' capacity (EMIS database 2016-2020; sample: Hungary, Poland, Ukraine)

Year	Number of operating companies, units*				Total operating revenue, thsd EUR				TOR, % **		
	Hungary	Poland	Ukraine	Total	Hungary	Poland	Ukraine	Total	Hungary	Poland	Ukraine
2020	134	90	31	255	517831	215992	189923	923746	56.1	23.4	20.6
2019	142	86	34	262	556110	214806	201620	972536	57.2	22.1	20.7
2018	126	87	33	246	504774	215071	179990	899835	56.1	23.9	20.0
2017	126	53	34	213	534094	149689	162543	846326	63.1	17.7	19.2
2016	138	14	21	173	507398	66529	101785	675712	75.1	9.8	15.1
Year	Total operating revenue per unit, EUR				Total operating revenue, annual growth				Operating companies, %		
	Hungary	Poland	Ukraine	Total	Hungary	Poland	Ukraine	Total	Hungary	Poland	Ukraine
2020	3864.4	2399.9	6126.5	3622.5	-6.88	0.55	-5.80	-5.02	52.5	35.3	12.2
2019	3916.3	2497.7	5930.0	3712.0	10.17	-0.12	12.02	8.08	54.2	32.8	13.0
2018	4006.1	2472.1	5454.2	3657.9	-5.49	43.68	10.73	6.32	51.2	35.4	13.4
2017	4238.8	2824.3	4780.7	3973.4	5.26	125.00	59.69	25.25	59.2	24.9	16.0
2016	3676.8	4752.1	4846.9	3905.8	-	-	-	-	79.8	8.1	12.1

*those companies that reported the main financial indicators to EMIS for the current year
**TOR, % – total operating revenue, % as national impact share to the common market for the year

Source: own calculations based on EMIS sample

Conversely, the efficiency of Hungarian enterprises demonstrated minimal fluctuations, with a range of EUR 3.7 to EUR 4.2 million in revenue per unit. Since 2017, a notable increase in profitability has been observed in Ukraine, from EUR 4.8 to 3.6 million, while in Poland, a substantial decline was recorded, from EUR 4.7 to EUR 2.4 million. This phenomenon may be attributed to the unbundling or restructuring of large enterprises and the concomitant increase in the number of SMEs (Figure 2).

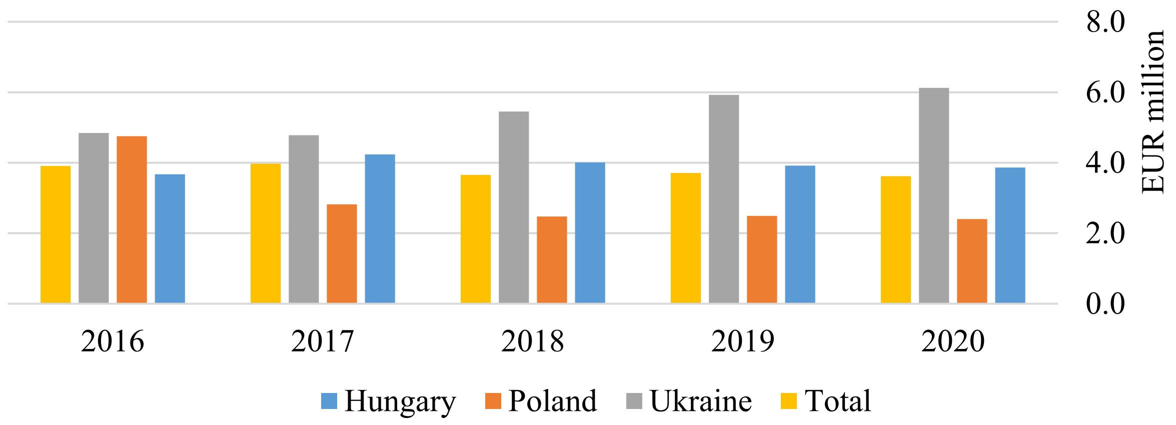


Figure 2. Efficiency of an enterprise's operating, total operating revenue per unit (EMIS database 2016-2020; sample: Hungary, Poland, Ukraine)

Source: own calculations based on EMIS sample

The geographical distribution of the studied companies is uneven, with regions in each country exhibiting the highest concentrations of dairy company revenues. In Poland, these are primarily the western regions, with the Wielkopolskie and Kujawsko-Pomorskie regions being of particular note (Figure 3).

Figure 3. Total operating revenue by regions in Poland, EUR thousand, 2020

Source: EMIS sample data, built in Tableau

In Hungary, the production is concentrated in the eastern and western regions, with Gyor-Moson-Sopron in the west and Hajdu-Bihar in the east, and less involvement in the central part of the country (Figure 4). In Ukraine, by contrast, the dairy production is predominantly centred in the central-north-eastern region, with the Poltava and Chernihiv regions being the most prominent, and the Volyn region in the north-west being a notable exception (Figure 5).

I will further analyse the dynamics of market distribution between large, medium and small enterprises using the Gini index and assess the concentration in the industry (Figure 5), but first it is important to examine in depth the geographic redistribution of the dairy industry revenues.

The map on Figure 3 provides a comprehensive overview of the geographical distribution of Polish dairy enterprises, based on their total operating profit in 2020. The regions have been grouped according to total operating revenue as follows:

Highest revenue (above EUR 50 mln) – Wielkopolskie: the leading region with a total operating revenue of EUR 63.6 million, indicating a significant concentration of large-scale dairy enterprises.

High revenue (EUR 30-40 mln) – Kujawsko-Pomorskie: with a total operating revenue of 37.2 mln, this region demonstrates strong activity in dairy enterprises, second to the Wielkopolskie region.

Medium revenue (EUR 20-30 mln) – Dolnośląskie: achieving 21.9 mln in total operating revenue, this region represents a moderate level of dairy sector activity.

Lower revenue (EUR 10-20 mln) – Zachodniopomorskie (13.1), Lubuskie (16.2), Opolskie (15.5). These regions exhibit consistent but lower revenue generation compared to the medium and high-revenue regions.

Minor revenue (EUR 5-10 mln) – Pomorskie (5.5), Warmińsko-Mazurskie (8,7), Łódzkie (8.8), Mazowiecki Regionalny (7.2), Lubelskie (EUR 6.3 million). These regions maintain a noticeable presence of dairy enterprises but with relatively modest operating revenues.

Least revenue (below EUR 5 mln) – Podlaskie (2.5), Śląskie (EUR 411,000), Małopolskie (3.97), Podkarpackie (4.6). These areas have the smallest total operating revenue, indicating either limited activity or smaller-scale operations.

The Wielkopolskie region is a prominent dairy hub, with the highest revenue generation levels in the sector. Regions such as Kujawsko-Pomorskie and Dolnośląskie are significant contributors to the dairy economy, exhibiting substantial economic activity in this sector. Areas where revenues are minimal or non-existent may indicate a limited business presence, smaller-scale operations, or specific challenges within the industry.

The geographical distribution of Hungarian dairy enterprises is represented on Figure 4.

Figure 4. Total operating revenue by regions in Hungary, EUR thousand, 2020

Source: EMIS sample data, built in Tableau

The following regions have been identified as those with the highest total operating revenue (60-65 EUR million): Győr-Moson-Sopron (62.7) and Hajdú-Bihar (61.6). These two regions dominate with the most significant concentration of large-scale dairy enterprises, indicating strong industry performance and possibly favourable conditions for dairy production and trade.

Regions with high total operating revenue from 50 to 60 EUR million are: Békés (52.7) and Szabolcs-Szatmár-Bereg (49.2). These areas also demonstrate robust revenue generation levels, ranking just behind the top two, indicating a significant presence of thriving dairy enterprises.

The following regions have been identified as those with medium total operating revenue: Veszprém (EUR 30.5 million), Vas (31.9), and Somogy (31.9). These regions represent a balanced distribution of enterprises with moderate revenue, indicating stable but less significant activity compared to the leading regions.

Regions with lower total operating revenue (10-20 EUR million): Fejér (26.7), Tolna (15.9), and Baranya (10.1). These areas demonstrate a smaller scale of operations and revenue generation compared to medium and high-ranking regions, suggesting potential for growth or challenges impacting performance.

The following regions have the lowest total operating revenue (0-5 EUR million): Budapest (1.5), Zala (3.5), and Heves (3.8). Dairy enterprises in these regions are operating on a minimal scale, either due to smaller markets, fewer enterprises, or less favourable conditions for the industry.

It is notable that Győr-Moson-Sopron and Hajdú-Bihar have a clear advantage in terms of revenue generation, making them the primary hubs for dairy enterprises. Regions such as Békés and Szabolcs-Szatmár-Bereg constitute the next cluster and continue to demonstrate a substantial economic impact within the dairy sector. Budapest and Zala, which have the lowest revenues, are experiencing limited activity in the dairy industry. This may be due to urbanisation or other economic priorities. Ukrainian figures are shown on Figure 5.

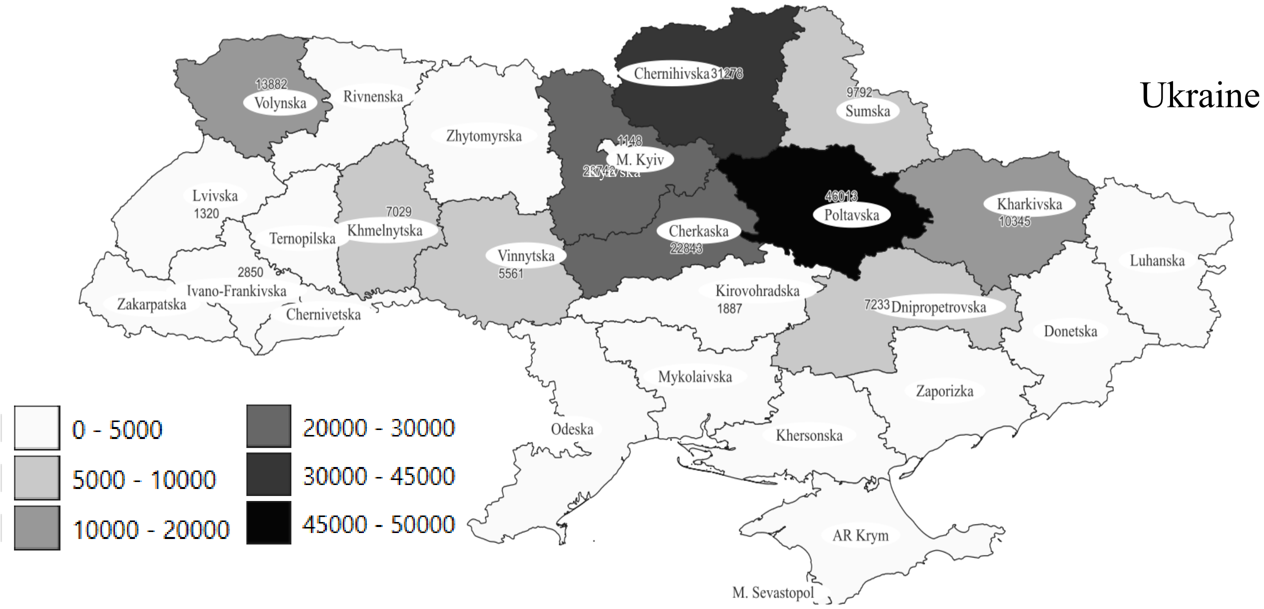


Figure 5. Total operating revenue by regions in Ukraine, EUR thousand, 2020

Source: EMIS sample data, built in Tableau

The distribution of Ukrainian dairy enterprises based on total operating revenue across regions (oblast in Ukrainian) in 2020 is as follows:

Highest Revenue (above 40 EUR million) – Poltavska oblast (40.0). This region is distinguished as the highest revenue-generating area for dairy enterprises, emphasising its substantial industry scale and economic contribution.

High Revenue (30-40 EUR million) – Chernihivska oblast (31.3). A notable centre for dairy farming with robust revenue generation, second only to the Poltavska region.

Medium Revenue (20-30 EUR million) – Cherkaska oblast (22.8) indicates moderate revenue generation, suggesting stable and significant dairy industry activity.

Lower Revenue (10-20 EUR million). Volynska (13.9), Kharkivska (10.39), Sumska (9.8), Dnipropetrovska (7.2), Khmelnytska (7.0) and Vinnytska (5.6) oblasts demonstrate smaller but consistent revenue generation levels, which may be indicative of regional-scale operations.

Minor Revenue (5-10 EUR million). Enterprises in the following areas operate on a limited scale and contribute modest revenues: Kyivska oblast (11.5), the city of Kyiv (23.7), and Ivano-Frankivska (2.8) oblasts.

Lowest Revenue (0-5 EUR million) – Lvivska (1.3) and Kirovohradska (1.9) oblasts, and the remaining blank regions are characterised by minimal revenue generation or sparse dairy enterprise presence.

Thus, Poltavska Region is the leading region, demonstrating the highest levels of revenue generation and likely functioning as a hub for the dairy industry in Ukraine. Chernihivska and Cherkaska oblasts follow as secondary centres, contributing significantly to the overall operating revenues. Regions with lower or minor revenues may encounter industry challenges, limited dairy enterprise activity, or reflect smaller-scale operations.

As a next step I analyse the dynamics of market distribution between large, medium and small enterprises using the Gini index (Table 6) and Lorenx curve (Figure 6) and assess the concentration in the industry.

Table 6. Gini Index by countries, 2016-2020

	By total operating revenue, %					By total assets, %				
Year	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Hungary	46.92	46.23	45.05	46.52	45.30	52.45	49.58	49.42	49.77	50.07
Poland	37.32	58.48	58.77	60.14	59.80	32.79	67.11	64.45	64.98	64.42
Ukraine	41.80	46.14	48.10	44.72	47.22	50.85	46.14	44.03	45.56	42.17

Source: Calculated by the author based on EMIS sample

In 2016, the Hungarian dairy market was the most monopolised, while the Polish market was the least monopolised. However, while in Hungary and Ukraine, market concentration indicators have remained relatively stable over the past five years, in Poland, the Gini coefficient has exhibited a marked increase, despite a substantial growth in the number of enterprises. In 2020, Poland's national market exhibited the highest degree of monopolisation, with a Gini index of 60%. In contrast, Ukraine and Hungary demonstrated a comparable level of concentration, with indices of 44.7 and 45.3%, respectively (Table 7).

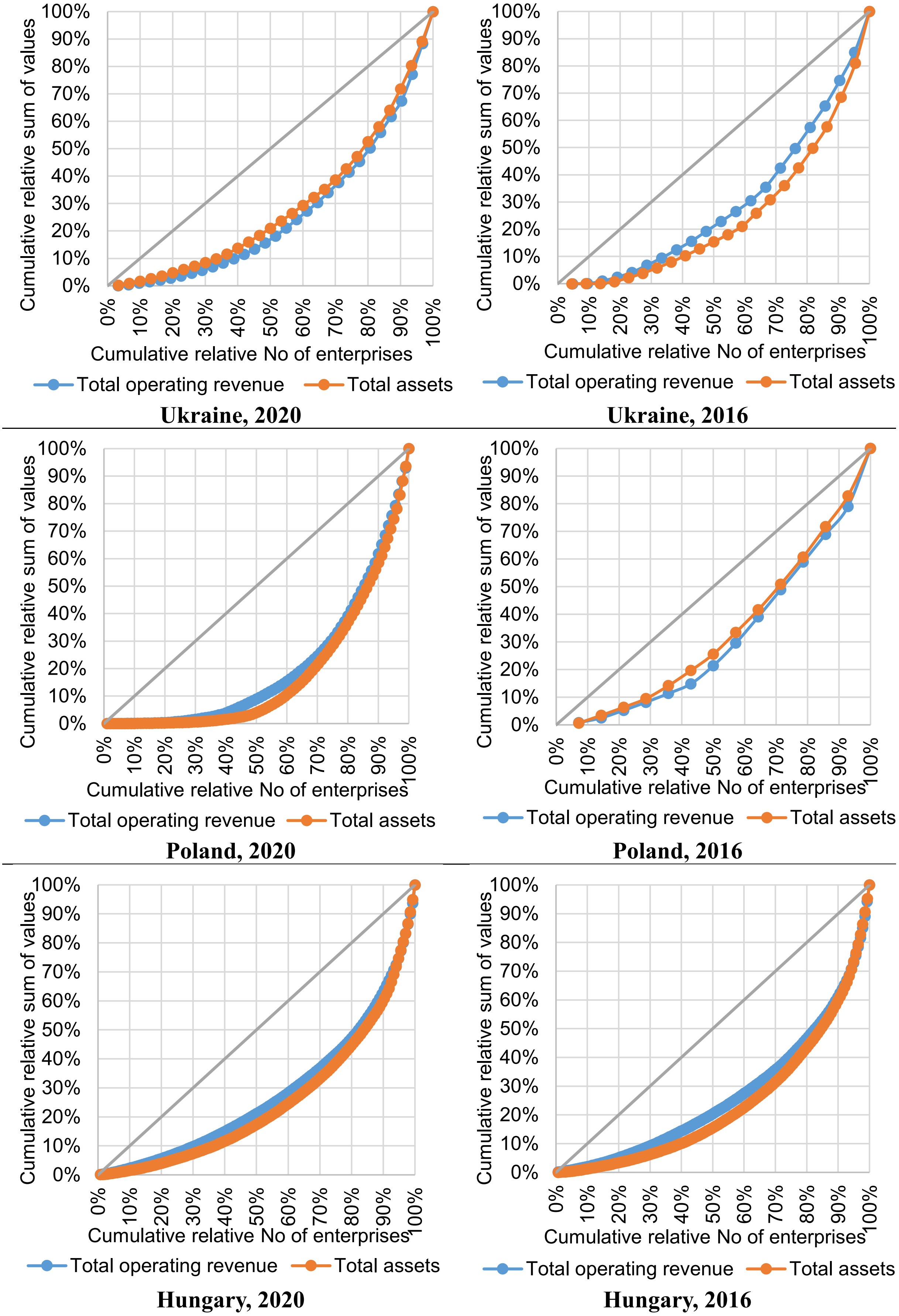


Figure 6. Lorenz curve in the dairy industry by countries, 2016-2020

Source: own calculations based on EMIS sample

Table 7. The distribution of dairy enterprises by sizes, 2016-2020

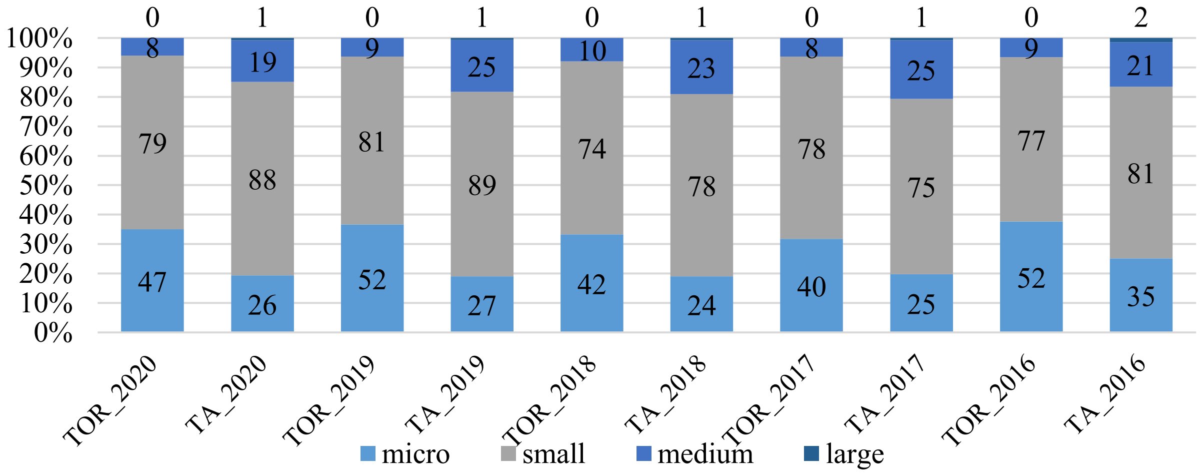
Year	2020				2019				2018				2017				2016			
Indicator	TOR*		TA**		TOR		TA		TOR		TA		TOR		TA		TOR		TA	
Units	n***	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Hungary																				
Micro	47	*35.1*	26	*19.4*	52	*36.6*	27	*19.0*	42	*33.3*	24	*19.0*	40	*31.7*	25	*19.8*	52	*37.7*	35	*25.2*
Small	79	*59.0*	88	*65.7*	81	*57.0*	89	*62.7*	74	*58.7*	78	*61.9*	78	*61.9*	75	*59.5*	77	*55.8*	81	*58.3*
Medium	8	*6.0*	19	*14.2*	9	*6.3*	25	*17.6*	10	*7.9*	23	*18.3*	8	*6.3*	25	*19.8*	9	*6.5*	21	*15.1*
Large	0	*0.0*	1	*0.7*	0	*0.0*	1	*0.7*	0	*0.0*	1	*0.8*	0	*0.0*	1	*0.8*	0	*0.0*	2	*1.4*
TOTAL	**134**	***100***	**134**	***100***	**142**	***100***	**142**	***100***	**126**	***100***	**126**	***100***	**126**	***100***	**126**	***100***	**138**	***100***	**139**	***100***
Poland																				
Micro	56	*62.2*	52	*51.5*	52	*60.5*	52	*51.5*	53	*60.9*	51	*51.5*	30	*56.6*	37	*55.2*	4	*28.6*	1	*7.1*
Small	31	*34.4*	40	*39.6*	33	*38.4*	38	*37.6*	33	*37.9*	36	*36.4*	22	*41.5*	21	*31.3*	9	*64.3*	8	*57.1*
Medium	3	*3.3*	9	*8.9*	1	*1.2*	11	*10.9*	1	*1.1*	12	*12.1*	1	*1.9*	9	*13.4*	1	*7.1*	5	*35.7*
Large	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*
TOTAL	**90**	***100***	**101**	***100***	**86**	***100***	**101**	***100***	**87**	***100***	**99**	***100***	**53**	***100***	**67**	***100***	**14**	***100***	**14**	***100***
Ukraine																				
Micro	8	*25.8*	1	*3.3*	8	*23.5*	3	*9.1*	9	*27.3*	3	*9.4*	8	*23.5*	3	*9.1*	6	*28.6*	4	*18.2*
Small	17	*54.8*	16	*53.3*	19	*55.9*	17	*51.5*	20	*60.6*	20	*62.5*	23	*67.6*	22	*66.7*	13	*61.9*	12	*54.5*
Medium	6	*19.4*	13	*43.3*	7	*20.6*	13	*39.4*	4	*12.1*	9	*28.1*	3	*8.8*	8	*24.2*	2	*9.5*	6	*27.3*
Large	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*	0	*0.0*
TOTAL	**31**	***100***	**30**	***100***	**34**	***100***	**33**	***100***	**33**	***100***	**32**	***100***	**34**	***100***	**33**	***100***	**21**	***100***	**22**	***100***

*TOR – total operating revenue
**TA – total assets
***n – number of enterprises
Source: own calculations based on EMIS sample

The structural distribution of dairy enterprises in all three countries is characterised by a predominance of micro and small enterprises (according to the European Commission methodology). Large enterprises, if present, are represented by 1-2 units (Figure 7-9).

The alterations in the quantity of micro, small, medium, and large enterprises in Hungary from 2016 to 2020 demonstrate discernible trends across diverse enterprise sizes (Figure 7). It is evident that micro enterprises, which are typically characterised by their small-scale operations, have demonstrated fluctuations in their representation based on total operating revenue (TOR) and total assets (TA).

In 2016, 52 micro enterprises accounted for 37.7% of TOR and 32 enterprises – for 25.2% of TA, but by 2020, their number and share had decreased to 35.1% of TOR and 19.4% of TA. This decline indicates a reduction in their relative contribution to Hungary's economy over time. Small enterprises exhibited a more stable presence during this period. In 2016, they represented 55.8% of TOR and 58.3% of TA. By 2020, their share had slightly increased to 59% of TOR and 65.7% of TA. This growth indicates that small enterprises maintained and slightly expanded their role in the economy, particularly in terms of asset utilisation.



(units on the bars, % share on the left axis)

Figure 7. The dynamics of the number of enterprises in Hungary, units

Source: own calculations based on EMIS sample

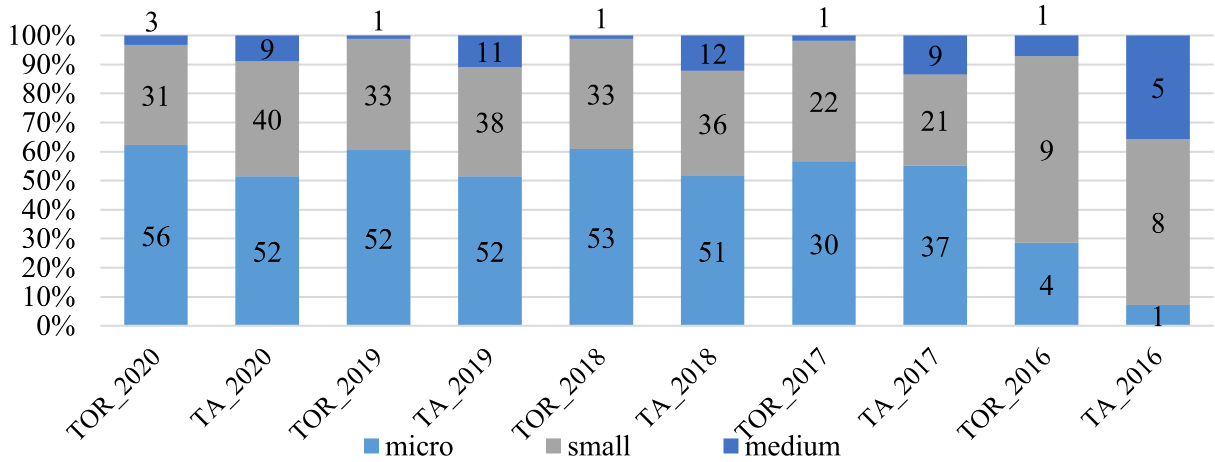
Medium-sized enterprises experienced modest changes. In 2016, these two categories accounted for 6.5% and 15.1% of TOR and TA, respectively. By 2020, the company's share had decreased to 6% of TOR but increased to 14% of TA. This mixed trend suggests a slight decline in revenue generation but a stable or growing asset base.

Large enterprises, which typically dominate in terms of scale and resources, showed minimal representation throughout the period. In 2016, the company did not contribute to a significant value of total operating revenue, but made at least and 1.4% of TA. By 2020, it's share had decreased to 0.7% of TA, indicating a decline in their relative economic impact.

It is important to note that these changes underscore a shifting dynamic amongst different enterprise sizes in Hungary. Specifically, micro enterprises have experienced a decline, small enterprises have demonstrated stability and growth, medium enterprises have exhibited mixed trends, and large enterprises have evidenced a reduction in their economic presence.

An analysis of the changes in the number of micro, small, and medium enterprises in Poland from 2016 to 2020 reveals distinct trends. The data presented in the form of bars in the chart represents the total count of enterprises, while the percentage scale illustrates the share of total operating revenue (TOR) and total assets (TA) contributed by these enterprises (Figure 8).

For micro enterprises, the number remained relatively stable over time. In 2017, micro enterprises accounted for 56.6% of TOR and 55.2% of TA, and these proportions remained consistent through to 2020, thereby highlighting the stability in their economic role. The number of micro enterprises remained consistently high during this period, thereby reflecting their considerable presence in Poland's economy.



(units on the bars, % share on the left axis)

Figure 8. The dynamics of the number of enterprises in Poland, units

Source: own calculations based on EMIS sample

In a similar fashion, small enterprises exhibited stability in their contributions. In 2017, the representation of TOR and TA was 41.5% and 31.3%, respectively, and these figures remained constant by 2020. The number of small enterprises has exhibited only slight variations over the years, thereby maintaining their importance in generating revenue and utilizing assets effectively.

Medium-sized enterprises, however, exhibited a subtle shift in their approach. The proportion of TOR accounted for by the subject decreased from 7.1% in 2016 to 3.3% in 2020, thus indicating a decline in their role in revenue generation. Conversely, the proportion of TAs decreased marginally, from 35.7% in 2016 to 8.9% in 2020. Despite the relatively stable number of medium enterprises over time, the observed decrease in their contribution to total assets may signal alterations in their operational strategies or the scaling up of their enterprises.

In summary, micro and small enterprises demonstrated consistent stability in their contributions to TOR and TA, thus playing a significant role in Poland's economy. Medium-sized enterprises demonstrated an inconclusive pattern, with a decline in their share of TOR and of TA, suggesting an evolving dynamic in their economic impact. These patterns are indicative of the overall structure and behaviour of enterprise sizes in Poland during the specified period.

The alterations in the quantity of micro, small, and medium enterprises in Ukraine from 2016 to 2020 disclose significant tendencies in their contributions to total operating revenue and total assets (Figure 9).

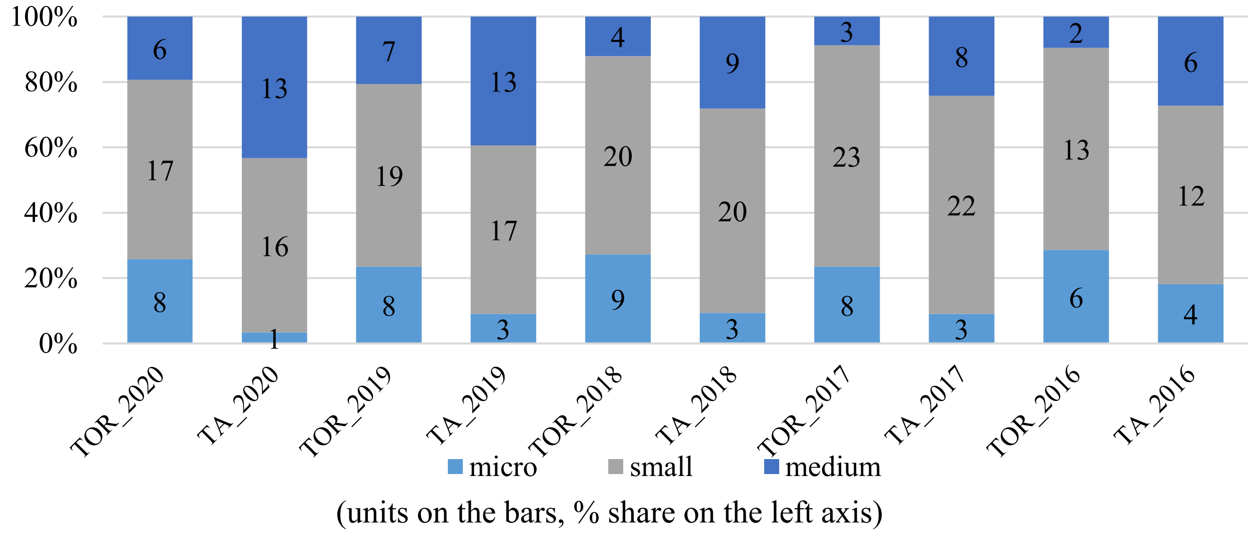


Figure 9. The dynamics of the number of enterprises in Ukraine, units

Source: own calculations based on EMIS sample

Micro enterprises demonstrated a relatively stable presence over the years. In 2016, these enterprises accounted for 4 enterprises contributing to 28.6% of TOR and 18.2% of TA. By 2020, the number of micro enterprises had increased to eight, with their share of TOR rising to 25.8%, while their share of TA decreased to 3.3%. This suggests an increasing role in revenue generation, but a reduced contribution to asset utilisation.

In terms of numerical representation, small enterprises consistently constitute the predominant proportion of entities analysed. In 2016, 13 small enterprises were responsible for 61.9% of TOR and 54.5% of TA. By 2020, the number of small enterprises had increased to 17, with their share of TOR decreasing slightly to 54.8%, while their share of TA remained stable at 53-65%%. This stability underscores their substantial and enduring contribution to the Ukrainian economy.

Medium-sized enterprises experienced fluctuations in both their numbers and economic contributions. In 2016, two medium enterprises contributed 9.5% of TOR and six to 27.3% of TA. By 2020, the number of medium enterprises had increased to 6, but their share of TOR decreased to 19.4%, while the share of 13 medium companies in TA rose to 43.3%. This suggests a shift in focus, with medium enterprises becoming more asset-intensive while generating a smaller proportion of revenue.

The data presented herein indicates an evolution in the dynamics between enterprise sizes in Ukraine. Recent studies have indicated an increase in the number of micro enterprises, as well as an increase in the revenue that they contribute to the economy. However, these studies have also shown a decrease in the asset share of micro enterprises. It is evident that small enterprises have sustained their predominant position in both TOR and TA. Conversely, medium enterprises have exhibited growth in terms of both numbers and asset contributions. However, this growth has been accompanied by a decline in revenue share. These trends are indicative of the evolving organisational structure and economic behaviour of enterprises in Ukraine during the specified period.

At the same time, the market structure differs significantly depending on which indicator is chosen for classification - according to total operating value, in 2016-2020, no large enterprises were registered (at least in the EMIS database) in any country (Figure 10).

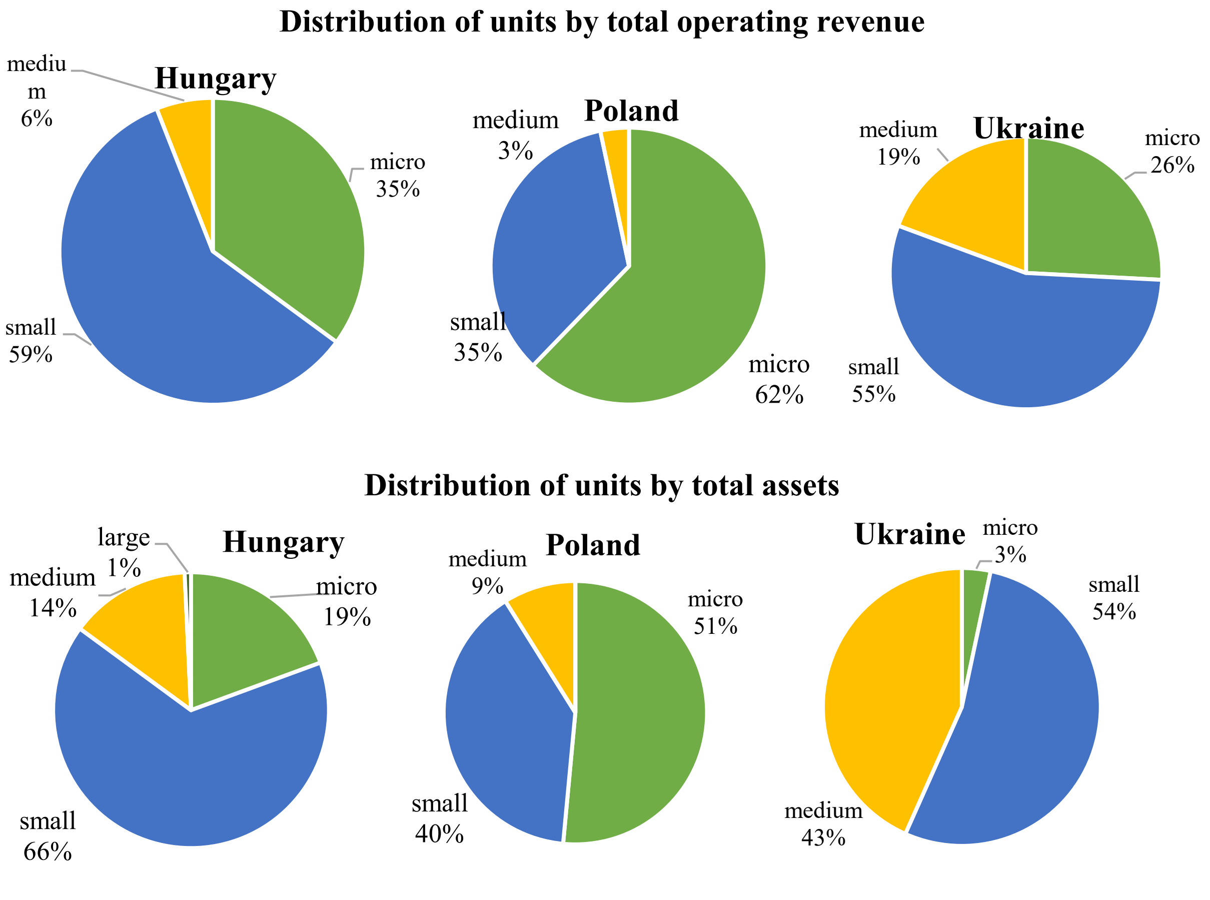


Figure 10. Comparing enterprises by sizes, 2020

Source: own calculations based on EMIS sample

In terms of total assets, only one large enterprise was permanently operating in Hungary – Tedej Zrt. (Hajdunanas, Hajdu-Bihar region) with an average book value of EUR 46.8 million (and the assets of this enterprise gradually increased in 2016-2018 - from 43. 876 million to 49.1 million, and then decreased to 46.3 million in 2020), and in 2016 Batortrade Kft. (Nyirbator, Szabolcs-Szatmar-Bereg region) had a book value of 45.487 million euros. However, in 2017, the assets of Batortrade Kft. decreased by 1.8 times (to 25.3 million), and by 2020, they were growing slowly – only to 31 million euros. Therefore, according to both criteria, this company now belongs to the medium-sized group.

The structural distribution by number of companies is extremely heterogeneous. For example, in Hungary, small enterprises accounted for 60-65% of the total in 2020, both in terms of sales and assets; in Ukraine, it was 55%, and in Poland, 35-40%. The distribution of other groups is already different. In terms of assets, microenterprises in Hungary accounted for 35% of all registered enterprises, but only 19% had a total operating value of more than EUR 2 million; in Ukraine, only 3% of companies could be classified as microenterprises in terms of assets, but this group already accounted for 26% in terms of sales; in Poland, the share of microenterprises was the largest - 51% in terms of assets and 62% in terms of sales. The largest share of medium-sized enterprises in terms of both total operating value and total assets was in Ukraine – 43% and 19% respectively, in Hungary – 16% and 6%, and the smallest in Poland – 9% and 6%.

Over the 2016-2020, the structure of the distribution of enterprises in Hungary has hardly changed, while in Poland, in 2017, the share of microenterprises increased sharply, and the market presence of small and medium-sized companies decreased accordingly. In 2017-2020, the microenterprise group was the largest, accounting for approximately 60% of total operating income and 50% of total assets, with the share of small companies at 35-40% by both criteria. In Ukraine, the number of microenterprises remained almost unchanged in terms of market size (25-28%), but at the same time fell sharply in terms of assets – from 18% in 2016 to 3% in 2020 (although in reality it was a decrease from 4 to 1 unit); the share of medium-sized enterprises grew from 27% to 43% in terms of assets and from 9.5% to 43% in terms of sales, with an increase in assets of more than 10% in 2019 compared to 2018, which should have led to an increase in revenue, but the onset of the crisis in 2020 levelled these expectations – in 2019-2020, only 20% of enterprises had an average annual revenue of more than €10 million. Finally, the largest group of small enterprises accounted for almost the same share by both criteria – 50-60%, although in 2017 it rose to 67-68%. Thus, small enterprises predominate in Hungary (60-66%), followed by Ukraine (55-56%), and Poland has the smallest number of them, although it is a fairly large group – 35-40% of the total number of enterprises. In terms of total operating value, micro-enterprises are in second place in Hungary, while in Ukraine micro- and medium-sized enterprises are represented in approximately the same proportion, and in Poland there are very few medium-sized enterprises compared to the number of micro- and small enterprises. However, according to the Gini index, Poland has the most concentrated market (60% by revenue), while in Hungary the figure is 46.5% and in Ukraine it is 44.7%. In Poland, the level of concentration increased sharply in 2017 (from 37% to 60%), while the market structure in

Ukraine and Hungary remained almost unchanged. I will usen total operating value as a criterion for grouping companies by size, as the market share that a company has managed to occupy is the best measure of the efficiency of using available resources.

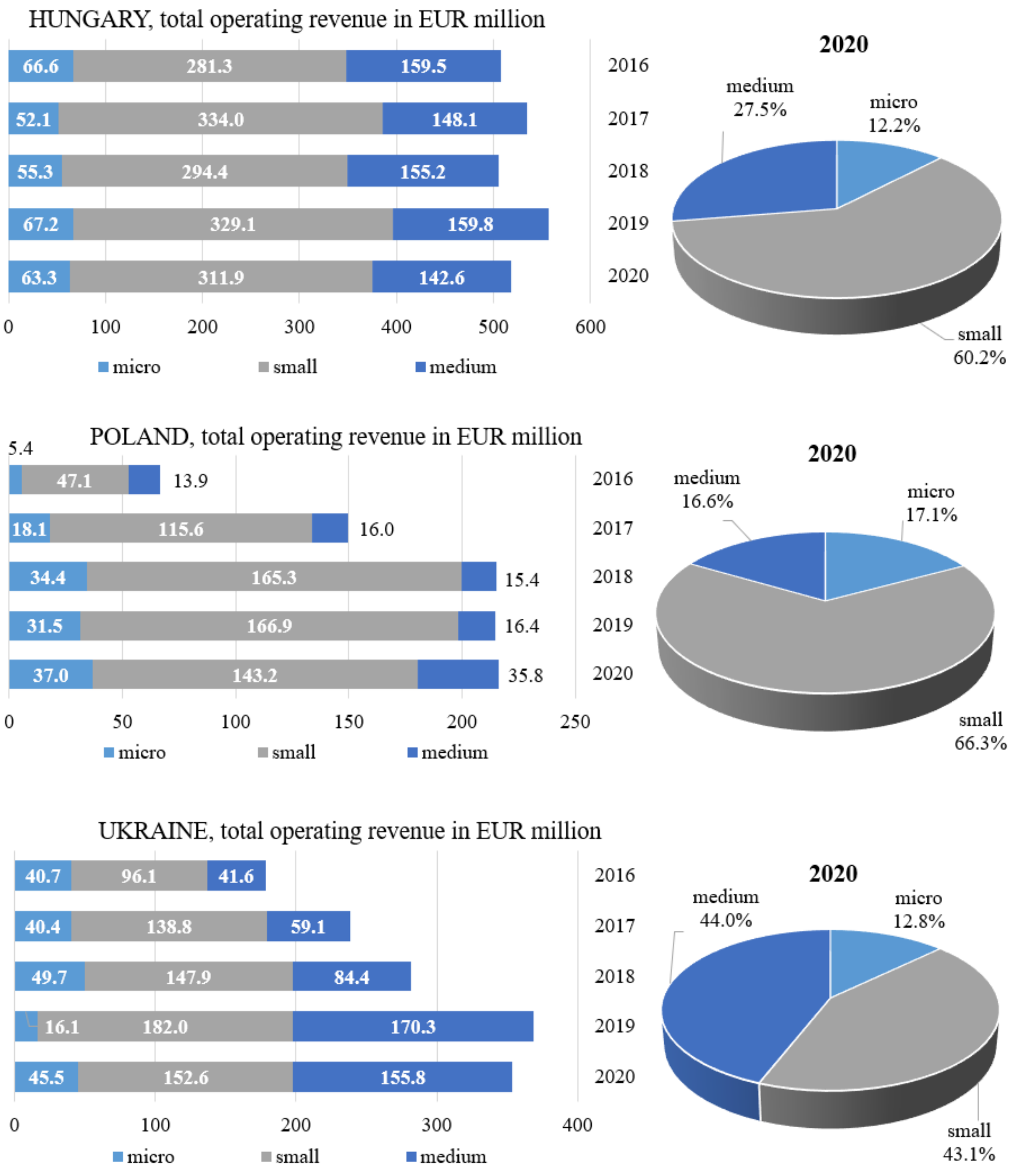


Figure 11. Total operating revenue by groups of enterprises, 2016-2020

Source: own calculations based on EMIS sample

In Hungary, the largest share of total revenue was contributed by small enterprises (60.2%), medium-sized enterprises (27.5%) and micro-enterprises (12.2%). A similar structure was observed in Poland, with small enterprises accounting for 66.3% of the total revenue of the dairy industry. The shares of medium-sized enterprises (16.6%) and micro-enterprises (17.1%) were almost equal (Figure 11).

In Ukraine, the industry's total revenue structure differs in its composition. While the share of microenterprises is the smallest compared to other groups (12.8%), medium and small enterprises share the remainder of the market equally (44.0% and 43.1%, respectively) in 2020. However, the structural changes in Ukraine in terms of total operating turnover, both in absolute and relative terms, were the most significant. In 2016, compared to 2017, there was an absolute increase in total revenue of €60 million per year. In 2018, the annual increase was €43.6 million. Concurrently, the share of medium-sized enterprises in total revenue exhibited an upward trajectory, attaining a twofold increase over a five-year period (from 23% to 44%), while the share of microenterprises underwent a nearly proportional decline (from 22.8% to 12.8%), and the share of small enterprises exhibited a slightly more modest decrease (from 53.9% to 43.1%).

The Hungarian dairy market is the largest in terms of total capacity. In 2020, revenues totalled more than €517.8 million. By comparison, the industry's total operating revenue in Ukraine was almost €353.8 million, and in Poland, almost €216 million (if to group the enterprises by the criteria suggested by European Commission). Furthermore, Hungary and Ukraine both experienced a marginal decrease in sales during 2020, with losses amounting to EUR 51.3 million and EUR 14.6 million, respectively. Notably, Poland incurred the least substantial losses since the onset of the crisis, with a total operating revenue loss of only EUR 265 thousand (Figure 12).

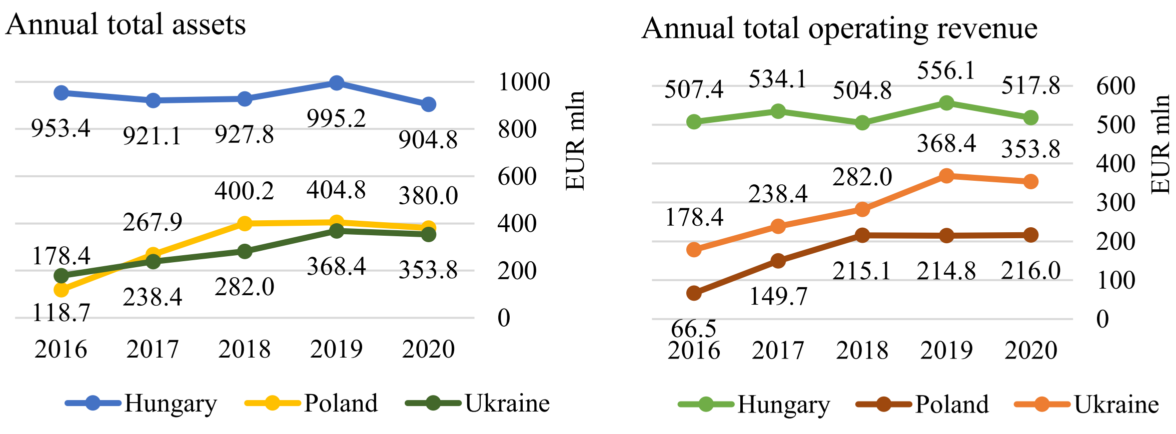


Figure 12. Total dairy industry dynamics, 2016-2020

Source: own calculations based on EMIS sample

In Hungary, the growth of companies' assets was predominantly negative (from EUR 953.4 million in 2016 to EUR 904.8 million in 2020), and total income exhibited fluctuations, though overall, there was a marginal increase. In contrast, there was an increase in both assets and market capacity in Ukraine and Poland (with a slowdown only in 2020).

3.3. FINANCIAL EFFICIENCY OF MILK PRODUCTION

Comparative analysis of the profitability of enterprises is usually based on such financial indicators as ROS, ROA, ROE, operating profit margin, net profit margin and EBITDA margin. This is an important metric for evaluating an enterprise's success in the market. It is less dependent on the amount of funds and resources a company has available, and more focused on how efficiently and thoroughly these resources are used. For instance, a small company often has superior profitability indicators, as its assets are not encumbered by substantial inventories and 'heavy' property that large companies accumulate. In order to understand the prevailing industry trend, it is necessary to compare the average indicators for all registered companies. However, when assessing management efficiency, it is preferable to evaluate these ratios in relation to a company's size.

Return on sales (ROS) is a ratio employed for the purpose of evaluating a company's operational efficiency. This measure provides insight into the profit generated per unit currency of sales. An increasing ROS is indicative of an improving efficiency ratio, while a decreasing figure could signal impending financial troubles. There is a close correlation between ROS and a firm's operating profit margin. It should be noted that in the practice of financial analysis in Ukraine, the ROS calculation formula uses net profit rather than operating profit. Therefore, it appears that ROS is equivalent to net profit margin. The EMIS database contains unified data, although this peculiarity should be taken into account when reading the operating accounts of Ukrainian companies from primary sources.

Return on assets (ROA) indicates how profitable a company is relative to its total assets. ROA is a metric that can ascertain the efficiency with which a company employs its resources to generate profit.

Return on equity (ROE) estimates a company's financial performance via dividing net income by shareholders' equity. Shareholders' equity is equivalent to a company's assets minus its debt; thus ROE is a metric by which to ascertain a company's return on net assets.

Operating profit margin (often equalled with ROS, although this is not entirely true) is the ratio between the operating profit and revenues. For the purpose of the current research, I will equal earnings before interest and taxes (EBIT) and operating profit, as they are frequently used interchangeably and can be regarded as synonymous. Nonetheless, we must remember that slight discrepancies may be observed in certain instances, particularly in instances where a company experiences non-operating income or expenses.

EBITDA margin assesses the effectiveness of a company's cost-cutting efforts. A company with a high EBITDA margin will have a lower proportion of operating expenses in relation to its total revenue. Due to the absence of a direct calculation of EBITDA in the Ukrainian accounting standards and the fact that the EMIS database does not contain data on other indicators that could be used to calculate EBITDA (e.g. depreciation and amortisation/net sales), the main indicator for Ukraine in this sub-group is the operating profit margin.

Net profit margin: Hungary's aggregated annual average NPM demonstrates a consistent enhancement between 2016 and 2020, commencing at 2.7% in 2016 and reaching its zenith at 11.7% in 2017, subsequently declining to 8.6% in 2020. Poland's figures are indicative of volatility; they began with a modest 2.4% in 2016, dipped to a dramatic -427% in 2018, but rebounded to -17.0% in 2020. Ukraine displays a consistent performance, with an increase from 22.4% in 2016 to 29.2% in 2017, and stabilising at approximately 9.5% by 2020, indicative of resilience despite fluctuations (Table 8).

Table 8. Net profit margin by countries, 2016-2020

Year	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	8.6	58.6	-45.5	104.1	12.9
2019	8.7	114.2	-44.2	158.5	15.9
2018	10.7	164.6	-21.7	186.2	19.4
2017	11.7	60.4	-66.6	127.0	16.0
2016	2.7	55.5	-70.9	126.4	14.1
Poland					
2020	-17.0	1857.4	-2602.1	4459.6	358.3
2019	12.7	1978.2	-1306.1	3284.4	269.3
2018	-427.0	3055.8	-41085.2	44141.1	4476.8
2017	5.0	401.3	-334.3	735.6	78.6
2016	2.4	33.3	-16.4	49.7	11.3
Ukraine					
2020	9.5	236.3	-234.9	471.2	70.9
2019	0.2	34.0	-191.0	225.0	49.2
2018	27.2	258.6	-1.9	260.5	43.9
2017	29.2	212.4	-10.2	222.6	37.2
2016	22.4	47.6	-5.4	53.0	15.4

Source: own calculations based on EMIS sample

Negative figures in Poland are due to the bulk of enterprises ended the financial year with losses, for example, 20 units out of 85 (23.5%) reported losses in 2020. The total losses for the industry made a bit less than EUR 5.2 million, of which -1.76 mln was reported by one company, three other ones got -906.0, -660.68 and -481.19 mln losses. So, four the most unprofitable companies were responsible for 73.2% of all negative outcome in the industry. If it were not for these 20 companies, the average annual NPM for Polish dairy enterprises would have made 32.3% that makes a fairly good result. Excluding unprofitable companies, average industry NPM in Ukraine made 27.5% in 2020 (only 4 companies out of 30, or 13.3%, in the EMIS database ended the financial year with losses). In Hungary, only 9.7% of all companies made losses (13 out of 134 units), the average positive NPM made 10.8%, the negative one – 157.8%, due to four companies whose NPM rate was within the range of 18-45%.

Return on Sales: In the Hungarian dairy industry, return on sales exhibited a trajectory analogous to that of net profit margins, increasing from 4.0% in 2016 to 12.8% in 2017, then stabilising at 9.6% in 2020. Poland demonstrated erratic behaviour; for example, in 2018, returns collapsed to -423.5% and finished at -12.1% in 2020. Ukraine demonstrated greater consistency, with a range of 27.8% in 2016 and a decline to 9.7% by 2020. However, it maintained a balance in contrast to the significant variations observed in Poland. Table 9 demonstrates ROA values in dynamics by countries' breakdown.

Table 9. Return on sales (ROS) by countries, 2016-2020

Year	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	9.6	63.4	-45.1	108.5	12.7
2019	9.9	119.5	-42.7	162.1	16.2
2018	11.5	176.3	-23.2	199.5	19.3
2017	12.8	61.6	-65.7	127.3	16.3
2016	4.0	57.8	-68.6	126.4	14.3
Poland					
2020	-12.1	1966.1	-2602.1	4568.2	362.5
2019	15.8	1822.4	-1120.9	2943.3	241.3
2018	-423.5	3055.8	-41078.2	44134.0	4476.6
2017	9.0	401.3	-334.3	735.6	76.9
2016	3.6	36.6	-16.2	52.8	11.9
Ukraine					
2020	9.7	261.3	-277.5	538.8	81.8
2019	2.1	34.0	-169.6	203.6	47.7
2018	20.5	41.7	0.1	41.6	11.4
2017	25.4	51.9	-5.6	57.6	15.7
2016	27.8	50.3	10.7	39.6	13.9

Source: own calculations based on EMIS sample

Return on Assets: Hungary has demonstrated sustained economic growth, with an increase from 0.9% in 2016 to 5.0% in 2017, followed by a moderate decline to 3.9% in 2020. Poland's results are characterised by significant variability, evidenced by figures such as 106.6% in 2019 and a pronounced -0.3% in 2020. Ukraine demonstrated balanced growth, rising from 13.6% in 2016 to 15.0% in 2017, though this figure declined slightly to 9.3% in 2020, showcasing stability amidst challenges. The ROA values are represented Table 10.

Table 10. Return on assets (ROA) by countries, 2016-2020

	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	3.9	30.3	-26.7	57.0	6.0
2019	3.2	20.5	-19.8	40.3	4.9
2018	4.0	33.4	-20.1	53.5	6.4
2017	5.0	21.2	-41.1	62.4	7.9
2016	0.9	73.2	-41.3	114.4	9.6
Poland					
2020	-0.3	94.9	-305.9	400.8	35.5
2019	106.6	9941.2	-416.2	10357.4	1043.4
2018	3.7	84.0	-95.1	179.1	18.4
2017	4.4	98.1	-20.1	118.2	15.6
2016	0.6	13.5	-8.7	22.2	5.1
Ukraine					
2020	9.3	26.7	-38.4	65.2	12.4
2019	3.4	23.9	-64.9	88.8	18.8
2018	13.4	45.3	-0.6	45.9	9.5
2017	15.0	32.1	-6.4	38.5	10.5
2016	13.6	29.2	-0.6	29.8	9.4

Source: own calculations based on EMIS sample

Return on Equity: Hungary, however, exhibited an outlier in 2016 with a staggering return of 389.6%, which subsequently decreased significantly to 13.1% by 2017, then stabilised closer to 7.5% by 2020. Poland's return on equity demonstrates significant variability, exhibiting notable highs of 49.1% in 2019 and notable lows of -80.0% in 2020. In contrast, Ukraine demonstrated stability, shifting from 16.2% in 2016 to 16.8% in 2017, and reaching a modest 10.4% in 2020. Table 11 demonstrates ROE values by countries.

Given that the use of equity capital is a key indicator of an enterprise's stability, and also demonstrates business practices, organisational structure and criteria for creating new enterprises, we will be examining the standard deviation of the return on equity indicator in greater detail.

The standard deviation of return on equity provides insights into the volatility and consistency of ROE values over time within each country. As for Hungary, it can be characterised by high initial volatility. In 2016, the standard deviation was exceptionally high (4419.0), reflecting extreme variability in ROE. This may indicate the presence of significant outliers or unusual financial events. Declining trend from 2017 to 2019 proves a consistent decrease, dropping to 13.9 in 2018 and slightly to 10.9 in 2019. This indicates further stabilisation in ROE performance during these years. In 2020, it climbed again to 26.0, indicating a resurgence in variability.

Table 11. Return on equity (ROE) by countries, 2016-2020

Year	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	7.5	289.1	-38.8	327.8	26.0
2019	4.5	47.1	-81.4	128.5	10.9
2018	7.0	100.4	-15.4	115.9	13.9
2017	13.1	642.2	-66.8	709.0	58.2
2016	389.6	52085.6	-67.3	52152.9	4419.0
Poland					
2020	-80.0	134.7	-7238.1	7372.9	751.4
2019	49.1	2663.9	-41.0	2704.9	288.6
2018	22.1	835.7	-39.7	875.4	90.9
2017	15.8	294.5	-45.1	339.6	42.5
2016	0.4	21.2	-16.1	37.3	8.6
Ukraine					
2020	10.4	27.2	-40.2	67.4	13.8
2019	3.2	25.4	-85.8	111.3	22.6
2018	14.5	57.3	-0.6	58.0	11.1
2017	16.8	34.6	-10.7	45.2	12.0
2016	16.2	38.4	-0.9	39.4	10.8

Source: own calculations based on EMIS sample

Poland is described by increasing volatility, as the standard deviation has shown a steady rise, from 8.6 in 2016 to 751.4 in 2020. This indicates growing fluctuations in ROE values, suggesting increasing disparities among enterprises or dynamic market conditions. The surge in 2020 may indicate heightened financial instability or varied responses to external factors, such as economic challenges caused by the beginning of the pandemics.

Ukraine performs with moderate stability: the standard deviation has remained relatively stable in comparison to Hungary and Poland, with values ranging between 10.8 and 22.6 from 2016 to 2020, despite there may be slight fluctuations. Excluding some variations over time, Ukraine demonstrates less extreme volatility in ROE, proving greater consistency among enterprises.

All three countries demonstrate changes in standard deviation values on an annual basis, as ROE conditions are subject to fluctuations, influenced by external factors or differing enterprise performances. Each country has at least one year in which the standard deviation values are notably high. These periods are indicative of heightened financial variability or instability. It is important to note that trends indicate ROE fluctuations across all countries, which may be attributable to economic cycles, policy changes, or external shocks (e.g., global events such as the beginning of global economic crisis caused by COVID pandemics in 2020). As demonstrated by the dramatic swings in standard deviation observed in Hungary and Poland, the economic environments of these countries are marked by significant variability. In contrast, Ukraine exhibits a greater degree of stability, underscoring the distinct dynamics that characterise each nation's economic landscape.

Table 12 represents the values of operating profit margin by three countries.

Table 12. Operating profit margin by countries, 2016-2020

Year	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	7.2	46.9	-28.4	75.3	9.1
2019	6.6	43.1	-27.6	70.7	8.4
2018	7.5	44.1	-20.6	64.6	9.2
2017	9.2	39.7	-43.5	83.2	11.1
2016	2.8	57.8	-45.0	102.8	10.3
Poland					
2020	-11.7	81.3	-1400.0	1481.3	151.2
2019	34.4	2770.8	-250.8	3021.6	300.9
2018	7.6	100.0	-55.7	155.7	23.4
2017	6.8	97.3	-128.6	225.9	28.2
2016	2.8	27.4	-13.8	41.2	9.4
Ukraine					
2020	4.2	73.1	-222.4	295.5	54.9
2019	2.1	33.3	-158.7	192.0	39.1
2018	16.7	37.8	0.0	37.8	12.1
2017	20.7	50.7	-4.8	55.5	15.5
2016	19.9	43.8	0.0	43.8	14.4

Source: own calculations based on EMIS sample

Operating profit margin: Hungary's indicator demonstrated consistent enhancements, commencing in 2.8% 2016 and reaching a zenith of 9.2% in 2017, subsequently stabilising at 7.2% by 2020. Poland experienced significant economic transformations, marked by a substantial surge to 34.4% in 2019, subsequently followed by a precipitous decline to -11.7% in 2020. Ukraine's figures demonstrated a notable performance, reaching 20.7% in 2017, though this figure was observed to soften to 4.2% by 2020, reflecting resilience and adaptability.

EBITDA margin: Hungary exhibited a consistent improvement, rising from 21.2% in 2016 to a peak of 28.5% in 2018, before stabilising at 25.8% in 2020. Poland once again exhibited volatility, with figures as high as 35.8% in 2018 and significant fluctuations, concluding at 22.0% in 2020. As for Ukraine, the EMIS database does not have relevant data (Table 13).

A comparative analysis of the profitability indicators for the three countries can be summarised as follows. The standard deviation provides insight into the variability or consistency of financial ratios. Poland appears to have the largest dispersion, its financial ratios, including net profit margin and return on equity, indicate high standard deviations, showcasing significant annual variability.

Table 13. EBITDA margin by countries*, 2016-2020

Year	Mean	Max	Min	Range	Standard deviation
Hungary					
2020	25.8	69.2	-13.9	83.1	14.8
2019	26.8	211.0	-25.0	236.0	26.0
2018	28.5	196.2	-16.2	212.3	24.7
2017	27.1	80.0	-58.5	138.5	21.1
2016	21.2	62.4	-43.4	105.8	16.1
Poland					
2020	22.0	2022.8	-974.7	2997.5	284.7
2019	24.2	1437.8	-893.4	2331.2	213.7
2018	35.8	1332.4	-39.6	1372.0	160.4
2017	26.7	478.9	-54.1	533.0	72.2
2016	14.3	45.8	-5.6	51.3	12.5

* *EBITDA margin data for Ukraine is not available in the EMIS database due to differences in accounting standards. Ukrainian accounting systems do not directly calculate EBITDA, and the absence of separate depreciation and amortisation data prevents retrospective calculation. Operating profit margin serves as the primary operational profitability metric for Ukrainian enterprises in this analysis.*

Source: own calculations based on EMIS sample

Hungary and Ukraine demonstrated more stable ranges, with Hungary exhibiting consistent improvement over time and Ukraine demonstrating resilience even during challenging periods. The standard deviation values for Hungary are relatively moderate across all metrics, which indicates a stable financial environment with limited fluctuations. For instance, net profit margin demonstrates variations ranging from 12.9% to 19.4%, while the return on assets fluctuates between 4.9% and 9.6%. These values suggest a predictable and uniform economic performance, with reduced risk of extreme changes. Despite the presence of some variability in return on equity (particularly in 2016, where it reached 4419%), Hungary as a whole demonstrates financial homogeneity over the observed period.

Poland demonstrates considerable heterogeneity, as evidenced by the elevated standard deviation values, particularly in net profit margin (for instance, 4476.8% in 2018), ROS, and ROE (751.4% in 2020). This variability is indicative of a financial landscape characterised by extreme fluctuations, which may be indicative of external shocks or policy changes. For instance, the EBITDA margin demonstrated deviations of up to 284.7% in 2020, indicating significant operational uncertainty. Poland's metrics are volatile, in contrast to Hungary's more stable figures.

Annual changes indicates that Hungary has demonstrated a consistent yet predictable performance, while Ukraine has exhibited a commendable capacity to balance growth and downturns. However, Poland has demonstrated erratic and extreme variations over the years, necessitating a more profound examination of the political and macroeconomic influences that characterise these periods.

In the Hungarian context, there is evidence to suggest that investment security with moderate returns is a consistent annual dynamic. Ukraine demonstrates considerable potential, exhibiting robust metrics in the majority of years. Poland, despite its inherent volatility, has the capacity to generate substantial returns during periods of peak performance. The annual fluctuations in financial ratios across these countries underscore the heterogeneity of economic trajectories. Hungary's steady improvement mirrors a robust financial structure, Poland's volatility suggests external shocks or reforms, and Ukraine's resilience points toward an emerging market recovering and growing steadily.

Ukraine's financial ratios demonstrate a balanced standard deviation range, situated between the stability exhibited by Hungary and the volatility observed in Poland. As demonstrated by the standard deviation of net profit margin (70.9% in 2020) and ROS (81.8% in 2020), there is evidence of moderate variability, indicative of certain challenges, however these are not as extreme as those observed in Poland. The stability is most evident in ROA and ROE, where standard deviations are relatively low. This suggests financial resilience and less erratic behaviour compared to Poland.

Thus, Hungary stands out for its financial consistency, as evidenced by its relatively low standard deviation values. Ukraine demonstrates moderate variability, indicating a combination of resilience and adaptability. In contrast, Poland's financial ratios exhibit high heterogeneity, reflecting an unstable and unpredictable business environment. As demonstrated by the data provided, a greater number of similarities are evident between Hungary and Ukraine in several indicators when compared with Poland.

A closer examination of the financial ratios of both Hungary and Ukraine reveals that they exhibit relatively low standard deviations, suggesting a greater degree of stability and consistency in their economic performance. For instance, the standard deviation of net profit margin in Hungary ranges from 12.9% to 19.4%, while Ukraine's values are comparable, ranging from 15.4% to 70.9%. Hungary's ROA deviation fluctuates between 4.9% and 9.6%, and Ukraine's ranges from 9.4% to 18.8%. In comparison to Poland, where the deviations are pronounced, these are comparatively lower.

Although Ukraine exhibits slightly higher ROE deviations (10.8%-22.6%), they still align more closely with Hungary (10.9%-58.2%) than with Poland's extreme values. Both countries demonstrate controlled variability in operating profit margins, with Hungary's standard deviations ranging from 8.4% to 11.1% and Ukraine's from 12.1% to 54.9%. These figures underscore operational efficiency and less erratic behaviour when compared to Poland's vastly higher deviations.

A comparison of the EBITDA margin deviations of Hungary and Ukraine reveals a similarity in the observed patterns, with ranges from 14.8% to 26.0% and from 11.4% to 22.6%, respectively. Conversely, Poland demonstrates significantly greater volatility, with deviations ranging from 12.5% to a remarkable 284.7% (Table 13).

The stability in financial ratios and standard deviations suggests that Hungary and Ukraine maintain resilience in their financial environments, adapting to challenges without extreme disruptions. Conversely, Poland's data exhibits considerably less predictability, characterised by substantial variations and outliers.

Hungary and Ukraine align most closely in: 1) net profit margin: both countries demonstrate more stable fluctuations in profitability, with moderate deviations reflecting a certain steadiness in earnings; 2) Return on assets. The stable deviation values indicate an efficient utilisation of resources and reduced volatility; 3) EBITDA margin: Hungary and Ukraine exhibit consistent operational performance and financial health relative to Poland's unpredictable trajectory.

In summary, the financial environment in Hungary and Ukraine is characterised by stability and predictability, as evidenced by the relatively lower standard deviations of their financial ratios. Poland, with its extreme fluctuations, is distinctive in terms of heterogeneity.

Table 14 presents profitability ratios for different groups of companies in Hungary for 2020, categorised according to their net profit margin (NPM).

The represented enterprises exhibiting an NPM within the range of 40% to 60% are characterised by a notable degree of profitability, thereby classifying them as small businesses with a substantial profit margin. The financial performance of these firms was demonstrated by an average return on sales (ROS) of 36.47%, an average return on assets (ROA) of 21.51%, and an average return on equity (ROE) of 23.30%.

Companies within the 30% to 40% NPM range, specifically micro and small enterprises, exhibited a heightened efficiency in converting sales into profits. The average return on equity (ROS) was 43.06%, the return on assets (ROA) was 11.92%, and the return on equity (ROE) was 13.50%. The subsequent category, characterised by an NPM ranging from 20% to 30%, encompassed a diverse array of micro and small companies with a lower level of profitability compared to the previous group, with an average return on sales (ROS) of 24.98%, a return on assets (ROA) of 11.44%, and a return on equity (ROE) of 14.60%.

Table 14. Profitability ratios by categories, Hungary 2020

NPM range	Mean NPM	Units, size	Group total operating revenue,		Group total assets		Groups net profit/loss		Mean ROS	Mean ROA	Mean ROE
%	%		EUR mln	%	EUR mln	%	EUR mln	%	%	%	%
40-60	55.02	3 small	20.207	4.2	43.215	5.2	8.662	20,9	36.47	21.51	23.30
30-40	32.88	1 micro, 2 small	9.220	1.9	17.488	2.1	2.282	5,5	43.06	11.92	13.50
20-30	24.24	5 micro, 8 small	41.625	8.7	72.350	8.7	7.553	18,3	24.98	11.44	14.60
10-20	14.04	7 micro, 22 small, 2 medium	129.304	27.0	230.605	27.9	13.958	33,8	15.13	6.51	9.24
5-10	7.02	10 micro, 14 small, 2 medium	97.556	20.4	163.384	19.8	5.261	12,7	7.88	3.44	6.02
0-5	2.51	15 micro, 27 small, 3 medium	180.505	37.7	300.162	36.3	3.631	8,8	4.48	1.17	1.74
TOTAL		121	478.417	100	827.204	100	41.347	100	–	–	–
–10-0	-3.47	4 micro, 3 small, 1 medium	32.776	83.8	66.875	86.2	–555.0	–	–2.61	–1.58	–1.99
< –10	26.01	5 micro	6.338	16.2	10.706	13.8	–1.020	–	–52.09	–12.33	39.53
TOTAL		5	39.114	100	77.581	100	–1.575	–	–	–	–

Source: own calculations based on EMIS sample

The most typical business segment was constituted by companies falling into the 10% to 20% NPM bracket, including micro, small, and some medium-sized firms. The profitability ratios indicated moderate financial performance, with an average return on sales (ROS) of 15.13%, a return on assets (ROA) of 6.51%, and a return on equity (ROE) of 9.24%. Meanwhile, firms with a margin between 5% and 10% remained profitable but demonstrated lower efficiency in generating returns, as reflected in their average ROS of 7.88%, ROA of 3.44%, and ROE of 6.02%.

The largest group in terms of revenue and assets comprised companies with an NPM between 0% and 5%. The profitability of these businesses was found to be relatively weak, with an average return on sales (ROS) of 4.48%, a return on assets (ROA) of 1.17%, and a return on equity (ROE) of 1.74%. Turning to the negative profitability categories, companies experiencing losses fell into the -10% to 0% range. The company's financial condition was deteriorating, as evidenced by a negative return on sales (ROS) of -2.61%, a return on assets (ROA) of -1.58%, and a return on equity (ROE) of -1.99%.

Firms with an NPM below -10% were consequently in severe financial trouble, with the majority being micro businesses facing extreme losses. The average net profit margin of these companies reached -26.01%, indicating severe financial distress. Each of these categories is indicative of distinct financial realities. It is observed that the most profitable businesses are those that enjoy strong returns, while those with negative margins face challenges in sustaining efficiency and profitability.

Businesses with an NPM>0 contributed significantly to their respective groups in terms of total operating revenue, total assets, and overall net profit. The most profitable companies, those with an NPM between 40% and 60%, accounted for a minor proportion of their group's total revenue and assets – 4.2% and 5.2% respectively, despite demonstrating a strong financial position. In a similar vein, firms with an NPM in the 30% to 40% range also did not exhibit a notable presence in asset distribution (2.1%) and revenue generation (1.9%).

As profitability declined across categories, the proportion of units with positive margins decreased, particularly in groups with an NPM between 0% and 5% (the largest group by total operating revenue – 37.7% of all profitable enterprises). In this sector, while certain companies continued to report profits, the aggregate contribution to group net profit remained negligible. Conversely, enterprises demonstrating negative profitability (NPM < 0) exerted a substantial drag on group performance, as their losses contributed to a decline in aggregate net profit and engendered financial instability. The segment characterised by severe losses, wherein NPM fell below -10%, exhibited the lowest proportion of units contributing positively to overall financial metrics. This finding serves to underscore the challenges faced by these firms.

In Poland, there were two outstanding micro enterprises with net profit margin values of 1857% and 151.47%, with ROS of 1966% and 151.47% respectively in 2020, which cannot be referred to a specific category as such values are quite unreliable and unstable. To prove, the first mentioned company ended 2019 with NPM equalled –1306% and ROS –1121%, while in 2018 it was extremely positive – 1260% and 1304% respectively. That might have been caused by low operational costs and other comprehensive income from different activities. On the contrary, one micro-enterprise had a negative NPM value in –2602%, with the same ROS, caused by the loss of EUR –14 000 and total operating revenue of EUR 1000 in 2020 (by the way, its assets accounted for EUR 471 000). The other enterprises showed consequent bands, nevertheless, they demonstrated much higher NPM ranges than the Hungarian dairy firms.

Table 15 sets out the profitability ratios for various groups of companies in Poland in 2020. The initial group, comprising two micro-companies with an NPM range of 60-70%, exhibited remarkable profitability. Their mean NPM stood at an impressive 66.13%, and they reported a mean return on sales (ROS) of 66.13%, signifying high revenue efficiency. Their mean return on assets (ROA) was 5.94%, and their mean return on equity (ROE) reached 51.89%, thus indicating their strong ability to generate equity returns. With their diminutive stature, these enterprises contributed a mere 0.02% of the group's aggregate operating revenue, 0.06% of its total assets, and 0.1% of its net profit/loss, thereby underscoring an impressively efficient utilisation of their constrained resources. Further analysis of the business practices of these companies is required to ascertain whether their remarkably high profitability is the result of deliberate management actions or arose by chance, due to a fortuitous combination of circumstances.

Table 15. Profitability ratios by categories, Poland 2020

NPM range	Mean NPM	Units, size	Group total operating revenue,		Group total assets		Groups net profit/loss		Mean ROS	Mean ROA	Mean ROE
%	%		EUR mln	%	EUR mln	%	EUR mln	%	%	%	%
60-70	66.13	2 micro	0.036	0.02	0.202	0,06	0.012	0,1	66.13	5.94	51.89
30-45	35.98	4 micro, 1 small	6.867	3.8	17.315	5.3	1.174	10,1	40.59	7.67	23.26
20-30	26.92	4 micro	1.871	1.0	4.061	1.2	0.438	3,8	28.27	17.26	33.38
10-20	14.75	7 micro, 6 small	38.181	21.2	82.352	25.3	5.016	43,0	16.40	6.64	7.31
5-10	8.02	1 micro, 6 small, 2 medium	52.844	29.3	94.408	29.1	3.792	32,5	9.23	3.79	5.87
0-5	1.89	14 micro, 15 small	80.583	44.7	126.627	39.0	1.229	10,5	2.64	3.52	7.80
TOTAL		64	180.382	100	324.965	100	11.661	100	–	–	–
–1-0	–0.16	4 micro, 1 medium	20.251	62.8	12.471	26.5	–41	–	0.21	–1.24	15.02
–10 - –45	–23.07	7 micro, 2 small	9.242	28.7	19.118	40.6	–2.018	–	–16.62	–41.89	–59.69
< –80	–-275.96	5 micro	2.754	8.5	15.500	32.9	–3.124	–	–252.47	–27.02	–145.86
TOTAL		19	32.247	100	47.089	100	–5.183	–	–	–	–

Source: own calculations based on EMIS sample

The second group, comprising four micro-companies and one small company, exhibited an NPM ranging from 30 to 45%. The mean NPM for this group was 35.98%, indicating a high level of profitability. The mean ROS for the group was 40.59%, while the mean ROA and ROE were 7.67% and 23.26%, respectively. This group contributed 3.8% of the total operating revenue and 5.3% of total assets, while accounting for a significant 10.1% share of net profit/loss, reflecting their substantial financial contribution relative to their size.

Within the 20-30% NPM category, four micro companies reported a mean NPM of 26.92%. The mean ROS was 28.27%, and the mean ROE and (ROI were 17.26% and 33.38%, respectively, signifying a solid return on investment. Despite their reduced scale, the group's contributions included 1.0% of the total operating revenue, 1.2% of total assets, and 3.8% of net profit/loss. These figures suggest that, concerning their modest size, they do not play a significant role in the financial performance of the dairy industry.

The group with an NPM range of 10-20% included seven micro companies and six small companies. The mean NPM recorded was 14.75%, while the ROS, ROA, and ROE averaged 16.40%, 6.64%, and 7.31%, respectively. Representing a relatively larger segment, these companies contributed 21.2% to the total operating revenue and 25.3% to total assets. It is also noteworthy that this category accounted for a significant 43.0% of the group's total net profit/loss, thereby underscoring its importance to overall profitability.

Companies with an NPM range of 5-10% were categorised as follows: one micro company, six small companies, and two medium-sized companies. The mean NPM was 8.02%, with a mean ROS of 12.44%, an ROA of 6.02%, and an ROE of 8.85%. This group contributed the largest share to total operating revenue (29.3%) and total assets (29.1%). However, the net profit/loss contribution was lower at 25.5%, reflecting their more moderate profitability compared to their larger size.

The profitability ratios and financial performance of groups with negative NPM provide a valuable source of information on businesses operating at a loss. The categorisation of these groups is based on their NPM range, which is divided into three categories: –1%-0; –10% to –45% and below –80%.

The initial group, characterised by an NPM range between -1% and 0%, encompasses 4 micro enterprises and one small company. The mean NPM for this group is –0.16%, reflecting financial losses close to the break-even point. The mean ROS for the group was -0.21%, the mean ROA was -1.24%, and the mean ROE was 15.02%. With regard to financial contributions, this group is responsible for 62.8% of the total operating revenue and 26.5% of total assets of all unprofitable enterprises. However, their absolute value of net loss is –miserable (only EUR –41 000), signifying that a negative impact on the overall profitability of the dairy sector was caused by two other groups. In absolute values, losses made about the half of the net profit figure of the industry (roughly –5 mln of negative income compared with 11.7 mln of net profit).

The second group, which includes companies with an NPM of less than –10% to –45%, comprises 7 micro and 2 small companies. This group exhibits substantial financial hardship, with an average NPM of –23.07%. The mean return on sales is –16.62%, the mean return on assets is –41.89%, and the mean return on equity is –59.69%. These figures indicate significant inefficiencies in converting sales, assets, and equity into returns. From a financial perspective, this group contributes 28.7% to the total operating revenue and 40.6% to total assets. Notwithstanding these contributions, their ratio to the net profit in absolute volume is 17%, which is indicative of their substantial losses and the burden they place on the financial health of the dairy sector.

In both categories, companies with a negative net profit margin (NPM) < 0 make limited positive contributions to their groups' total operating revenue and assets. Conversely, their losses have a significant impact on the sector's aggregate net profit/loss, thereby reducing overall profitability.

The third group (NPM < –80%) is comprised of companies that have consistently incurred losses over the course of the study period. Consequently, their experience should be assessed in terms of the factors that ultimately resulted in the bankruptcy of these enterprises. Possessing total assets amounting to EUR 15.5 million, they represent nearly 33% of the book value of all loss-making enterprises and 4% of the total value of all enterprises within the industry in 2020, the aforementioned group has demonstrated a persistent pattern of financial instability.

A negative NPM value is reported by 4 out of 30 enterprises represented in the Ukrainian dairy industry, with all 4 of them being unprofitable only in 2020, 2 of them in 2019, and in previous years only one enterprise had a relatively small loss (-218 thousand euros) in 2016. The data indicates that in 2020, there were four loss-making enterprises out of 30 in the industry, compared to three out of 31 in 2019, and no enterprises reported any losses in 2018. In 2017, there was one loss-making enterprise out of 32, and in 2016, one out of 19 enterprises had incurred losses. One enterprise performed with 236.3% of NPV in 2020.

Table 16 presents profitability ratios for various groups of companies in Ukraine. The group with NPM of 30-40% has a mean NPM of 32.69%, comprising three small and two medium-sized companies. The total operating revenue of the aforementioned entities amounts to EUR 46.424 million, constituting 25.4% of the aggregate revenue of profitable Ukrainian dairy enterprises. The group's total assets are valued at EUR 87.222 million, representing 21.7% of total assets. Their contribution to the net profit is particularly noteworthy, standing at EUR 14.766 million, which is 39.2% of the total. The mean return on sales (ROS) for this group is 33.25%, while the mean return on assets (ROA) is 20.43%, and the mean return on equity (ROE) is 22.60%. This group has been demonstrated to exhibit robust profitability, with a notable role in the overall financial performance.

Table 16. Profitability ratios by categories, Ukraine 2020

NPM range	Mean NPM	Units, size	Group total operating revenue,		Group total assets		Groups net profit/loss		Mean ROS	Mean ROA	Mean ROE
%	%		EUR mln	%	EUR mln	%	EUR mln	%	%	%	%
30-40	32,69	3 small, 2 medium	46.424	25.4	87.222	21.7	14.766.	39.2	33.25	20.43	22.60
20-30	24,66	5 small, 2 medium	68.543	37.5	109.974	27.4	15.371.	40.8	25.04	16.43	18.26
10-20	16,32	8 small	41.844	22.9	64.110	16.0	6.558.	17.4	16.55	11.32	12.81
4-6	5,19	2 medium	21.771	11.9	130.890	32.6	972.	2.6	6.38	3.19	3.79
0-1	0,52	3 micro	4.361	2.4	9.441	2.4	20.	0.1	8.36	0.19	0.31
TOTAL		26	182.943	100	401 637	100	37.687	100	–	–	–
–10/ –25	-18,18	2 micro	1.716.	53.6	192.248	43.8	–210	–	–16.04	–3.12	–4.33
–150/ –235	-196,29	2 micro	1.485	46.4	247.142	56.2	–2 372	–	–217.52	–23.48	–26.49
TOTAL		4	3.201	100.	439.390	100.	–2.582	–	–	–	–

Source: own calculations based on EMIS sample

The group with the NPM range of 20-30% consists of five small and two medium-sized companies. The mean NPM for the group is 24.66%. The total operating revenue of the aforementioned entities amounts to EUR 68.543 million, constituting 37.5% of the total revenue of profitable companies. The group's total assets amount to EUR 109.974 million, which is 27.4% of the total. The contribution of these entities to the net profit of the dairy industry is the most significant, amounting to EUR 15.371 million, which constitutes 40.8% of the total. The mean ROA is 16.43%, while the mean ROE is 18.26%. This group is a paradigm of strong financial efficiency and a substantial contribution to revenue and profit.

The group, which consists of eight small companies with the NPM range of 10-20%, has an average NPM of 16.32%. The total operating revenue of the aforementioned entities amounts to EUR 41.844 million, constituting 22.9% of the aggregate revenue. The group holds total assets valued at EUR 64.110 million, representing 16.0% of the total. The company's financial contribution to the net profit is €6,558 million, which constitutes 17.4% of the total. The mean ROS for this group is 16.55%, while the mean ROA and ROE are 11.32% and 12.81%, respectively. Despite their reduced scale, these groups contribute significantly to overall profitability.

The proportion of units with a NPM greater than zero is indicative of the collective total operating revenue of all units with a NPM greater than zero, which is 182,943 million euros. The total assets of the group are valued at EUR 401.637 million, and the aggregate net profit attributable to these business units amounts to EUR 37.687 million. These figures underscore the pivotal function of profitable companies in maintaining financial stability of the entire industry.

We distinguished two groups of companies with a negative NPM.

The NPM range from –15% to –10%. This group consists of two micro-companies, with a mean NPM of –18.18%. Their total operating revenue amounts to EUR 53.6 million, constituting 43.8% of the aggregate revenue of unprofitable firms. The group's total assets amount to EUR 26.840 million, which is 43.8% of the total. However, their contribution to net loss is much less, EUR -270 thousand, compared to EUR –3.372 million of the second group with NPM less than -150%. This group has been identified as experiencing moderate financial struggles, with revenue insufficient to cover costs and liabilities.

The NPM range from –15 % to –230%. This group also includes two micro companies, with a mean NPM of -196.29%. The total operating revenue of the aforementioned entities amounts to EUR 1.485 million, constituting 46.4% of the total revenue. The group's total assets stand at EUR 247.142 million, which is 56.2% of the overall assets of unprofitable units. Their contribution to net profit/loss is notably negative, at EUR -217.52 million. Both groups have all negative profitability ratios (ROA, ROA and ROE).

Table 17. Mean profitability ratios for Hungary, Poland, and Ukraine in 2016-2020

Ratio	Net profit margin, %					ROS, %					ROA, %					ROA, %				
Year	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016	2020	2019	2018	2017	2016
Hungary																				
Micro	9.2	9.4	11.7	15.3	8.4	10.2	10.8	12.7	15.6	9.4	4.7	5.1	6.1	7.0	3.8	7.2	8.4	7.2	10.1	5.2
Small	10.8	9.6	9.6	14.0	7.5	11.7	10.4	10.9	14.9	9.2	5.2	3.9	4.3	6.2	2.9	6.8	5.7	6.1	9.0	4.3
Medium	6.6	11.4	9.7	8.0	3.5	8.1	10.7	11.0	9.0	4.2	2.8	5.6	7.3	4.4	1.9	4.9	8.0	5.8	5.5	2.8
Poland																				
Micro	12.8	12.6	13.3	15.0	15.9	13.1	14.2	15.1	17.6	19.8	8.0	8.4	9.6	10.3	6.0	13.9	13.4	12.5	21.0	10.5
Small	6.8	4.5	3.9	6.5	3.4	7.8	5.7	5.1	6.6	3.4	3.3	2.6	2.2	3.3	1.5	4.8	4.7	4.2	6.1	1.8
Medium	8.9	–	–	1.8	–	7.7	–	–	2.6	–	3.9	–	–	1.9	–	6.1	–	–	3.9	–
Ukraine																				
Micro	0.5	9.6	18.9	17.1	16.4	13.8	11.3	18.4	17.6	28.1	0.2	5.0	13.4	11.4	8.4	0.3	5.4	12.1	12.2	9.2
Small	22.2	15.8	22.2	25.7	25.7	23.4	16.6	22.3	26.3	27.2	14.9	10.1	13.8	17.3	16.2	16.7	10.4	15.3	19.5	19.2
Medium	20.3	14.9	13.9	31.3	29.9	21.0	16.8	15.2	33.8	12.3	12.7	8.3	14.8	17.2	17.2	14.8	10.2	5.7	21.0	22.5

Source: own calculations based on EMIS sample

The following analysis will examine the dynamics of profitability indicators of enterprises generated profits. In order to circumvent any potential distortion of the data, it is better to exclude companies that exhibit exceedingly high (frequently, one-off) profitability rates that surpass 50%. The data is categorised by company size, namely micro, small, and medium-sized enterprises. The subsequent section presents a detailed analysis of the dynamics observed in the three countries, followed by a comparative analysis (Table 17).

Hungary

Micro enterprises: the net profit margin exhibited an upward trajectory from 8.4% in 2016 to a peak of 15.3% in 2018, subsequently declining to 9.2% in 2020. In a similar fashion, the ROS increased from 10.2% in 2016 to 15.6% in 2018, but then decreased to 10.8% in 2020. ROA exhibited a similar trend, climbing from 5.2% to 7.0% and later dropping to 4.7%. ROE exhibited considerable volatility, attaining 10.1% in 2018 before undergoing a decline to 3.8% in 2020.

Small-scale companies: the profitability ratios of these companies exhibited a divergent pattern. The NPM demonstrated a downward trend from 14.0% in 2016 to 9.6% in 2018, subsequently increasing to 10.8% in 2020. The ROS demonstrated relative stability, exhibiting a marginal decline in 2018 before demonstrating an upturn, reaching 11.7% in 2020. ROA witnessed a decline from 6.2% in 2016 to 4.3% in 2018, yet demonstrated an improvement to 5.2% in 2020. ROE exhibited a similar trend, reaching its lowest point at 6.1% in 2018 before demonstrating a slight increase.

Medium-sized companies. The group's performance exhibited a consistent decline over time. NPM fell from 8.0% in 2016 to 6.6% in 2020, while ROS declined from 10.7% to 8.1% over the same period. ROA decreased from 7.3% in 2016 to 2.8% in 2020, indicating a decline in asset efficiency. ROE, however, underwent a more precipitous decline, reaching a mere 1.9% in 2020.

Poland

Micro companies. Poland's micro enterprises demonstrated relatively consistent profitability. The NPM demonstrated a modest decrease from 15.9% in 2016 to 15.0% in 2018, subsequently decreasing to 12.8% in 2020. ROS followed a similar pattern, peaking at 17.6% in 2017 before declining to 13.1% in 2020. ROA increased to 10.3% in 2017, but by 2020 it had settled at 8.0%.

For small enterprises, profitability ratios remained stable but modest. NPM demonstrated a marginal decline, decreasing from 6.5% in 2017 to 3.9% in 2018, before exhibiting an upturn to 6.8% in 2020. ROS followed this trajectory, reaching 7.8% in 2020. ROA demonstrated stability, reaching approximately 3.3% by 2020.

Five years have seen an improvement in medium-sized enterprises in Poland. Their NPM rose steadily from 1.8% in 2017 to 8.9% in 2020, while their ROS increased from 2.6% in 2017 to

7.7% in 2020. ROA exhibited a consistent improvement, reaching 3.9% by the conclusion of the 2020 financial year while making only 1.9% in 2017.

Ukraine

Micro companies. Ukraine's micro businesses demonstrated a decline in profitability, with the NPM decreasing from 16.4% in 2016 to 0.5% in 2020. ROS followed suit, dropping from 28.1% to 13.8%. The return on assets (ROA) fell from 16.2% to 14.9%, while the return on equity (ROE) experienced the most precipitous decline, dropping from 9.2% in 2016 to just 0.3% in 2020.

Small companies. A downward trend characterised their performance. NPM fell from 25.7% to 22.2%, while ROS declined from 27.2% to 23.4%. ROA decreased slightly from 16.2% in 2016 to 14.9% in 2020, while ROE experienced a change from 19.2% to 16.2%.

Medium-sized companies. The profitability of the company declined more severely in this sector, with NPM decreasing from 29.9% in 2016 to 20.3% in 2020. On the contrary, ROS demonstrated eventual growth, leaping from 12.3% in 2016 to 33.8% in 2017, then back to 15.2% in 2018, but increased up to 21% in 2020. The return on assets ratio diminished from 17.2% to 12.7%, while the return on equity ratio declined from 22.5% to 14.8%, thereby reflecting the group's unsuccessful financial returns.

Hungary demonstrated robust profitability among its micro companies; however, a persistent decline was observed among its medium enterprises over time. The performance of small companies was found to be mixed, with a slight recovery observed in 2020. Poland demonstrated a more stable trend across all company sizes, with small and medium enterprises improving in recent years, particularly in terms of NPM and ROE. However, Ukraine experienced a marked downward trajectory across all company sizes, with consistent declines in profitability ratios from 2016 to 2020.

Poland's micro enterprises maintained the highest profitability levels among the three countries, peaking at an NPM of 15.9% in 2016, while Hungary's micro firms demonstrated greater fluctuations. Conversely, Ukraine's micro and small businesses experienced a marked deterioration, characterised by declining asset returns and profit margins.

Medium-sized enterprises in Poland (but they are very few, as we remember) demonstrated the most substantial financial enhancement, exhibiting an improvement in profitability from 2016 to 2020. Conversely, Hungary and Ukraine demonstrated a decline in performance, particularly with regard to ROA and ROE, suggesting challenges in achieving optimal asset efficiency. A comprehensive analysis of the data reveals that Poland exhibited the most stable profitability dynamics. In contrast, Hungary and Ukraine demonstrated increasing volatility and declining returns, a trend that was particularly evident among medium-sized businesses.

3.4. CORRELATION ANALYSIS

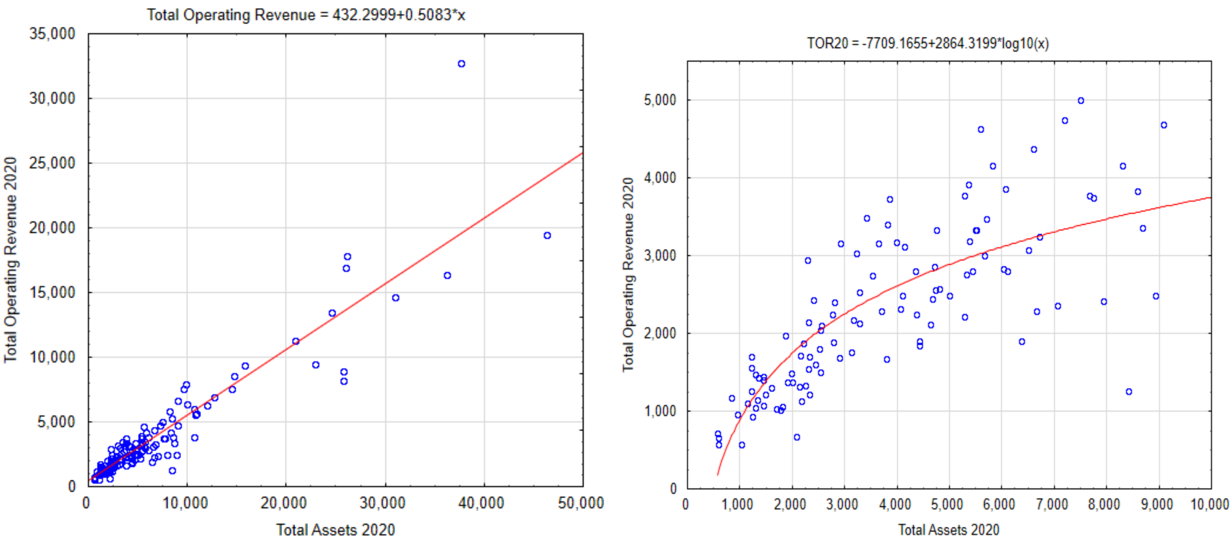
It is hypothesised that the magnitude of the enterprise exerts a favourable influence on its productivity, given that economies of scale are advantageous for industrial enterprises characterised by a substantial asset base (SAMUELSON and NORDHAUS, 2009). The most prominent agricultural enterprises are predominantly complexes of so-called closed production, wherein products are cultivated and processed within the same complex.

A specific term has been coined to denote an enterprise that provides an integrated processing cycle for crop and livestock products, encompassing the cultivation of crops and animals, and the subsequent packaging of finished products under its own brand. It is acknowledged that certain processes within this process chain may be outsourced, with the overall coordination of these processes being centrally managed.

The analysis is based on the correlation between the size of the enterprise (total assets) – the independent variable – and sales in the finished goods market (total operating revenue) – the dependent variable, for 2020 and the average figures for 2016-2020. The findings indicate that asset size exerts the most significant influence on Ukrainian firms, while its effect on Hungarian firms is comparatively less pronounced. The model described by the logarithmic equation yielded optimal results for small and micro enterprises with a book value of up to EUR 3 million and total operating revenue of up to EUR 2 million. However, it was observed that as the enterprise size increased, the distribution of enterprises became more heterogeneous. It is noteworthy that over half of the large and medium-sized enterprises demonstrated effective asset utilisation and generated commensurate revenues.

In the context of Poland, there appears to be an absence of a direct correlation between firm size and productivity. Although the general model is described to some extent by a logarithmic equation, and the performance of SMEs is described by a direct regression, the dispersion is too high. It is acknowledged that management efficiency may be a contributing factor to deviations from the general trend observed in a limited number of enterprises; however, it is postulated that market conditions in Ukraine are predominantly conducive to large enterprises. In Hungary, this is evidenced to a lesser extent, and Poland has been observed to establish equitable conditions for enterprises of all sizes (Figure 13).

Hungary



Poland

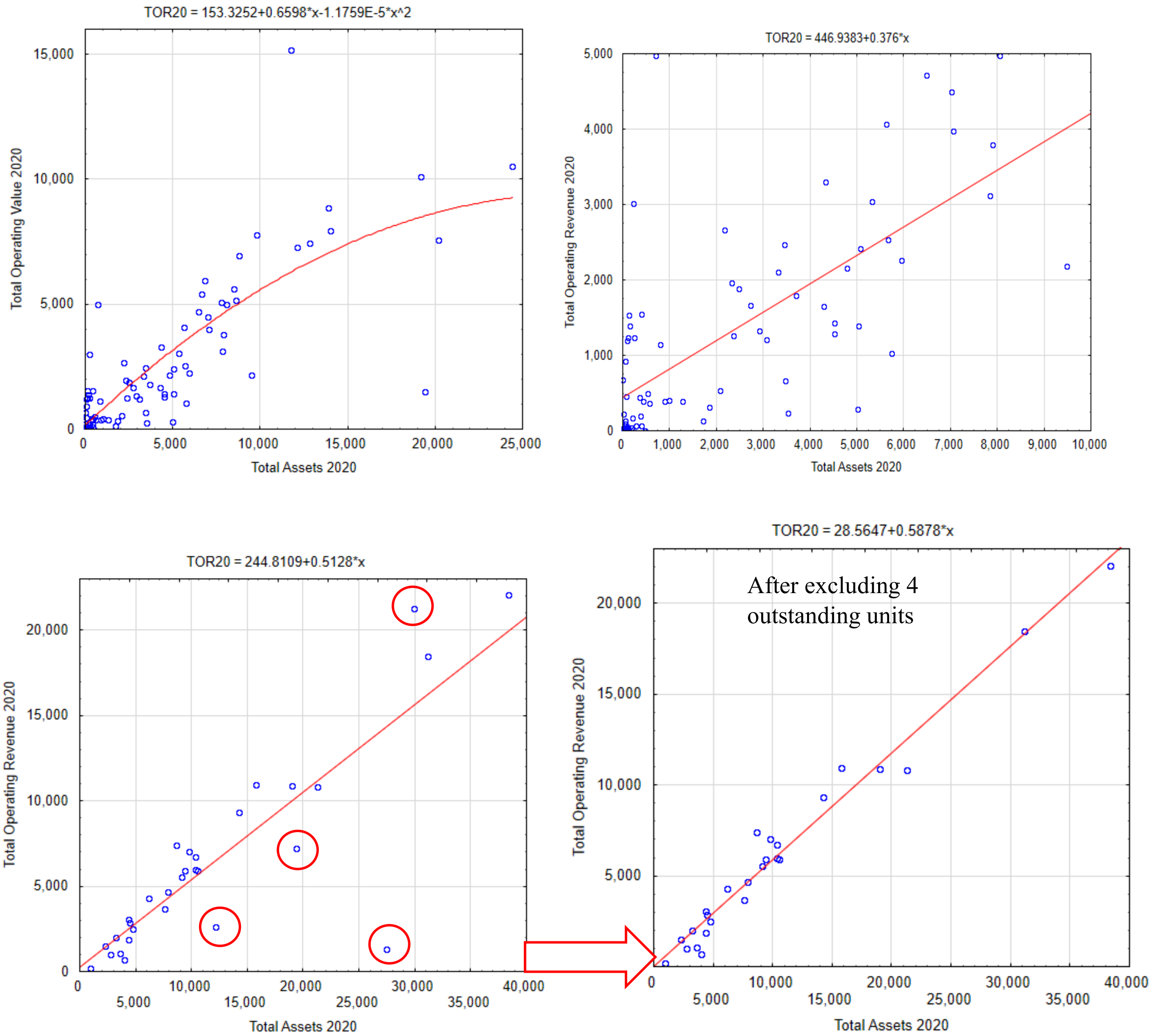


Figure 13. The dependency of total operating revenue on total assets in EMIS sample by country, 2020 *Source: own calculations based on EMIS sample*

In Ukraine, total operating revenue obtained from the official statistical sources differs from gross sales because of excluding the mentioned line from the financial statement, sales are shown after subtracting the volume of VAT and excise tax. So, the so-called R-ratios (ROA, ROS, ROE) pre-calculated by the enterprise itself are a bit higher. Theoretically, gross sales can be taken out of the fraction as ROS and total operating revenue are reported, but it would be more correct methodologically to use the same indicators from the EMIS database for countries' comparison.

It is logical to assume that there is a link between the value of assets (the total size of the company) and its profitability. For example, the article FONSECA et al. (2022) sets a primary research question whether firm size is a determining factor of profitability for new firms, and if increased size is necessary for achieving profitability. The authors say that despite the long-standing interest in the relationship between size and profitability, the extant empirical evidence is mixed and inconclusive. They have evaluated the effects of size on the profitability of newly established firms in their first years of business. Their findings demonstrate that firm size exerts a positive influence on the profitability of new firms, and an increase in the number of employees has a positive effect on the return on assets.

Work MARGONO et al. (2021) proves that the size of the company, its leverage, profitability and dividend policy have a simultaneous effect on the company's value. The hypothesis that firm size exerts an influence on company value is refuted by the evidence. The authors demonstrate that there is a positive correlation between the application of leverage and the enhancement of company value. It is noted that a company's profitability exerts a favourable influence on its overall value, and a company's dividend policy has a positive impact on its value. The coefficient of determination of 0.917 indicates that firm size, leverage, profitability and dividend policy have a significant impact on firm value, accounting for 91.7% of the variance.

The findings ALARUSSI et al. (2023) demonstrate a positive and significant relationship between firm size, working capital and intangible assets on the one hand, and profitability (return on assets and earnings per share (EPS)) on the other. Positive working capital is of significance in the reduction of the cost of capital and the enhancement of companies' profitability. Intangible assets have also been demonstrated to be a pivotal factor in enhancing profitability, primarily due to their low cost. Furthermore, the article demonstrates a negative and significant relationship between liquidity and profitability, indicating that companies experience diminished profit due to the inefficient utilisation of liquid assets. The data processed from annual reports of non-financial Chinese listed companies on the Shanghai stock exchange of 100 companies during the period of 2017-2019 prove that the debt ratio makes a positive and significant correlation with ROA, but not with EPS. Conversely, the leverage ratio exhibits a strong but negative correlation with ROA, yet no correlation with EPS. The findings of this study corroborate the inverted U-shaped relationship between leverage and profitability, a relationship which is contingent upon the balance between the benefits and costs of debt.

Our objective is to test the hypothesis that the larger the company, the more profitable its operations are. We must establish a proportional relationship between net profit and the book value of the company (as well as between ROS and book value), or refute the hypothesis. Initially, we will examine the financial data for 2020 (a particularly pertinent year given the impact of the pandemic, which caused many small and medium-sized enterprises to face bankruptcy and required state support to survive). We will also analyse the average figures from 2016 to 2020. Figures 13-17 shows the data for three countries. In the absence of preliminary standardisation of the data and the exclusion of outliers, the coefficient of determination (R^2) for Ukrainian firms is 0.4324, indicating that 43.24% of all net profit values can be predicted by book value. The exclusion of outliers from the model is recommended in order to enhance the reliability of the results (with total assets in between EUR 15-20 million and net profit less than EUR 1 million) and those with net loss, R^2 boosts to 86.93% for 2020, proving the strong linear dependence. It's interesting to note that the 2020 figures are more inclined to linear regression for the group of SME and large-scale medium ones (an area delineated with total assets < 15 mln and total operating revenue < 2 mln), while several larger companies can be better depicted by the exponential equation. Almost the same is true for the 2016-2020 averages, after having excluded only two outstanding units from the model (the one with EUR 30 to 35 mln total assets and net loss up to 1 mln, and a very profitable on with total assets in between 20-25 mln and net profit over 5 mln), R^2 increases from 36.5% to 77.64%. The difference is that smaller enterprises are better depicted by the polynomial function (however, the linear can be used as well, while the larger entities demonstrate clear linear dependency. As for ROS/total assets relationship in 2020, a linear dependency was obvious from the first glance when the chart is zoomed out, nevertheless, the coefficient of determination was poor; after having deleted 3 outstanding units R^2 increased from 0.0074 (which theoretically eliminates the existence of regression) to 14.37% (still too low). Finally, after having deleted 3 units with negative ROS (consequently, which made losses in 2020), R^2 made 6.29%. Thus, there is no correlation between ROS and total assets, at least if not to cluster the cases. For some group (outlined in green) the dependency might be found, but it stands for the next step, cluster analysis, which will prove that the dairy enterprises in Ukraine are not homogeneous in scale of profitability – the last does not depend exclusively on the unit's size. After the final data cleansing, R_2 was still extra low – only 19.91%

The subsequent stage of the research will involve the testing of the model by first standardising the data. By tracing the dynamics of the relationship between the book value of the enterprise and its net profit and sales, it is observed that for Ukrainian enterprises the greatest dependence is between total operating income (y, dependent variable) and total assets (x). The highest coefficient of determination was observed in 2019, at 78.99% for the entire set of enterprises studied and 93.56% for the model excluding outstanding units. The lowest value is more challenging to ascertain, with R^2 standing at 7.16% in 2016. However, upon excluding two enterprises from the sample, R^2 escalated to 90.53%. In the 2017-2018 period, an average of 45% of all companies exhibited a direct dependence of gross income on asset value, and following the removal of 2-3 outliers, R^2 increased to 86-88%.

Conversely, net profit exhibited a lesser correlation with the magnitude of the enterprise. When excluding companies with markedly divergent values, a pronounced fluctuation in the degree of dependence emerges over a five-year period. This oscillates from 7% in 2016 (indicating complete independence) to a pronounced increase to 30.48% in 2017, followed by a sharp decline in 2018 to 11.13%, and a notable rise in 2019 to 37.22%. Notably, in 2019, R^2 attained 43.24%. Upon the elimination of outstanding units, a wholly distinct dynamic becomes apparent: a marginal decline in 2017 to 26.62%, yet the dependency remained relatively stable in the 2016-2018 period at 33%. Thereafter, it underwent a substantial increase in 2019-2020, reaching 54.59% and 77.65%, respectively (Figures 14-15).

Ukraine

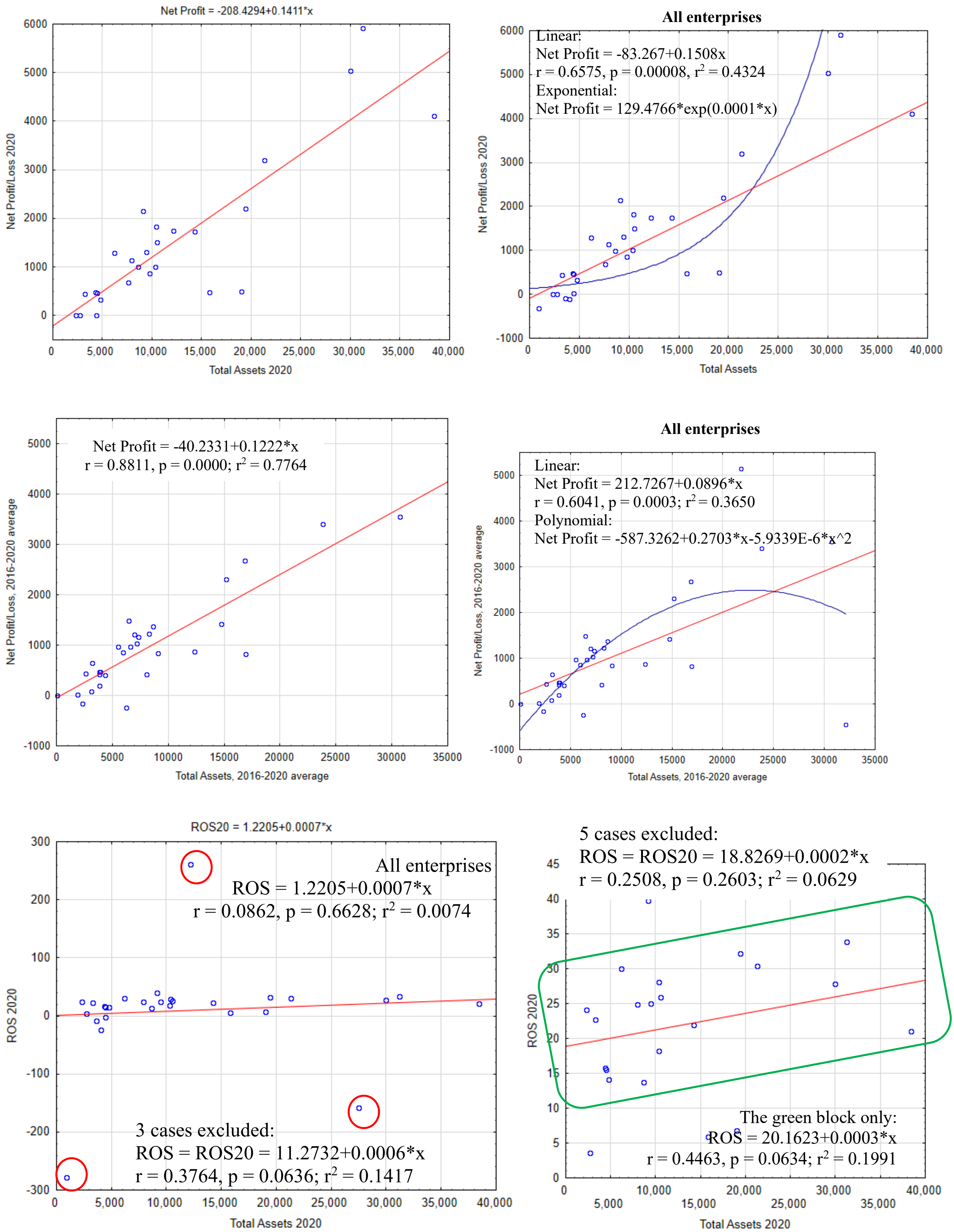
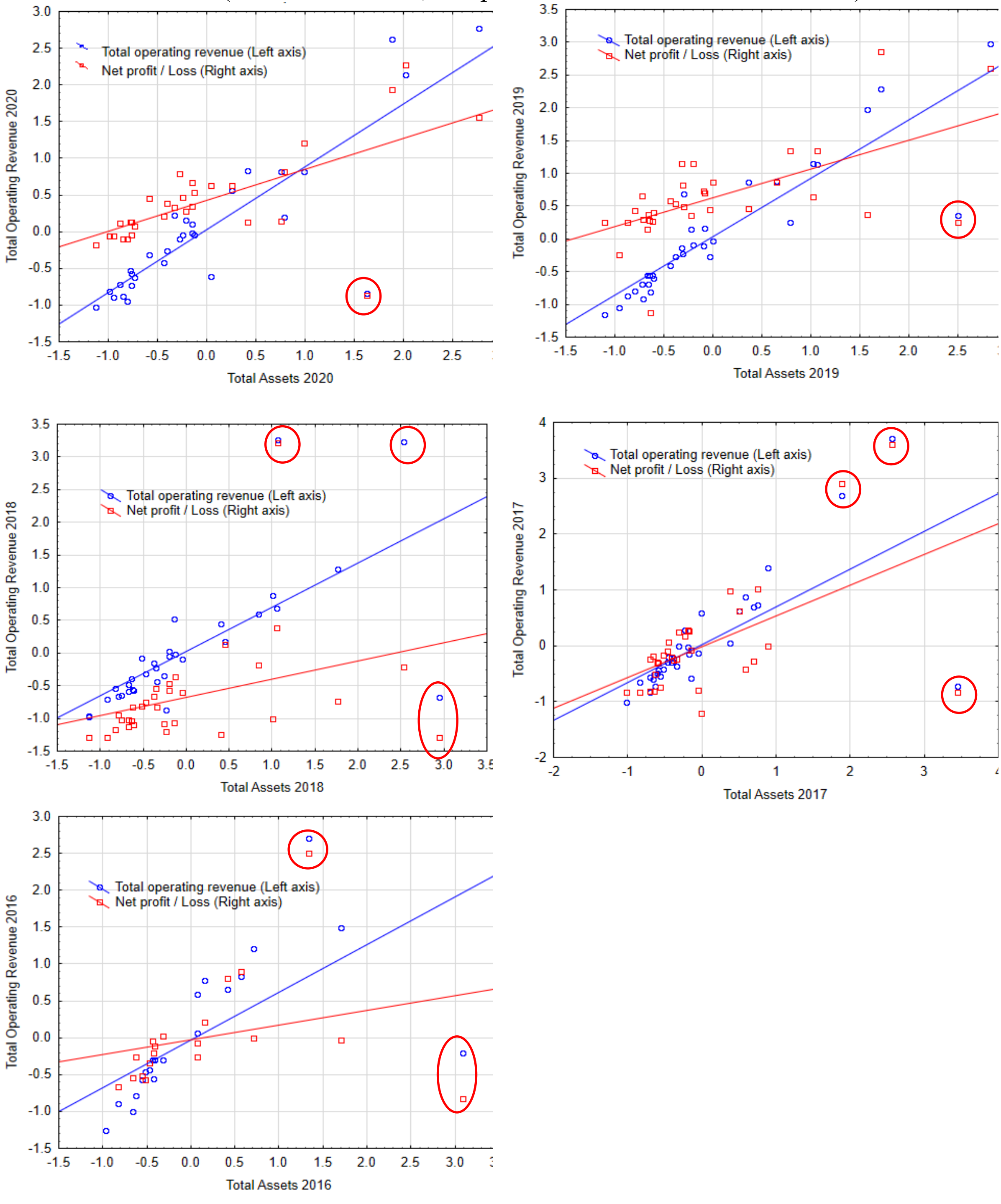


Figure 14. The dependency of net profit/losses and ROS on total assets, Ukraine

Source: own calculations based on EMIS sample

Ukraine (Standardized data, independent variable "x" = Total assets)



Indicator	2016	2017	2018	2019	2020
Total operating revenue	-0.0299+0.6463x	0.0246+0.6762x	0.0252+0.6759x	0.0272+0.8911x	0.0288+0.8564x
R, p	0.6466, 0.0015	0.6728, 0.00002	0.6723, 0.00003	0.8888, 0.0000	0.8530, 0.00000
R^2	0.4180	0.4527	0.4520	**0.7899**	0.7276
Net profit / Loss	-0.0411+0.2694x	-0.0177+0.5527x	0.0601+0.5826x	-0.0213+0.6128x	-5.7887E-17+0.6575x
R, p	0.2675, 0.2681	0.5521, 0.0011	0.3335, 0.0667	0.6101, 0.0002	0.6575, 0.00008
R^2	0.0716	0.3048	0.1113	0.3722	***0.4324***
Outstanding cases excluded	2	3	2	1	1
Total operating revenue	0.0825+1.1744x	0.1135+1.0457x	0.0652+0.9298x	0.1108+1.0835x	0.1148+1.0012x
R, p	0.9515, 0.0000	0.9302, 0. 0000	0.9412, 0.0000	0.96737, 0.0000	0.9617, 0.0000
R^2	0.9053	0.8653	0.8858	**0.9356**	0.9248
Net profit / Loss	0.0859+0.5177x	-0.0693+0.5326x	-0.1004+0.3459x	0.555+0.8277x	0.1178+0.8559x
R, p	0.5822, 0.0142	0.5159, 0.0042	0.5704, 0.0012	0.7388, 0.0000	0.8812, 0.0000
R^2	0.3389	0.2662	0.3254	0.5459	***0.7765***

Figure 15. The dependency of sales and net profit/losses on total assets in, Ukraine

Source: own calculations based on EMIS sample

In 2020, a negligible correlation was observed between net profit and asset size for Hungarian enterprises, with only 20% of enterprises demonstrating a direct proportional relationship. Notably, within the group of small and micro enterprises (with a book value of up to EUR 10 million and net profit of up to EUR 500 thousand, net loss of up to EUR 300 thousand), the degree of correlation decreased by twofold. Furthermore, for enterprises with a net loss of up to -300 thousand EUR, the degree of dependence decreased by a factor of 2, with the coefficient of determination standing at a mere 10.11%. This indicates that, in the case of microenterprises, the size of assets had no discernible impact on the absolute value of net profit (loss). The exclusion of unprofitable enterprises from the model did not contribute to the enhancement of the result, as the scatterplot remained dispersed.

A similar scenario is observed in the average figures for 2016-2020, with R^2 showing a modest 3% increase for the group of small and micro enterprises (with a book value of up to EUR 10 million and net profit of up to EUR 600 thousand, net loss of up to EUR -400 thousand). However, upon excluding the four loss-making outstanding enterprises, the coefficient of determination increased to 24.14%, which, while not sufficient to confirm a direct relationship, does suggest that for a quarter of small and micro enterprises, the size of net profit is determined by the size of assets.

For Hungarian enterprises, no direct relationship between book value and return on sales (ROS) was identified, either for the annual average model or separately for the year 2020. It can be hypothesised that an indirect inverse relationship may exist for a micro-sample of 10 medium-sized companies with a book value of more than EUR 20 million. It is noteworthy that this relationship is decreasing; that is to say, with an increase in company size from 20 to 30 million euros, the return on sales (ROS) begins to decline sharply proportionally, from almost 40% to 0, and for five companies with assets over 30 million, the return on sales does not rise above 10%. This is a negative trend, and it could be recommended that dairy companies located in Hungary should not increase their book value above EUR 30 million, as the 5 largest companies used their assets extremely inefficiently. Conversely, there is a notable example of small enterprises that have attained an average annual profitability of 20% or more, despite possessing assets of less than EUR 10 million (Figure 16).

Hungary

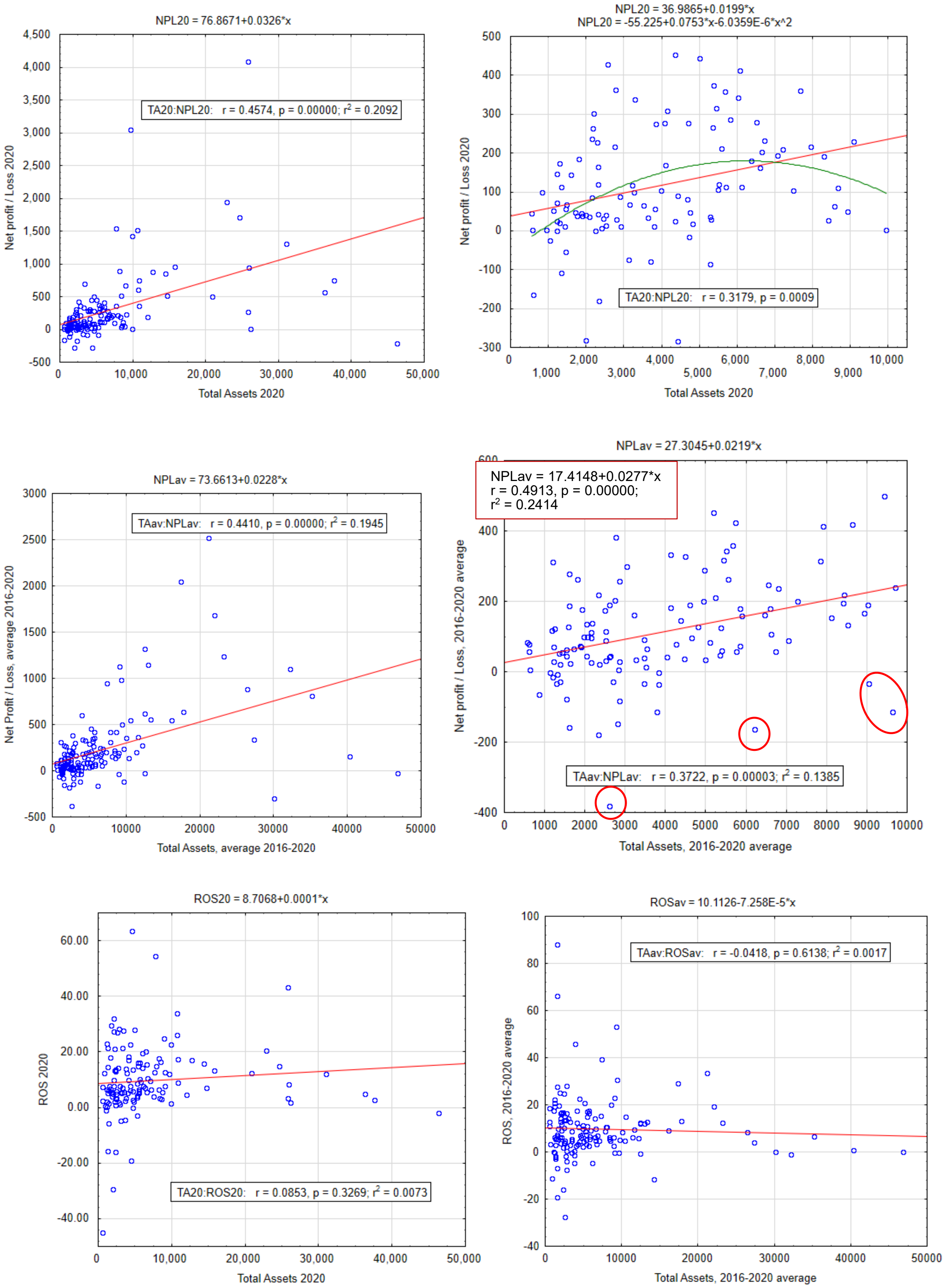


Figure 16. The dependency of net profit/losses and ROS on total assets, Hungary

Source: own calculations based on EMIS sample

During the period 2016-2020, Hungarian enterprises exhibited a notable tendency to exhibit a relatively high degree of dependence of their total operating value on total assets (in 2016, 2018-2020 at the level of 85-88%, only in 2017 the coefficient of determination decreased to 78.55%). Conversely, the degree of dependence of absolute net profit exhibited significant fluctuations, ranging from just over 20% in 2019-2020 (after the exclusion of four atypical enterprises – 34-37%), while in 2016-2017, R^2 did not exceed 1% and only reached 11% in 2018. However, in 2017, following the exclusion of a single outlier, 27.64% of companies exhibited a net profit that was contingent on book value. It is noteworthy that the removal of a single enterprise from the 2018 sample resulted in a deterioration of the model parameters, as evidenced by a decline in the coefficient of determination for total operating value. Furthermore, in 2016, the exclusion of a number of enterprises was necessary in order to adjust the dependence of net profit on the value of assets. In the Hungarian dairy industry, for instance, the correlation between sales and assets is significant; however, it is unfeasible to predict net profit based on total assets. It is important to note that, in contrast to the situation in Ukraine, where it was possible to employ non-linear models or to divide enterprises into groups, in Hungary, if the indicators are highly scattered, this method will not be effective. The size of the enterprise exerts a less significant influence on financial outcomes in Hungary than in Ukraine.

A similar situation is observed in Poland, where this relationship is even weaker. For instance, in 2020, a mere 16.5% of enterprises had assets as a determinant of net profit (after excluding two loss-making enterprises from the sample, this figure rose to 34%, but it is still much lower than in Ukraine (43%) and Hungary (20% of the total sample). The average annual figures for 2016-2020 demonstrate an even lower degree of dependence, with figures of 11.72% and 24.66% respectively, the latter being after the exclusion of three cases. It is impractical to separate enterprises by asset size, as was done for Hungary and Ukraine, due to the large dispersion. The mean annual return on sales (excluding two loss-making enterprises with ROS of -13.8 thousand per cent and -2.6 thousand per cent, as well as four units with ROS > 100 per cent) demonstrates an absence of correlation within the group of small and micro enterprises with total assets < EUR 5 mln. Conversely, for small enterprises that are proximate to medium-sized and medium and large enterprises with a book value of more than EUR 5 million, the value of profitability exhibits a precipitous decline, while a certain correlation is already evident. Excluding two more enterprises from the sample (with sales profitability of approximately 35% and -10%), despite the absence of correlation (R^2 increased twice to 0.86%, though this value is statistically insignificant), certain limits can be delineated. For instance, the majority of profitable enterprises with a book value in excess of EUR 5 million exhibited an average annual return on sales of less than 10%. This finding indicates that medium and large enterprises in the Polish dairy industry demonstrate an inefficient asset utilisation pattern when benchmarked against small companies. Conversely, a profitability of 10% is regarded as adequate for manufacturing companies. However, when examining relative performance indicators to assess the investment attractiveness of companies, small companies emerge as more appealing (Figures 17-18).

Poland

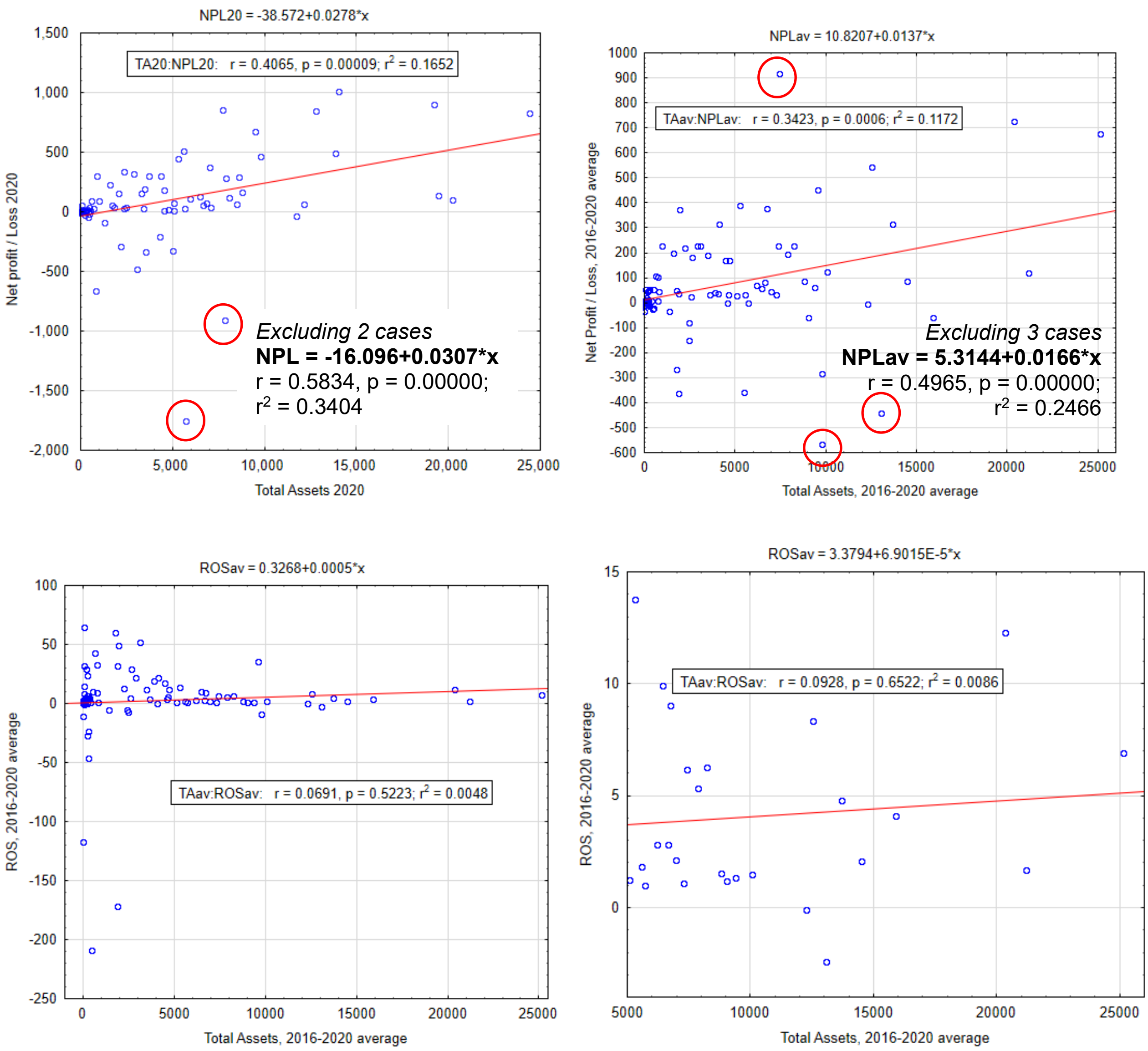
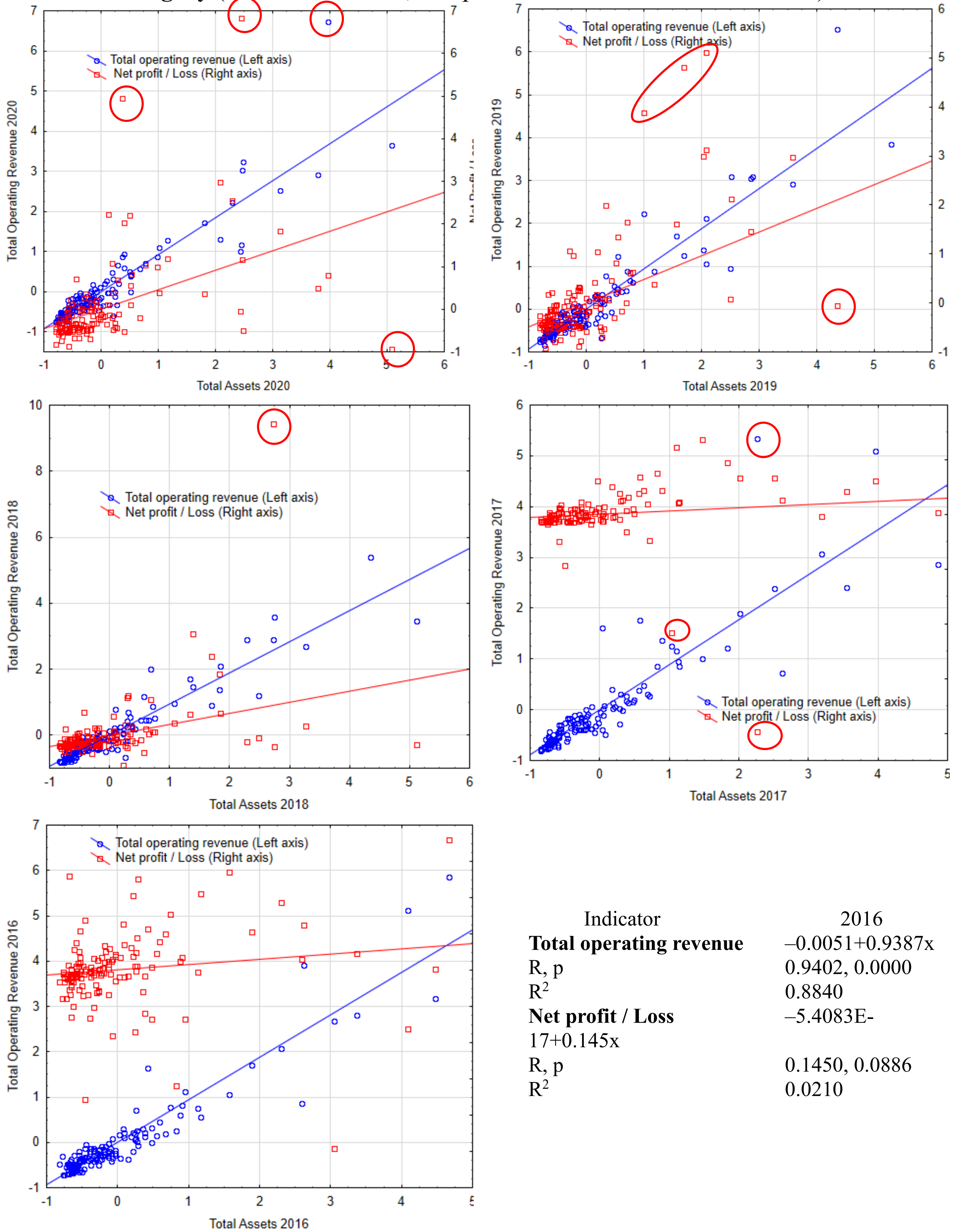


Figure 17. The dependency of net profit/losses and ROS on total assets, Poland

Source: own calculations based on EMIS sample

Hungary (Standardized data, independent variable "x" = Total assets)

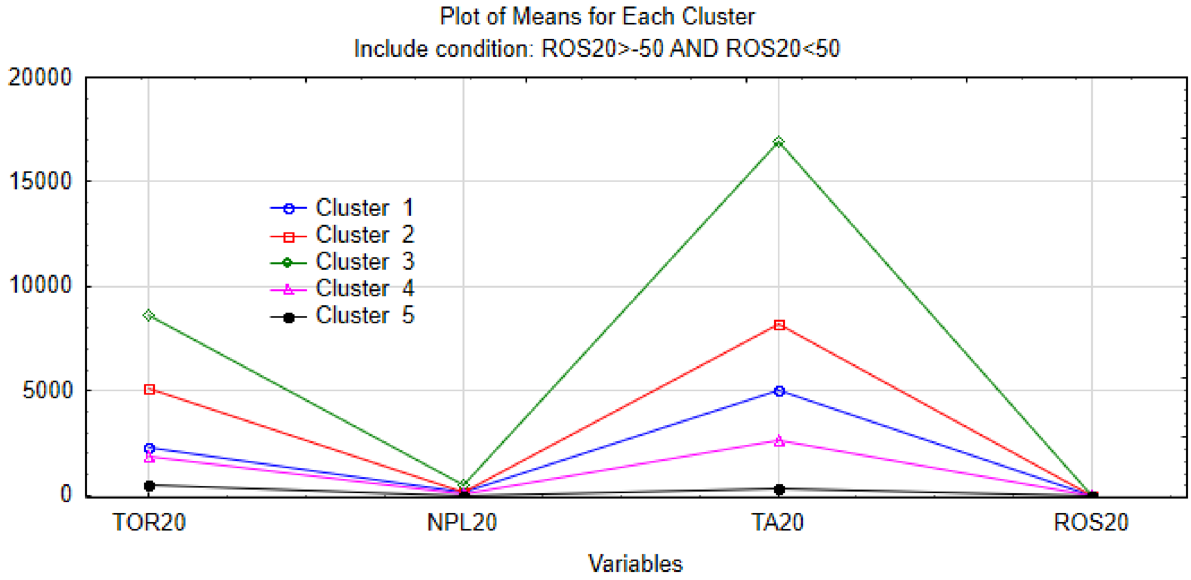


Indicator	2016
Total operating revenue	–0.0051+0.9387x
R, p	0.9402, 0.0000
R^2	0.8840
Net profit / Loss	–5.4083E-17+0.145x
R, p	0.1450, 0.0886
R^2	0.0210

Figure 18. The dependency of sales and net profit/losses on total assets, Hungary

Source: own calculations based on EMIS sample

Given the absence of correlation between sales, net profit/losses and total assets for Polish companies, the utilisation of cluster analysis is more appropriate for the identification of analogous groups within these companies. Using the 2020 indicators, 4 clusters (groups of companies) were identified, which were expected to form according to asset size and market size, although the values of the classification parameters differ slightly from those recommended by the European Commission for determining the size of companies. The initial sample was excluded from six enterprises with ROS values outside the ±50% range (Figure 19).



Variable	Exclude condition: ROS20<-50 and ROS20>50				
	Cluster No. 1	Cluster No. 2	Cluster No. 3	Cluster No. 4	Cluster No. 5
Number of cases	11	15	8	12	25
Total operating revenue	2322.64	5092.13	8639.37	1903.25	486.92
Net profit / Loss	134.27	182.53	535	67.67	9.16
Total assets	5015.18	8196.6	16962.13	2672.25	344.48
ROS	6.19	5.27	8.79	12.32	4.91

Figure 19. Cluster means for Polish dairy enterprises, 2020

Source: own calculations based on EMIS sample

Cluster 5 comprises the largest number of enterprises, which are predominantly microenterprises with low asset values and the lowest return on sales (ROS) of just 4%. The subsequent category comprises small and micro enterprises, which, on average, possess book values of EUR 2-3 million, while exhibiting a ROS of 12%. Consequently, microenterprises demonstrate the lowest profitability within the Polish market, whilst small enterprises show a much better performance. It is noteworthy that medium and large enterprises with an asset value of EUR 16.96 million on average, an average profit of EUR 535 million, and an ROS of 8.79% demonstrate the most favourable performance.

3.5. MILK PRICE ANALYSIS: TRENDS AND DETERMINANTS

This chapter analyses milk price developments from 2014 to 2024 across the European Union (EU), focusing on Poland, Hungary, and Ukraine. Based on EUROSTAT data (2025), it highlights market dynamics and price trends in these regions. Due to the lack of Ukraine's data in EUROSTAT, insights from regional sources were included (UKRAINIAN MILK PRODUCERS ASSOCIATION, 2025).

Hungary's milk prices increased from €33.10 per 100 litres in 2014 to €43.57 in 2024, driven by EU integration, improved production efficiency, and rising costs due to climate-related impacts on yields. Poland's prices rose from €32.87 to €50.15, supported by strategic investments and adherence to EU policies, though 2024 saw higher costs reducing profitability.

Ukraine's milk prices fluctuated, starting at €22.58 in 2014, peaking at €55.82 in 2019, and stabilizing at €46.90 in 2024. This volatility stemmed from a full-scale war and economic instability, impacting production and competitiveness. A 20% price surge in late 2023 challenged Ukrainian cheese exports against Polish imports.

The EU's average milk price increased from €37.73 in 2014 to €48.06 in 2024, influenced by market stabilization policies. However, the year 2024 saw regional inconsistency, with Ireland experiencing a 15% rise while Finland (-12%), Portugal (-10%), and Spain (-8%) faced declines. Overall, 2014-2024 was transformative for the dairy sectors in Poland, Hungary, Ukraine, and the EU. Poland and Hungary benefited from EU integration, while Ukraine showed resilience despite external pressures.

3.5.1 Comparative analysis of milk prices in Ukraine, Poland, Hungary and the EU

The overall European milk market significantly surpasses the Eastern European market in terms of revenue and size. Europe is projected to generate US$60.77 billion in 2025, while Eastern Europe accounts for US$12.34 billion, which is just over 20% of the entire European market. The revenue inconsistency reflects both the higher consumption levels and the more developed dairy industry in Western European countries, where demand for premium dairy products, organic milk, and value-added dairy products is stronger.

However, when given the capacity of development, Eastern Europe is experienced more CAGR (6.73%) than the growth rate of 4.66% of the European market. This indicates that while Europe has a mature dairy market, Eastern Europe is expanding at a rapid pace due to increasing demand, improving dairy production capabilities, and increasing investment in the dairy sector of the region.

It is worth noting that per capita milk revenue in Europe amounts to US$71.64, which is much higher than Eastern Europe's US$51.90. This fact establishes greater purchasing power in Western European countries combined with a higher preference for dairy products in the West. The average milk consumption per capita in Europe amounts to 45.4 kg, almost twice as Eastern Europe's 26.2 kg. The huge gap indicates significantly lower dairy consumption in Eastern Europe. This could be attributed to dietary habits, economic constraints, or the availability of dairy alternatives.

In production, milk output in Europe is projected to hit 40.93 billion kg by 2030, while Eastern Europe is expected to produce about 6.84 billion kg. Volume increase stands at 1.3% for Europe and 2.4% for Eastern Europe in 2026, hence showing the gradually increased production capacity within Eastern Europe. The trend thus posits that Eastern European countries are trying to increase the milk production volume, possibly encouraged through the injection of investments in modern dairy farming technologies and processing capabilities.

It is projected that by 2025, the revenue of the milk market in Ukraine will amount to nearly US$2.07 billion, while a compound annual growth rate (CAGR) of around 10.82% is expected to prevail from 2025 onward, until 2030. The per capita revenue is predicted to reach US$53.00 with an average per capita consumption volume of 27.8 kilograms. By the year 2030, the total market volume is expected to be around 1.38 billion kilograms, with a demand growth of 7.5% in the year 2026.

The dairy industry in Ukraine is undergoing a transformation, especially in the area of processing. As of January 1, 2024, the national dairy herd numbers 1.35 million cows, of which 390,000 are held on industrial farms and 960,000 are on private farms. Industrial farms are fundamental to Ukrainian dairy production, constituting 94.5% of the total processed milk. Industrial farms are expected to grow in number to 441,000 cows by 2025, raising total production by 50% to 3.45 million tonnes of raw milk each year.

Production growth notwithstanding, Ukraine had a troubled start in 2024, with 3% lower raw milk production than in 2023, at 7.2 million tons, which is down 17% from the 2021 level. Contributing to the decline were hot weather conditions in the summer and power blackouts due to missile attacks on energy infrastructure. Somewhat battling these factors, industrial farms managed to produce 3.1 million tonnes in 2024, which was 5% more than in 2023.

Historically quite volatile, prices for milk in Ukraine stood at €22.58 per ton in 2014, reached €55.82 per ton in 2019, and were again down to €46.90 per ton in 2024. Price changes were caused by a full-scale war and numerous economic challenges. In late 2023, milk prices rose

20%, which resulted in weakening the competitiveness of the local cheese against Polish imports, which triggered a price increase in Ukrainian cheese by 10%, while Polish products remained reasonably priced.

The Polish milk market revenue is expected to total $2.09 billion by 2025, after witnessing a CAGR growth of 4.72% in the years 2025-2030 per the estimates. Per capita revenue is estimated at $54.82, with an average consumption volume of 65.1 kg per person. The market volume is expected to reach 2.80 billion kg by 2030, with 2.7% volume growth expected in 2026.

Poland is equipped with a well-established dairy infrastructure and a strong tradition of dairy farming. This industry has recently acquired modern technologies and sustainable best practices aimed at achieving EU standards, giving Polish dairy products a competitive edge in the international market.

Milk prices in Poland climbed from €32.87 to €50.15 in 2024 thanks to strategic investments geared toward dairy farming and EU agricultural policy compliance. There were nevertheless problems in the early months of 2024, with lower milk output and higher production expenses sending raw milk prices drop to €47.93 per 100 litres.

The milk market in Hungary is expected to earn a revenue amounting to US$482.41 million in 2025 along with an expected CAGR of 6.87% for the period of 2025-2030. Per capita figures are expected to be US$50.08 while an average consumption volume is forecasted to be 54.7 kilograms per person. In 2030 the market volume is expected to grow to 636.73 million kilograms, including a growth of 3.9% in the year 2026.

Hungarian dairy sector engaged in modernization and efficiency improvements for increasing productivity. Government support is a crucial factor for the development of this industry as policies assist dairy farmers, improve infrastructure, and promote export. To his own advantages, Hungary can thus increase its dairy exports based on its strategic location in Europe.

Prices of milk generally in Hungary have risen from €33.10 per 100 litres in 2014 to €43.57 in 2024 due to this background, which is a function of deeper integration into the EU agricultural framework that brings improvement in efficiencies and market access. The extreme summer heat in 2024 caused a reduction in milk output, increasing production costs and purchase prices, thus affecting both producers and consumers.

The EU's average milk prices began at €37.73 in 2014 and reached €48.06 by 2024. However, 2024 presented mixed trends, with Ireland experiencing a 15% increase in milk prices, contrasting with declines in 16 other EU member states, including Finland (-12%), Portugal (- 10%), and Spain (-8%). This variation underscored regional variations within the EU's agricultural markets. Hungary and Poland show relatively steady price trends, with Hungary experiencing fluctuations between 2014 and 2021, reaching higher prices in 2022-2024. Ukraine's price is particularly unstable (Figure 20), with significant spikes in 2018 and 2021. The EU average follows a similar trend to Poland, showing overall price growth across the EU.

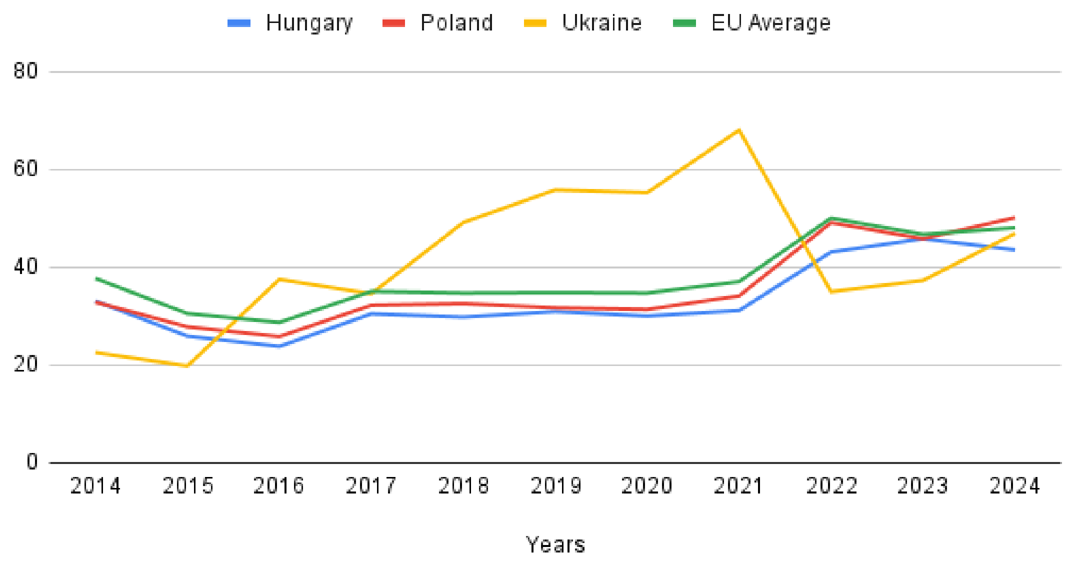


Figure 20: Average milk price trends for Hungary, Poland, Ukraine, and the EU (€ per 100 litres)

Source: Eurostat and own research for Ukraine's data

The average milk prices in the EU (Figure 21) exhibited strong ups and downs from 2014 to 2024, mirroring the price trends of other major dairy products. Milk prices reached €37.73 in 2014; for the most part, all other dairy products priced for the same were stable: butter (€315.84), cheddar (€317.86), and whole milk powder (WMP) (€316.18). Such an unprecedented drop was experienced in milk pricing in 2015 and 2016, when it fell to €28.73 in 2016, very much attributable to weak demand coupled with oversupply in the dairy sector. On the extreme, SMP fell from €309.32 in 2014 to €179.48 in 2016, and WMP went down to €232.79.

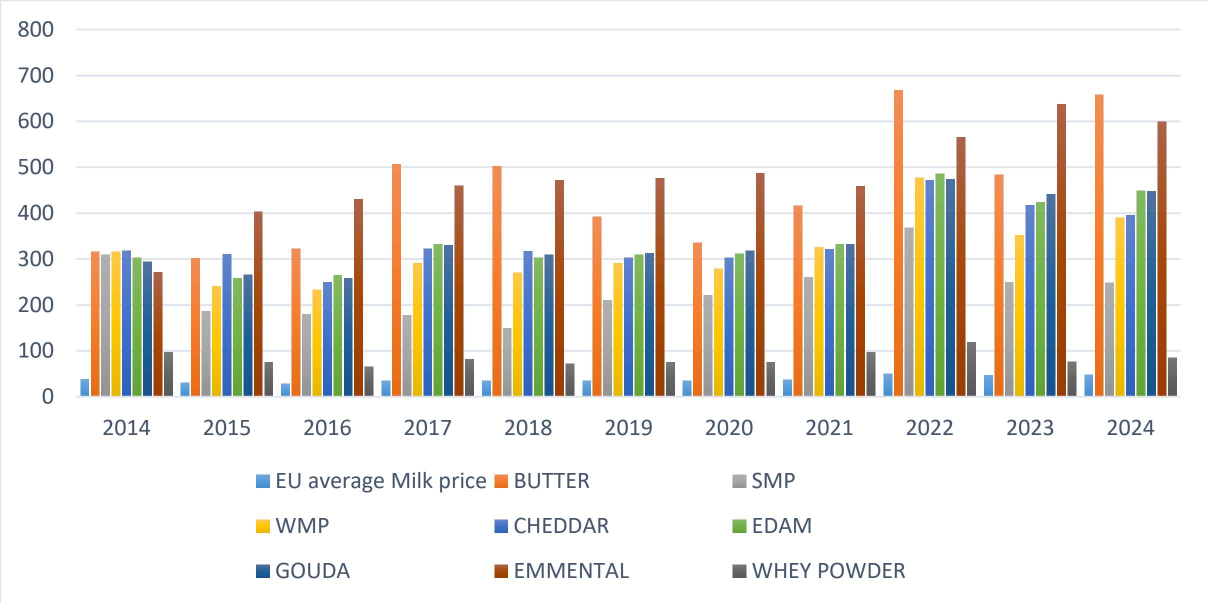


Figure 21: EU average milk price vs another dairy products price (€ per 100 kg)

Source: Eurostat data

A strong recovery began in 2017, with milk prices rising to €35.06, coinciding with a dramatic spike in butter prices, which surged to €506.06, reflecting increased global demand. Cheese prices, including cheddar (€322.75) and gouda (€330.25), also saw upward movement in that time. Between 2018 and 2021, milk prices remained mainly unaffected from their values of €34.73 to €37.06, except for a little upward movement in cheese prices. Butter continued to be very unstable, peaking again at €416.58 in 2021.

For the first time in 2020, the price hike occurred with the highest milk price: €50.06 in 2022. It is the maximum recorded price within the last ten years. Similar price hikes were found in dairy products, for example, butter, which sells an average of €667.77, cheddar, which sells an average of €471.42, and gouda, €473.73. Prices had relaxed somewhat in 2023, with milk costing €46.73, still more than before 2020, however.

The price of milk is anticipated to rally slightly upward to €48.06 in 2024. On the contrary, considerable values were maintained in some cheese types like Emmental (at €599.5) and gouda (at €447.5).

3.5.2 Factors influencing price formation in regional dairy markets

Over the past decade, the dairy markets of the European Union (EU) and Ukraine have experienced significant fluctuations due to various economic, political, and structural factors. A comparative analysis of milk prices from 2014 to 2024 discloses distinct trends and underlying reasons that have shaped the dairy industries in these regions.

From 2014 to 2021, Ukraine's milk prices were consistently lower than in Hungary, Poland, and the EU average. In 2014, Ukraine's price was €22.58 against an EU average of €37.73. This difference can be attributed to lower costs of production as opposed to varying structures in the market under which Ukraine operates. However, in 2016, the scenario changed, with Ukraine's price reaching €37.52 against the EU price of €28.73. The significant price increase was determined by internal market adjustments and external economic pressures.

Prices between 2018 and 2021 skyrocketed in Ukraine, with the peak price of €68.04 recorded in 2021, while the EU saw an average price of €37.06 during that period. Widespread labour shortages, power outages, and disruption of dairy processing plants amid geopolitical tensions and the full-scale war contributed to the price hike in Ukraine. Indeed, Ukraine witnessed a major decrease in its ability to process milk due to the loss of dairy processing plants, which plummeted from 178 in 2021 to around 110-112, as several plants operated in war-affected areas.

After 2021, the prices for milk dropped in Ukraine to €35 in 2022 and stayed below the EU average of €50.06. This depreciation resulted from oversupply of raw milk and a slump in domestic demand, which led to a major drop in purchase prices. The average purchase price of extra grade milk in Ukraine, in May 2024, was UAH 13.99 per kilogram excluding VAT, moving down from the previous month.

Year in and year out (Figure 22), significant fluctuations have occurred between annual price gaps existing between Ukraine and the EU average. In 2014, the price gap was €15.15, with prices in Ukraine being lower. Moving to 2016, prices in Ukraine exceeded the EU average by €8.79, with the biggest price gap registered in the year 2021 of €30.98 above the EU average. In the year 2022, the earlier trend took a reverse route, with Ukraine prices being lower than the EU average by €15.06. Such fluctuations showcase the volatility of the Ukrainian dairy market when juxtaposed with a much stable EU side.

The EU dairy sector is regulated by policies and subsidy regimes that bring some stability of prices and farmer support. In the face of recent uncertainty, regulatory environments to be followed in terms of ecologically acceptable behaviour have stalled investments into food production, decreasing European milk production by 1% in the last year.

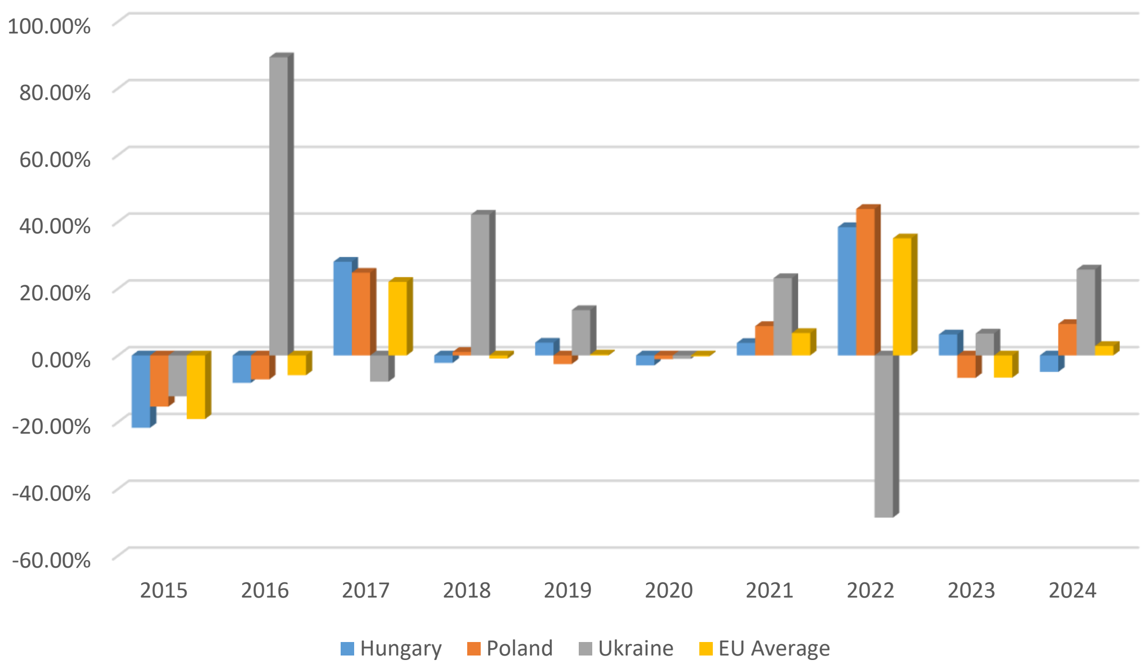


Figure 22: Year-on-Year Price Change (%) in Milk Prices (2014-2024)

Source: Eurostat and Own research for Ukraine's data

The Common Agrarian Policy of the EU provides substantial subsidies that cover almost 50% of modernization costs in turning into a dairy farmer. Such subsidies contribute to sustaining good production levels and market stability. On the other hand, Ukraine's dairy sector does not similarly support its dairy farmers, leading to underinvestment in either modernization or efficiency improvement. According to UCAB (2025) Even a 25% subsidy in Ukraine could create a basis for the modernization of raw milk production capacities."

The lack of considerable subsidies in Ukraine has thereby resulted in a market without a proper structure, as many small-scale producers cannot afford any investment in modern technologies. This fragmentation is not only hampering the efficient product quality but also competitiveness in the international market. Also believed to improve raw milk quality as well as market efficiency within Ukraine would be the joining of backyard farmers into dairy cooperatives, a common practice widely used in the EU.

The comprehensive analysis of European and Eastern European milk markets reveals significant disparities in market size, growth rates, consumption patterns, and price dynamics. While the overall European milk market dominates in terms of revenue, Eastern Europe represents only about 20% of this market. However, Eastern Europe demonstrates stronger growth potential with a CAGR of 6.73% compared to Europe's 4.66%, indicating an emerging market with substantial development opportunities.

The per capita consumption metrics further illustrate the market divide, with Europeans consuming nearly twice as much milk (45.4 kg) as Eastern Europeans (26.2 kg), and generating higher per capita revenue (US$71.64 versus US$51.90). This gap reflects differences in purchasing power, dietary habits, and market maturity between the regions.

A closer examination of Ukraine, Poland, and Hungary reveals distinct market characteristics and challenges. Ukraine's dairy industry is undergoing transformation amid war instability, with industrial farms driving production despite challenges from weather conditions and infrastructure issues. Poland benefits from a well-established dairy infrastructure and has successfully modernized to meet EU standards, giving its products competitive advantages. Hungary's dairy sector is experiencing government-supported modernization with strategic advantages due to its location.

Price analysis from 2014-2024 demonstrates notable volatility, particularly in Ukraine, where prices fluctuated dramatically from €22.58 per ton in 2014 to a peak of €68.04 in 2021, before declining again. This contrasts with the relative stability observed in EU markets, where regulatory frameworks and subsidy regimes help maintain market equilibrium despite some fluctuations.

The comparative analysis between EU and Ukrainian markets highlights how different policy approaches impact market development. The EU's Common Agrarian Policy provides substantial subsidies covering nearly 50% of modernization costs, fostering stability and consistent quality. In contrast, Ukraine's lack of comparable subsidies has resulted in a fragmented market with many small-scale producers unable to invest in modern technologies, limiting overall market efficiency and international competitiveness.

Looking forward, Eastern European markets, particularly Ukraine, have significant growth potential if structural challenges can be addressed. The consolidation of small farms into cooperatives, increased government support for modernization, and continued integration with EU standards could accelerate development. However, a full-scale war, climate challenges, and policy uncertainties remain significant risks that could impact market stability and growth trajectories.

As the dairy industry continues to evolve globally, these regional disparities will likely narrow, but the pace of convergence will depend largely on policy frameworks, investment patterns, and broader economic conditions in the respective markets.

3.6. THE IMPACT OF WAR ON THE UKRAINIAN DAIRY INDUSTRY

The dairy industry has historically occupied a significant position within Ukraine's agro-industrial complex, contributing substantially to rural employment, food security and agricultural export revenues. Prior to the full-scale Russian invasion in February 2022, Ukraine ranked amongst the leading milk producers in Europe, with annual output exceeding 9 million tonnes. The sector featured a diverse structure comprising both industrial-scale dairy farms and smallholder households, with the latter contributing over 30% of total raw milk production. Ukrainian dairy products – including milk, cheese, butter and powdered milk – served as essential staples for domestic consumption and notable export commodities, particularly to CIS countries, the Middle East and North Africa.

Before the war, the dairy supply chain in Ukraine demonstrated relative stability, with processing capacities concentrated predominantly in central and western regions. The sector had experienced gradual modernisation, bolstered by investment programmes and donor-funded initiatives aimed at improving milk quality, animal welfare and farm efficiency. However, even in this pre-war period, the industry confronted persistent structural challenges including low productivity per cow, fragmentation of production, considerable dependence on household suppliers and fluctuating global market prices.

The full-scale invasion of Ukraine by Russia in 2022 has drastically disrupted the country's agricultural landscape, with the dairy sector experiencing particularly severe impacts. Destruction of farm infrastructure, occupation of major agricultural regions, logistical bottlenecks and economic instability have led to sharp declines in milk production and cattle numbers. Many producers have been forced to cease operations, relocate, or adopt survival strategies to maintain minimal output.

This chapter aims to systematically assess the consequences of war on the Ukrainian dairy industry, identify critical vulnerabilities and highlight pathways for recovery and resilience. Given the limited availability of centralised, up-to-date statistical information – especially in war-affected zones – this research integrates national and international data from the State Statistics Service of Ukraine, industry reports by the Ukrainian Agribusiness Club (UCAB), the Association of Milk Producers (AMP) and international organisations, including the FAO, USDA and EBRD, expert insights and comparative assessments to reflect the current state of the sector and contribute to shaping policies and development strategies for the post-war period.

Understanding the dynamics of Ukraine's dairy industry during wartime holds broader significance beyond the national context. It provides a case study of how agricultural systems function under extreme stress and informs global discussions on food security, rural sustainability and the resilience of supply chains in war-affected regions.

3.6.1 Production losses and infrastructure damage

The full-scale Russian invasion of Ukraine in February 2022 has significantly disrupted the country's agricultural sector, with the dairy industry amongst the hardest hit. Regions such as Kharkiv and Kherson, previously leaders in dairy cattle numbers and raw milk production, have experienced occupation and intense hostilities that severely reduced production capacity. According to the Kyiv School of Economics (KSE), agricultural losses in Kharkiv oblast alone were estimated at over USD 3 billion due to the war's impact on crop and livestock production, including dairy farming (KSE Agricultural Damage Assessment, 2023).

Data from the Association of Milk Producers (AMP) indicate that as of November 1, 2023, the total number of dairy cows in Ukraine dropped by 8% compared to the same period in 2022, falling to 1.32 million heads. The most pronounced decline occurred in the household sector, where the cow population fell by 9% to 939,600. Consequently, household milk production dropped by over 14% in the first 10 months of 2023, totalling approximately 3.9 million tonnes. This continues the downward trend caused by the war, insecurity and economic difficulties confronting small producers (AMP, 2023).

Milk production in Ukraine has experienced a notable downward trajectory between 2019 and 2024, reflecting the broader disruptions induced by economic instability, wartime occupation and systemic shifts in both household and industrial dairy farming. According to aggregated industry data from the STATE STATISTICS SERVICE OF UKRAINE (2022), total milk production declined from approximately 9.3 million tonnes in 2019 to a projected 7.2 million tonnes in 2024, marking an overall decrease of nearly 23% over six years.

The most significant reduction occurred in 2022, following the onset of the full-scale Russian invasion. Milk output fell from 8.7 million tonnes in 2021 to 7.8 million tonnes in 2022 as producers in frontline regions lost access to infrastructure, feed and safe logistics. The situation further deteriorated in 2023 due to continued insecurity and disruptions in rural supply chains.

Although the rate of decline began to stabilise by 2024, with some recovery in western regions and EU-supported programmes, the long-term structural challenges remain acute. These include the depopulation of rural areas, declining household production and insufficient investment in productivity-enhancing technologies.

The cattle population (Figure 23) in Ukraine has undergone a consistent and concerning decline over the past six years, falling from approximately 3.2 million heads in 2019 to an estimated 2.3 million heads in 2024. This downward trend reflects a combination of structural, economic and wartime factors that have adversely affected livestock farming across the country.

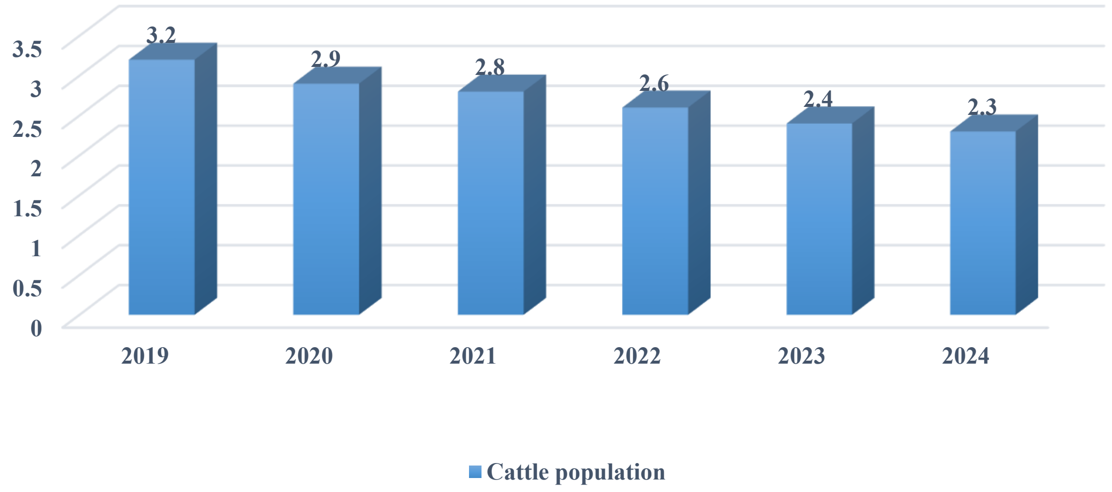


Figure 23. Cattle population in Ukraine, mln cattle, 2019–2024

Source: aggregated sectoral data, 2024

The steepest reductions occurred between 2021 and 2023 when the full-scale Russian invasion led to the loss of livestock in occupied territories, disruption of veterinary and feed supply chains, and displacement of rural farming communities. Household farms, which previously accounted for more than half of the national cattle stock, were particularly vulnerable to these disruptions.

Although some industrial farms in western Ukraine managed to preserve herd numbers, the overall contraction in cattle population has severe implications for national milk production, rural employment and long-term food security. This trend may undermine the sector’s recovery potential without targeted support for herd restoration and modernisation of animal husbandry practices.

The military aggression has resulted in extensive destruction of dairy farms and infrastructure. More than 100 commercial dairy farms have been wholly or partially destroyed due to shelling, occupation or targeted attacks. According to the AMP, many farms in de-occupied areas such as Kharkiv and Kherson oblasts continue to lose cattle due to injuries from shrapnel and explosions, resulting in forced culling of animals (AMP, 2023).

Additionally, landmine contamination of pastures and hayfields has made it dangerous or impossible to graze cattle or harvest fodder. This further reduces the feed base and negatively affects milk yields and the economic viability of dairy farms. In some areas, power outages, destroyed water systems and lack of veterinary services have significantly reduced productivity and animal health.

The war has also triggered mass mobilisation, migration and displacement of the population, causing a severe labour shortage in the agricultural sector. According to a survey conducted during the International Dairy Congress 2023, the shortage of skilled workers due to mobilisation and emigration was ranked amongst the top three threats to the sustainability of dairy farms.

Many experienced farm workers from frontline or occupied regions fled their homes or were drafted into military service. As a result, numerous farms were left without essential staff, forcing producers to reduce herd sizes or suspend operations. Household producers, particularly in rural areas near the frontlines, were often forced to abandon their dairy cows due to safety concerns or lack of resources to continue care (AMP, 2023).

Despite these challenges, industrial dairy farms in relatively safe western and central Ukrainian regions have increased production. In the first 10 months of 2023, commercial farms increased milk output by 7% compared to the previous year, reaching 2.6 million tonnes. By the end of 2023, they were expected to deliver around 2.9 million tonnes of milk to processors – nearly matching pre-war levels (AMP, 2023).

To better understand the impact of the war, it is essential to examine the trends in Ukraine's dairy sector over the past six years. Between 2019 and 2021, before the full-scale invasion, Ukraine's dairy industry was already experiencing a gradual decline. Total cow numbers fell from 1.77 million in 2019 to 1.61 million in 2021, reflecting broader structural challenges in the sector, such as low profitability, ageing infrastructure and dependence on small-scale household production (Table 17).

However, the situation sharply deteriorated following the onset of the war in 2022. The cow population dropped by 11% that year alone, falling to 1.44 million, and continued its decline to 1.32 million in 2023. Preliminary estimates for 2024 suggest only a marginal decrease, indicating some stabilisation in the sector.

Milk production followed a similar pattern. From 2019 to 2021, total milk output decreased from 9.3 to 8.4 million tonnes. After the start of the war, it dropped further to 7.7 million tonnes in 2022 and 7.0 million in 2023. The most significant reduction occurred in household milk production, which fell by over 40% between 2019 and 2023 (from 6.5 to 3.9 million tonnes). This highlights the vulnerability of small producers to war-related disruptions.

In contrast, industrial farms have demonstrated greater resilience. Their share of total milk output increased steadily, with production stabilising at around 3.0-3.2 million tonnes annually. In 2024, early data indicates a possible recovery to 3.1 million tonnes, suggesting that professional dairy farms in safer regions are leading the sector's gradual revival.

These figures underscore the Ukrainian dairy sector's long-term structural transformation – one in which wartime conditions have dramatically accelerated.

Table 18. Ukrainian Dairy Industry Data (2019-2024)

Year	Total Cow Population (mln heads)	Household Cow Population (mln heads)	Total Milk Production (mln tons)	Milk by Households (mln tons)	Milk by Industrial Farms (mln tons)
2019	1.77	1.29	9.3	6.5	2.8
2020	1.68	1.21	8.8	5.8	3.0
2021	1.61	1.15	8.4	5.3	3.1
2022	1.44	1.03	7.7	4.5	3.2
2023	1.32	0.94	7.0	3.9	2.9
2024*	1.30 (est.)	0.92 (est.)	6.9 (est.)	3.8 (est.)	3.1 (est.)

*2024 values are preliminary estimates based on sectoral forecasts by AMP and analytical centres.

Source: Own research (2025)

The war in Ukraine has profoundly impacted the dairy industry's labour dynamics and social sustainability. Beyond the destruction of physical infrastructure, the displacement of rural populations and labour shortages have created systemic challenges for maintaining livestock operations and ensuring continuity in dairy processing.

According to CABINET OF MINISTERS OF UKRAINE (2025) and UNDP UKRAINE (2023), over five million people have been internally displaced since 2022. This demographic shift has had a direct impact on the availability of agricultural labour, particularly in war-affected and de-occupied territories. Many dairy farms, especially those relying on manual and seasonal workforces, have reported severe shortages of skilled labour for animal care, milking operations and veterinary services.

Moreover, the war has disproportionately affected women in rural areas, who previously comprised a significant share of on-farm and administrative dairy labour. The closure or destruction of production facilities led to job losses in every value chain segment – from raw milk collection to retail. While some displaced workers have re-engaged with the sector in western regions, the overall employment recovery remains uneven and fragile due to limited access to housing, transportation and formal retraining programmes.

Several government and donor-supported initiatives have attempted to address these challenges. Programmes funded by the European Union and the United Nations Development Program (UNDP) have included emergency wage subsidies, agricultural startup grants and vocational training for displaced workers. However, their reach and effectiveness remain limited. Structural solutions – including the development of rural vocational centres, incentives for youth engagement and targeted support for women – will be crucial for restoring a viable agricultural workforce.

Without comprehensive investment in human capital, the dairy industry's technical and economic recovery may be undermined by long-term labour instability and social dislocation.

3.6.2 Challenges in processing and logistics during wartime

The full-scale Russian invasion of Ukraine in February 2022 has triggered a profound transformation in the operational environment of the Ukrainian dairy industry. Among the most severely affected areas are milk processing and logistics, which depend on stable infrastructure, predictable market demand and uninterrupted energy and fuel supply. The compounded impact of military operations, infrastructural degradation and the economic destabilisation of regional markets has generated multidimensional challenges. This section analyses these challenges and their implications for the sector's resilience and development potential.

The dairy industry operates through an intricate and highly synchronised supply chain, where the perishability of raw milk requires immediate transport to processing facilities, often within a few hours of milking. The onset of hostilities led to the destruction of key road and rail networks in frontline regions, particularly in Kharkiv, Kherson and Mykolaiv oblasts. These disruptions critically undermined the ability of producers to access traditional processing plants.

Many dairy farms, especially in occupied or combat-affected zones, reported being unable to evacuate or process milk. In numerous instances, milk was discarded or distributed without compensation to local populations. Some producers attempted to redirect deliveries to functioning processors in relatively safer areas, such as Vinnytsia or Lviv regions. However, this redirection significantly increased transport distances, fuel consumption and delivery times, increasing both spoilage risks and costs.

Moreover, farmers were forced to reduce production by altering feeding practices in response to the inability to market their output. This involved lowering nutrient inputs to dairy cows to intentionally reduce milk yields – a strategy that, while reducing losses, had negative implications for animal productivity and farm profitability in the medium term.

The contraction of the domestic market emerged as a second major constraint. Due to widespread displacement and emigration – over 6 million Ukrainians fled the country, and several million more became internally displaced – the consumption of dairy products decreased markedly. Estimates provided by the Ukrainian Agribusiness Club and supported by field surveys indicate a decline of up to 22% in domestic demand for milk and dairy products in 2022 compared to the pre-war year 2021.

This contraction prompted many enterprises to prioritise exports to sustain operations and secure liquidity. However, the war imposed numerous restrictions on international trade, primarily due to the blockade of Black Sea ports (notably Odesa and Mykolaiv), the destruction of port and refrigeration infrastructure, and limitations on customs clearance capacity at western borders. In response, exporters rerouted their supply chains via EU land corridors, notably through Romania (Port of Constanța), Poland and Hungary. This rerouting increased transit times and costs and, in many cases, lowered the competitiveness of Ukrainian dairy products in global markets.

Nevertheless, by the end of 2023, Ukraine restored and expanded specific export channels, especially to Eastern Europe and the Middle East. Notably, over 10,000 tonnes of butter and 12,000 tonnes of skimmed milk powder were exported, primarily to EU countries and the MENA region (Middle East and North Africa). These exports were facilitated by support from the EU Green Corridors initiative and donor-funded programmes.

One of the most pronounced effects of the war has been the dramatic escalation in energy and fuel prices. According to UCAB (2023) and INFAGRO ANALYTICAL AGENCY (2023), the average logistics cost per tonne of milk increased by over 60% in 2022, driven by fuel price inflation (diesel prices nearly doubled in some regions), increased wage expectations for logistics personnel due to war risk, and longer delivery distances to reach operational processing facilities or export hubs.

The deliberate targeting of Ukraine's energy infrastructure significantly affected the dairy sector's ability to maintain stable production. Rolling blackouts and voltage fluctuations caused widespread downtime in milk pasteurisation, packaging and refrigeration facilities. On average, industrial dairy plants reported a 22% loss in operating hours in 2022, with a modest recovery in 2023 due to the installation of diesel-powered generators and partial adaptation of production cycles.

Milk and dairy products require uninterrupted refrigeration across the supply chain. The loss of electricity, destruction of cold storage warehouses and transport delays resulted in substantial spoilage. Reports from frontline regions indicate that up to 40% of milk collected during active combat periods was wasted due to a lack of refrigeration capacity.

The structure of milk utilisation in Ukraine has changed markedly over the past six years, with significant implications for industrial processing and supply chain logistics. Between 2019 and 2021, Ukraine maintained relatively stable milk processing volumes – averaging around 4 million tonnes annually – while household consumption and feeding of calves accounted for approximately 55% of the total national milk output.

However, following the escalation of hostilities in 2022, milk processing volumes plummeted to 2.9 million tonnes (Figure 24) due to widespread disruptions in collection, damage to infrastructure and the occupation of key industrial zones. While a modest recovery was observed in 2023 and is projected to continue in 2024, the overall share of milk entering formal processing remains below pre-war levels. The logistics of milk collection and delivery have been further complicated by fuel shortages, road damage and the need to reroute transportation to facilities located in western regions. Many dairy plants in eastern and southern oblasts were destroyed or rendered inoperable. These logistical bottlenecks have contributed to regional imbalances in supply, with some western processors operating below capacity while producers in isolated areas struggle to sell raw milk.

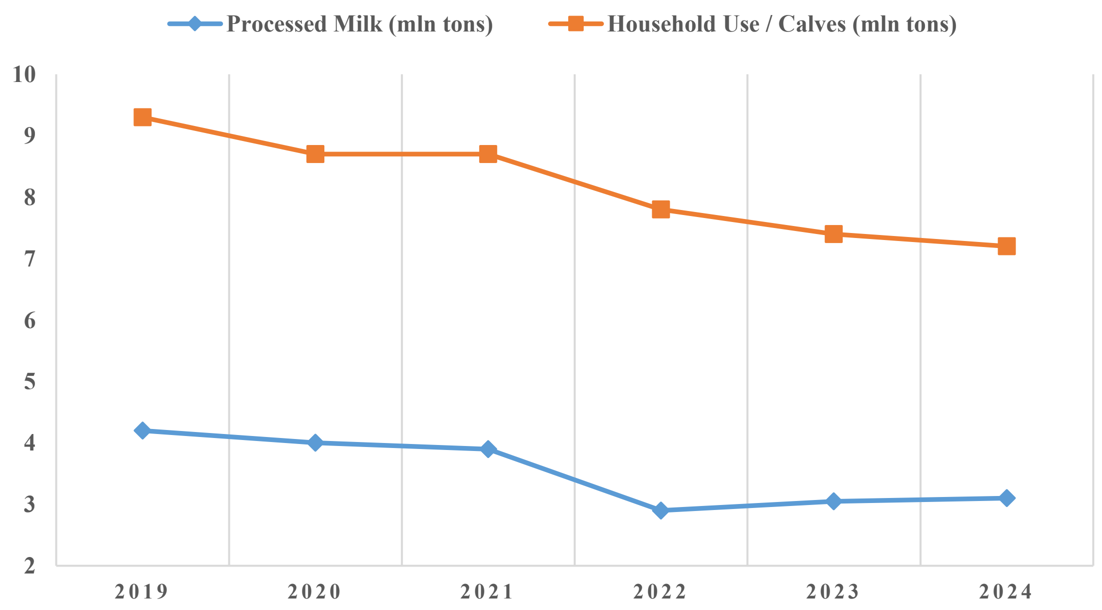


Figure 24. Comparison of milk processed and used in households/calves in Ukraine, 2019-2024

Source: UCAB, industry estimates, 2024

The regional fragmentation of dairy logistics in wartime Ukraine has resulted in a profound east-west divide. Dairy plants in western oblasts such as Lviv, Ternopil and Volyn remained operational and even absorbed excess milk volumes from relocated or redirected producers. In contrast, enterprises in eastern regions such as Kharkiv and Mykolaiv suffered extensive damage or were cut off from farm supply networks due to destroyed roads and active combat zones.

Furthermore, the decrease in household milk deliveries to processors – once a major component of the rural dairy economy – has contributed to the overall reduction in milk processed. Small-scale producers, often located in vulnerable or semi-occupied areas, have struggled with limited access to collection services and increased perishability of unprocessed milk. Some were forced to abandon dairy activity altogether or shift to local cheese and fermented product production without access to proper distribution channels.

Despite these challenges (Table 19), several initiatives have emerged to restore processing and logistics efficiency. Temporary milk collection points have been established near de-occupied territories to bridge the gap between isolated farms and operational processors. Donor-funded refrigeration units and mobile milk tanks have helped maintain cold chain integrity in select regions. Strategic partnerships between medium-sized farms and processors have allowed for long-term supply contracts with adjusted routing schemes.

These interventions, though localised, reflect a broader potential for reconfiguring Ukraine's dairy logistics to be more resilient and decentralised.

Table 19. Overview of Challenges in Dairy Processing and Logistics (2022–2023)

Category	Observed Effects	Enterprise Responses
Destruction of infrastructure	Inaccessibility of roads and processing hubs; milk dumping	Rerouting, production minimization
Domestic market contraction	22%+ fall in demand due to displacement and lower purchasing power	Export shift, product repurposing
Export route disruption	Inaccessibility of ports, increased customs time	Use of Romanian and Polish land corridors
Fuel price surge	+60-80% increase in transportation costs	Cooperative logistics, investment in route planning
Blackouts	Loss of 20-25% of processing time due to power cuts	Generator installation, adaptation of processing shifts
Cold storage loss	Spoilage of 30-40% of raw milk in affected areas	Emergency chilling units, partnership with cold facilities in EU

Source: Own compilation

The challenges outlined above reflect a sector operating under extreme duress, forced to make difficult trade-offs between maintaining production, ensuring product quality, and preserving financial viability. The dairy industry's ability to withstand these challenges is partially due to its structural diversity – larger enterprises with access to capital and logistics infrastructure adapted faster than smallholder producers.

Addressing these challenges in the medium and long term requires:

- Reconstruction of critical infrastructure in liberated regions.
- Development of resilient energy systems (solar, biogas, hybrid models).
- Establishment of regional cold chain hubs.
- Simplification of export procedures and better integration into EU logistics networks.

Moreover, targeted state aid and international donor programs will be essential in supporting producers, especially those in frontline and de-occupied territories, to restore their operational capacity and adapt to the post-war economic environment.

3.6.3 Adaptation strategies and resilience mechanisms

Beyond physical destruction and market disruptions, dairy producers have had to navigate a complex economic environment marked by sharp increases in input costs, the contraction of profit margins and broader macroeconomic instability. These factors have profoundly impacted production efficiency, financial performance and long-term strategic planning in the sector. This section provides an overview of key policy responses and financial instruments introduced since 2022.

One of the immediate consequences of the war has been the surge in costs associated with key production inputs. Dairy farming depends heavily on a stable supply of feed, energy, veterinary services and labour. The disruption of supply chains, damage to transport routes and restricted access to agricultural inputs have driven up prices, particularly for feed and fuel. In 2022, average feed costs rose by over 50 percent, largely due to domestic shortages and volatility in global grain markets. Electricity and fuel costs also soared, particularly during periods of widespread power outages and infrastructure attacks. The rising costs were exacerbated by the depreciation of the Ukrainian hryvnia, which raised the price of imported inputs such as machinery and feed supplements.

A recent sectoral survey conducted by the Ukrainian Agribusiness Club (UCAB, 2023) indicates a dramatic escalation in the cost of key production inputs for the dairy sector. In particular, the average cost of dairy feed increased by 52% in 2022 compared to the previous year. This surge was primarily driven by two interrelated factors: a domestic shortage of grains and concentrates due to extensive war-related damage in major agricultural regions, and a significant rise in global grain prices associated with the naval blockade of the Black Sea ports.

The evolution of feed costs over the past four years is presented in Figure 25, where the cost index (2021 = 100) illustrates the magnitude of this inflationary trend. While 2022 witnessed the sharpest spike (index = 152), a modest decrease was observed in 2023 (index = 146), followed by a projected stabilisation in 2024 (index = 139), assuming uninterrupted supply flows from western regions of Ukraine.

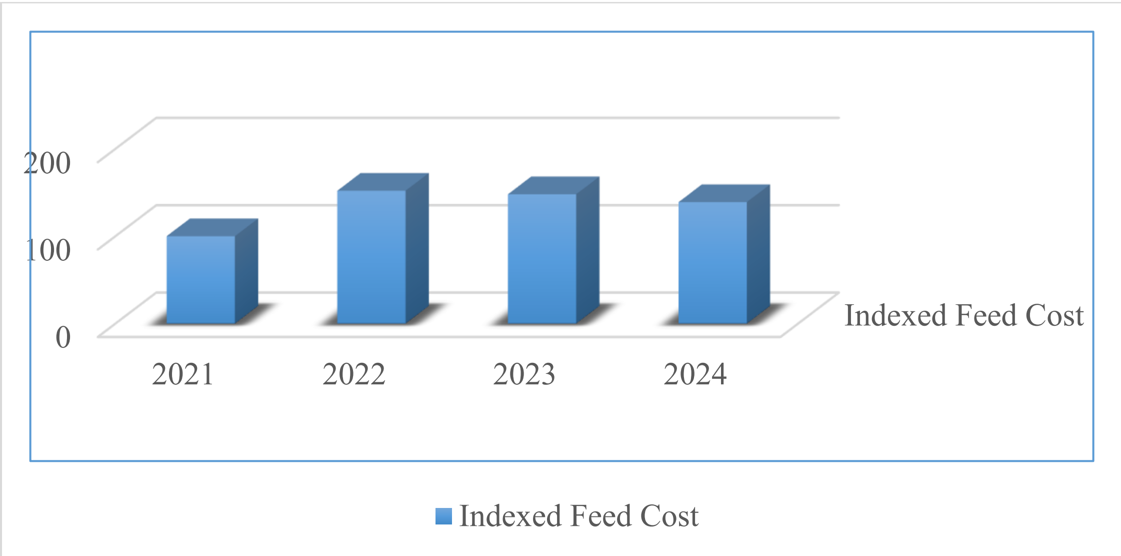


Figure 25. Indexed Feed Cost for Dairy Production in Ukraine, thousands UAH (2021-2024)

*Projected values based on preliminary forecasts (UCAB, 2023)
Source: Ukrainian Agribusiness Club (UCAB), 2023

In parallel, the prices for diesel fuel and electricity, both critical for dairy operations, surged by an estimated 70-90% during periods of intensified hostilities, particularly in the fourth quarter of 2022. This price hike adversely affected multiple operational domains, including raw milk collection and delivery logistics, the operation of milking and chilling systems, and the continuous power supply necessary for processing facilities.

The financial strain was further exacerbated by the increasing cost of equipment maintenance and replacement. Due to Ukraine's dependence on imported machinery and spare parts, currency devaluation significantly inflated replacement costs. For instance, the price of a standard milking unit increased from approximately €3,000 in 2021 to over €4,800 by 2023 – representing a 60% nominal rise.

Taken together, these cost dynamics have placed substantial pressure on the operational efficiency of dairy producers, particularly those with limited financial reserves or access to preferential credit facilities. Without targeted intervention and structural support, the risk of declining competitiveness and market withdrawal remains high for small and medium-sized enterprises in the sector.

Despite nominal increases in milk prices, the rapid escalation of production costs has significantly outpaced revenue growth, resulting in a narrowing of profit margins. The average profitability of milk production fell below five percent in 2022 (Table 20), compared to over seventeen percent in 2021. Small and medium-sized farms were particularly affected, as they lack the economies of scale and financial buffers that allow larger vertically integrated enterprises to remain solvent. This erosion of margins has limited the sector's ability to invest in herd health, infrastructure maintenance and technological upgrades. In many cases, farms were forced to reduce herd sizes, cut labour costs or postpone modernisation projects.

Table 20. Declining Profit Margins and Enterprise Viability

Year	Average Farmgate Milk Price (UAH/kg)	Average Cost of Production (UAH/kg)	Net Margin (UAH/kg)	Profitability Rate (%)
2021	10.80	9.20	1.60	17.4
2022	11.40	11.05	0.35	3.1
2023	12.80	12.30	0.50	3.9
2024*	13.50 (est.)	12.90 (est.)	0.60 (est.)	4.6

*based on data from AMP, UCAB, and preliminary KSE AgriCentre projections.

Source: own compilation based on SSSU, AMP, UCAB, and preliminary KSE AgriCentre projections

This near-collapse in profitability has had several consequences:

- Suspension of investment in farm modernisation and herd improvement
- Delays in payments to suppliers, increasing financial risks
- Reduction of herd size to decrease operational burden
- Labour optimisation, often through layoffs or automation

Only large-scale enterprises with vertical integration (e.g., own feed mills, processing plants) managed to sustain viable profitability levels above 7-8%.

Macroeconomic instability further compounded the challenges facing the dairy sector. In 2022, Ukraine experienced an inflation rate exceeding 26 percent (Table 21), with food prices rising even more sharply. The devaluation of the national currency further increased the cost of imported agricultural inputs, while access to credit became limited as interest rates rose and financial institutions became risk-averse. Domestic demand for dairy products also declined, driven by reduced consumer purchasing power and shifts in household consumption priorities.

Retail sales of milk, cheese and other dairy goods fell substantially, deepening the revenue losses experienced by producers.

The combined effect of input cost inflation, shrinking margins and macroeconomic instability has placed the Ukrainian dairy sector in a highly vulnerable position. While larger enterprises have shown some capacity to adapt through vertical integration and resource optimisation, the broader sector remains fragile. Policy measures, including subsidised credit, support for input localisation and investment in energy resilience, are essential to prevent further degradation of production capacity. Strategic adaptation, technological modernisation and coordinated public-private responses will be crucial for ensuring the long-term viability of Ukraine's dairy industry under wartime conditions.

Table 21. Economic Pressures on Dairy Producers (2022–2024)

Factor	Effect
Feed cost increase (+52%)	Decreased profitability; lower milk yield strategies
Energy and fuel prices ↑ 70–90%	Higher transport and cooling costs
Inflation (↑ 26% in 2022)	Increased household poverty, reduced demand
Currency depreciation	Higher cost of imported farm inputs
Margin drop (↓ from 17% to <5%)	Investment deferral; financial risk increase
Retail demand drop (-15 to -18%)	Excess inventory, price discounting, sales decline

Source: own compilation

In 2023, Ukraine's dairy trade profile reflected both the war-induced supply limitations and the shifting structure of domestic production and demand. The value of dairy exports was dominated by cheese, which accounted for over $200 million in revenues – largely due to stable demand in Eastern European markets. Other significant export categories included butter ($16.6 million) and fermented dairy products ($17.4 million).

Conversely, the country remained heavily dependent on imports of certain dairy products. Milk and cream imports reached $85.2 million, while butter imports stood at $41.8 million – nearly triple the export value for this category. This trade imbalance is indicative of both supply shortages and the disruption of domestic processing capabilities caused by the war.

The geographic orientation of trade shifted towards neighbouring EU countries, as maritime exports were limited by port blockades and high logistics costs. Increased demand for Ukrainian dairy products in Poland, Moldova and Israel helped offset losses in other traditional markets.

Ukraine's dairy trade (Figure 26) remains structurally constrained by uneven export capacity and rising import needs. Targeted support for processing infrastructure, certification compliance and export diversification will be essential for restoring a sustainable trade balance and enhancing competitiveness in international markets.

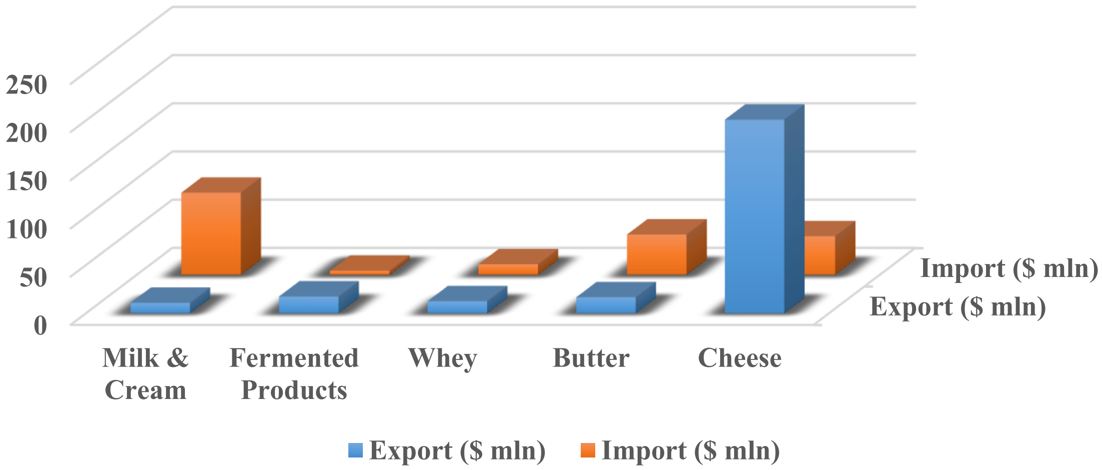


Figure 26. Export vs Import of Dairy Products in Ukraine (2023)

Source: UCAB (2024)

The Government of Ukraine has historically maintained a system of financial support for agricultural producers, including actors in the dairy value chain. These mechanisms have typically focused on direct subsidies, investment grants and input compensation programmes, covering not only dairy farming but also allied sectors such as beekeeping and aquaculture. In 2018, the state allocated a record UAH 6.3 billion in subsidies to the agricultural sector. However, several research institutions, including the Kyiv School of Economics, have raised concerns regarding the efficiency, targeting and transparency of these programmes. Critics argue that without a rigorous framework for impact assessment and strategic prioritisation, such financial interventions may fail to yield sustainable improvements.

In the context of wartime disruption, the Ukrainian Ministry of Agrarian Policy and Food, in cooperation with the European Union, introduced a special relief package targeting small and medium agricultural producers. This programme offers a per-hectare payment of UAH 3,100 for farms cultivating up to 120 hectares, and UAH 5,300 per head of cattle for herds up to 100 cows. The objective of this initiative is to safeguard the continuity of agricultural production in war-affected zones and to stabilise household incomes. This marks a shift in policy toward greater inclusivity, especially for smallholders who previously had limited access to national-level subsidies.

International organisations have become indispensable actors in the stabilisation and development of Ukraine's dairy sector during wartime. The Food and Agriculture Organization (FAO), with co-financing from the European Union, launched several rounds of competitive grant programmes intended to improve the economic resilience of rural producers. These grants range from UAH 416,500 (approximately USD 10,000) for individual farmers to UAH 1,041,250 (USD 25,000) for small agricultural enterprises, cooperatives and associations. The grant scheme supports diversification of production, equipment modernisation and the reconstruction of damaged assets.

Complementing FAO's activities, the United States Department of Agriculture (USDA), through its Foreign Agricultural Service, announced a technical assistance grant programme titled 'Technical Support for Ukraine's Dairy Sector'. With total funding of USD 250,000, this programme seeks to strengthen productivity, enhance veterinary practices and establish collaborative ties with U.S.-based dairy institutions. These efforts contribute to both short-term recovery and long-term modernisation.

Additionally, the European Bank for Reconstruction and Development (EBRD), in partnership with FAO, has reiterated its commitment to the Ukrainian dairy industry, acknowledging its strategic role in ensuring both domestic food security and broader regional market stability. Their joint programmes aim to strengthen policy dialogue, support sustainable value chains and improve access to technical expertise and financial instruments among Ukrainian producers.

Together, these national and international interventions form a crucial pillar of resilience for Ukraine's dairy sector. Nevertheless, further harmonisation of support instruments, data-driven targeting of beneficiaries and continued donor coordination will be essential to fully realise the transformative potential of such aid. In the long term, a shift from short-term crisis mitigation to strategic development planning will be necessary to rebuild a more competitive, sustainable and inclusive dairy industry in post-war Ukraine.

The unprecedented disruptions caused by the war have compelled Ukrainian dairy producers to develop adaptive strategies to sustain operations and preserve livelihoods. These survival strategies are characterised by a mix of short-term coping mechanisms and long-term structural adjustments. This section outlines three major dimensions of adaptation: relocation and small-scale processing, cooperation and vertical integration, and the implementation of innovative technologies (Table 22).

In the early months of the war, several dairy farms operating in frontline regions such as Kharkiv, Sumy and Kherson oblasts were forced to cease operations due to direct shelling, occupation and the destruction of critical infrastructure. Whilst full-scale relocation remains capital-intensive and logistically complex, some producers managed to transfer operations to safer regions in western Ukraine. However, the most widespread adaptation has been the shift to small-scale, localised processing.

Table 22. Adaptive strategies among Ukrainian dairy producers (2022–2024)

Adaptation Strategy	Description	Impact
Relocation	Shifting farms to safer regions in western Ukraine	Preservation of livestock and assets
Small-scale processing	On-farm production of cheese, yogurt, etc.	Reduced perishability, local market development
Cooperation	Formation of producer cooperatives	Improved access to logistics, credit, and market linkages
Vertical integration	Internal feed, vet services, sales channels	Cost control, reduced dependence on third parties
Biogas energy	Manure-based electricity generation	Energy security, waste valorisation
Precision livestock tools	Sensors, automated feeding, monitoring	Efficiency, disease control, data-driven decisions

Source: own compilation

Faced with broken supply chains and limited access to industrial processing facilities, many farms began investing in on-site processing equipment to produce cheeses, yogurts and sour milk products. This allowed them to maintain income streams, reduce product perishability risks and meet local food security needs. Small-scale processing also enhanced community resilience by stimulating local food economies.

Producer cooperation has emerged as a vital mechanism for risk mitigation and resource optimisation. By forming or joining cooperatives, farmers were able to pool financial, technical and logistical resources to facilitate milk collection, shared processing and collective bargaining. Cooperatives have helped to reduce overhead costs, improve access to financial aid and strengthen market access.

In parallel, a growing number of enterprises pursued vertical integration by internalising key segments of the value chain. Some expanded into feed production, on-site veterinary care and direct-to-consumer distribution. This integration has enabled better control over input quality, pricing and supply continuity, all of which are crucial in an unstable economic and security environment.

War-related challenges accelerated the adoption of innovative solutions in the Ukrainian dairy sector. Among the most significant developments has been the deployment of biogas systems for energy autonomy. Given the instability of the national grid and rising fuel costs, farms that invested in anaerobic digesters for manure processing gained resilience through self-produced electricity and heat.

Precision livestock farming technologies have also gained traction. These include the use of wearable sensors to monitor animal health, automated feeding systems and software for tracking productivity indicators. Such technologies not only improve efficiency but also support early disease detection and individualised animal care.

The Ukrainian dairy sector has demonstrated remarkable adaptability under conditions of crisis. While these adaptations vary in scale and scope, they collectively reflect a sector-wide shift toward decentralisation, technological advancement and cooperative models. Moving forward, these transformations may serve as a blueprint for building long-term resilience in Ukraine's agri-food system.

4. CONCLUSIONS AND RECCOMENDATIONS

The comprehensive analysis conducted in this dissertation reveals significant insights into the structure, dynamics, and integration mechanisms within the dairy sectors of Ukraine, Hungary, and Poland. These findings provide a foundation for understanding differential development pathways and identifying strategic opportunities for enhancing competitiveness, building resilience, and supporting sustainable growth in the Eastern European dairy industry. This chapter synthesises the key conclusions derived from the research and outlines evidence-based recommendations for stakeholders across the dairy value chain.

The comprehensive analysis of dairy enterprises in Hungary, Poland, and Ukraine during 2016-2020 reveals significant differences in market structure, concentration, and financial performance across these three markets.

Hungarian companies maintained the largest market share throughout the study period, though it decreased notably from 75.1% in 2016 to 56.1% in 2020. This relative decline occurred despite the stable number of operating Hungarian enterprises (approximately 130-140 units annually). Hungarian dairy enterprises demonstrated the most stable financial performance, with standard deviation of net profit margin ranging from 12.9-19.4%, and only 9.7% of enterprises reporting losses in 2020. Conversely, Polish companies experienced remarkable growth, increasing from 14 units with a 9.8% market share in 2016 to 90 units with a 23.4% market share by 2020. However, Polish enterprises exhibited extreme financial volatility, with standard deviation of net profit margin ranging from 11.3-4476.8%, and 23.5% of enterprises reporting losses in 2020. Ukrainian enterprises similarly expanded their market presence from 15.1% to 20.6%, while maintaining a relatively consistent proportion (12-13%) of the total number of businesses across all three countries. Ukrainian enterprises achieved the highest revenue efficiency at €6,127 average revenue per enterprise in 2020, compared to Hungary's €3,864 and Poland's €2,400, with 13.3% of enterprises reporting losses.

The Gini index and Lorenz curve analysis demonstrates evolving market concentration patterns. In 2016, Hungary had the most monopolized dairy market with a Gini index of 46.92%, whilst Poland was the least monopolised at 37.32%. However, by 2020, Poland exhibited the highest degree of monopolisation with a Gini index of 59.80% (an increase of +22.48 percentage points), despite the substantial growth in the number of enterprises. In contrast, Ukraine showed moderate fluctuation from 41.80% to 47.22% (+5.42 percentage points), and Hungary remained stable with minimal change from 46.92% to 45.30%, indicating more balanced market structures.

The most striking structural change occurred in Poland, where micro enterprises increased from 4 to 56 units (1400% growth), whilst Ukrainian medium enterprises saw their market share grow dramatically from 9.5% to 43.3%. Hungarian structure remained stable with 59-66% small enterprise dominance.

The regional distribution patterns of dairy enterprises reveal significant concentration in specific areas within each country. In Poland, the western regions – particularly Wielkopolskie and Kujawsko-Pomorskie – emerged as dairy hubs, with Wielkopolskie generating the highest revenue of €63.6 million in 2020. In Hungary, production is concentrated in eastern and western regions, with Győr-Moson-Sopron (€62.7 million) and Hajdú-Bihar (€61.6 million) leading in 2020, while central regions show minimal involvement. Ukraine demonstrates concentration in the central-north-eastern region, with Poltava (€40.0 million) and Chernihiv (€31.3 million) oblasts dominating, and Volyn in the north-west as a notable exception.

Correlation analysis between enterprise size (total assets) and performance metrics yielded revealing insights about market conditions in each country. In Ukraine, there is a strong relationship between company size and financial performance, particularly for larger enterprises. After controlling for outliers, up to 86.93% of net profit values in 2020 could be predicted by total assets, demonstrating that market conditions in Ukraine strongly favour large enterprises. This dependency strengthened over time, with R^2 for net profit increasing from just 7% in 2016 to 43.24% in 2020 (reaching 77.65% after excluding outliers).

In contrast, Hungarian enterprises showed a much weaker relationship between size and profitability, with only about 20% of enterprises demonstrating a direct proportional relationship in 2020. While Hungarian companies exhibited strong correlation between total operating revenue and total assets (R^2 of 85-88% throughout most of the period), the relationship between assets and net profit was significantly weaker and more volatile, ranging from nearly 0% to 37% across different years.

The Polish dairy market demonstrated the weakest relationship between enterprise size and profitability, with only 16.5% of enterprises showing assets as a determinant of net profit in 2020 (increasing to just 34% after excluding outliers). Cluster analysis revealed that Polish small enterprises (with total assets of €2-3 million) achieved the highest return on sales (ROS) at 12.32%, outperforming both microenterprises (4.91% ROS) and larger enterprises. However, medium and large enterprises (with average assets of €16.96 million) showed relatively strong performance with 8.79% ROS and the highest absolute profits.

Financial analysis reveals striking differences in profitability across the three countries. In 2020, Poland's net profit margin exhibited extreme volatility (-17.0% mean, ranging from -2602.1% to 1857.4%), primarily due to a significant proportion of loss-making enterprises (23.5%). Ukraine maintained more stable performance with a 9.5% mean NPM, with only 13.3% of companies reporting losses. Hungary demonstrated the most balanced performance with an 8.6% mean NPM and the lowest proportion of loss-making enterprises at 9.7%. These patterns suggest that while Hungary maintains the most stable business environment, Poland's market allows for extreme variations in performance, and Ukraine occupies a middle ground with moderate stability.

These findings indicate fundamentally different market dynamics across the three countries. The Ukrainian dairy market disproportionately rewards scale, with larger enterprises achieving significantly better financial results. Hungary presents a more balanced picture, though with evidence that extremely large enterprises (over €30 million in assets) experience diminishing returns, with ROS not exceeding 10%. Poland offers the most level playing field, where enterprise size has minimal influence on profitability, and where small enterprises can achieve superior relative performance compared to larger competitors.

In terms of investment attractiveness and future market outlook, these findings suggest that:

- In Ukraine, investment in larger dairy enterprises is likely to yield better financial returns, reflecting the advantages of scale in this market.
- In Hungary, mid-sized enterprises represent the optimal investment target, as the largest enterprises demonstrate inefficient asset utilization.
- In Poland, smaller enterprises present attractive investment opportunities based on their superior ROS, though medium and large enterprises still generate substantial absolute profits.

These distinct market characteristics reflect different stages of industry development, competitive dynamics, and regulatory environments across the three countries, offering valuable insights for investors, policymakers, and dairy industry stakeholders.

The analysis of milk price trends and market relationships yields several significant conclusions regarding integration processes and market dynamics:

First, there are substantial disparities in market size, growth rates, and consumption patterns between Western and Eastern European dairy markets. While Europe is projected to generate US$60.77 billion in revenue in 2025, Eastern Europe accounts for just US$12.34 billion (approximately 20% of the European market). However, Eastern Europe demonstrates stronger growth potential with a CAGR of 6.73% compared to Europe's 4.66%, indicating an emerging market with substantial development opportunities. The per capita consumption metrics further illustrate market divides, with Europeans consuming nearly twice as much milk (45.4 kg) as Eastern Europeans (26.2 kg), reflecting differences in purchasing power, dietary traditions, and market development stages.

Second, milk price analysis from 2014-2024 demonstrates notable volatility, particularly in Ukraine, where prices fluctuated dramatically from €22.58 per ton in 2014 to a peak of €68.04 in 2021, before declining again. This contrasts with the relative stability observed in EU markets, where regulatory frameworks and subsidy regimes help maintain market equilibrium despite some fluctuations. The research reveals that different policy approaches significantly impact market stability and development trajectories. The EU's Common Agrarian Policy provides substantial subsidies covering nearly 50% of modernisation costs, fostering stability and consistent quality. In contrast, Ukraine's lack of comparable subsidies has resulted in a fragmented market with many small-scale producers unable to invest in modern technologies.

Third, correlation analysis between milk prices in different countries reveals varying degrees of market integration. The EU average prices show stronger correlation with Polish prices than with Ukrainian prices, indicating deeper integration of Polish dairy markets into EU structures. Ukraine's price trends demonstrate more independence from EU patterns, reflecting both different market dynamics and the effects of geopolitical factors on trade relationships. These findings suggest that market integration processes remain incomplete, with significant potential for further convergence as institutional frameworks develop.

The comparative analysis of milk prices reveals Ukraine's unique position within the European market. Ukrainian milk prices demonstrated the highest volatility, ranging from €22.58 per 100 litres in 2014 to a peak of €55.82 in 2019, before stabilising at €46.90 in 2024. This contrasts sharply with Hungary's stable progression from €33.10 to €43.57, and Poland's steady increase from €32.87 to €50.15 over the same period. The price gap between Ukraine and the EU average fluctuated dramatically, from -€15.15 in 2014 to +€30.98 in 2021, before reversing to -€15.06 in 2022. These extreme fluctuations reflect Ukraine's vulnerability to external shocks and lack of stabilising policy mechanisms compared to EU members.

The war's impact on Ukraine's dairy sector is starkly illustrated by production data. Between 2021 and 2023, total cow numbers declined from 1.61 million to 1.32 million heads, with the steepest drop occurring in 2022 (11% reduction). Milk production fell from 8.4 million tonnes in 2021 to 7.0 million tonnes in 2023, with household production experiencing the most dramatic decline (from 5.3 to 3.9 million tonnes). Conversely, industrial farms demonstrated resilience, maintaining production at approximately 3.0-3.2 million tonnes annually. By 2024, industrial farms were projected to increase their share of total production from 36.9% to 44.9%, highlighting a structural shift towards more resilient production models.

The Ukrainian dairy sector has endured profound disruptions as a result of the full-scale war that began in 2022. Total milk production declined from 8.4M to 6.9M tonnes (-17.9%) between 2021-2024, whilst cattle population reduced from 1.61M to 1.30M heads (-19.3%). The cumulative impacts of territorial occupation, infrastructure destruction, labour shortages and market contraction have substantially altered both the production landscape and economic dynamics of the industry. The household sector experienced the most severe impact, with production falling from 5.3M to 3.8M tonnes (-28.3%), whilst industrial farms demonstrated resilience by maintaining 3.0-3.2M tonnes production levels. Over the course of the full-scale war, total cow population and milk output have continued to decline, particularly within the household sector. Industrial producers in relatively safer regions have shown greater resilience, maintaining near pre-war levels of milk delivery.

War-affected regions contributed 42.3% of pre-war industrial milk production, with processing capacity severely reduced from 178 to 110-112 operational plants (-38%). Challenges in logistics, energy access and cold chain reliability have severely hampered processing efficiency and market accessibility. Economic impacts were severe, with feed costs increasing by +52% (2021-2022), profit margins compressing from 17.4% to 3.1% average profitability, and fuel/energy costs surging by +70-90% during intense hostilities. Infrastructure damage was extensive, with >100 commercial farms wholly or partially destroyed, cold storage losses causing 30-40% spoilage in affected areas, and processing downtime averaging 22% loss in operating hours (2022). Profit margins have narrowed due to the unprecedented increase in input costs, inflation and limited access to credit. Despite these constraints, producers have adopted a range of coping strategies including small-scale processing, cooperation, vertical integration and investment in innovation. National and international support programmes have played a critical role in stabilising the sector, yet long-term recovery remains uncertain and highly dependent on the duration and intensity of the full-scale war.

To ensure the sustainable recovery and future development of the Ukrainian dairy industry, a coordinated approach is needed that integrates public policy, donor assistance and private sector innovation. Establishing a National Dairy Modernisation Fund with €500M initial capitalisation by the second quarter of post-war reconstruction, implementing differential subsidy rates of 35% for farms <100 cows, 25% for farms 100-500 cows, and 15% for farms >500 cows, and creating „Dairy Resilience Zones” in 5 central and western oblasts by the end of the first post-war year represent essential strategic directions.

The following strategic directions are recommended:

- Strengthen rural infrastructure and energy resilience, including targeted investments in renewable energy for processing and storage.
- Expand financial instruments to support small and medium-sized farms, including concessional credit and guarantees for equipment modernisation.
- Enhance support for cooperative models to facilitate shared processing, marketing and risk management.
- Streamline access to export markets by improving customs procedures and harmonising sanitary regulations with EU standards.
- Promote digital transformation and precision livestock farming through subsidised technology adoption.
- Establish a national dairy development programme focused on long-term competitiveness and inclusion, prioritising youth and women in agriculture.

With the right mix of recovery measures and strategic vision, the Ukrainian dairy sector has the potential not only to rebuild but also to emerge more sustainable, innovative and resilient than before. This will require consistent commitment from national authorities, robust support from international partners and continued adaptability among producers.

Based on these conclusions, key strategic recommendations emerge for major stakeholders:
For policy makers:

1. Implement context-specific development strategies: Recognise each country’s unique market structure rather than applying standardised approaches. Given Ukraine’s strong correlation between enterprise size and performance ($R^2 = 0.8693$ after outlier removal) where large enterprises (>€15M assets) averaged 27.2% higher ROA than small enterprises (<€2M assets), support for efficient consolidation whilst protecting smaller producers during transition is essential. For Ukraine, support efficient consolidation while protecting smaller producers during transition; for Hungary, given the optimal performance range of €10-30M assets (15.3% ROS) and diminishing returns above €30M (average ROS <10%), focus should be on optimising mid-sized enterprise efficiency through capping individual farm assets at €25M for subsidy eligibility and introducing management efficiency certification programmes; for Hungary, focus on optimising mid-sized enterprise efficiency; and for Poland, and for Poland, given the

minimal correlation between enterprise size and performance ($R^2 = 0.165$) and small enterprise advantages (micro enterprises achieving 12.32% ROS vs. 8.79% for medium enterprises), policies should maintain multi-scale enterprise success through creating Small Dairy Farm Support Schemes with €25M annual budget and establishing 10 regional dairy cooperatives.

2. Strengthen integration and infrastructure: Develop programmes that enhance horizontal and vertical integration across dairy value chains, particularly supporting cooperatives in Ukraine. Prioritise investment in rural transportation, cold chain facilities, and energy systems to facilitate market access.
3. Align with EU standards: Harmonise quality standards and regulations with EU frameworks while providing appropriate transition periods and technical support for producers. Complete regulatory alignment for Ukraine within 24 months of war's end, with measurable targets including 90% of Ukrainian processing facilities EU-compliant by the end of the second post-war year, 50% reduction in border inspection delays by the third post-war year, and 100% traceability system implementation by the second post-war year.
4. . Develop region-specific policies that capitalise on existing geographic concentrations of dairy production. For Ukraine, this means prioritising support for the central-north-eastern dairy belt while developing strategies to expand production in less affected western regions. For Hungary, policies should address the underutilisation of central regions while supporting the continued development of eastern and western hubs. For Poland, maintaining the competitive advantage of western regions while encouraging balanced development across the country should be prioritised.

For dairy enterprises:

1. Strategically optimise scale and integration: Adapt enterprise size to market context – Ukrainian enterprises should target optimal scale ranges of 200-800 cow herds for maximum efficiency, requiring scale expansion investments of €2,000-3,000 per cow capacity and technology adoption costs of €50,000-100,000 per farm, with expected payback periods of 4-5 years. Expansion for Ukrainian companies, Hungarian enterprises should optimise at 150-400 cow scale to avoid diminishing returns, focusing on efficiency improvements requiring €1,000-2,000 per cow and energy systems costing €75,000-150,000 per farm, with expected payback periods of 3-4 years. Cautious growth for Hungarian firms, and flexible scale strategies for Polish enterprises. Pursue vertical integration opportunities, especially in feed production and direct marketing channels.

2. Invest in technology and resilience: Adopt precision livestock technologies and energy-efficient systems that enhance competitiveness and reduce vulnerability to disruptions. Ukrainian companies should particularly focus on technologies that support distributed production and energy autonomy.
3. Adapt financial strategies to country-specific market conditions. Ukrainian enterprises should focus on building financial reserves to weather external shocks, given the strong correlation between size and performance. Ukrainian enterprises should focus on building financial reserves to weather external shocks, maintaining minimum 6-month operating cost reserves and implementing comprehensive insurance coverage, given the demonstrated profit margin compression from 17.4% to 3.1%. Hungarian firms should optimise operations to avoid the diminishing returns observed in enterprises exceeding €30 million in assets. Polish companies need robust risk management strategies to navigate the high volatility environment where small enterprises can achieve superior ROS but face significant survival challenges.

For International development partners:

1. Coordinate comprehensive support: Implement sector-wide approaches to Ukraine's dairy reconstruction that integrate infrastructure development, technical assistance, and market access support. €1.2B coordinated international support over 5 post-war years should be allocated with 40% to infrastructure reconstruction, 30% to technology transfer, 20% to capacity building, and 10% to market access facilitation. Prioritise investments in climate-smart technologies and renewable energy systems.
2. Facilitate knowledge transfer and human capital development: Establish mechanisms for sharing expertise between EU and Ukrainian dairy stakeholders through exchange programmes and targeted training initiatives, with special focus on supporting young farmers and entrepreneurs. Establish 5 EU-Ukraine Dairy Excellence Centres by the second post-war year, implement exchange programmes for 1,000 dairy professionals annually, and provide targeted training with expected outcomes of training 10,000 dairy professionals over 3 years and achieving 30% increase in youth engagement in dairy farming.

The implementation of these recommendations requires coordinated efforts across sectors, with the overarching aim of enhancing integration – horizontally among producers, vertically across value chains, and institutionally through coherent policy frameworks – to support sustainable dairy development in all three countries.

Looking toward the future, Eastern European dairy markets, particularly Ukraine, have significant growth potential if structural challenges can be effectively addressed. The consolidation of small farms into cooperatives, increased government support for modernisation, and continued integration with EU standards could accelerate development. However, a full-scale war, climate challenges, and policy uncertainties remain significant risks that require careful management through adaptive, evidence-based approaches.

The dairy sectors' recovery and development trajectories will ultimately depend on the successful combination of strategic vision, policy coherence, private sector innovation, and international solidarity. By building on the differential strengths identified in this comparative analysis while addressing specific vulnerabilities, stakeholders can contribute to creating more robust, competitive, and inclusive dairy value chains that support broader socioeconomic development goals across Eastern Europe.

5. NEW AND NOVEL RESULTS OF THE DISSERTATION

This dissertation contributes several significant findings to the understanding of dairy sector dynamics in Eastern Europe:

1. The comparative analysis of dairy enterprises in Ukraine, Hungary, and Poland revealed distinct patterns in the relationship between enterprise size and financial performance across the three countries.
2. Identified a counter-intuitive development in Poland's dairy sector where market concentration increased (Gini index rising to 60% by 2020) despite substantial enterprise number growth (from 14 to 90 units), challenging conventional assumptions about market liberalisation.
3. Established distinct patterns in the relationship between enterprise size and financial performance across three countries: Ukraine demonstrates strong correlation (R^2 reaching 86.93%), Hungary shows non-linear relationship with diminishing returns above €30 million in assets, and Poland exhibits minimal influence of enterprise size on profitability (R^2 of only 16.5%).
4. Documented unprecedented milk price volatility in Ukraine (ranging from €22.58 to €68.04 per 100 litres) compared to EU markets, revealing vulnerability to external shocks and absence of stabilising policy mechanisms.
5. Documented quantifiable resilience mechanisms during wartime, showing industrial farms maintained production levels while household producers experienced 18% decline, and cascade effects triggered compression of net margins from 17.4% to 3.1%.
6. Established specific regional concentration patterns: Poland's western regions (Wielkopolskie generating €63.6 million), Hungary's eastern and western regions (Győr-Moson-Sopron with €62.7 million), and Ukraine's central-north-eastern region (Poltava with €40.0 million).
7. Revealed structural shift in Ukrainian dairy sector during wartime, with industrial farms increasing their share of total production from 36.9% to projected 44.9% by 2024, demonstrating adaptation to crisis conditions.

The research documents four categories of adaptation strategies employed by Ukrainian dairy enterprises during wartime: spatial adaptation through operational relocation and distributed production systems; vertical integration via internalisation of supply chain components and on-farm processing; technological adaptation employing energy autonomy solutions and digital management systems; and cooperative arrangements including resource pooling and shared risk mechanisms. These findings extend agricultural resilience theory beyond climate and economic shocks to include war conditions, with quantified effectiveness metrics for each approach.

SUMMARY

The dissertation addresses the critical challenges and transformative dynamics within the dairy industries of Ukraine, Hungary, and Poland, focusing on market structures, financial performance, integration mechanisms, and resilience during periods of significant economic and geopolitical disruption. The research is particularly significant given the unique context of Eastern European dairy sectors, characterized by post-socialist transitions, EU integration processes, and the unprecedented challenges posed by the full-scale Russian invasion of Ukraine.

The dissertation aimed to:

- Analyse the structural characteristics, market concentration, and financial performance of dairy enterprises across Ukraine, Hungary, and Poland (2016-2020).
- Evaluate milk price dynamics and market relationships between these Eastern European countries and the broader EU market.
- Assess the impact of the Russian invasion on Ukraine's dairy industry, documenting production losses, infrastructure damage, and market disruptions.
- Identify effective integration mechanisms and policy frameworks that could enhance the competitiveness and sustainability of the Ukrainian dairy sector.

The research employed a mixed-methods approach, including:

- Quantitative analysis using financial data from the EMIS database.
- Comparative analysis across three countries.
- Correlation and regression analyses.
- Gini index calculations for market concentration.
- Profitability ratio assessments.
- Qualitative insights from industry reports and expert assessments.
- Time-series analysis of milk prices and production data.
- Cluster analysis of enterprise performance.

Data sources included EMIS database, State Statistics Services, EU and international agricultural databases, Industry reports, Expert interviews and sectoral assessments.

The key findings of the study included:

1. Market structure and performance:
    - Distinct patterns of enterprise size and financial performance across countries.
    - Ukraine shows strong correlation between enterprise size and profitability.

- Poland demonstrated increased market concentration despite growth in enterprise numbers.
- Hungary exhibited moderate stability in financial performance.

2. Milk price dynamics:
   - Significant price volatility in Ukraine (€22.58 to €68.04 per 100 liters).
   - Variations in market integration and price convergence.
   - Influence of policy frameworks and subsidy regimes on market stability.
3. War impact on Ukrainian dairy sector:
   - 8% decline in dairy cow population and 23% reduction in milk production from 2019 to 2024.
   - Shift towards industrial farm production (increasing from 36.9% to 44.9% of total production).
   - Emergence of adaptive strategies including small-scale processing and cooperative models.

The dissertation provides critical insights into:

- Differential development pathways in Eastern European dairy sectors.
- Strategies for resilience in agricultural systems during external shocks.
- The importance of policy support and integration mechanisms.
- Potential for modernization and competitive positioning.

Key recommendations focused on strategic interventions for stakeholders. Policy makers should develop targeted agricultural strategies and align regulatory frameworks with EU standards. Dairy enterprises must optimise scale, invest in technological resilience, and maintain financial flexibility. International partners are urged to provide coordinated support, facilitate knowledge exchange, and invest in human capital development within agricultural sectors.The research contributes significantly to understanding dairy sector dynamics in transition economies, offering evidence-based guidance for agricultural development, particularly in the context of European integration and post-conflict reconstruction.

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List of publications related to the dissertation

Articles, studies (7)

1. **Gereles, A.**, Szőllősi, L.: A Study of Ukrainian Dairy Industry: Financial Performance and Trends. *SEA - Practical Application of Science. 13* (38), 89-105, 2025. EISSN: 2360-2554. DOI: http://dx.doi.org/10.70147/s3889105
2. **Gereles, A.**: Focus on Ukrainian agriculture and dairy industry: the risks and impacts of war. *Journal Association 1901 SEPIKE. Special Edition* (Ukraine), 23-30, 2022. ISSN: 2196-9531.
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5. **Gereles, A.**, Szőllősi, L.: The current state and latest trends of the Ukrainian dairy sector. *Annals of the Polish Association of Agricultural and Agribusiness Economists. 21* (2), 69-78, 2019. ISSN: 1508-3535. DOI: http://dx.doi.org/10.5604/01.3001.0013.2180
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8. **Gereles, A.**: Integration processes in the dairy industry of Ukraine as a magor component of its development.
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9. **Gereles, A.**: Dairy industry in ukraine: modern overview and trends.
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Annex A

Number of cattle in Ukraine, 2010-2022 (thousand heads)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	The growth rate, %, 2022/2012
All categories of farms	Large horned cattle	4826.7	4494.4	4425.8	4645.9	4397.7	3884.0	3750.3	3806.2	3586.0	3353.5	3140.4	2891.9	2704.3	-38.9 %
	Incl. cows	2736.5	2631.2	2582.2	2554.3	2443.0	2262.7	2166.6	2065.5	1963.6	1843.8	1728.2	1662.1	1552.7	-39.9 %
Agricultural enterprises/ farms	Large horned cattle	1627.1	1526.4	1510.6	1506.5	1417.6	1310.2	1270.5	1175.1	1142.9	1057.1	1004.1	1009.5	1004.6	-33.5 %
	Incl. cows	604.6	589.1	583.7	575.2	560.3	529.2	505.1	469.7	467.9	438.3	421.1	422.8	423.7	-27.41 %
Household farms	Large horned cattle	3199.6	2968.0	2915.2	3139.4	2980.1	2573.8	2479.8	2631.1	2443.1	2296.4	2136.3	1882.4	1699.7	-41.69 %
	Incl. cows	2131.9	2042.1	1998.5	1979.1	1882.7	1733.5	1661.5	1595.8	1495.7	1405.5	1307.1	1239.3	1129.0	-43.51

Annex B

Milk production in Ukraine by type of farms, 2010-2022 (thousand tonnes)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All categories of farms	11248.6	11084.8	11376.6	11490.0	11191.6	10615.1	10381.8	10279.6	10064.0	9697.0	9267.4	8728.8	522.1
Agricultural enterprises/farms	2216.5	2245.6	2535.3	2582.7	2646.3	2669.1	2705.8	2764.7	2755.7	2727.8	2761.3	2767.4	243.3
Household farms	9032.1	8839.2	8841.3	8907.3	8545.3	7946.0	7676.0	7514.9	7308.3	6969.2	6506.1	5961.4	278.8

Methodological Note: *Data for 2022 may be incomplete due to the inability to collect statistics from temporarily occupied territories and areas of active military operations. Figures for agricultural enterprises exclude data from entities in territories not controlled by the Ukrainian government as of the reporting date.*

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TOR20	134	85,9	3864,41	2511,00	Multiple	2	517831,00	573,00	32732,00	1601,00	3861,00	32159,0	2260,0	4295,13	3,591	17,179
TOR19	142	91,0	3916,27	2591,50	Multiple	2	556110,00	174,00	32367,00	1503,00	4290,00	32193,0	2787,0	4364,67	3,372	14,959
TOR18	126	80,8	4006,14	2684,50	Multiple	1	504774,00	620,00	26033,00	1681,00	4580,00	25413,0	2899,0	4077,52	2,718	8,884
TOR17	126	80,8	4238,84	2902,50	Multiple	2	534094,00	524,00	28798,00	1721,00	4534,00	28274,0	2813,0	4602,83	3,077	11,619
TOR16	138	88,5	3676,80	2404,00	2825.000	2	507398,00	507,00	29233,00	1520,00	4040,00	28726,0	2520,0	4369,20	3,559	14,864
EBIT20	134	85,9	301,37	156,50	44.00000	3	40383,00	-325,00	3120,00	56,00	348,00	3445,0	292,0	448,57	2,832	12,068
EBIT19	142	91,0	263,80	138,00	60.00000	4	37460,00	-621,00	2674,00	37,00	307,00	3295,0	270,0	471,21	2,966	10,711
EBIT18	126	80,8	274,97	146,50	Multiple	2	34646,00	-1033,00	3210,00	64,00	347,00	4243,0	283,0	476,69	2,850	13,779
EBIT17	126	80,8	293,30	242,50	Multiple	3	36956,00	-6602,00	2748,00	98,00	480,00	9350,0	382,0	874,39	-4,232	33,697
EBIT16	139	89,1	102,85	73,00	83.00000	3	14296,00	-1003,00	1335,00	-1,00	225,00	2338,0	226,0	307,47	0,271	4,389
PBIT20	134	85,9	307,90	130,00	Multiple	3	41259,00	-285,00	4120,00	43,00	348,00	4405,0	305,0	562,47	3,860	19,660
PBIT19	141	90,4	259,48	124,00	Multiple	3	36587,00	-680,00	2861,00	24,00	296,00	3541,0	272,0	497,55	2,950	10,666
PBIT18	126	80,8	324,30	127,50	37.00000	4	40862,00	-1084,00	8733,00	41,00	302,00	9817,0	261,0	902,37	7,009	61,636
PBIT17	126	80,8	281,92	220,50	Multiple	2	35522,00	-6595,00	2737,00	82,00	450,00	9332,0	368,0	878,15	-4,082	32,648
PBIT16	139	89,1	77,89	58,00	Multiple	2	10827,00	-1459,00	1260,00	-5,00	179,00	2719,0	184,0	318,87	-0,464	6,274
IT20	114	73,1	-13,06	-6,15	-3.63000	2	-1488,48	-145,81	-0,01	-15,93	-2,59	145,8	13,3	21,19	-4,352	23,220
IT19	127	81,4	-12,83	-5,73	Multiple	2	-1629,07	-156,97	-0,02	-13,61	-3,08	157,0	10,5	22,39	-4,423	22,644
IT18	108	69,2	-17,76	-7,42	-2.58000	2	-1918,33	-165,51	-0,52	-15,35	-3,91	165,0	11,4	28,60	-3,282	11,854
IT17	117	75,0	-18,09	-9,97	-6.89000	3	-2116,74	-116,43	-0,14	-22,64	-5,02	116,3	17,6	22,19	-2,550	6,999
IT16	114	73,1	-11,54	-5,65	Multiple	2	-1315,63	-76,39	-0,32	-14,19	-2,76	76,1	11,4	14,49	-2,447	6,646
PAIT20	134	85,9	296,80	118,12	Multiple	1	39770,81	-284,67	4087,27	36,36	336,93	4371,9	300,6	554,50	3,944	20,494
PAIT19	142	91,0	246,17	110,49	Multiple	1	34956,10	-679,83	2704,20	13,82	280,99	3384,0	267,2	480,58	2,888	10,161
PAIT18	126	80,8	309,08	125,78	Multiple	1	38944,38	-1084,21	8715,70	37,44	287,36	9799,9	249,9	889,88	7,233	65,016
PAIT17	126	80,8	265,12	215,44	Multiple	1	33405,32	-6646,72	2637,33	69,48	432,26	9284,1	362,8	870,97	-4,298	34,343
PAIT16	139	89,1	68,47	57,56	Multiple	1	9517,73	-1458,51	1183,36	-5,89	176,32	2641,9	182,2	309,78	-0,630	6,608
NPL20	134	85,9	296,81	118,50	10.00000	3	39772,00	-285,00	4087,00	36,00	337,00	4372,0	301,0	554,49	3,944	20,494
NPL19	142	91,0	246,20	110,50	Multiple	2	34960,00	-680,00	2704,00	14,00	281,00	3384,0	267,0	480,57	2,888	10,161
NPL18	126	80,8	309,08	125,50	Multiple	2	38944,00	-1084,00	8716,00	37,00	287,00	9800,0	250,0	889,88	7,233	65,024
NPL17	126	80,8	265,13	215,00	119.0000	3	33407,00	-6647,00	2637,00	69,00	432,00	9284,0	363,0	871,00	-4,298	34,344
NPL16	139	89,1	68,47	58,00	65.00000	3	9517,00	-1459,00	1183,00	-6,00	176,00	2642,0	182,0	309,81	-0,631	6,609
TA20	134	85,9	6752,13	4392,50	Multiple	1	904785,00	564,00	46299,00	2291,00	7754,00	45735,0	5463,0	7785,74	2,720	8,214
TA19	142	91,0	7008,65	4583,50	Multiple	1	995229,00	583,00	48844,00	2350,00	8463,00	48261,0	6113,0	7898,76	2,737	8,854
TA18	126	80,8	7363,13	4950,00	Multiple	2	927754,00	557,00	49098,00	2565,00	9182,00	48541,0	6617,0	8159,87	2,686	8,573
TA17	126	80,8	7310,49	4941,00	Multiple	1	921122,00	494,00	46102,00	2485,00	8846,00	45608,0	6361,0	7979,77	2,515	7,268
TA16	139	89,1	6859,15	4361,00	10863.00	2	953422,00	122,00	45487,00	1965,00	8606,00	45365,0	6641,0	8277,91	2,768	8,461
PPE20	134	85,9	3165,22	1890,03	Multiple	1	424139,16	75,60	20370,80	968,01	3904,02	20295,2	2936,0	3631,38	2,467	6,760
PPE19	141	90,4	3305,35	1946,84	Multiple	1	466054,78	87,77	21381,02	949,12	4030,33	21293,3	3081,2	3875,75	2,612	7,746

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
PPE18	126	80,8	3458,99	2003,46	Multiple	1	435832,11	124,07	22638,60	1001,57	4354,54	22514,5	3353,0	4028,02	2,468	6,954
PPE17	126	80,8	3524,23	1991,43	Multiple	1	444052,87	133,85	21687,30	964,84	4493,42	21553,5	3528,6	4177,06	2,392	6,180
PPE16	138	88,5	3517,92	1800,56	Multiple	1	485472,40	0,22	26531,60	868,46	4197,84	26531,4	3329,4	4643,38	2,733	8,352
INTA20	73	46,8	36,18	2,35	Multiple	2	2641,43	0,01	1095,04	0,47	13,88	1095,0	13,4	140,13	6,539	47,152
INTA19	75	48,1	37,78	2,74	.0400000	2	2833,78	0,04	941,50	0,74	12,98	941,5	12,2	131,01	5,478	33,179
INTA18	68	43,6	41,05	2,43	Multiple	2	2791,44	0,01	684,20	0,67	27,84	684,2	27,2	123,33	4,230	17,781
INTA17	63	40,4	39,17	2,34	.3800000	3	2467,56	0,02	756,72	0,73	31,84	756,7	31,1	118,18	4,956	26,309
INTA16	73	46,8	28,38	1,49	Multiple	2	2071,44	0,00	532,62	0,61	24,11	532,6	23,5	72,65	5,185	33,049
CASH20	131	84,0	462,21	153,00	2.000000	6	60549,00	1,00	12582,00	30,00	448,00	12581,0	418,0	1273,25	7,579	66,916
CASH19	139	89,1	448,71	103,00	1.000000	11	62370,00	1,00	10113,00	18,00	387,00	10112,0	369,0	1243,43	5,816	37,898
CASH18	122	78,2	529,76	112,50	Multiple	5	64631,00	1,00	9143,00	20,00	439,00	9142,0	419,0	1128,68	4,643	29,148
CASH17	120	76,9	567,50	115,00	3.000000	6	68100,00	1,00	7558,00	23,00	576,50	7557,0	553,5	1126,60	3,677	16,301
CASH16	134	85,9	405,38	65,50	2.000000	8	54321,00	1,00	5357,00	13,00	406,00	5356,0	393,0	778,80	3,418	14,572
TE20	134	85,9	4780,67	2989,50	7310.000	2	640610,00	-94,00	29843,00	1479,00	5362,00	29937,0	3883,0	5488,32	2,714	8,143
TE19	142	91,0	5014,25	3160,50	Multiple	1	712023,00	76,00	32679,00	1537,00	5689,00	32603,0	4152,0	5811,36	2,640	7,895
TE18	126	80,8	5172,74	3728,00	Multiple	1	651765,00	-1855,00	32279,00	1571,00	6205,00	34134,0	4634,0	5852,08	2,593	8,073
TE17	126	80,8	5225,40	3554,50	1363.000	2	658400,00	-1925,00	33284,00	1492,00	6191,00	35209,0	4699,0	6058,25	2,688	8,839
TE16	138	88,5	4753,22	3128,00	1107.000	2	655944,00	-1256,00	32606,00	1328,00	5487,00	33862,0	4159,0	5798,94	2,867	9,846
EAO20	134	85,9	4780,61	2989,38	Multiple	1	640602,24	-94,11	29843,31	1478,70	5362,00	29937,4	3883,3	5488,31	2,714	8,143
EAO19	142	91,0	5014,23	3160,61	Multiple	1	712020,03	75,93	32679,37	1537,24	5688,66	32603,4	4151,4	5811,35	2,640	7,895
EAO18	126	80,8	5172,75	3727,55	Multiple	1	651766,53	-1855,18	32279,17	1571,01	6204,94	34134,4	4633,9	5852,12	2,593	8,073
EAO17	126	80,8	5225,38	3554,50	Multiple	1	658397,48	-1924,96	33284,04	1492,13	6191,05	35209,0	4698,9	6058,25	2,688	8,839
EAO16	139	89,1	4698,81	2952,82	Multiple	1	653133,95	-1255,76	32605,91	1281,04	5486,92	33861,7	4205,9	5804,12	2,859	9,820
IC20	134	85,9	572,09	182,72	8.220000	6	76659,39	0,68	8686,99	52,04	545,83	8686,3	493,8	1218,06	4,723	26,170
IC19	142	91,0	614,84	194,58	9.080000	10	87306,67	0,76	9596,64	48,41	602,99	9595,9	554,6	1315,55	4,801	27,306
IC18	126	80,8	677,80	211,60	9.330000	9	85402,67	0,78	9865,57	51,32	664,37	9864,8	613,1	1379,48	4,435	23,365
IC17	126	80,8	700,98	219,35	9.670000	9	88323,99	0,81	10227,25	53,20	688,72	10226,4	635,5	1430,41	4,435	23,360
IC16	139	89,1	654,04	209,02	9.650000	10	90912,13	0,06	10198,32	46,78	677,33	10198,3	630,6	1368,33	4,635	25,701
RE20	133	85,3	1970,34	1171,71	Multiple	1	262055,13	-2649,07	14037,03	581,84	2427,68	16686,1	1845,8	2513,88	2,444	7,340
RE19	142	91,0	2108,26	1251,23	Multiple	1	299373,02	-3203,06	14774,38	563,08	2707,86	17977,4	2144,8	2722,45	2,287	6,877
RE18	125	80,1	2126,15	1416,73	Multiple	1	265768,52	-7385,49	15010,00	614,67	2785,27	22395,5	2170,6	2917,55	1,676	5,949
RE17	125	80,1	2103,15	1308,61	Multiple	1	262893,40	-4396,05	14961,77	462,61	2712,87	19357,8	2250,3	2804,09	2,004	5,965
RE16	137	87,8	1998,82	1174,38	Multiple	1	273838,94	-4542,55	15122,79	487,58	2476,64	19665,3	1989,1	2722,59	2,222	7,236
PLP20	130	83,3	286,26	113,60	Multiple	1	37214,08	-273,78	3930,96	33,93	303,79	4204,7	269,9	540,31	3,907	19,992
PLP19	142	91,0	242,03	108,76	Multiple	1	34368,27	-669,19	2661,89	13,60	276,59	3331,1	263,0	471,48	2,870	10,025
PLP18	126	80,8	306,09	124,74	Multiple	1	38567,10	-1075,29	8644,01	37,13	285,00	9719,3	247,9	881,31	7,252	65,361
PLP17	126	80,8	264,23	214,80	Multiple	1	33292,90	-6626,83	2629,44	69,27	430,97	9256,3	361,7	868,11	-4,303	34,377

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
PLP16	133	85,3	67,78	57,64	Multiple	1	9014,99	-1460,59	1185,05	1,77	176,57	2645,6	174,8	306,93	-0,799	7,103
TL20	134	85,9	1971,56	929,50	Multiple	2	264189,00	51,00	19496,00	467,00	2060,00	19445,0	1593,0	3231,76	3,785	15,729
TL19	142	91,0	1994,44	1104,50	Multiple	2	283211,00	21,00	22480,00	440,00	1954,00	22459,0	1514,0	3186,51	4,062	19,399
TL18	126	80,8	2190,41	1057,00	Multiple	1	275992,00	33,00	21980,00	521,00	2236,00	21947,0	1715,0	3471,58	3,607	14,363
TL17	126	80,8	2085,11	1060,00	398.0000	2	262724,00	62,00	24753,00	504,00	2333,00	24691,0	1829,0	3274,38	4,141	21,738
TL16	139	89,1	2140,13	1033,00	Multiple	2	297478,00	43,00	24310,00	471,00	2183,00	24267,0	1712,0	3612,38	4,242	21,374
ROA20	134	85,9	3,87	2,73	Multiple	2	518,80	-26,72	30,26	1,01	6,61	57,0	5,6	6,00	-0,134	7,399
ROA19	142	91,0	3,24	2,89	Multiple	2	460,44	-19,75	20,50	0,48	6,05	40,3	5,6	4,94	-0,241	4,702
ROA18	126	80,8	4,04	2,94	Multiple	2	508,85	-20,06	33,44	1,16	6,08	53,5	4,9	6,44	1,080	6,134
ROA17	126	80,8	5,00	4,69	Multiple	2	630,43	-41,14	21,22	1,91	8,68	62,4	6,8	7,88	-2,467	12,050
ROA16	139	89,1	0,87	1,25	Multiple	2	121,45	-41,26	73,16	-0,34	3,08	114,4	3,4	9,58	1,912	26,856
ROE20	134	85,9	7,49	3,74	Multiple	2	1003,17	-38,79	289,05	1,61	9,22	327,8	7,6	25,95	9,699	106,084
ROE19	142	91,0	4,49	4,31	5.060000	3	638,28	-81,38	47,12	0,72	7,91	128,5	7,2	10,92	-2,771	29,387
ROE18	126	80,8	6,98	3,81	Multiple	2	879,76	-15,41	100,44	1,83	10,42	115,9	8,6	13,94	4,382	25,012
ROE17	126	80,8	13,12	6,90	Multiple	2	1653,15	-66,78	642,18	3,39	12,17	709,0	8,8	58,20	10,256	111,565
ROE16	139	89,1	389,59	2,02	Multiple	2	54153,27	-67,27	52085,62	0,19	4,68	52152,9	4,5	4419,02	11,770	138,685
ROCE20	134	85,9	5,00	4,01	Multiple	2	670,07	-38,45	22,88	2,08	8,30	61,3	6,2	7,67	-1,745	9,787
ROCE19	142	91,0	4,26	4,06	3.400000	3	605,59	-70,21	35,72	1,34	7,64	105,9	6,3	9,05	-3,827	33,800
ROCE18	126	80,8	6,68	4,21	Multiple	2	841,21	-14,35	107,43	2,25	8,78	121,8	6,5	12,20	5,605	41,882
ROCE17	126	80,8	11,41	7,02	Multiple	2	1437,59	-151,04	709,45	3,71	11,28	860,5	7,6	64,98	9,935	109,036
ROCE16	139	89,1	3,36	2,45	Multiple	2	466,76	-83,92	190,30	0,02	4,85	274,2	4,8	25,86	4,876	38,623
NPM20	134	85,9	8,60	6,17	3.330000	2	1151,93	-45,50	58,64	2,41	13,69	104,1	11,3	12,94	0,397	5,047
NPM19	142	91,0	8,74	6,59	.7300000	2	1241,06	-44,22	114,24	0,96	12,44	158,5	11,5	15,87	3,160	19,298
NPM18	126	80,8	10,74	6,98	Multiple	2	1353,83	-21,68	164,55	2,46	13,96	186,2	11,5	19,39	4,462	31,873
NPM17	126	80,8	11,65	12,59	Multiple	2	1468,32	-66,61	60,37	4,36	21,00	127,0	16,6	15,97	-1,818	8,435
NPM16	138	88,5	2,67	2,93	4.450000	2	368,54	-70,85	55,52	0,19	8,18	126,4	8,0	14,10	-0,675	6,814
GPM20	50	32,1	-4,34	-3,35	Multiple	1	-216,96	-78,45	20,96	-8,69	6,47	99,4	15,2	15,77	-2,254	9,079
GPM19	48	30,8	-2,73	-3,30	8.210000	2	-131,07	-30,25	21,60	-11,76	7,55	51,9	19,3	12,45	-0,033	-0,469
GPM18	36	23,1	-5,44	-3,01	Multiple	1	-195,75	-77,25	23,76	-9,87	4,22	101,0	14,1	17,79	-2,195	7,097
GPM17	37	23,7	-0,46	-0,47	Multiple	1	-17,05	-35,55	25,18	-9,86	8,52	60,7	18,4	13,49	-0,380	0,130
GPM16	50	32,1	-12,51	-10,02	0.000000	3	-625,55	-43,22	19,44	-26,08	0,00	62,7	26,1	16,02	-0,153	-0,886
ROS20	134	85,9	9,64	7,38	3.290000	2	1292,34	-45,11	63,41	3,35	14,83	108,5	11,5	12,67	0,238	5,589
ROS19	142	91,0	9,86	7,71	11.40000	3	1400,37	-42,67	119,47	1,91	13,68	162,1	11,8	16,17	3,466	21,872
ROS18	126	80,8	11,46	8,07	Multiple	2	1444,11	-23,19	176,26	3,94	15,51	199,5	11,6	19,31	5,271	42,589
ROS17	126	80,8	12,85	13,65	2.830000	2	1618,73	-65,70	61,63	5,70	21,16	127,3	15,5	16,30	-1,662	8,247
ROS16	138	88,5	3,97	3,99	Multiple	2	547,57	-68,62	57,79	0,05	10,22	126,4	10,2	14,31	-0,496	6,310
EBITDAM20	81	51,9	25,76	24,61	Multiple	1	2086,30	-13,85	69,24	14,85	34,38	83,1	19,5	14,78	0,508	0,754

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
EBITDAM19	94	60,3	26,80	22,69	Multiple	2	2518,82	-24,98	210,98	14,00	32,54	236,0	18,5	26,02	4,756	30,534
EBITDAM18	90	57,7	28,54	25,16	Multiple	1	2568,74	-16,18	196,15	14,91	38,00	212,3	23,1	24,67	3,697	23,432
EBITDAM17	89	57,1	27,14	27,17	Multiple	1	2415,61	-58,50	79,96	15,93	39,84	138,5	23,9	21,12	-1,315	4,681
EBITDAM16	91	58,3	21,22	19,91	7.910000	2	1930,66	-43,38	62,42	12,72	27,59	105,8	14,9	16,13	-0,231	3,021
OROA20	134	85,9	4,28	3,34	Multiple	2	573,58	-26,49	20,60	1,66	6,79	47,1	5,1	5,64	-0,870	7,128
OROA19	142	91,0	3,74	3,21	Multiple	2	530,40	-19,06	21,72	0,97	6,33	40,8	5,4	4,88	-0,234	4,996
OROA18	126	80,8	4,35	3,35	Multiple	2	548,48	-21,45	35,82	1,73	6,74	57,3	5,0	6,04	0,816	7,887
OROA17	126	80,8	5,55	5,32	5.680000	2	699,26	-40,58	22,25	2,64	9,25	62,8	6,6	7,95	-2,406	11,715
OROA16	139	89,1	1,46	1,97	Multiple	2	202,39	-39,69	76,15	-0,03	3,81	115,8	3,8	9,70	2,249	28,274
INVT20	50	32,1	3,57	2,80	Multiple	2	178,68	1,09	22,23	2,15	4,02	21,1	1,9	3,02	5,039	30,680
INVT19	48	30,8	3,50	2,70	Multiple	2	168,17	1,04	26,24	2,16	3,56	25,2	1,4	3,67	5,386	32,691
INVT18	36	23,1	3,99	3,03	Multiple	2	143,58	1,44	37,93	2,20	3,32	36,5	1,1	5,93	5,650	33,068
INVT17	37	23,7	3,76	2,87	Multiple	2	139,26	1,48	19,75	2,40	3,75	18,3	1,4	3,23	3,847	17,316
INVT16	49	31,4	7,94	2,89	0.000000	3	388,92	0,00	81,22	2,06	4,25	81,2	2,2	15,79	3,411	11,856
TRT20	62	39,7	50,43	16,32	22.62000	2	3126,96	1,64	632,11	11,36	24,29	630,5	12,9	119,64	3,958	15,566
TRT19	68	43,6	108,82	14,06	Multiple	1	7399,78	1,17	2564,04	10,07	24,72	2562,9	14,7	398,76	5,200	27,933
TRT18	69	44,2	40,88	13,54	Multiple	1	2820,67	0,85	564,01	8,61	22,23	563,2	13,6	101,32	4,353	19,132
TRT17	71	45,5	227,04	13,23	Multiple	2	16120,02	1,10	10592,60	8,10	28,25	10591,5	20,2	1289,33	7,709	62,003
TRT16	77	49,4	31,79	12,53	Multiple	2	2447,45	0,00	515,20	8,34	15,95	515,2	7,6	76,03	5,038	27,525
CAT20	134	85,9	1,20	1,12	1.390000	5	160,80	0,34	3,36	0,87	1,41	3,0	0,5	0,51	1,500	4,184
CAT19	142	91,0	1,17	1,07	.9300000	5	166,28	0,16	4,47	0,86	1,37	4,3	0,5	0,58	2,612	11,526
CAT18	126	80,8	1,13	1,01	Multiple	4	141,82	0,29	5,79	0,83	1,38	5,5	0,6	0,59	4,218	31,240
CAT17	126	80,8	1,20	1,12	1.150000	5	151,21	0,23	5,96	0,83	1,35	5,7	0,5	0,63	3,780	25,018
CAT16	139	89,1	1,25	1,02	Multiple	4	173,53	0,00	10,69	0,81	1,34	10,7	0,5	1,20	6,266	44,979
NCAT20	134	85,9	0,97	0,82	.8200000	5	129,97	0,12	4,56	0,57	1,20	4,4	0,6	0,62	2,672	11,260
NCAT19	142	91,0	0,95	0,78	.5200000	5	134,56	0,07	6,49	0,57	1,14	6,4	0,6	0,76	4,806	31,050
NCAT18	126	80,8	0,93	0,79	.5400000	5	117,73	0,08	6,06	0,57	1,16	6,0	0,6	0,66	4,179	28,157
NCAT17	126	80,8	0,96	0,80	.5200000	4	120,97	0,23	3,71	0,59	1,16	3,5	0,6	0,59	2,095	5,664
NCAT16	138	88,5	30,52	0,71	Multiple	5	4211,83	0,00	4055,56	0,51	1,08	4055,6	0,6	345,14	11,746	137,984
TAT20	134	85,9	0,49	0,45	Multiple	6	65,08	0,09	1,18	0,36	0,58	1,1	0,2	0,18	0,990	1,788
TAT19	142	91,0	0,47	0,45	.3600000	9	66,07	0,06	1,48	0,36	0,56	1,4	0,2	0,18	1,355	6,812
TAT18	126	80,8	0,46	0,43	Multiple	6	58,28	0,06	1,28	0,34	0,54	1,2	0,2	0,18	1,160	2,734
TAT17	126	80,8	0,49	0,45	.3300000	6	61,19	0,17	1,38	0,35	0,57	1,2	0,2	0,20	1,546	3,931
TAT16	139	89,1	0,55	0,39	.3300000	8	76,24	0,00	9,71	0,31	0,55	9,7	0,2	0,87	9,082	92,301
TPT20	62	39,7	12,55	5,07	.4900000	2	778,39	-7,14	150,79	0,49	17,19	157,9	16,7	22,75	4,125	22,354
TPT19	68	43,6	8,91	4,97	Multiple	2	605,63	-3,86	102,01	0,16	12,68	105,9	12,5	15,09	3,937	21,372
TPT18	69	44,2	11,69	4,07	.1400000	3	806,37	-0,58	201,85	0,23	11,39	202,4	11,2	28,13	5,266	32,286

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TPT17	71	45,5	7,35	4,18	.0200000	2	521,66	-11,59	41,74	0,06	13,56	53,3	13,5	9,88	1,058	1,091
TPT16	77	49,4	9,82	4,20	Multiple	2	756,07	-1,45	86,55	0,20	14,22	88,0	14,0	14,97	2,844	10,248
WCT20	134	85,9	-2,98	1,67	1.260000	3	-399,62	-667,12	49,84	1,05	2,88	717,0	1,8	58,46	-11,183	127,933
WCT19	142	91,0	1,47	1,49	Multiple	3	208,40	-50,48	76,60	0,90	2,77	127,1	1,9	9,64	1,956	32,275
WCT18	126	80,8	-2,64	1,41	.9600000	4	-333,21	-404,04	27,16	0,75	2,56	431,2	1,8	36,86	-10,514	114,985
WCT17	126	80,8	-2,21	1,46	Multiple	3	-278,27	-479,79	66,16	0,87	2,50	546,0	1,6	44,55	-10,022	107,901
WCT16	139	89,1	0,98	1,35	Multiple	3	136,07	-51,71	48,01	0,77	2,33	99,7	1,6	10,63	-1,397	14,644
BV20	134	85,9	4950,22	3108,50	1211.000	2	663329,00	-154,00	31026,00	1537,00	5573,00	31180,0	4036,0	5659,79	2,697	8,045
BV19	142	91,0	5075,87	3211,00	1516.000	2	720774,00	76,00	33196,00	1550,00	5777,00	33120,0	4227,0	5868,44	2,624	7,790
BV18	126	80,8	5195,64	3744,00	Multiple	1	654651,00	-1933,00	32545,00	1548,00	6254,00	34478,0	4706,0	5872,02	2,584	7,993
BV17	126	80,8	5222,02	3564,50	Multiple	2	657975,00	-1995,00	33383,00	1497,00	6210,00	35378,0	4713,0	6060,54	2,700	8,920
BV16	139	89,1	4696,65	2948,00	3318.000	2	652834,00	-1320,00	32558,00	1279,00	5477,00	33878,0	4198,0	5766,71	2,880	9,968
NECA20	134	85,9	-1580,13	-746,00	Multiple	2	-211737,00	-20242,00	12571,00	-1760,00	-212,00	32813,0	1548,0	3511,31	-2,539	13,673
NECA19	142	91,0	-1578,13	-835,00	Multiple	2	-224095,00	-22821,00	9625,00	-1787,00	-139,00	32446,0	1648,0	3527,80	-2,917	14,965
NECA18	126	80,8	-1690,56	-755,00	Multiple	2	-213011,00	-22034,00	8781,00	-2142,00	-193,00	30815,0	1949,0	3698,44	-2,891	12,052
NECA17	126	80,8	-1549,10	-812,00	Multiple	2	-195187,00	-24724,00	7371,00	-1936,00	-148,00	32095,0	1788,0	3441,86	-3,373	18,729
NECA16	139	89,1	-1746,84	-758,00	Multiple	2	-242811,00	-24181,00	5065,00	-1847,00	-179,00	29246,0	1668,0	3533,99	-3,829	19,079
DEBT20	57	36,5	1583,21	764,13	Multiple	1	90243,15	0,57	11934,33	294,60	1688,03	11933,8	1393,4	2391,09	2,800	7,971
DEBT19	59	37,8	1481,85	572,18	Multiple	1	87429,13	0,38	12508,02	313,98	1643,74	12507,6	1329,8	2411,30	3,086	9,977
DEBT18	60	38,5	1407,07	664,74	Multiple	1	84423,93	0,30	13076,62	212,59	1340,43	13076,3	1127,8	2388,76	3,366	12,191
DEBT17	64	41,0	1320,14	682,01	Multiple	1	84488,93	0,72	15567,22	178,62	1520,58	15566,5	1342,0	2273,36	4,437	24,816
DEBT16	69	44,2	1453,01	674,67	Multiple	1	100257,50	8,68	15295,06	256,24	1814,27	15286,4	1558,0	2237,89	4,065	21,672
LDEBT20	47	30,1	1259,99	594,43	Multiple	1	59219,42	12,16	7708,56	178,69	1131,09	7696,4	952,4	1969,71	2,550	5,666
LDEBT19	51	32,7	839,86	326,32	Multiple	1	42833,09	8,38	8702,74	90,44	946,17	8694,4	855,7	1458,89	3,823	17,453
LDEBT18	54	34,6	770,55	333,38	98.60000	2	41609,70	2,44	8297,94	110,23	834,85	8295,5	724,6	1359,26	3,956	18,547
LDEBT17	59	37,8	698,56	401,27	Multiple	1	41215,09	4,59	6823,01	121,45	750,43	6818,4	629,0	1067,54	3,798	18,663
NewVar165	66	42,3	917,53	392,61	Multiple	1	60557,20	5,70	11219,99	130,64	1070,21	11214,3	939,6	1584,72	4,737	28,099
SDEBT20	56	35,9	554,00	325,78	Multiple	1	31023,73	0,57	4302,68	111,26	743,65	4302,1	632,4	725,62	2,997	12,342
SDEBT19	57	36,5	782,39	396,37	Multiple	1	44596,07	0,38	8399,94	137,12	632,40	8399,6	495,3	1365,14	3,929	18,312
SDEBT18	58	37,2	738,18	278,64	Multiple	1	42814,26	0,30	8182,11	96,78	703,32	8181,8	606,5	1330,70	3,949	18,334
SDEBT17	62	39,7	697,97	252,71	Multiple	1	43273,86	0,72	8744,21	109,68	639,85	8743,5	530,2	1301,90	4,455	24,469
SDEBT16	67	42,9	592,54	313,86	Multiple	1	39700,36	2,06	4712,02	99,60	672,37	4710,0	572,8	863,31	3,106	10,936
NDEBT20	133	85,3	205,19	-46,00	-2.00000	4	27290,00	-13082,00	11904,00	-253,00	267,00	24986,0	520,0	2116,53	0,283	20,366
NDEBT19	140	89,7	171,09	-27,50	-1.00000	9	23953,00	-10222,00	12491,00	-223,00	184,50	22713,0	407,5	2154,94	1,304	15,563
NDEBT18	123	78,8	156,12	-30,00	-1.00000	4	19203,00	-9151,00	12948,00	-364,00	167,00	22099,0	531,0	2186,07	2,135	15,302
NDEBT17	122	78,2	132,63	-24,50	-1.00000	3	16181,00	-7496,00	15464,00	-293,00	229,00	22960,0	522,0	2116,98	2,845	24,079
NDEBT16	135	86,5	340,84	-6,00	-2.00000	6	46013,00	-5250,00	15201,00	-176,00	353,00	20451,0	529,0	1851,08	4,215	32,010

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
WCAP20	134	85,9	1519,66	894,00	Multiple	1	203634,58	-4511,46	17363,60	379,46	1551,46	21875,1	1172,0	2605,18	3,190	14,176
WCAP19	142	91,0	1346,87	771,40	Multiple	1	191255,85	-5076,26	13951,13	251,01	1595,31	19027,4	1344,3	2396,39	2,499	9,563
WCAP18	126	80,8	1448,90	840,97	Multiple	1	182560,78	-3191,40	13073,58	295,43	1951,04	16265,0	1655,6	2340,17	2,578	9,329
WCAP17	126	80,8	1523,71	964,63	Multiple	1	191987,81	-6629,68	13048,52	258,82	1960,36	19678,2	1701,5	2363,91	1,842	7,332
WCAP16	139	89,1	1219,81	735,62	Multiple	1	169553,77	-4314,18	11719,66	116,37	1660,94	16033,8	1544,6	2043,32	2,197	7,917
CAPE20	134	85,9	5730,70	3539,53	Multiple	1	767914,45	370,61	35672,99	1755,83	6352,39	35302,4	4596,6	6598,34	2,664	7,900
CAPE19	142	91,0	5653,38	3586,44	Multiple	1	802780,12	75,93	34917,34	1641,48	6712,35	34841,4	5070,9	6351,13	2,501	7,196
CAPE18	126	80,8	5897,99	3880,64	Multiple	1	743146,33	-602,10	35748,57	1679,23	6785,38	36350,7	5106,2	6478,06	2,428	6,942
CAPE17	126	80,8	5937,54	3745,97	Multiple	1	748129,69	2,62	34862,66	1662,24	7217,20	34860,0	5555,0	6547,52	2,473	7,322
CAPE16	139	89,1	5443,94	3427,99	Multiple	1	756707,87	-14,18	37391,70	1392,83	6340,05	37405,9	4947,2	6521,26	2,674	8,341
CURR20	134	85,9	4,82	2,50	Multiple	3	646,13	0,46	79,27	1,44	4,93	78,8	3,5	8,36	6,150	48,849
CURR19	142	91,0	4,68	2,17	1.660000	3	664,96	0,32	37,19	1,32	5,93	36,9	4,6	6,33	2,919	9,610
CURR18	126	80,8	4,95	2,24	Multiple	2	623,15	0,40	65,95	1,32	5,72	65,6	4,4	7,87	4,759	30,456
CURR17	126	80,8	4,87	2,44	Multiple	2	613,57	0,39	81,22	1,43	5,74	80,8	4,3	8,31	6,674	57,556
CURR16	139	89,1	3,89	2,11	Multiple	3	540,34	0,28	46,36	1,24	4,72	46,1	3,5	5,32	4,799	31,663
QUIR20	134	85,9	2,98	1,11	Multiple	3	399,90	0,07	65,19	0,61	2,72	65,1	2,1	6,74	6,757	56,456
QUIR19	142	91,0	2,81	0,98	.9200000	3	399,14	0,10	27,40	0,58	2,96	27,3	2,4	4,53	3,180	11,469
QUIR18	126	80,8	3,05	1,12	Multiple	3	384,73	0,19	52,18	0,63	2,95	52,0	2,3	5,89	5,625	40,841
QUIR17	126	80,8	3,06	1,29	Multiple	3	385,17	0,11	65,13	0,65	3,10	65,0	2,5	6,51	7,407	67,269
QUIR16	139	89,1	2,33	1,13	.4500000	3	324,55	0,02	32,76	0,57	2,67	32,7	2,1	3,72	4,956	33,932
DDAR20	119	76,3	1,42	0,25	.0100000	10	168,67	0,01	32,45	0,06	0,89	32,4	0,8	4,25	5,505	33,387
DDAR19	116	74,4	1,46	0,23	.0100000	15	169,04	0,01	20,56	0,05	1,21	20,6	1,2	3,24	3,754	15,749
DDAR18	106	67,9	1,67	0,25	.0100000	16	177,22	0,01	31,88	0,04	1,48	31,9	1,4	4,27	5,113	30,497
DDAR17	107	68,6	1,74	0,30	.0200000	9	185,65	0,01	54,14	0,04	1,37	54,1	1,3	5,68	7,800	69,758
DDAR16	115	73,7	1,16	0,16	.0100000	13	132,98	0,01	26,76	0,04	0,87	26,8	0,8	3,06	5,936	44,355
CASHR20	120	76,9	1,53	0,29	.0100000	10	184,06	0,01	32,45	0,07	0,94	32,4	0,9	4,45	5,005	27,517
CASHR19	117	75,0	1,54	0,23	.0100000	15	179,80	0,01	20,56	0,05	1,21	20,6	1,2	3,42	3,535	13,359
CASHR18	107	68,6	1,69	0,26	.0100000	16	180,82	0,01	31,88	0,04	1,48	31,9	1,4	4,29	5,040	29,615
CASHR17	108	69,2	1,78	0,31	.0300000	9	192,63	0,01	54,14	0,05	1,37	54,1	1,3	5,72	7,595	66,908
CASHR16	116	74,4	1,19	0,16	.0100000	14	138,53	0,01	26,76	0,04	0,92	26,8	0,9	3,09	5,808	42,481
ALTZ20	134	85,9	9,16	5,90	Multiple	2	1226,81	-2,39	98,89	3,75	10,35	101,3	6,6	12,32	4,465	25,424
ALTZ19	142	91,0	9,77	5,70	3.830000	3	1387,54	-4,34	91,30	3,34	10,82	95,6	7,5	12,87	3,317	14,441
ALTZ18	126	80,8	9,44	5,93	.4900000	2	1190,01	-5,63	83,02	3,13	11,08	88,7	8,0	11,85	3,218	14,094
ALTZ17	126	80,8	9,33	5,96	Multiple	2	1175,68	-6,87	101,31	3,54	11,21	108,2	7,7	11,93	4,459	29,135
ALTZ16	139	89,1	7,63	5,22	Multiple	2	1060,78	-4,97	65,72	3,02	9,48	70,7	6,5	8,92	3,498	17,677
ATER20	134	85,9	136,05	134,46	Multiple	1	18231,29	-2129,49	833,40	116,31	158,72	2962,9	42,4	212,92	-8,853	98,777
ATER19	142	91,0	201,21	137,17	Multiple	1	28571,78	101,23	4872,18	114,95	167,56	4771,0	52,6	422,34	9,991	108,357

Hungary	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
ATER18	126	80,8	143,90	134,79	132.4400	2	18131,48	-500,78	382,24	113,03	164,76	883,0	51,7	82,66	-3,582	30,958
ATER17	126	80,8	1325,59	133,95	113.6600	2	167023,96	-136,16	146529,98	114,25	164,99	146666,1	50,7	13040,73	11,221	125,944
ATER16	139	89,1	2785,56	135,90	108.0400	2	387192,90	-4772,48	369108,90	117,79	169,00	373881,4	51,2	31299,71	11,786	138,938
CTTA20	133	85,3	6,33	3,73	.0300000	3	841,36	0,02	48,76	0,78	8,02	48,7	7,2	8,73	2,628	7,849
CTTA19	140	89,7	6,10	2,40	Multiple	3	853,34	0,01	54,04	0,28	7,83	54,0	7,5	9,15	2,619	8,156
CTTA18	124	79,5	6,56	2,79	.0400000	4	813,45	0,01	44,92	0,30	10,24	44,9	9,9	8,92	2,054	4,784
CTTA17	122	78,2	7,07	2,91	.0300000	4	862,70	0,01	55,24	0,56	9,14	55,2	8,6	9,53	2,213	6,120
CTTA16	137	87,8	6,01	1,92	Multiple	4	823,04	0,01	58,56	0,30	7,07	58,6	6,8	9,51	2,996	11,435
TRTA20	62	39,7	4,06	2,53	Multiple	2	251,76	0,06	35,92	1,44	4,03	35,9	2,6	5,43	3,900	19,594
TRTA19	68	43,6	4,30	2,86	Multiple	2	292,20	0,02	46,15	1,34	4,73	46,1	3,4	6,14	5,066	32,544
TRTA18	69	44,2	4,62	3,00	Multiple	2	318,84	0,06	44,45	1,54	5,23	44,4	3,7	6,08	4,535	27,291
TRTA17	70	44,9	4,85	3,67	Multiple	2	339,46	0,02	51,35	1,86	5,57	51,3	3,7	6,68	5,212	34,539
TRTA16	86	55,1	4,37	2,77	0.000000	9	375,81	0,00	61,44	1,14	4,24	61,4	3,1	7,51	5,707	40,166
INTA20	133	85,3	20,48	17,95	15.27000	2	2724,05	1,65	50,04	13,36	27,57	48,4	14,2	10,46	0,734	0,092
INTA19	142	91,0	20,12	18,65	Multiple	2	2857,00	0,48	48,62	13,53	25,61	48,1	12,1	9,89	0,708	0,382
INTA18	126	80,8	19,44	17,40	Multiple	2	2449,76	1,21	50,12	12,86	24,77	48,9	11,9	9,48	0,910	0,876
INTA17	126	80,8	18,87	16,42	Multiple	2	2376,99	1,08	44,31	12,29	24,41	43,2	12,1	9,35	0,824	0,467
INTA16	138	88,5	19,20	17,00	5.420000	2	2649,21	0,00	49,45	12,27	23,34	49,5	11,1	10,34	0,907	0,585
FXTA20	134	85,9	47,23	47,65	Multiple	2	6329,19	8,26	84,54	39,27	56,68	76,3	17,4	14,41	-0,174	0,199
FXTA19	141	90,4	46,83	47,13	Multiple	2	6602,69	6,13	90,35	35,83	57,20	84,2	21,4	14,76	-0,080	0,312
FXTA18	126	80,8	46,10	46,95	50.33000	2	5809,21	6,93	80,14	37,58	54,85	73,2	17,3	14,57	-0,098	-0,117
FXTA17	126	80,8	46,75	47,46	Multiple	2	5890,33	10,82	80,82	39,03	56,50	70,0	17,5	15,02	-0,203	-0,104
FXTA16	138	88,5	47,75	50,29	Multiple	1	6589,41	0,18	87,25	36,31	59,66	87,1	23,4	17,25	-0,351	-0,004
CLTL20	134	85,9	70,59	72,86	100.0000	18	9458,99	20,28	100,00	52,42	91,69	79,7	39,3	22,69	-0,329	-0,996
CLTL19	142	91,0	75,80	79,97	100.0000	23	10764,28	13,06	100,00	62,07	94,78	86,9	32,7	21,53	-0,743	-0,221
CLTL18	126	80,8	74,50	75,47	100.0000	16	9386,53	15,44	100,00	62,32	93,15	84,6	30,8	20,94	-0,815	0,295
CLTL17	126	80,8	72,07	71,21	100.0000	18	9080,93	13,88	100,00	57,94	91,30	86,1	33,4	21,59	-0,497	-0,303
CLTL16	139	89,1	72,48	74,15	100.0000	21	10074,75	16,24	100,00	54,56	92,68	83,8	38,1	21,75	-0,409	-0,738

Annex D

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TOR20	90	80,4	2399,91	1359,50	1	3	215992,00	1,00	15157,00	288,00	3297,00	15156,0	3009,0	2914,80	1,834	3,841
TOR19	86	76,8	2497,74	1312,50	Multiple	2	214806,00	-24,00	16398,00	239,00	3914,00	16422,0	3675,0	3028,20	1,828	4,355
TOR18	87	77,7	2472,08	1363,00	Multiple	2	215071,00	10,00	15399,00	237,00	4174,00	15389,0	3937,0	2892,63	1,712	3,723
TOR17	53	47,3	2824,32	1189,00	1127	2	149689,00	-72,00	16034,00	423,00	5051,00	16106,0	4628,0	3295,77	1,698	3,669
TOR16	14	12,5	4752,07	4899,50	Multiple	1	66529,00	518,00	13949,00	1956,00	6613,00	13431,0	4657,0	3532,47	1,235	2,385
EBIT20	88	78,6	111,97	48,50	4	4	9853,00	-1717,00	1424,00	2,50	173,50	3141,0	171,0	367,67	-0,661	8,710
EBIT19	85	75,9	55,20	15,00	6	3	4692,00	-665,00	2184,00	-4,00	82,00	2849,0	86,0	332,44	3,224	20,506
EBIT18	84	75,0	105,20	67,50	5	3	8837,00	-905,00	922,00	1,50	205,00	1827,0	203,5	220,13	-0,280	6,613
EBIT17	52	46,4	173,56	97,50	1	3	9025,00	-248,00	1246,00	1,50	242,50	1494,0	241,0	272,32	2,308	6,610
EBIT16	14	12,5	21,29	100,50	Multiple	1	298,00	-842,00	499,00	-50,00	156,00	1341,0	206,0	311,06	-1,628	4,369
PBIT20	88	78,6	87,83	32,50	4	4	7729,00	-1757,00	1017,00	1,50	187,00	2774,0	185,5	357,14	-1,228	8,706
PBIT19	87	77,7	34,77	12,00	16	4	3025,00	-770,00	2184,00	-10,00	79,00	2954,0	89,0	326,56	3,048	21,965
PBIT18	86	76,8	81,88	48,00	48	3	7042,00	-1026,00	627,00	1,00	174,00	1653,0	173,0	206,17	-1,435	9,528
PBIT17	57	50,9	143,04	61,00	1	4	8153,00	-370,00	1242,00	1,00	221,00	1612,0	220,0	278,64	2,254	7,104
PBIT16	14	12,5	-0,79	90,00	Multiple	1	-11,00	-963,00	454,00	-88,00	162,00	1417,0	250,0	335,32	-1,885	5,074
IT20	35	31,3	5,35	1,27	1	2	187,32	-0,95	36,87	0,33	7,69	37,8	7,4	8,11	2,350	6,402
IT19	40	35,7	12,08	1,70	Multiple	1	483,18	-0,90	335,95	0,49	5,00	336,9	4,5	52,80	6,221	39,085
IT18	39	34,8	6,67	1,71	1	2	260,01	-0,23	53,23	0,54	9,03	53,5	8,5	11,86	3,026	9,708
IT17	9	8,0	0,36	0,24	1	2	3,25	-0,23	1,17	0,10	0,63	1,4	0,5	0,43	0,620	0,198
IT16	1	0,9	0,01	0,01	0	1	0,01	0,01	0,01	0,01	0,01		0,0			0,000
PAIT20	95	84,8	79,38	22,96	Multiple	2	7540,95	-1756,83	1010,57	-0,09	158,71	2767,4	158,8	342,30	-1,253	9,543
PAIT19	93	83,0	27,31	8,87	Multiple	1	2539,69	-772,25	1847,71	-2,93	62,32	2620,0	65,3	291,88	2,275	16,869
PAIT18	93	83,0	72,96	37,55	Multiple	2	6785,63	-1041,31	626,28	-0,04	156,12	1667,6	156,2	198,87	-1,448	10,629
PAIT17	60	53,6	135,82	52,42	Multiple	2	8148,96	-370,14	1241,65	-0,16	211,13	1611,8	211,3	273,28	2,336	7,578
PAIT16	14	12,5	-0,76	90,04	Multiple	1	-10,69	-963,50	454,17	-88,49	162,34	1417,7	250,8	335,48	-1,885	5,075
NPL20	87	77,7	81,20	28,00	4	4	7064,00	-1757,00	1011,00	1,00	165,00	2768,0	164,0	354,58	-1,267	8,974
NPL19	85	75,9	23,28	10,00	8	4	1979,00	-772,00	1848,00	-10,00	64,00	2620,0	74,0	301,10	2,251	16,384
NPL18	86	76,8	78,49	48,00	3	4	6750,00	-1041,00	626,00	1,00	170,00	1667,0	169,0	205,73	-1,497	10,083
NPL17	57	50,9	142,98	61,00	1	4	8150,00	-370,00	1242,00	1,00	221,00	1612,0	220,0	278,67	2,254	7,102
NPL16	14	12,5	-0,79	90,00	Multiple	1	-11,00	-963,00	454,00	-88,00	162,00	1417,0	250,0	335,32	-1,885	5,074
TA20	101	90,2	3762,37	1716,00	2	4	379999,00	1,00	24401,00	127,00	5675,00	24400,0	5548,0	5017,35	1,918	3,987
TA19	101	90,2	4007,64	1846,00	Multiple	2	404772,00	1,00	25546,00	147,00	6196,00	25545,0	6049,0	5382,93	1,879	3,732
TA18	99	88,4	4042,52	1843,00	Multiple	2	400209,00	1,00	24876,00	119,00	6348,00	24875,0	6229,0	5345,58	1,828	3,482
TA17	67	59,8	3998,01	673,00	Multiple	2	267867,00	3,00	25744,00	76,00	7118,00	25741,0	7042,0	5574,99	1,825	3,547
TA16	14	12,5	8479,00	8187,00	Multiple	1	118706,00	752,00	20341,00	3714,00	11739,00	19589,0	8025,0	5200,59	0,674	0,576
PPE20	71	63,4	3416,95	2476,30	Multiple	1	242603,63	0,29	17205,83	272,36	4755,53	17205,5	4483,2	3770,04	1,753	3,419
PPE19	72	64,3	3653,29	2456,15	2	2	263036,78	0,58	18689,50	305,18	5078,94	18688,9	4773,8	4115,44	1,743	3,284
PPE18	75	67,0	3500,72	2189,00	Multiple	2	262554,16	0,89	18321,35	307,68	4862,38	18320,5	4554,7	4009,08	1,744	3,294
PPE17	50	44,6	3361,78	2034,76	15	2	168088,99	0,36	15464,19	233,49	5196,93	15463,8	4963,4	3872,77	1,479	2,074

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
PPE16	14	12,5	5498,66	4815,83	Multiple	1	76981,19	381,78	14784,04	2681,16	7710,27	14402,3	5029,1	3717,03	1,138	1,875
INTA20	12	10,7	8,90	1,66	Multiple	1	106,82	0,14	60,62	0,50	8,90	60,5	8,4	17,36	2,829	8,455
INTA19	15	13,4	11,36	2,38	Multiple	1	170,41	0,01	91,22	0,45	7,86	91,2	7,4	24,20	3,024	9,490
INTA18	20	17,9	11,62	2,67	1	2	232,31	0,02	93,22	0,71	7,00	93,2	6,3	25,94	2,843	7,050
INTA17	15	13,4	7,73	2,68	Multiple	1	115,99	0,40	46,32	0,98	11,33	45,9	10,4	11,75	2,834	9,102
INTA16	7	6,3	8,53	3,51	Multiple	1	59,73	0,21	23,23	0,38	19,71	23,0	19,3	9,56	0,817	-1,275
CASH20	58	51,8	338,84	52,50	2	6	19653,00	2,00	3849,00	8,00	271,00	3847,0	263,0	766,64	3,508	12,814
CASH19	60	53,6	249,93	33,50	1	4	14996,00	1,00	2861,00	6,00	177,00	2860,0	171,0	548,18	3,365	11,924
CASH18	63	56,3	181,16	37,00	4	5	11413,00	1,00	1976,00	6,00	120,00	1975,0	114,0	372,62	3,253	11,478
CASH17	42	37,5	318,86	43,00	1	5	13392,00	1,00	3656,00	8,00	246,00	3655,0	238,0	787,41	3,585	12,818
CASH16	12	10,7	486,08	175,50	Multiple	1	5833,00	6,00	2169,00	46,50	685,00	2163,0	638,5	663,02	1,829	3,116
TE20	100	89,3	2705,66	514,50	2	5	270566,00	-2466,00	23113,00	26,50	4032,50	25579,0	4006,0	4318,23	2,343	6,679
TE19	102	91,1	2771,09	530,00	1	4	282651,00	-2334,00	24216,00	15,00	3903,00	26550,0	3888,0	4528,15	2,392	6,967
TE18	99	88,4	2849,25	562,00	11	4	282076,00	-1589,00	23702,00	13,00	4269,00	25291,0	4256,0	4486,04	2,369	6,746
TE17	67	59,8	3096,18	545,00	Multiple	2	207444,00	-1389,00	24112,00	12,00	5031,00	25501,0	5019,0	4954,38	2,240	5,841
TE16	14	12,5	6583,79	5256,50	Multiple	1	92173,00	130,00	19514,00	2677,00	9500,00	19384,0	6823,0	5216,70	1,118	1,502
EAO20	101	90,2	2678,85	506,32	Multiple	1	270563,43	-2465,82	23113,43	22,99	3787,24	25579,3	3764,3	4305,02	2,357	6,758
EAO19	102	91,1	2771,07	530,24	Multiple	1	282649,41	-2333,97	24216,42	14,55	3902,58	26550,4	3888,0	4528,21	2,392	6,967
EAO18	99	88,4	2849,25	562,16	11	2	282075,67	-1589,26	23701,65	12,79	4269,14	25290,9	4256,4	4486,02	2,369	6,745
EAO17	67	59,8	3096,12	545,05	8	2	207440,16	-1389,43	24111,75	11,99	5030,56	25501,2	5018,6	4954,41	2,240	5,840
EAO16	14	12,5	6583,83	5256,93	Multiple	1	92173,65	130,42	19513,67	2677,44	9499,76	19383,3	6822,3	5216,60	1,118	1,502
IC20	96	85,7	912,48	41,31	1	12	87598,48	0,15	11604,19	4,38	1295,03	11604,0	1290,7	1820,22	3,830	18,351
IC19	97	86,6	961,16	42,27	1	12	93232,20	0,16	12575,09	4,79	1311,24	12574,9	1306,5	1964,95	3,873	18,670
IC18	95	84,8	999,75	36,51	1	11	94975,79	0,16	12453,72	4,74	1447,35	12453,6	1442,6	1966,68	3,772	17,863
IC17	65	58,0	1075,07	24,02	1	8	69879,34	0,17	11291,33	3,84	1558,42	11291,2	1554,6	1879,55	2,983	12,744
IC16	14	12,5	2239,92	1747,01	Multiple	1	31358,83	21,02	10645,34	1294,98	2792,95	10624,3	1498,0	2637,81	2,745	8,970
RE20	35	31,3	-503,11	-49,89	Multiple	1	-17608,85	-7256,78	220,47	-439,86	10,85	7477,3	450,7	1323,52	-4,266	20,778
RE19	35	31,3	-457,53	-26,13	Multiple	1	-16013,65	-7863,94	1566,65	-298,49	5,02	9430,6	303,5	1505,68	-3,893	17,989
RE18	38	33,9	-349,12	0,59	Multiple	1	-13266,49	-7788,04	1572,20	-188,34	81,78	9360,2	270,1	1479,54	-3,995	18,347
RE17	23	20,5	-66,81	-4,89	Multiple	1	-1536,53	-1663,71	1487,11	-41,39	59,85	3150,8	101,2	531,75	-0,349	6,262
RE16	4	3,6	-667,21	-359,77	Multiple	1	-2668,82	-1924,42	-24,87	-1185,25	-149,16	1899,6	1036,1	855,79	-1,755	3,248
PLP20	82	73,2	79,46	28,00	11	2	6515,45	-1692,17	973,37	0,76	159,24	2665,5	158,5	349,52	-1,298	8,579
PLP19	83	74,1	28,01	12,63	Multiple	1	2325,19	-779,57	1865,21	-9,60	86,43	2644,8	96,0	311,63	2,144	14,943
PLP18	84	75,0	70,84	32,97	Multiple	2	5950,24	-1032,04	620,70	0,13	140,45	1652,7	140,3	207,29	-1,286	9,633
PLP17	56	50,0	156,94	62,30	Multiple	2	8788,64	-377,90	1267,66	1,10	244,58	1645,6	243,5	289,81	2,104	6,259
PLP16	14	12,5	-0,76	88,81	Multiple	1	-10,58	-950,36	447,97	-87,29	160,12	1398,3	247,4	330,90	-1,885	5,075
TL20	94	83,9	1161,39	461,50	Multiple	2	109171,00	1,00	9248,00	90,00	1540,00	9247,0	1450,0	1817,44	2,635	7,079
TL19	97	86,6	1256,18	452,00	Multiple	2	121849,00	-8,00	11136,00	83,00	1593,00	11144,0	1510,0	2021,55	2,735	8,204
TL18	91	81,3	1298,29	565,00	Multiple	2	118144,00	3,00	11920,00	104,00	1466,00	11917,0	1362,0	2079,61	2,875	9,319

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TL17	63	56,3	996,35	372,00	15	3	62770,00	-15,00	7651,00	76,00	1552,00	7666,0	1476,0	1546,92	2,846	9,370
TL16	14	12,5	1895,21	1324,00	Multiple	1	26533,00	297,00	7352,00	621,00	1903,00	7055,0	1282,0	2011,36	2,053	3,896
ROA20	94	83,9	-0,30	1,93	2	2	-27,80	-305,93	94,87	-0,06	6,33	400,8	6,4	35,50	-6,880	60,815
ROA19	91	81,3	106,57	1,23	0	4	9697,77	-416,19	9941,17	-1,22	4,74	10357,4	6,0	1043,40	9,511	90,643
ROA18	94	83,9	3,65	1,60	Multiple	2	343,41	-95,14	84,00	-0,05	4,47	179,1	4,5	18,39	0,185	14,008
ROA17	60	53,6	4,45	1,87	Multiple	2	266,72	-20,06	98,11	-0,14	6,63	118,2	6,8	15,57	3,767	22,144
ROA16	14	12,5	0,56	0,95	Multiple	1	7,87	-8,65	13,51	-1,24	2,31	22,2	3,6	5,11	0,638	3,183
ROE20	94	83,9	-79,96	3,53	Multiple	2	-7515,85	-7238,14	134,74	0,34	12,66	7372,9	12,3	751,40	-9,504	91,370
ROE19	91	81,3	49,12	3,20	0	2	4470,28	-41,02	2663,89	-0,04	23,47	2704,9	23,5	288,58	8,595	77,315
ROE18	94	83,9	22,12	4,60	Multiple	2	2078,97	-39,65	835,74	0,21	11,87	875,4	11,7	90,86	7,966	70,784
ROE17	60	53,6	15,80	7,03	45	2	947,94	-45,14	294,46	1,11	19,06	339,6	17,9	42,49	5,021	32,046
ROE16	14	12,5	0,37	1,07	2	2	5,13	-16,10	21,15	-1,89	2,83	37,3	4,7	8,59	0,423	2,430
ROCE20	94	83,9	-66,15	3,30	Multiple	1	-6217,65	-8231,56	1811,43	0,61	8,38	10043,0	7,8	872,21	-8,904	85,244
ROCE19	90	80,4	130,94	2,03	Multiple	2	11784,88	-27,23	10924,42	-0,06	10,99	10951,7	11,1	1150,75	9,481	89,924
ROCE18	91	81,3	19,99	3,18	24	2	1819,29	-20,06	835,73	0,04	8,07	855,8	8,0	91,36	8,166	72,534
ROCE17	54	48,2	10,29	4,29	Multiple	2	555,87	-45,14	98,16	1,24	14,47	143,3	13,2	20,69	1,893	7,318
ROCE16	14	12,5	1,42	1,08	Multiple	1	19,85	-9,22	18,41	-0,62	2,90	27,6	3,5	6,63	0,879	3,033
NPM20	85	75,9	-16,97	2,66	1	2	-1442,72	-2602,13	1857,44	0,13	13,80	4459,6	13,7	358,30	-2,889	41,198
NPM19	82	73,2	12,67	0,64	Multiple	2	1038,76	-1306,14	1978,24	-0,69	9,18	3284,4	9,9	269,35	3,409	42,307
NPM18	85	75,9	-427,05	3,98	Multiple	2	-36298,83	-41085,24	3055,84	0,26	11,24	44141,1	11,0	4476,82	-9,125	83,883
NPM17	52	46,4	4,97	2,58	0	2	258,40	-334,30	401,25	0,32	13,85	735,6	13,5	78,62	0,810	19,069
NPM16	14	12,5	2,37	1,98	Multiple	1	33,18	-16,44	33,30	-2,26	4,83	49,7	7,1	11,28	1,371	4,239
GPM20	5	4,5	36,36	20,96	Multiple	1	181,81	3,12	100,00	10,22	47,51	96,9	37,3	39,37	1,372	1,450
GPM19	5	4,5	36,22	22,40	Multiple	1	181,08	2,40	100,00	13,13	43,15	97,6	30,0	38,68	1,485	2,156
GPM18	5	4,5	36,33	15,78	Multiple	1	181,64	4,97	100,00	15,66	45,23	95,0	29,6	38,62	1,523	1,985
GPM17	2	1,8	41,96	41,96	Multiple	1	83,91	36,86	47,05	36,86	47,05	10,2	10,2	7,21		
GPM16	2	1,8	6,22	6,22	Multiple	1	12,43	-7,74	20,17	-7,74	20,17	27,9	27,9	19,74		
ROS20	86	76,8	-12,07	3,80	Multiple	2	-1038,17	-2602,13	1966,09	0,32	14,21	4568,2	13,9	362,50	-2,487	41,064
ROS19	83	74,1	15,83	2,03	1	2	1314,21	-1120,86	1822,40	-0,08	14,07	2943,3	14,2	241,33	3,930	44,609
ROS18	85	75,9	-423,46	5,13	Multiple	2	-35994,08	-41078,18	3055,84	0,37	14,37	44134,0	14,0	4476,56	-9,125	83,873
ROS17	50	44,6	8,98	3,34	Multiple	2	448,89	-334,30	401,25	0,40	13,56	735,6	13,2	76,92	0,921	21,586
ROS16	14	12,5	3,65	2,23	2	2	51,07	-16,20	36,57	-0,85	5,91	52,8	6,8	11,89	1,462	4,467
EBITDAM20	69	61,6	22,00	16,06	21	2	1518,05	-974,74	2022,78	2,78	24,20	2997,5	21,4	284,71	4,480	38,701
EBITDAM19	64	57,1	24,22	13,63	Multiple	1	1550,22	-893,39	1437,84	4,88	21,21	2331,2	16,3	213,66	3,447	36,246
EBITDAM18	68	60,7	35,81	14,04	Multiple	2	2434,77	-39,62	1332,42	7,98	21,72	1372,0	13,7	160,44	8,111	66,488
EBITDAM17	46	41,1	26,70	14,15	0	2	1228,11	-54,07	478,89	5,66	26,36	533,0	20,7	72,18	5,679	35,990
EBITDAM16	12	10,7	14,26	14,19	Multiple	1	171,16	-5,55	45,79	9,60	17,38	51,3	7,8	12,49	1,164	3,650
OROA20	94	83,9	0,45	2,52	Multiple	2	41,98	-293,49	94,87	0,32	7,07	388,4	6,8	34,41	-6,709	58,995
OROA19	90	80,4	119,38	1,43	Multiple	2	10744,01	-416,19	10924,42	-0,70	5,36	11340,6	6,1	1152,66	9,463	89,707

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
OROA18	91	81,3	4,43	2,38	Multiple	2	402,97	-95,15	84,00	-0,02	4,89	179,2	4,9	18,59	0,096	13,854
OROA17	54	48,2	6,21	2,64	3	2	335,40	-18,56	98,11	0,60	7,30	116,7	6,7	15,68	4,077	22,550
OROA16	14	12,5	1,12	0,97	Multiple	1	15,72	-8,52	14,84	-0,47	2,64	23,4	3,1	5,32	0,792	3,363
INVT20	4	3,6	1,96	1,58	Multiple	1	7,85	0,77	3,93	1,07	2,86	3,2	1,8	1,38	1,456	2,405
INVT19	4	3,6	2,16	1,62	Multiple	1	8,64	0,74	4,67	1,02	3,31	3,9	2,3	1,74	1,544	2,484
INVT18	4	3,6	2,09	1,54	Multiple	1	8,35	0,94	4,34	1,09	3,09	3,4	2,0	1,55	1,667	2,774
INVT17	2	1,8	2,39	2,39	Multiple	1	4,78	0,58	4,20	0,58	4,20	3,6	3,6	2,56		
INVT16	2	1,8	0,97	0,97	Multiple	1	1,93	0,78	1,15	0,78	1,15	0,4	0,4	0,26		
TRT20	81	72,3	14,38	10,89	Multiple	2	1164,67	0,09	189,10	6,75	17,25	189,0	10,5	21,36	7,015	57,245
TRT19	78	69,6	16,96	11,53	Multiple	1	1322,74	-0,23	341,61	6,35	17,42	341,8	11,1	38,38	8,062	68,770
TRT18	82	73,2	16,77	11,56	Multiple	2	1375,44	0,01	258,41	5,70	18,32	258,4	12,6	29,78	6,913	54,886
TRT17	49	43,8	3495,95	10,72	10	2	171301,33	-1,79	170625,85	6,26	14,07	170627,6	7,8	24373,12	7,000	49,000
TRT16	13	11,6	12,63	10,95	Multiple	1	164,22	4,69	32,05	9,36	15,27	27,4	5,9	6,97	1,854	4,865
CAT20	86	76,8	6,36	1,59	Multiple	2	546,79	0,04	313,53	1,00	2,52	313,5	1,5	33,69	9,127	84,141
CAT19	82	73,2	7,39	1,77	Multiple	2	605,74	-0,14	395,34	1,11	2,59	395,5	1,5	43,46	8,999	81,298
CAT18	85	75,9	3,24	1,86	11	3	275,58	0,01	25,40	1,05	2,87	25,4	1,8	4,26	2,773	9,131
CAT17	52	46,4	5,14	1,91	Multiple	2	267,18	-0,95	81,02	0,88	3,53	82,0	2,7	12,81	4,964	26,584
CAT16	14	12,5	1,51	1,44	Multiple	1	21,07	0,86	2,35	1,18	1,87	1,5	0,7	0,50	0,278	-1,148
NCAT20	76	67,9	21,69	0,74	1	3	1648,73	-1,00	657,92	0,38	1,16	658,9	0,8	93,56	5,553	32,967
NCAT19	71	63,4	3,63	0,68	Multiple	2	257,59	-0,01	115,44	0,42	1,16	115,5	0,7	14,62	6,841	50,750
NCAT18	74	66,1	16,32	0,67	0	3	1207,47	0,01	481,78	0,43	1,13	481,8	0,7	75,07	5,639	31,886
NCAT17	46	41,1	20,36	0,71	Multiple	2	936,76	-1,85	660,21	0,46	1,14	662,1	0,7	98,60	6,360	41,841
NCAT16	14	12,5	0,73	0,72	1	2	10,28	0,31	1,67	0,44	0,78	1,4	0,3	0,35	1,501	2,941
TAT20	86	76,8	5,43	0,51	0	4	466,89	0,02	313,53	0,28	0,76	313,5	0,5	33,80	9,122	84,076
TAT19	81	72,3	6,42	0,49	0	5	520,36	-0,01	395,34	0,29	0,83	395,4	0,5	43,85	8,941	80,269
TAT18	85	75,9	1,83	0,49	Multiple	3	155,81	0,01	15,52	0,28	0,77	15,5	0,5	3,58	2,594	5,639
TAT17	52	46,4	4,03	0,52	1	3	209,67	-0,63	81,02	0,32	0,85	81,7	0,5	13,03	4,966	26,434
TAT16	14	12,5	0,48	0,51	1	2	6,69	0,23	0,97	0,33	0,53	0,7	0,2	0,18	1,341	3,552
TPT20	57	50,9	-0,37	0,20	Multiple	2	-21,02	-67,84	10,73	-0,22	1,00	78,6	1,2	9,44	-6,693	48,814
TPT19	60	53,6	0,68	0,13	0	3	40,55	-5,23	12,31	-0,12	0,89	17,5	1,0	2,61	2,183	8,257
TPT18	59	52,7	2,95	1,13	Multiple	2	173,87	-20,45	38,49	-0,02	3,72	58,9	3,7	7,32	2,042	10,966
TPT17	41	36,6	11,63	1,74	Multiple	2	476,67	-0,82	183,81	0,70	7,45	184,6	6,8	31,34	4,672	24,050
TPT16	14	12,5	1,63	0,26	Multiple	1	22,87	-1,48	10,39	-0,10	3,12	11,9	3,2	3,01	2,064	5,159
WCT20	86	76,8	-425,66	2,47	Multiple	2	-36606,65	-37779,05	1601,84	1,05	5,92	39380,9	4,9	4084,74	-9,209	85,181
WCT19	82	73,2	-6,94	2,13	Multiple	2	-569,19	-1641,95	395,34	0,90	7,22	2037,3	6,3	199,55	-6,894	57,452
WCT18	85	75,9	8,97	2,48	Multiple	2	762,05	-1358,63	1742,50	0,87	6,30	3101,1	5,4	256,61	1,673	34,607
WCT17	52	46,4	0,30	1,50	312	2	15,36	-1165,40	312,48	0,25	5,29	1477,9	5,0	180,40	-5,237	35,727
WCT16	14	12,5	4,22	2,29	Multiple	1	59,02	1,22	16,26	1,53	4,10	15,0	2,6	4,33	2,056	4,106
BV20	88	78,6	3138,64	888,50	3	3	276200,00	-2560,00	23997,00	41,50	4696,50	26557,0	4655,0	4669,07	2,173	5,731

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
BV19	91	81,3	3025,51	730,00	Multiple	2	275321,00	-2312,00	23951,00	29,00	4655,00	26263,0	4626,0	4655,71	2,235	6,054
BV18	93	83,0	3009,87	745,00	11	4	279918,00	-1604,00	23834,00	19,00	4679,00	25438,0	4660,0	4621,99	2,281	6,207
BV17	62	55,4	3220,81	637,00	8	2	199690,00	-1361,00	23607,00	9,00	5139,00	24968,0	5130,0	4955,91	2,165	5,453
BV16	14	12,5	6670,57	5329,50	Multiple	1	93388,00	130,00	19780,00	2704,00	9611,00	19650,0	6907,0	5287,68	1,119	1,507
NECA20	96	85,7	-967,90	-221,50	Multiple	2	-92918,00	-9448,00	3427,00	-1411,50	-28,00	12875,0	1383,5	1988,73	-2,160	5,991
NECA19	97	86,6	-1091,33	-194,00	Multiple	2	-105859,00	-11029,00	2151,00	-1522,00	-28,00	13180,0	1494,0	2050,51	-2,543	7,650
NECA18	93	83,0	-1157,83	-299,00	Multiple	2	-107678,00	-12023,00	1414,00	-1383,00	-32,00	13437,0	1351,0	2113,84	-2,820	9,241
NECA17	62	55,4	-780,65	-150,00	Multiple	2	-48400,00	-7450,00	2677,00	-1194,00	-14,00	10127,0	1180,0	1616,05	-2,091	6,720
NECA16	14	12,5	-1498,93	-1146,00	Multiple	1	-20985,00	-6099,00	1675,00	-1883,00	-420,00	7774,0	1463,0	2047,99	-1,176	1,576
DEBT20	58	51,8	1001,08	428,03	Multiple	1	58062,57	1,12	8372,17	76,72	1155,37	8371,1	1078,7	1651,96	2,932	9,328
DEBT19	56	50,0	1087,71	387,35	Multiple	1	60911,56	6,14	8405,66	69,06	1287,78	8399,5	1218,7	1756,35	2,860	8,829
NewVar158	58	51,8	1012,12	391,94	10	2	58702,89	0,65	9254,78	78,61	1147,16	9254,1	1068,6	1712,01	3,526	13,962
NewVar159	35	31,3	732,66	451,65	13	2	25643,22	12,84	3697,91	72,04	812,24	3685,1	740,2	934,35	1,942	3,246
DEBT16	11	9,8	661,42	432,67	Multiple	1	7275,58	0,00	2557,53	121,15	998,97	2557,5	877,8	785,24	1,717	2,676
LDEBT20	49	43,8	917,08	243,01	Multiple	1	44937,05	1,51	7745,24	74,92	738,69	7743,7	663,8	1689,02	2,910	8,400
LDEBT19	46	41,1	1032,01	313,83	Multiple	1	47472,68	4,54	7973,32	74,72	925,70	7968,8	851,0	1837,65	2,757	7,441
LDEBT18	49	43,8	970,91	441,55	7	2	47574,56	7,33	8243,39	102,49	1008,04	8236,1	905,6	1724,46	3,364	11,902
LDEBT17	30	26,8	600,33	335,03	10	2	18009,77	10,09	3277,11	69,57	568,58	3267,0	499,0	870,27	2,351	4,755
LDEBT16	9	8,0	586,27	492,22	Multiple	1	5276,43	36,21	2304,02	93,37	562,07	2267,8	468,7	705,53	2,123	5,114
SDEBT20	49	43,8	267,87	132,03	Multiple	1	13125,51	1,12	2439,98	45,89	333,24	2438,9	287,4	421,97	3,580	15,518
SDEBT19	45	40,2	298,64	136,83	Multiple	1	13438,89	2,72	2668,30	35,51	283,41	2665,6	247,9	472,78	3,444	14,579
SDEBT18	46	41,1	241,92	165,78	3	2	11128,37	0,65	1443,09	21,48	313,24	1442,4	291,8	310,07	2,175	5,099
SDEBT17	29	25,9	263,22	121,59	3	2	7633,41	2,75	897,86	23,48	398,24	895,1	374,8	293,11	1,080	-0,021
SDEBT16	9	8,0	222,13	114,58	Multiple	1	1999,13	41,20	1083,59	59,53	188,67	1042,4	129,1	330,34	2,761	7,889
NDEBT20	76	67,9	495,46	59,50	-2	4	37655,00	-3996,00	8218,00	-50,00	765,00	12214,0	815,0	1734,93	1,893	7,941
NDEBT19	75	67,0	614,08	60,00	Multiple	2	46056,00	-2834,00	8403,00	-35,00	946,00	11237,0	981,0	1720,58	2,624	9,633
NDEBT18	78	69,6	604,91	77,00	-1	3	47183,00	-1793,00	9251,00	-7,00	890,00	11044,0	897,0	1621,00	3,510	15,679
NDEBT17	48	42,9	260,88	16,50	3	2	12522,00	-3340,00	3036,00	-60,50	580,50	6376,0	641,0	1176,68	-0,363	3,593
NDEBT16	14	12,5	97,43	60,00	Multiple	1	1364,00	-2199,00	2551,00	-285,00	496,00	4750,0	781,0	1142,61	0,157	1,471
WCAP20	100	89,3	652,87	195,89	Multiple	1	65287,03	-6828,76	7511,19	7,47	978,92	14340,0	971,5	1468,39	0,496	11,299
WCAP19	101	90,2	652,85	186,97	Multiple	1	65937,98	-7136,67	7493,67	6,89	978,13	14630,3	971,2	1492,72	0,431	12,098
WCAP18	98	87,5	652,78	137,20	5	2	63972,09	-4169,72	6079,72	4,49	1060,25	10249,4	1055,8	1205,25	1,219	6,883
WCAP17	66	58,9	687,43	84,17	4	2	45370,39	-3830,26	7309,87	0,91	814,62	11140,1	813,7	1472,86	1,726	7,078
WCAP16	14	12,5	1619,08	1292,97	Multiple	1	22667,13	24,29	4462,73	788,77	1783,45	4438,4	994,7	1375,49	1,310	0,816
CAPE20	101	90,2	3401,08	1533,16	Multiple	1	343508,76	-2289,38	24620,88	48,70	5370,13	26910,3	5321,4	4879,99	2,105	5,119
CAPE19	102	91,1	3457,19	1475,15	Multiple	1	352633,59	-2293,15	24696,18	31,74	5354,72	26989,3	5323,0	5005,50	2,057	4,760
CAPE18	99	88,4	3580,66	1658,36	19	2	354485,14	-274,80	24450,95	38,02	5408,51	24725,8	5370,5	4984,85	2,052	4,749
CAPE17	67	59,8	3339,75	605,11	18	2	223763,05	-275,03	24190,71	19,67	5341,43	24465,7	5321,8	4970,03	2,130	5,299
CAPE16	14	12,5	7568,57	6738,74	Multiple	1	105960,04	450,31	19972,91	3480,69	10114,62	19522,6	6633,9	4968,00	1,025	1,788

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
CURR20	86	76,8	6,36	2,07	2	3	547,33	0,05	157,01	1,10	3,72	157,0	2,6	18,38	6,931	54,559
CURR19	88	78,6	5,51	1,83	Multiple	2	485,05	-0,50	106,26	1,15	3,43	106,8	2,3	15,24	5,847	35,520
CURR18	87	77,7	5,51	2,11	1	3	479,58	0,07	124,55	1,08	4,13	124,5	3,1	14,16	7,219	59,425
CURR17	59	52,7	41,20	1,65	Multiple	2	2431,06	0,04	2124,83	0,96	5,66	2124,8	4,7	276,23	7,657	58,739
CURR16	14	12,5	3,66	2,36	Multiple	1	51,17	1,08	9,44	1,81	5,21	8,4	3,4	2,75	1,124	-0,035
QUIR20	86	76,8	4,64	1,03	Multiple	2	399,36	0,05	149,63	0,44	2,19	149,6	1,8	17,23	7,470	61,026
QUIR19	88	78,6	4,09	0,98	Multiple	3	359,98	-0,20	106,26	0,41	2,06	106,5	1,7	14,83	6,208	39,062
QUIR18	87	77,7	3,79	1,05	1	4	329,51	0,03	115,94	0,47	2,50	115,9	2,0	12,97	7,851	67,006
QUIR17	59	52,7	39,64	0,99	1	4	2338,80	0,04	2124,83	0,45	2,59	2124,8	2,1	276,42	7,658	58,756
QUIR16	14	12,5	1,53	0,80	Multiple	1	21,45	0,11	5,61	0,38	3,11	5,5	2,7	1,64	1,450	1,460
DDAR20	55	49,1	1,57	0,17	0	7	86,56	0,01	16,40	0,04	1,37	16,4	1,3	3,47	3,046	9,055
DDAR19	55	49,1	0,81	0,13	0	5	44,36	-0,10	9,74	0,03	0,84	9,8	0,8	1,67	3,629	15,576
DDAR18	60	53,6	1,08	0,16	0	9	64,90	0,01	12,88	0,04	0,85	12,9	0,8	2,23	3,543	14,667
DDAR17	37	33,0	17,28	0,38	0	3	639,50	0,01	509,39	0,07	2,72	509,4	2,7	84,39	5,833	34,698
DDAR16	12	10,7	0,86	0,27	Multiple	1	10,28	0,01	4,26	0,07	1,05	4,3	1,0	1,30	2,045	3,954
CASHR20	55	49,1	1,57	0,17	0	7	86,56	0,01	16,40	0,04	1,37	16,4	1,3	3,47	3,046	9,055
CASHR19	55	49,1	0,81	0,13	0	5	44,36	-0,10	9,74	0,03	0,84	9,8	0,8	1,67	3,629	15,576
CASHR18	60	53,6	1,08	0,16	0	9	64,90	0,01	12,88	0,04	0,85	12,9	0,8	2,23	3,543	14,667
CASHR17	37	33,0	17,28	0,38	0	3	639,50	0,01	509,39	0,07	2,72	509,4	2,7	84,39	5,833	34,698
CASHR16	12	10,7	0,86	0,27	Multiple	1	10,28	0,01	4,26	0,07	1,05	4,3	1,0	1,30	2,045	3,954
ALTZ20	98	87,5	41,28	3,81	Multiple	2	4045,45	-116,08	3272,16	1,13	8,65	3388,2	7,5	331,98	9,704	95,300
ALTZ19	99	88,4	41,15	3,14	Multiple	2	4073,62	-116,08	3274,28	1,03	6,88	3390,4	5,9	329,86	9,806	97,033
ALTZ18	94	83,9	80,74	3,74	Multiple	2	7590,01	-116,08	3804,07	0,88	7,85	3920,2	7,0	514,50	6,790	45,410
ALTZ17	62	55,4	39,68	3,52	0	2	2460,16	-116,08	2243,17	0,83	8,44	2359,3	7,6	284,97	7,827	61,512
ALTZ16	14	12,5	8,91	5,66	Multiple	1	124,78	-0,05	26,23	2,12	12,81	26,3	10,7	9,23	1,151	-0,066
ATER20	101	90,2	-2612,49	131,67	100	3	-263861,26	-293894,49	18332,67	106,22	194,90	312227,2	88,7	29379,66	-9,938	99,507
ATER19	102	91,1	418,88	136,05	100	3	42725,58	-12880,02	22155,32	107,10	257,98	35035,3	150,9	2718,03	4,090	46,206
ATER18	99	88,4	68,43	130,55	100	5	6774,78	-10627,48	3884,25	104,96	214,00	14511,7	109,0	1316,32	-5,971	47,867
ATER17	67	59,8	19,99	125,02	100	6	1339,58	-10470,09	1698,84	102,85	164,50	12168,9	61,7	1400,27	-6,564	49,426
ATER16	14	12,5	192,33	125,39	Multiple	1	2692,63	104,24	576,43	108,70	156,52	472,2	47,8	156,39	2,130	3,333
CTTA20	62	55,4	12,47	2,69	0	3	773,39	0,01	96,00	0,26	12,10	96,0	11,8	21,48	2,290	4,770
CTTA19	64	57,1	10,05	1,85	0	5	643,05	0,01	99,67	0,16	8,52	99,7	8,4	19,02	2,798	8,571
CTTA18	65	58,0	10,82	1,71	0	4	703,46	0,01	96,52	0,37	10,38	96,5	10,0	20,88	2,855	8,305
CTTA17	42	37,5	14,15	4,56	Multiple	2	594,20	0,01	99,99	0,61	12,78	100,0	12,2	25,21	2,432	5,197
CTTA16	13	11,6	5,04	2,04	Multiple	1	65,50	0,01	22,33	0,67	5,70	22,3	5,0	6,50	1,855	3,464
TRTA20	88	78,6	19,77	4,85	6	2	1739,63	0,03	99,97	2,87	26,05	99,9	23,2	28,59	1,689	1,527
TRTA19	89	79,5	19,81	4,91	Multiple	2	1762,74	0,19	99,97	2,85	22,28	99,8	19,4	27,74	1,610	1,322
TRTA18	85	75,9	17,44	4,52	Multiple	2	1482,44	0,13	89,86	2,26	15,99	89,7	13,7	25,27	1,700	1,593
TRTA17	56	50,0	18,99	5,99	81	2	1063,17	0,01	87,96	2,83	24,55	88,0	21,7	26,34	1,621	1,231

Poland	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TRTA16	13	11,6	4,46	4,54	Multiple	1	58,02	1,64	8,65	3,01	5,61	7,0	2,6	2,14	0,375	-0,388
INTA20	62	55,4	17,06	17,70	Multiple	1	1057,43	1,38	53,30	10,01	21,48	51,9	11,5	9,52	0,881	2,321
INTA19	64	57,1	17,83	16,23	Multiple	2	1141,38	0,54	74,66	9,94	21,73	74,1	11,8	12,91	1,875	6,056
INTA18	63	56,3	16,41	15,30	Multiple	2	1033,77	0,82	60,12	10,07	22,02	59,3	12,0	10,21	1,359	4,253
INTA17	42	37,5	17,12	15,89	Multiple	1	718,92	-41,03	74,80	11,94	22,60	115,8	10,7	15,54	0,058	8,045
INTA16	14	12,5	20,77	19,49	Multiple	1	290,73	10,70	39,69	16,50	24,38	29,0	7,9	7,33	1,252	2,483
FXTA20	71	63,4	56,24	64,00	19	2	3992,97	0,04	97,47	42,84	71,56	97,4	28,7	24,55	-0,917	0,128
FXTA19	72	64,3	57,26	62,90	69	2	4122,37	0,71	96,44	46,17	74,33	95,7	28,2	24,27	-0,844	0,045
FXTA18	75	67,0	58,37	64,56	Multiple	2	4378,09	1,26	96,88	47,70	73,16	95,6	25,5	23,23	-1,007	0,458
FXTA17	50	44,6	55,65	61,12	11	2	2782,69	1,24	98,46	46,50	69,89	97,2	23,4	24,07	-0,755	0,236
FXTA16	14	12,5	63,74	68,91	Multiple	1	892,42	41,59	75,23	50,78	72,46	33,6	21,7	11,84	-1,002	-0,714
CLTL20	86	76,8	69,81	81,21	100	28	6003,98	1,26	100,00	41,78	100,00	98,7	58,2	32,50	-0,684	-0,969
CLTL19	88	78,6	58,16	82,80	100	29	5118,19	-949,24	100,00	38,15	100,00	1049,2	61,9	113,60	-8,192	73,056
CLTL18	87	77,7	64,49	71,72	100	24	5611,01	1,58	100,00	29,79	100,00	98,4	70,2	34,23	-0,532	-1,155
CLTL17	59	52,7	73,18	78,35	100	18	4317,52	2,30	100,00	57,07	100,00	97,7	42,9	29,33	-0,999	0,041
CLTL16	14	12,5	65,56	68,48	Multiple	1	917,87	16,05	98,57	49,51	94,45	82,5	44,9	28,36	-0,483	-0,900

Annex E

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
EMPL	35	100,0	230,63	127,00	Multiple	3	8072,00	1,00	3000,00	54,00	226,00	2999,0	172,0	496,73	5,382	30,638
EMPD	35	100,0	2022,09	2023,00	2023.000	22	70773,00	2020,00	2024,00	2020,00	2023,00	4,0	3,0	1,40	-0,773	-1,286
TOR20	31	88,6	6126,55	4642,00	Multiple	1	189923,00	165,00	22096,00	1887,00	7386,00	21931,0	5499,0	5764,34	1,575	2,148
TOR19	34	97,1	5930,00	4675,50	Multiple	1	201620,00	6,00	21114,00	2403,00	7712,00	21108,0	5309,0	5097,36	1,342	1,591
TOR18	33	94,3	5454,24	3700,00	Multiple	1	179990,00	15,00	23756,00	2130,00	6450,00	23741,0	4320,0	5617,49	2,208	5,315
TOR17	34	97,1	4780,68	3400,00	Multiple	1	162543,00	-9,00	22235,00	2068,00	6114,00	22244,0	4046,0	4704,57	2,234	5,829
TOR16	21	60,0	4846,90	3707,00	Multiple	1	101785,00	3,00	15226,00	2667,00	7357,00	15223,0	4690,0	3842,44	1,077	1,139
avTOR	34	97,1	5277,68	3868,63	Multiple	1	179440,98	4,25	19913,20	2055,75	6491,50	19909,0	4435,8	4804,01	1,658	2,490
EBIT20	28	80,0	1311,75	1015,00	Multiple	1	36729,00	-2060,00	6201,00	320,00	1919,00	8261,0	1599,0	1714,64	1,141	2,046
EBIT19	29	82,9	850,52	658,00	658.0000	2	24665,00	-2342,00	5348,00	133,00	1206,00	7690,0	1073,0	1447,42	1,348	3,961
EBIT18	29	82,9	1125,21	786,00	Multiple	1	32631,00	2,00	7857,00	367,00	1270,00	7855,0	903,0	1480,46	3,618	15,777
EBIT17	30	85,7	1236,70	867,00	Multiple	1	37101,00	-363,00	6191,00	603,00	1471,00	6554,0	868,0	1451,70	2,485	6,732
EBIT16	17	48,6	1394,24	1112,00	Multiple	1	23702,00	141,00	5967,00	627,00	1596,00	5826,0	969,0	1403,19	2,391	6,939
avEBIT	30	85,7	1151,39	959,63	Multiple	1	34541,67	-511,00	5406,50	445,67	1356,75	5917,5	911,1	1271,03	1,797	3,680
PBIT20	30	85,7	1228,17	929,50	Multiple	1	36845,00	-2060,00	5910,00	326,00	1738,00	7970,0	1412,0	1627,74	1,193	2,195
PBIT19	32	91,4	764,81	437,00	Multiple	1	24474,00	-2638,00	5038,00	84,50	1154,00	7676,0	1069,5	1380,24	1,196	4,192
PBIT18	31	88,6	1059,16	793,00	Multiple	1	32834,00	2,00	7624,00	323,00	1266,00	7622,0	943,0	1409,40	3,614	16,068
PBIT17	32	91,4	1145,19	839,50	Multiple	1	36646,00	-515,00	6084,00	284,50	1432,50	6599,0	1148,0	1372,81	2,320	6,305
PBIT16	19	54,3	1227,53	1028,00	Multiple	1	23323,00	-217,00	5645,00	307,00	1269,00	5862,0	962,0	1320,69	2,301	6,639
IT20	1	2,9	-1,73	-1,73	-1.73000	1	-1,73	-1,73	-1,73	-1,73	-1,73		0,0			0,000
IT19	1	2,9	-0,41	-0,41	-.410000	1	-0,41	-0,41	-0,41	-0,41	-0,41		0,0			0,000
IT18	2	5,7	0,75	0,75	Multiple	1	1,50	-0,47	1,97	-0,47	1,97	2,4	2,4	1,73		
IT17	2	5,7	-1,54	-1,54	Multiple	1	-3,08	-2,08	-1,00	-2,08	-1,00	1,1	1,1	0,76		
IT16	3	8,6	-0,52	-0,06	Multiple	1	-1,56	-1,48	-0,02	-1,48	-0,02	1,5	1,5	0,83	-1,728	
PAIT20	30	85,7	1228,06	929,49	Multiple	1	36841,72	-2061,85	5910,14	326,28	1738,13	7972,0	1411,9	1627,88	1,193	2,195
PAIT19	33	94,3	741,74	414,09	Multiple	1	24477,56	-2637,64	5038,25	71,33	1119,41	7675,9	1048,1	1365,06	1,244	4,349
PAIT18	32	91,4	1026,11	688,47	Multiple	1	32835,42	-0,28	7623,98	307,97	1249,09	7624,3	941,1	1399,05	3,629	16,289
PAIT17	33	94,3	1110,36	817,51	Multiple	1	36641,91	-514,87	6084,39	123,46	1375,75	6599,3	1252,3	1365,96	2,339	6,432
PAIT16	21	60,0	1110,54	866,57	Multiple	1	23321,36	-218,14	5645,25	271,73	1229,64	5863,4	957,9	1306,34	2,322	6,835
NPL20	30	85,7	1228,10	929,50	Multiple	1	36843,00	-2062,00	5910,00	326,00	1738,00	7972,0	1412,0	1627,88	1,193	2,195
NPL19	32	91,4	764,81	437,00	Multiple	1	24474,00	-2638,00	5038,00	84,50	1154,00	7676,0	1069,5	1380,24	1,196	4,192
NPL18	31	88,6	1059,06	793,00	Multiple	1	32831,00	1,00	7624,00	323,00	1266,00	7623,0	943,0	1409,47	3,614	16,065
NPL17	32	91,4	1145,81	839,50	Multiple	1	36666,00	-515,00	6084,00	284,50	1432,50	6599,0	1148,0	1372,27	2,322	6,314
NPL16	19	54,3	1227,47	1028,00	Multiple	1	23322,00	-218,00	5645,00	307,00	1269,00	5863,0	962,0	1320,75	2,300	6,638
TA20	30	85,7	11793,07	9290,00	Multiple	1	353792,00	917,00	38423,00	4411,00	15801,00	37506,0	11390,0	9626,03	1,299	1,034
TA19	33	94,3	11162,67	8035,00	Multiple	1	368368,00	49,00	39471,00	4584,00	14758,00	39422,0	10174,0	10003,30	1,427	1,497
TA18	32	91,4	8811,94	6477,00	Multiple	1	281982,00	40,00	31510,00	3763,50	12111,00	31470,0	8347,5	7716,52	1,527	2,014

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TA17	33	94,3	7222,91	4783,00	Multiple	1	238356,00	40,00	31402,00	3001,00	9878,00	31362,0	6877,0	7023,63	2,020	4,305
TA16	22	62,9	8108,27	4652,00	Multiple	1	178382,00	12,00	33892,00	2902,00	11529,00	33880,0	8627,0	8347,61	1,727	3,288
PPE20	30	85,7	3928,10	2441,92	Multiple	1	117842,92	5,36	17481,66	961,52	5599,76	17476,3	4638,2	4314,10	1,687	2,693
PPE19	33	94,3	3936,52	2054,76	Multiple	1	129905,22	7,68	21168,95	734,77	5467,07	21161,3	4732,3	4774,24	2,077	4,682
PPE18	32	91,4	3079,08	1657,31	Multiple	1	98530,46	13,75	18120,21	735,20	3563,92	18106,5	2828,7	3933,97	2,431	6,528
PPE17	33	94,3	2535,75	1412,79	Multiple	1	83679,62	5,85	15935,76	596,92	2869,20	15929,9	2272,3	3450,53	2,515	6,851
PPE16	21	60,0	3299,70	1805,32	Multiple	1	69293,65	39,78	19774,69	763,44	3705,22	19734,9	2941,8	4565,85	2,702	8,409
INTA20	16	45,7	205,38	2,78	Multiple	1	3286,15	0,16	1988,50	1,00	102,73	1988,3	101,7	524,06	3,126	9,966
INTA19	15	42,9	188,63	4,13	Multiple	1	2829,48	0,19	1537,51	1,17	92,39	1537,3	91,2	446,27	2,642	6,426
INTA18	14	40,0	54,65	3,20	3.310000	2	765,16	0,03	700,95	0,38	12,83	700,9	12,5	186,10	3,736	13,968
INTA17	15	42,9	38,75	1,55	Multiple	1	581,19	0,03	523,92	0,33	5,55	523,9	5,2	134,38	3,858	14,913
INTA16	11	31,4	4,49	1,72	Multiple	1	49,44	0,04	25,23	0,49	6,86	25,2	6,4	7,36	2,633	7,482
CASH20	30	85,7	372,50	118,00	Multiple	2	11175,00	1,00	2433,00	18,00	537,00	2432,0	519,0	615,90	2,684	7,276
CASH19	29	82,9	214,24	74,00	3.000000	3	6213,00	1,00	1106,00	4,00	385,00	1105,0	381,0	283,25	1,612	2,294
CASH18	28	80,0	202,36	62,50	1.000000	2	5666,00	1,00	1651,00	15,00	167,00	1650,0	152,0	362,57	2,902	9,340
CASH17	30	85,7	136,23	49,00	4.000000	3	4087,00	2,00	800,00	7,00	237,00	798,0	230,0	190,86	2,008	4,430
CASH16	18	51,4	119,67	40,50	Multiple	1	2154,00	2,00	722,00	10,00	76,00	720,0	66,0	211,46	2,320	4,454
TE20	30	85,7	9964,67	8271,00	Multiple	1	298940,00	858,00	33127,00	4255,00	13959,00	32269,0	9704,0	7913,28	1,332	1,531
TE19	33	94,3	9279,42	7475,00	Multiple	1	306221,00	44,00	33087,00	3787,00	10928,00	33043,0	7141,0	7797,20	1,333	1,538
TE18	32	91,4	7232,38	5451,50	Multiple	1	231436,00	39,00	23405,00	3546,00	9817,50	23366,0	6271,5	5771,73	1,304	1,256
TE17	33	94,3	5786,48	4330,00	Multiple	1	190954,00	37,00	20402,00	2877,00	5808,00	20365,0	2931,0	5067,84	1,740	2,697
TE16	22	62,9	6392,45	4274,50	Multiple	1	140634,00	12,00	23223,00	2723,00	9753,00	23211,0	7030,0	6081,03	1,378	1,584
EAO20	30	85,7	9964,66	8271,17	Multiple	1	298939,79	858,32	33127,13	4255,35	13958,95	32268,8	9703,6	7913,22	1,332	1,531
EAO19	33	94,3	9279,39	7474,83	Multiple	1	306219,86	43,83	33087,12	3786,69	10927,83	33043,3	7141,1	7797,25	1,333	1,538
EAO18	32	91,4	7232,34	5451,12	Multiple	1	231434,84	39,26	23405,27	3545,69	9817,88	23366,0	6272,2	5771,75	1,304	1,256
EAO17	33	94,3	5786,44	4329,99	Multiple	1	190952,67	36,95	20401,68	2876,66	5808,20	20364,7	2931,5	5067,82	1,740	2,697
EAO16	22	62,9	6392,47	4274,61	Multiple	1	140634,29	11,79	23223,32	2722,76	9752,56	23211,5	7029,8	6081,07	1,378	1,584
IC20	28	80,0	1646,54	55,30	Multiple	1	46103,17	0,50	22597,68	4,63	741,15	22597,2	736,5	4562,74	4,008	17,512
IC19	31	88,6	1713,87	44,70	Multiple	1	53129,98	0,58	26154,53	7,27	434,83	26154,0	427,6	5044,20	4,224	19,476
IC18	30	85,7	1427,00	36,12	Multiple	1	42809,92	0,47	21790,12	2,87	315,32	21789,7	312,5	4277,23	4,159	18,810
IC17	31	88,6	1308,56	33,14	Multiple	1	40565,24	0,45	20631,33	2,72	298,55	20630,9	295,8	3988,74	4,231	19,474
IC16	21	60,0	1949,82	67,55	Multiple	1	40946,19	0,19	24313,57	27,62	509,77	24313,4	482,2	5532,37	3,747	14,752
RE20	30	85,7	7325,03	7156,11	Multiple	1	219750,93	-4287,95	25041,99	1726,05	8870,44	29329,9	7144,4	7573,50	1,141	0,918
RE19	33	94,3	6482,67	4773,03	Multiple	1	213928,27	-2055,94	22658,62	1412,12	8005,94	24714,6	6593,8	6709,40	1,182	0,792
RE18	32	91,4	4929,87	4307,21	Multiple	1	157755,95	-1714,50	18389,21	1324,98	6085,32	20103,7	4760,3	4761,16	1,183	1,145
RE17	33	94,3	3744,04	2991,99	Multiple	1	123553,23	-920,30	16496,73	1268,26	4662,31	17417,0	3394,1	3733,58	1,713	3,629
RE16	21	60,0	3707,46	3446,73	Multiple	1	77856,72	-1090,44	14017,05	352,82	3970,99	15107,5	3618,2	3908,45	1,271	1,416

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
TL20	30	85,7	1828,47	975,50	Multiple	1	54854,00	40,00	9160,00	207,00	2708,00	9120,0	2501,0	2249,95	1,668	2,595
TL19	33	94,3	1883,42	742,00	Multiple	1	62153,00	2,00	12082,00	206,00	2846,00	12080,0	2640,0	2643,48	2,275	6,062
TL18	32	91,4	1579,66	796,50	1.000000	2	50549,00	1,00	11434,00	184,50	2462,00	11433,0	2277,5	2290,95	2,854	10,500
TL17	33	94,3	1436,39	359,00	Multiple	1	47401,00	1,00	11691,00	141,00	1999,00	11690,0	1858,0	2353,88	2,968	10,843
TL16	21	60,0	1797,48	842,00	Multiple	1	37747,00	2,00	10669,00	180,00	2396,00	10667,0	2216,0	2528,06	2,423	7,096
ROA20	30	85,7	9,26	12,37	16.21000	2	277,65	-38,42	26,73	2,94	16,21	65,2	13,3	12,41	-2,040	6,550
ROA19	32	91,4	3,42	6,43	3.900000	2	109,51	-64,89	23,88	1,36	12,01	88,8	10,6	18,84	-2,861	8,944
ROA18	31	88,6	13,38	13,17	Multiple	1	414,79	-0,62	45,26	5,37	19,42	45,9	14,1	9,50	1,078	2,812
ROA17	33	94,3	14,96	17,86	Multiple	1	493,68	-6,44	32,07	4,61	22,55	38,5	17,9	10,54	-0,415	-1,035
ROA16	21	60,0	13,62	12,55	Multiple	1	286,11	-0,64	29,15	5,83	21,73	29,8	15,9	9,38	0,050	-1,288
ROE20	30	85,7	10,42	14,20	17.04000	2	312,52	-40,18	27,22	3,56	18,21	67,4	14,7	13,78	-1,874	5,173
ROE19	33	94,3	3,24	6,85	Multiple	1	106,76	-85,83	25,43	1,21	12,70	111,3	11,5	22,63	-3,083	10,287
ROE18	32	91,4	14,51	14,70	Multiple	1	464,44	-0,64	57,32	7,37	20,71	58,0	13,3	11,13	1,687	5,908
ROE17	33	94,3	16,80	21,66	Multiple	1	554,24	-10,68	34,56	6,49	25,85	45,2	19,4	11,98	-0,513	-0,815
ROE16	21	60,0	16,15	15,20	Multiple	1	339,25	-0,94	38,42	8,17	24,06	39,4	15,9	10,84	0,100	-0,790
ROCE20	28	80,0	10,58	15,43	Multiple	1	296,10	-47,17	27,22	4,71	18,75	74,4	14,0	14,91	-2,370	7,629
ROCE19	29	82,9	3,70	7,59	Multiple	1	107,39	-74,32	25,26	3,04	12,81	99,6	9,8	21,79	-2,903	8,763
ROCE18	29	82,9	14,15	13,36	Multiple	1	410,32	0,01	53,22	6,49	19,89	53,2	13,4	10,13	1,962	6,969
ROCE17	30	85,7	17,11	19,10	Multiple	1	513,24	-7,52	34,70	8,67	23,94	42,2	15,3	10,77	-0,532	-0,538
ROCE16	18	51,4	17,78	17,52	Multiple	1	319,99	0,00	33,41	11,65	24,26	33,4	12,6	8,66	-0,190	-0,469
NPM20	30	85,7	9,53	18,31	Multiple	1	285,86	-234,93	236,30	4,61	27,21	471,2	22,6	70,92	-0,785	8,404
NPM19	33	94,3	0,15	12,23	Multiple	1	4,95	-191,00	34,01	1,80	19,21	225,0	17,4	49,23	-3,347	11,112
NPM18	32	91,4	27,20	23,45	Multiple	1	870,28	-1,88	258,59	10,44	30,17	260,5	19,7	43,86	5,005	27,064
NPM17	33	94,3	29,23	28,08	Multiple	1	964,73	-10,20	212,42	7,05	37,44	222,6	30,4	37,19	3,833	19,060
NPM16	21	60,0	22,38	22,88	Multiple	1	470,06	-5,42	47,57	11,50	33,72	53,0	22,2	15,35	-0,096	-1,144
GPM20	28	80,0	20,32	24,88	Multiple	1	569,04	-33,33	40,56	14,73	31,57	73,9	16,8	16,59	-1,525	2,931
GPM19	29	82,9	14,76	13,56	Multiple	1	428,10	-17,29	38,70	5,23	26,14	56,0	20,9	13,56	-0,072	-0,378
GPM18	29	82,9	24,53	23,82	Multiple	1	711,27	8,58	41,35	16,89	32,71	32,8	15,8	9,73	0,219	-1,133
GPM17	31	88,6	27,95	32,37	Multiple	1	866,49	-1,22	51,26	17,95	37,51	52,5	19,6	12,88	-0,376	-0,598
GPM16	19	54,3	27,90	30,84	Multiple	1	530,10	3,59	49,09	17,86	40,97	45,5	23,1	13,56	-0,117	-1,166
ROS20	28	80,0	9,74	21,47	Multiple	1	272,84	-277,51	261,28	6,38	27,96	538,8	21,6	81,75	-0,906	8,650
ROS19	29	82,9	2,13	12,88	Multiple	1	61,88	-169,58	34,01	4,88	21,71	203,6	16,8	47,67	-3,272	10,243
ROS18	29	82,9	20,53	21,05	Multiple	1	595,51	0,11	41,66	10,38	29,62	41,6	19,2	11,36	-0,077	-0,943
ROS17	30	85,7	25,42	29,15	Multiple	1	762,60	-5,63	51,92	11,75	36,19	57,6	24,4	15,69	-0,427	-0,845
ROS16	17	48,6	27,81	27,84	Multiple	1	472,80	10,70	50,28	13,53	37,30	39,6	23,8	13,86	0,185	-1,385
OROA20	28	80,0	9,81	13,21	Multiple	1	274,65	-45,39	26,73	3,95	17,19	72,1	13,2	13,93	-2,451	8,500
OROA19	29	82,9	3,84	6,64	Multiple	1	111,48	-60,43	23,88	2,82	12,10	84,3	9,3	18,24	-2,760	8,164

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
OROA18	29	82,9	12,89	12,44	17.89000	2	373,82	0,01	46,64	5,22	17,89	46,6	12,7	9,33	1,575	4,840
OROA17	30	85,7	15,55	18,34	Multiple	1	466,46	-4,54	32,20	6,72	22,89	36,7	16,2	9,78	-0,447	-0,842
OROA16	17	48,6	16,55	18,20	Multiple	1	281,35	5,29	30,81	9,58	22,52	25,5	12,9	7,60	0,223	-1,088
INVT20	30	85,7	3,61	1,65	Multiple	2	108,21	0,26	58,16	1,37	2,25	57,9	0,9	10,33	5,429	29,635
INVT19	33	94,3	30,20	1,63	1.330000	2	996,70	0,66	790,50	1,33	2,30	789,8	1,0	137,72	5,592	31,718
INVT18	31	88,6	1,74	1,48	1.390000	2	53,83	0,32	6,23	0,95	1,88	5,9	0,9	1,24	2,062	5,083
INVT17	32	91,4	1,62	1,34	Multiple	2	51,85	0,21	4,50	1,18	1,83	4,3	0,6	1,04	1,727	3,052
INVT16	20	57,1	1,61	1,43	Multiple	1	32,27	0,46	5,97	0,97	1,87	5,5	0,9	1,14	3,122	12,064
TRT20	30	85,7	439,66	15,04	Multiple	1	13189,86	0,26	11724,00	8,18	41,24	11723,7	33,1	2133,69	5,458	29,849
TRT19	30	85,7	54,73	21,59	25.39000	2	1641,97	0,88	896,92	10,98	31,29	896,0	20,3	160,92	5,284	28,490
TRT18	31	88,6	32,43	14,69	8.010000	2	1005,22	0,27	364,23	8,01	31,08	364,0	23,1	64,98	4,747	24,414
TRT17	31	88,6	41,88	10,26	Multiple	1	1298,25	0,82	687,23	4,53	31,83	686,4	27,3	121,76	5,291	28,820
TRT16	19	54,3	276,29	23,01	Multiple	1	5249,42	2,94	4193,17	7,30	54,35	4190,2	47,1	958,85	4,216	18,046
CAT20	30	85,7	1,05	1,06	Multiple	2	31,49	0,08	2,45	0,76	1,29	2,4	0,5	0,56	0,183	0,108
CAT19	33	94,3	1,16	1,16	Multiple	2	38,43	0,31	3,08	0,84	1,29	2,8	0,5	0,56	1,499	3,901
CAT18	32	91,4	1,21	1,22	1.320000	2	38,79	0,07	3,93	0,88	1,39	3,9	0,5	0,66	2,052	8,781
CAT17	33	94,3	1,05	1,14	Multiple	2	34,64	0,08	1,78	0,82	1,33	1,7	0,5	0,43	-0,487	-0,257
CAT16	21	60,0	1,08	1,08	.4200000	2	22,62	0,28	1,62	0,88	1,34	1,3	0,5	0,39	-0,568	-0,303
NCAT20	30	85,7	1,64	1,40	.9300000	2	49,07	0,08	6,61	0,93	2,09	6,5	1,2	1,23	2,519	8,826
NCAT19	33	94,3	1,50	1,27	Multiple	1	49,61	0,11	4,74	0,92	1,88	4,6	1,0	0,91	1,667	4,220
NCAT18	32	91,4	1,80	1,44	Multiple	2	57,44	0,09	6,42	1,10	2,00	6,3	0,9	1,36	2,119	5,108
NCAT17	33	94,3	2,51	1,67	1.670000	3	82,78	0,06	26,26	1,26	2,34	26,2	1,1	4,37	5,299	29,476
NCAT16	21	60,0	1,61	1,65	Multiple	1	33,76	0,07	3,92	1,13	1,91	3,9	0,8	0,99	0,672	0,672
TAT20	30	85,7	0,56	0,64	Multiple	2	16,70	0,05	0,94	0,43	0,70	0,9	0,3	0,23	-0,902	-0,049
TAT19	33	94,3	0,56	0,58	.4200000	3	18,32	0,11	1,13	0,42	0,66	1,0	0,2	0,19	0,223	1,928
TAT18	32	91,4	0,60	0,62	Multiple	3	19,27	0,05	1,40	0,49	0,72	1,4	0,2	0,26	0,337	2,402
TAT17	33	94,3	0,59	0,63	.5500000	3	19,54	0,03	0,99	0,47	0,74	1,0	0,3	0,24	-0,797	0,512
TAT16	21	60,0	0,56	0,61	Multiple	2	11,81	0,07	0,99	0,43	0,70	0,9	0,3	0,23	-0,682	0,278
TPT20	29	82,9	142,27	31,31	Multiple	1	4125,88	0,91	1999,63	10,86	103,22	1998,7	92,4	374,19	4,701	23,566
TPT19	31	88,6	93,75	24,81	Multiple	1	2906,15	2,19	1279,06	7,47	64,74	1276,9	57,3	236,91	4,524	22,307
TPT18	31	88,6	301,90	18,92	Multiple	1	9358,83	1,12	3969,36	9,81	52,30	3968,2	42,5	905,07	3,622	12,473
TPT17	30	85,7	316,25	22,06	Multiple	1	9487,46	1,82	6814,50	5,60	154,13	6812,7	148,5	1238,26	5,330	28,841
TPT16	19	54,3	400,51	29,76	Multiple	1	7609,63	4,78	6189,55	9,67	105,56	6184,8	95,9	1408,80	4,291	18,562
WCT20	30	85,7	1,41	1,31	Multiple	1	42,36	0,10	3,41	0,95	1,86	3,3	0,9	0,76	0,558	0,420
WCT19	33	94,3	0,86	1,32	1.060000	3	28,30	-15,87	4,04	0,90	1,75	19,9	0,9	3,14	-4,969	27,007
WCT18	32	91,4	2,52	1,46	Multiple	2	80,54	0,09	26,37	1,06	1,83	26,3	0,8	4,78	4,522	21,549
WCT17	33	94,3	-0,37	1,31	1.500000	3	-12,13	-56,04	3,58	0,85	1,57	59,6	0,7	10,02	-5,699	32,643

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
WCT16	21	60,0	1,41	1,55	Multiple	1	29,58	-0,27	2,56	0,97	1,86	2,8	0,9	0,69	-0,604	0,247
BV20	30	85,7	8675,33	6816,50	Multiple	1	260260,00	756,00	29156,00	3746,00	12241,00	28400,0	8495,0	6949,93	1,363	1,626
BV19	33	94,3	8399,33	6509,00	Multiple	1	277178,00	40,00	30217,00	3460,00	9984,00	30177,0	6524,0	7102,56	1,358	1,626
BV18	32	91,4	7114,63	5378,00	Multiple	1	227668,00	39,00	23084,00	3499,50	9686,00	23045,0	6186,5	5669,23	1,317	1,331
BV17	33	94,3	6424,94	4820,00	Multiple	1	212023,00	41,00	22702,00	3204,00	6469,00	22661,0	3265,0	5624,37	1,756	2,778
BV16	21	60,0	6720,19	4494,00	Multiple	1	141124,00	34,00	23314,00	2825,00	9789,00	23280,0	6964,0	6078,38	1,369	1,536
NECA20	30	85,7	-1281,67	-695,50	Multiple	1	-38450,00	-8060,00	637,00	-1800,00	-46,00	8697,0	1754,0	1918,03	-1,981	4,453
NECA19	33	94,3	-1548,61	-670,00	Multiple	1	-51104,00	-11035,00	885,00	-2217,00	-52,00	11920,0	2165,0	2473,03	-2,209	5,872
NECA18	32	91,4	-1384,34	-771,00	-1.00000	2	-44299,00	-11214,00	722,00	-2084,50	-140,50	11936,0	1944,0	2244,95	-2,923	11,401
NECA17	32	91,4	-1507,56	-356,00	Multiple	1	-48242,00	-13016,00	737,00	-2350,00	-100,50	13753,0	2249,5	2675,23	-2,924	10,635
NECA16	21	60,0	-1701,48	-476,00	Multiple	1	-35731,00	-10701,00	525,00	-2398,00	-105,00	11226,0	2293,0	2582,74	-2,368	6,823
DEBT20	11	31,4	978,68	640,77	Multiple	1	10765,53	23,06	2673,61	106,10	1840,84	2650,6	1734,7	898,11	0,816	-0,462
DEBT19	12	34,3	1041,21	947,33	Multiple	1	12494,52	4,74	2678,20	407,98	1505,76	2673,5	1097,8	804,60	0,630	-0,003
DEBT18	14	40,0	840,44	686,93	Multiple	1	11766,12	0,91	2566,87	140,05	1463,18	2566,0	1323,1	787,68	0,780	-0,139
DEBT17	14	40,0	774,96	501,98	Multiple	1	10849,49	24,46	2831,89	229,19	1239,36	2807,4	1010,2	765,19	1,583	2,974
DEBT16	10	28,6	874,40	435,58	Multiple	1	8744,02	83,00	3869,72	180,99	634,48	3786,7	453,5	1213,52	2,129	4,165
LDEBT20	8	22,9	850,90	500,54	Multiple	1	6807,18	10,85	2276,19	203,83	1555,70	2265,3	1351,9	901,28	1,045	-0,569
LDEBT19	8	22,9	1016,58	760,27	Multiple	1	8132,63	147,99	2678,20	387,20	1505,76	2530,2	1118,6	848,06	1,164	0,923
LDEBT18	9	25,7	950,23	713,15	Multiple	1	8552,10	274,30	2555,17	520,76	1097,16	2280,9	576,4	697,44	1,772	3,357
LDEBT17	9	25,7	936,97	755,10	Multiple	1	8432,70	220,91	2745,21	362,86	1239,36	2524,3	876,5	792,51	1,650	3,105
LDEBT16	6	17,1	1006,88	287,22	Multiple	1	6041,25	11,13	3155,39	125,32	2174,98	3144,3	2049,7	1327,31	1,160	-0,529
SDEBT20	8	22,9	494,79	312,99	Multiple	1	3958,34	23,06	1480,53	108,63	805,77	1457,5	697,1	517,49	1,201	0,508
SDEBT19	8	22,9	545,24	370,29	Multiple	1	4361,91	4,74	1358,88	181,53	947,33	1354,1	765,8	481,24	0,721	-0,875
SDEBT18	12	34,3	267,83	114,02	Multiple	1	3214,01	0,91	1061,24	30,11	426,02	1060,3	395,9	337,12	1,488	1,540
SDEBT17	11	31,4	219,71	229,19	Multiple	1	2416,79	0,00	658,35	56,39	305,90	658,4	249,5	198,54	1,067	1,042
SDEBT16	8	22,9	337,85	329,41	Multiple	1	2702,79	83,00	714,34	187,60	435,73	631,3	248,1	202,92	0,720	0,296
NDEBT20	30	85,7	31,00	-22,50	Multiple	2	930,00	-2133,00	2569,00	-232,00	-1,00	4702,0	231,0	912,47	0,787	2,558
NDEBT19	32	91,4	213,09	-2,00	-2.00000	4	6819,00	-1011,00	2552,00	-153,00	364,00	3563,0	517,0	787,39	1,414	1,951
NDEBT18	32	91,4	192,97	-1,50	-1.00000	2	6175,00	-1630,00	2502,00	-149,50	443,00	4132,0	592,5	812,50	0,834	1,590
NDEBT17	32	91,4	196,78	-4,00	-4.00000	3	6297,00	-891,00	2757,00	-98,50	301,50	3648,0	400,0	691,61	1,912	5,190
NDEBT16	19	54,3	346,47	8,00	Multiple	1	6583,00	-725,00	3834,00	-46,00	413,00	4559,0	459,0	1032,03	2,585	7,480
WCAP20	30	85,7	4414,78	3076,81	Multiple	1	132443,30	172,22	19842,69	2062,72	5404,55	19670,5	3341,8	4000,04	2,295	6,905
WCAP19	33	94,3	4022,05	3060,37	Multiple	1	132727,81	-68,22	16396,63	2292,18	5007,72	16464,9	2715,5	3405,06	1,854	4,617
WCAP18	32	91,4	3552,61	2755,57	Multiple	1	113683,58	0,16	10615,81	1862,51	5331,85	10615,7	3469,3	2607,89	1,127	0,930
WCAP17	33	94,3	3244,25	2739,32	Multiple	1	107060,36	-0,08	9112,69	1858,34	4137,58	9112,8	2279,2	2274,94	1,207	1,236
WCAP16	21	60,0	3029,55	2450,52	Multiple	1	63620,57	-11,63	8096,02	1902,54	4064,20	8107,7	2161,7	2182,10	0,833	0,273
CAPE20	30	85,7	9127,77	7452,49	Multiple	1	273833,07	755,56	29161,36	3799,50	12648,19	28405,8	8848,7	7270,60	1,246	1,122

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
CAPE19	33	94,3	8835,24	6897,70	Multiple	1	291562,78	40,04	30228,20	3459,92	12076,16	30188,2	8616,2	7412,00	1,213	0,967
CAPE18	32	91,4	7469,62	5524,39	Multiple	1	239027,84	38,75	23208,70	3536,12	10775,89	23170,0	7239,8	6008,33	1,224	0,879
CAPE17	33	94,3	6753,92	4867,82	Multiple	1	222879,35	41,15	22721,74	3203,79	7304,00	22680,6	4100,2	5898,26	1,643	2,274
CAPE16	22	62,9	6732,17	4402,47	Multiple	1	148107,78	11,84	23314,38	2742,31	10053,73	23302,5	7311,4	6351,13	1,272	1,046
CURR20	30	85,7	11,12	8,46	Multiple	1	333,73	1,09	33,36	3,74	15,35	32,3	11,6	8,77	0,998	0,425
CURR19	33	94,3	10,43	6,80	Multiple	1	344,28	0,40	40,01	3,60	16,50	39,6	12,9	9,90	1,474	1,736
CURR18	32	91,4	9,46	7,88	Multiple	1	302,83	1,11	38,49	4,57	11,42	37,4	6,8	7,89	1,923	4,933
CURR17	33	94,3	14,00	8,05	Multiple	1	462,08	0,98	124,36	3,54	14,79	123,4	11,3	22,17	4,150	19,992
CURR16	21	60,0	7,60	6,04	Multiple	1	159,62	0,19	22,71	2,38	9,57	22,5	7,2	6,85	1,199	0,359
QUIR20	30	85,7	5,08	4,73	Multiple	1	152,32	0,15	12,01	2,41	7,02	11,9	4,6	3,51	0,541	-0,773
QUIR19	32	91,4	4,48	2,86	Multiple	1	143,34	0,17	20,24	1,18	6,25	20,1	5,1	4,49	1,882	4,045
QUIR18	32	91,4	3,87	2,66	10.22000	2	123,77	0,32	12,05	1,21	5,66	11,7	4,5	3,28	1,022	0,006
QUIR17	33	94,3	4,91	3,06	Multiple	1	162,13	0,29	19,37	1,07	7,81	19,1	6,7	4,81	1,398	1,801
QUIR16	21	60,0	3,18	1,34	Multiple	1	66,69	0,14	11,17	0,89	3,71	11,0	2,8	3,57	1,369	0,483
DDAR20	26	74,3	0,98	0,37	Multiple	2	25,36	0,01	8,63	0,06	0,77	8,6	0,7	1,81	3,410	13,287
DDAR19	24	68,6	1,28	0,19	Multiple	2	30,64	0,01	8,04	0,06	0,92	8,0	0,9	2,54	2,299	3,870
DDAR18	28	80,0	0,85	0,18	.0100000	6	23,90	0,01	7,34	0,02	0,45	7,3	0,4	1,92	2,734	6,353
DDAR17	28	80,0	0,97	0,10	Multiple	4	27,23	0,01	7,13	0,02	0,85	7,1	0,8	2,00	2,536	5,256
DDAR16	14	40,0	0,79	0,08	Multiple	2	11,09	0,01	7,00	0,02	0,42	7,0	0,4	1,88	3,201	10,641
CASHR20	26	74,3	0,98	0,37	Multiple	2	25,36	0,01	8,63	0,06	0,77	8,6	0,7	1,81	3,410	13,287
CASHR19	24	68,6	1,28	0,19	Multiple	2	30,64	0,01	8,04	0,06	0,92	8,0	0,9	2,54	2,299	3,870
CASHR18	28	80,0	0,85	0,18	.0100000	6	23,90	0,01	7,34	0,02	0,45	7,3	0,4	1,92	2,734	6,353
CASHR17	28	80,0	0,97	0,10	Multiple	4	27,23	0,01	7,13	0,02	0,85	7,1	0,8	2,00	2,536	5,256
CASHR16	14	40,0	0,79	0,08	Multiple	2	11,09	0,01	7,00	0,02	0,42	7,0	0,4	1,88	3,201	10,641
ALTZ20	30	85,7	22,61	15,23	Multiple	1	678,18	1,16	63,63	10,95	29,82	62,5	18,9	17,17	0,970	0,018
ALTZ19	33	94,3	21,33	11,68	Multiple	1	703,99	0,76	69,11	8,70	36,55	68,4	27,9	17,68	1,105	0,517
ALTZ18	32	91,4	21,10	15,27	Multiple	1	675,28	1,72	69,01	10,95	29,02	67,3	18,1	15,44	1,241	1,506
ALTZ17	33	94,3	21,84	16,69	Multiple	1	720,56	2,04	69,57	9,55	31,13	67,5	21,6	17,30	1,331	1,575
ALTZ16	21	60,0	17,05	11,86	Multiple	1	358,00	-1,44	49,57	7,02	18,99	51,0	12,0	14,59	1,050	-0,061
ATER20	30	85,7	122,39	112,56	Multiple	1	3671,82	101,84	317,62	104,30	129,99	215,8	25,7	39,45	4,446	22,149
ATER19	33	94,3	119,59	111,83	Multiple	1	3946,58	101,70	249,11	103,64	126,03	147,4	22,4	26,78	3,756	17,494
ATER18	32	91,4	118,74	111,52	Multiple	1	3799,73	101,74	210,80	104,36	121,42	109,1	17,1	22,32	2,666	8,823
ATER17	33	94,3	120,24	112,00	Multiple	1	3967,82	101,71	196,62	104,44	120,40	94,9	16,0	23,82	1,795	2,554
ATER16	22	62,9	122,47	117,80	Multiple	1	2694,38	100,00	163,21	103,42	140,17	63,2	36,8	19,01	0,621	-0,762
CTTA20	30	85,7	3,64	1,14	Multiple	2	109,33	0,01	21,24	0,47	6,31	21,2	5,8	5,27	2,160	4,827
CTTA19	31	88,6	2,95	0,73	.0100000	3	91,37	0,01	28,23	0,06	2,92	28,2	2,9	5,82	3,317	12,203
CTTA18	29	82,9	3,27	1,34	.0200000	3	94,91	0,02	30,17	0,24	2,99	30,2	2,8	6,41	3,282	11,569

Ukraine	Valid N	% Valid obs.	Mean	Median	Mode	Frequency of Mofe	Sum	Minimum	Maximum	Lower Quartile	Upper Quartile	Range	Quartile Range	Std.Dev.	Skewness	Kurtosis
CTTA17	31	88,6	3,24	0,82	Multiple	2	100,33	0,01	31,01	0,16	4,24	31,0	4,1	6,02	3,628	15,466
CTTA16	20	57,1	2,14	0,47	.0300000	3	42,73	0,01	21,04	0,07	1,27	21,0	1,2	4,84	3,520	13,361
TRTA20	29	82,9	5,48	3,84	9.140000	2	158,84	0,12	26,30	1,72	7,73	26,2	6,0	5,94	2,120	5,270
TRTA19	30	85,7	5,02	2,69	2.150000	2	150,47	0,03	36,32	1,96	4,28	36,3	2,3	7,09	3,450	13,447
TRTA18	31	88,6	6,90	4,20	Multiple	1	213,86	0,09	41,94	1,83	7,81	41,9	6,0	8,70	2,761	8,731
TRTA17	31	88,6	8,29	3,96	1.890000	2	256,98	0,06	47,54	1,73	10,19	47,5	8,5	10,46	2,465	6,841
TRTA16	19	54,3	4,43	2,66	Multiple	1	84,13	0,02	16,10	1,03	5,87	16,1	4,8	4,87	1,342	0,585
INTA20	30	85,7	27,86	29,20	Multiple	1	835,75	0,08	65,48	20,73	35,58	65,4	14,9	12,99	0,214	1,686
INTA19	33	94,3	27,88	31,72	Multiple	1	920,03	0,02	47,40	21,61	36,48	47,4	14,9	13,81	-0,768	-0,265
INTA18	32	91,4	29,91	30,90	Multiple	1	957,10	0,02	47,37	21,19	40,45	47,4	19,3	12,45	-0,572	-0,446
INTA17	33	94,3	30,87	33,90	Multiple	1	1018,58	0,02	62,73	23,54	40,17	62,7	16,6	14,02	-0,393	0,158
INTA16	21	60,0	29,16	30,53	Multiple	1	612,45	1,57	50,63	20,07	39,16	49,1	19,1	13,69	-0,382	-0,557
FXTA20	30	85,7	30,66	31,85	Multiple	1	919,80	0,04	68,17	14,92	40,12	68,1	25,2	17,07	0,144	-0,237
FXTA19	33	94,3	35,44	34,69	Multiple	1	1169,59	0,07	95,74	20,85	46,53	95,7	25,7	20,91	0,612	0,940
FXTA18	32	91,4	34,52	33,34	Multiple	1	1104,55	0,20	97,32	21,18	43,89	97,1	22,7	19,88	0,913	2,166
FXTA17	33	94,3	33,61	33,86	Multiple	1	1109,08	0,09	92,21	20,17	43,99	92,1	23,8	19,86	0,718	1,352
FXTA16	21	60,0	37,93	39,34	Multiple	1	796,63	4,44	91,62	25,15	48,18	87,2	23,0	21,19	0,761	0,992
CLTL20	30	85,7	84,77	99,64	100.0000	14	2542,97	24,50	100,00	75,63	100,00	75,5	24,4	24,63	-1,472	0,680
CLTL19	33	94,3	85,41	99,93	100.0000	16	2818,65	25,29	100,00	76,44	100,00	74,7	23,6	22,02	-1,383	0,692
CLTL18	32	91,4	84,12	99,95	100.0000	16	2691,73	26,30	100,00	61,48	100,00	73,7	38,5	23,98	-1,208	0,027
CLTL17	33	94,3	84,70	100,00	100.0000	19	2795,01	8,08	100,00	78,85	100,00	91,9	21,2	25,57	-1,617	1,623
CLTL16	21	60,0	86,62	100,00	100.0000	11	1818,93	32,25	100,00	88,53	100,00	67,8	11,5	24,13	-1,689	1,226