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Economic Diversification Potential: Insights from Mongolia's Livestock Product Value Chains

Mongolia, endowed with abundant natural resources, faces a critical challenge in reducing its reliance on the mining sector and achieving economic diversification. This study aims to identify the potential for economic diversification by developing the non-mining processing industry. To this end, a Revealed Comparative Advantage (RCA) analysis and value chain mapping were employed. The RCA results highlight the importance of livestock-derived products and recognise the livestock sector as having the best potential for achieving economic diversification. Consequently, the value chain of livestock-derived products was mapped, and key challenges at each stage were identified. The study provides actionable recommendations for developing this value chain. The findings underscore that the value chain of livestock-derived products encounters numerous obstacles that must be addressed to build a competitive sector. Key strategies for addressing the issues throughout the value chain include improving animal health, ensuring compliance with good practices and standards, and enhancing competitiveness through advanced technologies, increased financial and investment support, and improved logistics and infrastructure.

Keywords: Economic diversification, Revealed Comparative Advantage, value chain mapping, livestock-derived products, Mongolia

JEL classifications: Q13, Q17.

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Introduction

Economic diversification remains a key component of development strategies for many countries, particularly resource-rich economies like Mongolia. While natural resources significantly contribute to economic growth and improve the livelihoods of local people, extensive research highlights the risks of heavy reliance on a single sector. Such dependence often leads to economic vulnerabilities, including susceptibility to commodity price fluctuations and diminished competitiveness in other traditional sectors (Tserendorj and Purejav, 2012; Taguchi and Ganzorig, 2018; Dagys *et al.*, 2020).

By the end of 2023, Mongolia's mining sector accounted for 29% of GDP, a 5% increase from 2020. In contrast, the contribution made by agriculture dropped to 10%, a 3% decrease, and that of manufacturing fell to 7%, reflecting a 2% decline. Additionally, mining products made up 86% of exports, while light manufacturing and agricultural products accounted for just 5% and 2%, respectively (NSO, 2024a, 2024b). These figures highlight Mongolia's growing dependence on mining and the weakening competitiveness of its traditional sectors.

To reduce dependence on raw material extraction and exports, diversifying Mongolia's economy and export structure is essential. Such diversification aims to mitigate risks and vulnerabilities associated with fluctuations in raw material prices. Therefore, strategic objectives, including supporting the manufacturing industry, establishing value-adding factories for agricultural and mineral products, and increasing the variety, quantity, and monetary value of export-oriented mining and non-mining products, are reflected in

key policy documents in Mongolia. These include the Long-term Development Policy "Vision – 2050", the Medium-term "New Revival Policy", the Five-year Development Guidelines for Mongolia (2021-2025), and the Government Action Program (2024-2028) (Parliament of Mongolia, 2020, 2021a, 2021b, 2024).

Several studies have examined Mongolia's export diversification and proposed policy recommendations. Tsenguunjav and Munkhzul (2015) utilised the RCA index to identify export diversification strategies, assess products with export potential, conduct market research on non-mining products, and analyse production challenges, ultimately proposing strategies to enhance export diversification. Byambatsogt (2019) employed input-output analysis to evaluate the agricultural sector's role in economic diversification and calculate an economic expansion index. Khuslen and Davaajargal (2017) used the Economic Complexity Index and Product Space visualisations to identify priority sectors and products. Dagys *et al.* (2025) examined key sectors for diversification using an input-output methodology. Other studies, such as those of Batdelger (2022) and Helbe *et al.* (2020), provide descriptive analyses of export structures and sector development, identifying value chain challenges and suggesting export diversification strategies. These studies highlight the importance of developing non-mining products to diversify the economy and boost exports, alongside corresponding policy recommendations.

However, there is a notable research gap: no published study to date has systematically mapped the value chain of livestock-derived products, nor has anyone comprehensively identified the challenges encountered at each stage of the

chain. This paper, therefore, aims to explore Mongolia's economic diversification potential in developing the processing industry for livestock-derived products through an RCA analysis and value chain mapping. Constraints at each stage are identified through a review of existing literature, and policy recommendations are proposed to address these challenges.

The remainder of the paper is organised as follows: Section 2 summarises diversification-related theories, methodology, and the data sources; Section 3 assesses the competitiveness and challenges of livestock-derived exports based on RCA and value chain mapping; Section 4 discusses policy recommendations; and Section 5 presents the conclusions.

Materials and methods

Theoretical framework

Economic diversification is crucial for any country, especially for those with economies heavily dependent on the extraction and export of natural resources. Researchers have studied economic diversification from various perspectives and established theoretical frameworks. The Revealed Comparative Advantage (RCA) concept measures a country's competitive strength in international trade based on its actual export performance (Balassa, 1965). Thus, focusing on competitive export products is essential for Mongolia's economic diversification. Conversely, Porter (1990) highlights that competitive advantage arises from a country's ability to innovate and upgrade its industries, which is also vital for diversification.

Furthermore, Porter's value chain concept can foster economic diversification by enhancing competitive advantage (Porter, 1985; Porter and Millar, 1985). This concept can be further extended to the Global Value Chain (GVC) framework, which emphasises input-output, territorial, and governance structures that are important for participation in global commodity chains (Gereffi, 1994).

Complementing Porter's competitive advantage concept, the Resource-Based View (RBV) approach highlights that a firm (or country)'s sustained competitive advantage depends on the potential of its resources, which possess four attributes: value, rareness, imitability, and sustainability (Barney, 1991).

Moreover, Economic Complexity Theory (ECT), introduced by Hidalgo and Hausmann (2009), provides a perspective on how a country's economy develops through the complexity of its productive structure, driven by the accumulation of capabilities, allowing the country to diversify more sophisticated and higher-value products.

Methodology and data employed

Based on the theoretical concepts discussed, it can be concluded that Balassa's RCA concept forms a foundational element for many of these theories. The core objectives of these theories are to achieve competitive advantage, diversify the economy through value addition, and leverage the uniqueness of resources and products. Therefore, we deemed it appropriate to identify products crucial for Mongolia's economic diversification that possess competitive export potential. Given that livestock products are the primary source for processing industries, we aimed to map the livestock value chain, pinpoint challenges at each stage, and explore potential solutions. We believe that addressing these value chain challenges would enable the production of higher-value, high-end, innovative, and knowledge-based products. This approach aligns with the unique characteristics of livestock resources by building capabilities for a complex productive structure and facilitates participation in GVCs. Ultimately, these efforts could pave the way for a more diversified economy in Mongolia.

To conduct this study, we calculate the RCA index for exported products to identify those crucial for economic diversification, the value chains they belong to, and their raw material sources. Next, we map the value chain for livestock-derived products, recognising that most non-mining products originate from the livestock sector. Challenges and constraints are identified at each stage of the chain based on a comprehensive review of existing literature. These findings provide the basis for formulating policy recommendations aimed at advancing economic diversification. Figure 1 shows the methodological framework used in this study.

The main indicator used to assess export products essential for economic diversification is the RCA index. The RCA index measures the competitiveness of country *A* for product *i* compared to the global average.

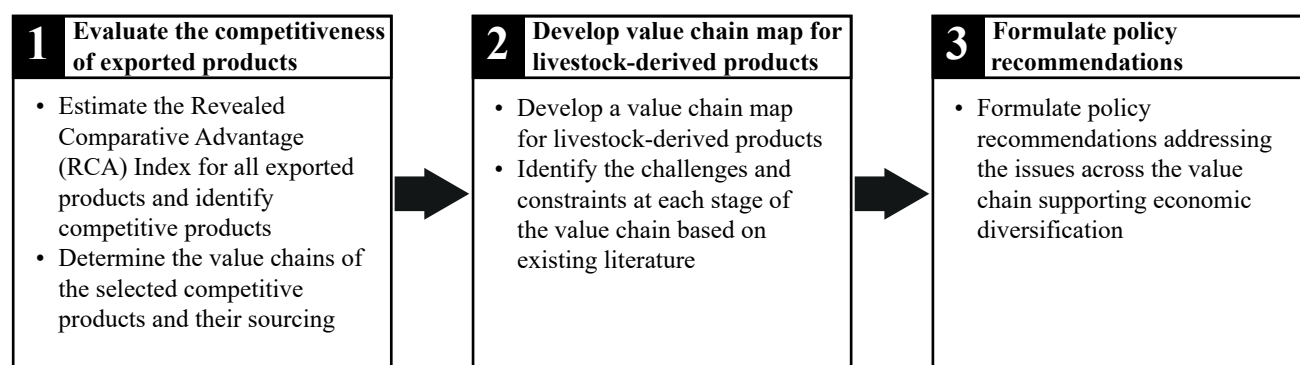


Figure 1: Logical framework scheme of the paper.

Source: Authors' elaboration

$$RCA_{Ai} = \frac{X_{Ai} / \sum_{j \in P} X_{Aj}}{X_{wi} / \sum_{j \in P} X_{wj}} \quad (1)$$

Where:

RCA_{Ai} – revealed comparative advantage index of country A for product i

P – product group, where $i \in P$

X_{Ai} – export value of product i for A

X_{wi} – world export value of product i

$\sum_{j \in P} X_{Aj}$ – total export value for country A across product group P

$\sum_{j \in P} X_{wj}$ – total world export value across product group P

The condition $RCA_{Ai} > 1$ indicates that country A has a comparative advantage in product i , suggesting the product is competitive relative to the world average.

A value chain map for products sourced from the livestock sector is developed as an adaption of the value chain framework developed by Porter and Millar (1985), as shown in Figure 2. The map illustrates the primary activities and identifies constraints at each stage of the chain in Mongolia.

The data used to calculate the RCA index were sourced from the International Trade Centre (ITC) database (ITC Trade Map, 2024). The following datasets for 2023 were utilised:

- Export value of products for Mongolia and the world, as HS4 digits.
- Total exports for Mongolia and the world, as HS4 digits.
- Factors negatively affecting the value chain for livestock-derived products were gathered from a comprehensive review of existing literature.

Results

Competitiveness of livestock-derived products

Figure 3 presents Mongolia's competitive export products, identified by an RCA index greater than one. The results indicate that Mongolia's competitive products predominantly consist of mining raw materials, livestock-derived

raw materials, and manufactured goods produced from these resources. Detailed RCI scores are available in Appendix 1.

Among the mining products, coal, ferrous and non-ferrous metal ores, and precious metal concentrates emerge as the most competitive. Mongolia holds over 500 deposits of 80 different mineral commodities (Gerel *et al.*, 2021), including coal, iron ore, non-ferrous metals like copper, lead, zinc, tin, and tungsten, as well as precious metals such as gold and silver. The RCA index for these products ranges from over 2 to as high as 258, reflecting their presence in the global market. Notably, industrial minerals like feldspar, leucite, nepheline, and fluorspar exhibit strong competitiveness, with an exceptional RCA of 258, the highest among Mongolia's mining products. Additionally, RCA indexes of 61 and 63 for coal and copper, respectively, indicate significant competitiveness.

Livestock-derived raw materials and related manufacturing goods also demonstrate strong global competitiveness. Products related to the meat value chain, including primary products such as meat and by-products like guts, hides, and skins, show high RCA indexes. Additionally, wool, cashmere, and animal hair, along with semi-finished and finished goods such as garments made from these materials, further underscore Mongolia's comparative advantage in the global market. Notably, fine or coarse animal hair shows the highest RCA of 1570 among all exported products, while carded and combed wool and animal hair achieve an RCA of 67. These statistics highlight Mongolia's significant comparative advantage in wool and fibre products, attributed to the unique characteristics of the country's nomadic livestock sector. In particular, the highest RCA values for livestock-derived products, such as animal hair and meat, are closely linked to horse products, as horse-derived goods are relatively uncommon in other countries.

Several interrelated factors could influence the future competitiveness of the livestock sector and the RCA scores of livestock-derived products. Notably, there are numerous limitations on the production and export of high-potential products, particularly cashmere. China holds a near-monopoly in the global cashmere market, accounting for nearly 55% of global supply and dominating raw cashmere processing (Morton *et al.*, 2024). This dominance poses substantial challenges for Mongolia, as competition in the cashmere market remains fierce, and potential tariffs imposed by China

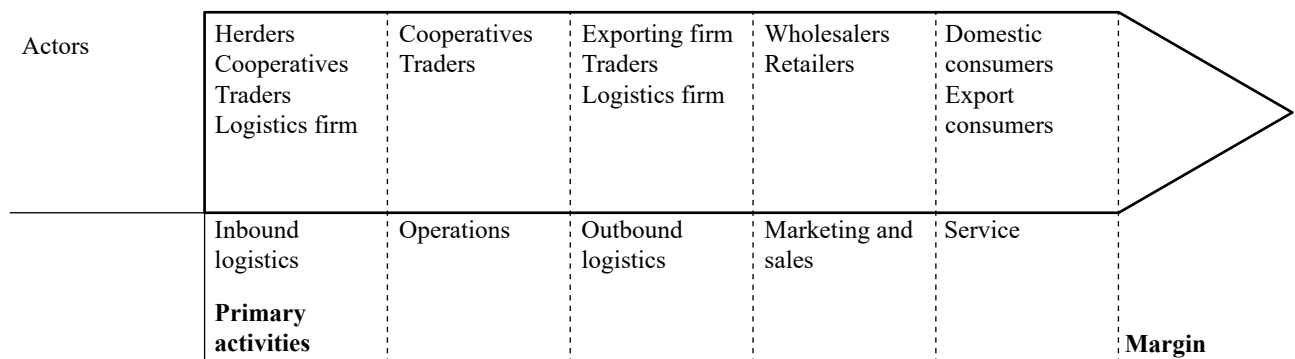


Figure 2: Value chain for livestock-derived products.

Source: Adapted based on Porter and Millar (1985)

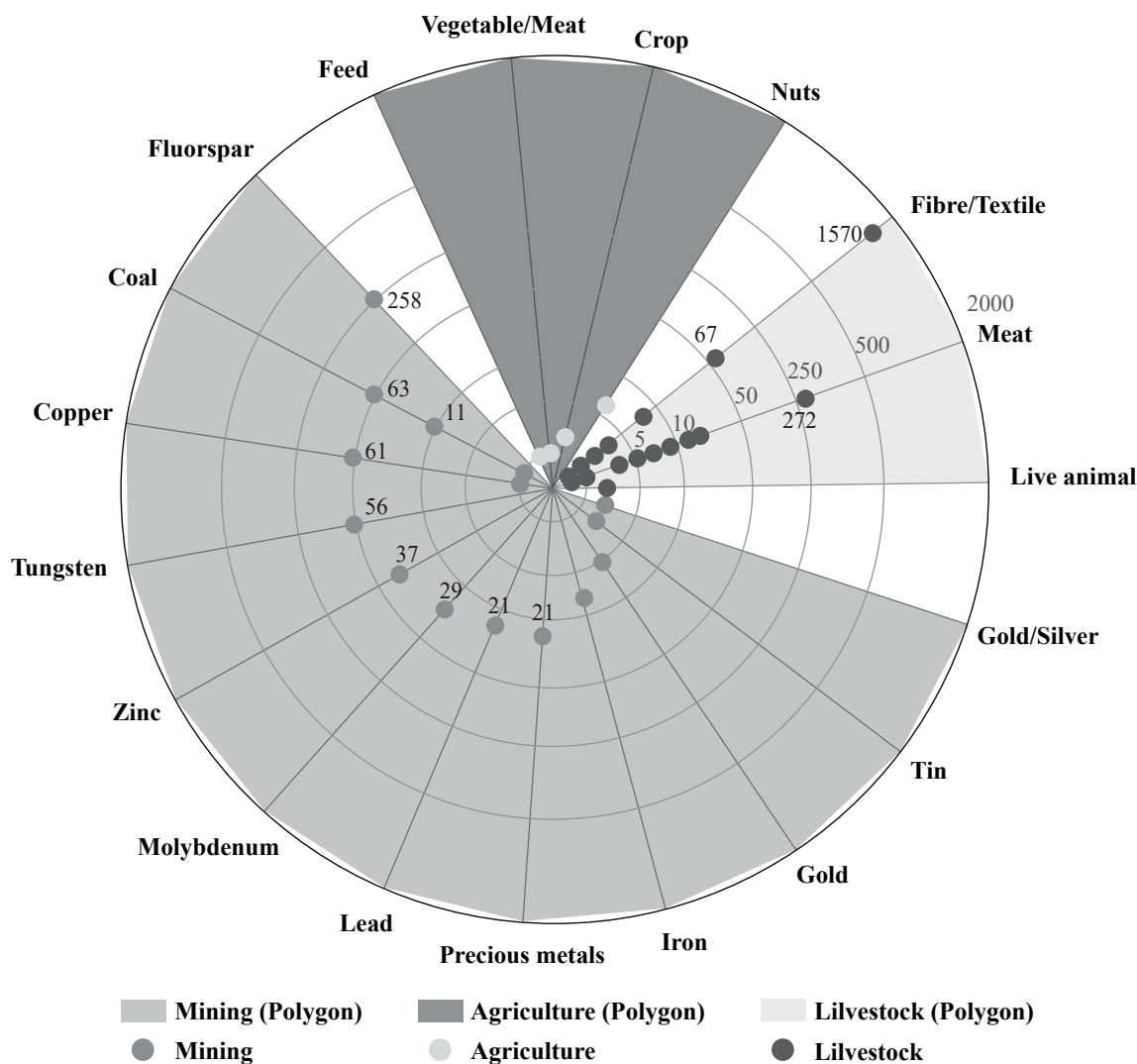


Figure 3: RCA index visualisation for Mongolia's competitive export products, average of 2019-2023 (HS4 digits).

Note: Detailed information regarding this figure can be found in Appendix 1.

Source: Authors' elaboration using Python (Python Software Foundation, 2024).

could further hinder Mongolian exports. Additionally, ongoing trade tensions between major global powers (Midfa, 2025) may further impact competition in the cashmere market and the overall competitiveness of Mongolia's cashmere products. Moreover, the growing demand for eco-friendly, ethically sourced, and sustainable products in European countries (EU, 2024), the primary high-end luxury cashmere market for Mongolian products, presents further difficulties for Mongolian producers and processors. Infectious livestock diseases also pose a persistent threat, potentially leading to international trade bans that restrict exports (Grieger, 2024).

The reliance on nomadic livestock makes the sector highly vulnerable to climate change, affecting both production resources and product quality. Intensifying environmental challenges, including dzuds, droughts, pasture degradation, and water shortages, exacerbate hardships for livestock producers. Furthermore, the deterioration of livestock quality and shifts in herding practices degrade product standards, impeding the development of high-end and sustainable processing industries (MULS, 2018).

Additionally, structural weaknesses in the livestock value chain, such as non-compliance with good practices and standards, limited infrastructure, particularly in road networks and storage facilities, and outdated technology in processing industries, could undermine competitiveness and further impact RCA scores (Dagys *et al.*, 2024).

Mongolia has 42 competitive export products across 19 value chains, with raw materials sourced from three primary sectors: mining, crop and vegetable production, and livestock. Out of these 19 value chains, 12 are linked to mining products, where nearly every mining product forms a distinct value chain due to differences in extraction and processing technologies, storage requirements, logistics, and sales.

In the crop and vegetable sector, four value chains are identified based on four products: two cereals, one nut, and one fodder product. In contrast, only three value chains are related to livestock products, with the meat value chain being the most significant, encompassing 11 export products.

Overall, 15 products are part of the 12 mining-related value chains, while 24 export-competitive products belong

to 3 livestock-based value chains. This highlights the potential role of the livestock sector in reducing Mongolia's reliance on mining, supporting the non-mining manufacturing sector, and ultimately enhancing economic diversification. The next sections will focus on value chain mapping for livestock-derived products and the constraints encountered at each stage of the chain.

To assess the relative advantages of export products with higher RCA, a comparison of the selected 42 products across 19 value chains was conducted with the RCAs of similar products from Kazakhstan and Kyrgyzstan. These countries were chosen due to their similar economic structures and land-locked status. To facilitate comparison and reduce the high magnitudes of RCA values, natural logarithmic forms of the values were employed. This comparison, illustrated in Figure 4, reveals that the RCAs of most Mongolia's main export products are higher than those of Kazakhstan and Kyrgyzstan. This finding highlights Mongolia's greater potential for the production and exportation of livestock-derived and mining products and commodities.

A sensitivity analysis was performed to assess the robustness of the RCI results. Given that the export value of coal (2701) accounts for nearly half of the total exports, we examined how the RCI indices of the selected products changed when the coal export value increased and decreased by 10% and 20%, respectively. With a 10% change in coal export value, no product's RCI index fell below 1. However, a 20% increase in coal export value caused the RCI index for livestock by-products (0511) to drop below 1.

Additionally, because the RCI indices for certain products, such as livestock by-products (0510, 0511) and garments (6102), were below 1.5, we investigated their sensitivity to determine how their indices changed when their

respective export values decreased by 10% and 20%, respectively. The RCI indices for 0510 and 6102 remained above 1.0 even when their export values decreased by 20%. However, in both cases of a 10% and 20% decrease in the export value of 0511, its RCI value fell below 1.

The results suggest that the RCI for all products remains robust to increases in coal export value up to 20%, except for 0511. Moreover, the decrease of up to 20% in export value for 0510 and 6102 also indicates the RCI for these products is robust. However, for 0511, its RCI falls below 1 due to a 20% increase in coal and a 10% decrease in its export value, indicating that this type of animal by-product should be processed and value-added domestically prior to exporting. Detailed information regarding the sensitivity analysis can be found in Appendix 2.

Value chain mapping for livestock-derived products

As a vital source of export-oriented products and a cornerstone for economic diversification, a value chain mapping of non-mining products sourced from the livestock sector has been conducted. Figure 5 illustrates the value chain of livestock-derived products.

Mongolia raises five types of livestock: camels, horses, cattle, sheep, and goats. As of 2023, the country had 67.6 million head of livestock (NSO, 2024b). The raw material supply for the light manufacturing industry is entirely dependent on this sector. Additionally, 20% of households directly rely on animal husbandry for their livelihoods, and herders comprise 25% of the national workforce (NSO, 2024b). These figures not only underscore the livestock sector's crucial role in the economy as a key driver of diversification but also

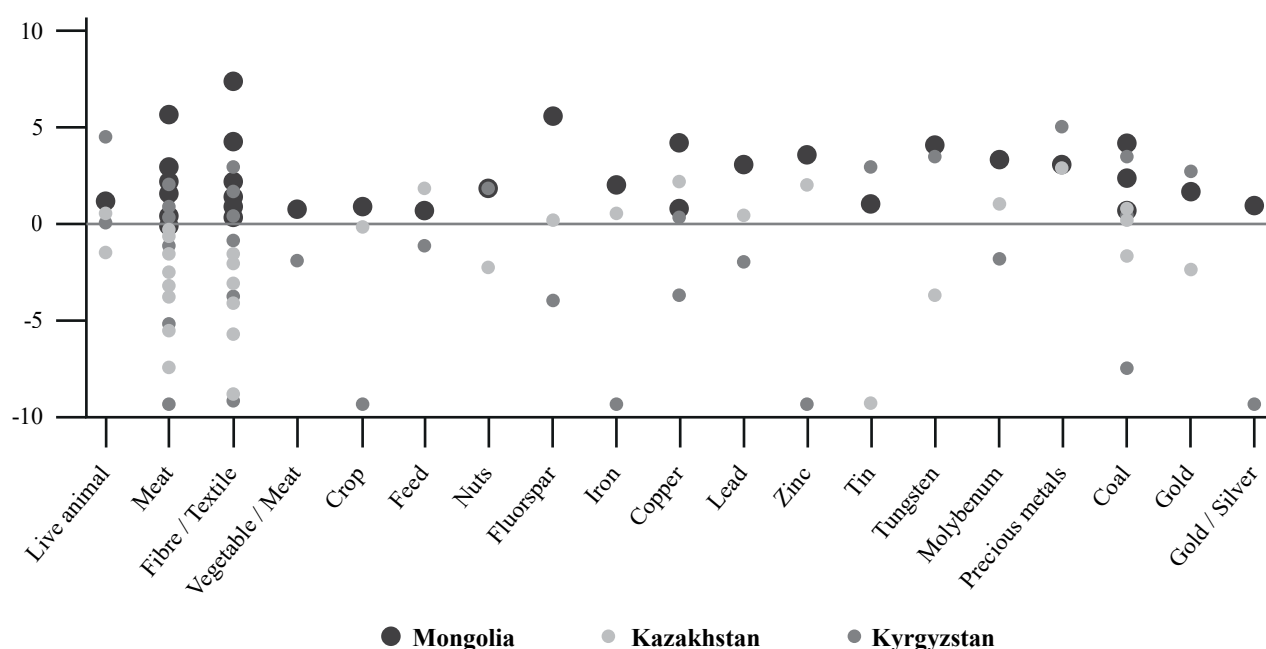


Figure 4: RCA index (logarithmic form) for selected products in different value chains in Mongolia, Kazakhstan, and Kyrgyzstan, average of 2019-2023 (HS4 digits).

Source: Authors' elaboration using Stata (StataCorp, 2013)

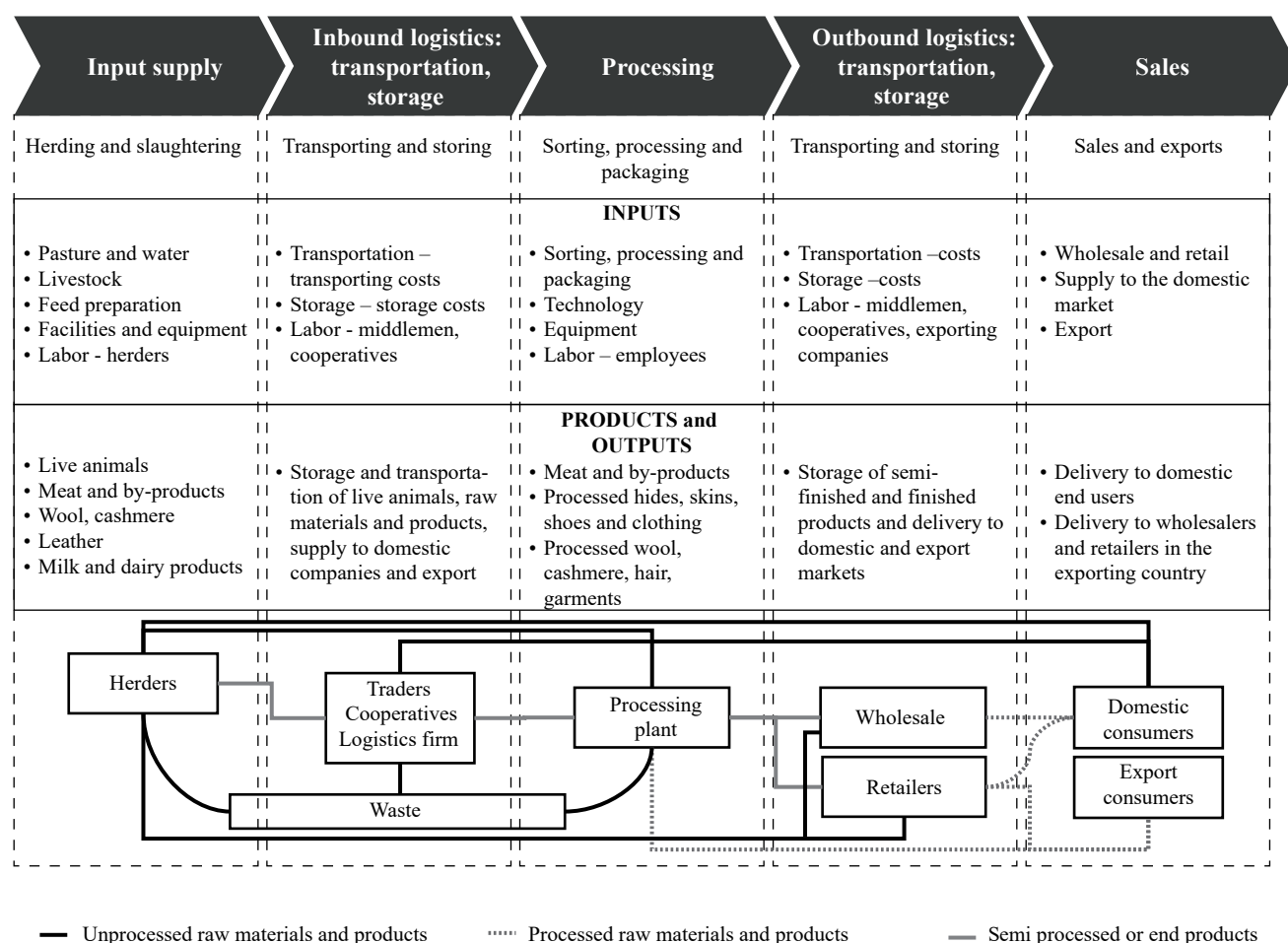


Figure 5: Value chain mapping of livestock products of Mongolia.

Source: Authors' elaboration based on Porter and Millar (1985)

highlight the sector's positive externalities in terms of livelihood for a significant portion of the population.

Livestock products such as meat, wool (from camels, sheep, and yaks), cashmere, hair, leather, milk, and by-products are supplied to the domestic market as final products or exported in raw, semi-processed, or processed forms. These products pass through various channels, including processing plants (manufacturing) and traders (intermediaries). Herders sell food products (meat, milk, and dairy) directly to wholesalers, retailers, processing plants, or end consumers, sometimes via traders. Conversely, non-food raw materials for the light industry, such as wool, cashmere, hides, and skins, are mainly passed through traders and cooperatives, and in some cases, supplied directly from producers to processing plants (Gonchigsumlaa *et al.*, 2018; MULS, 2018; Morton *et al.*, 2024).

Despite its importance, the level of processing for raw materials and products from animal husbandry remains relatively low. For example, only about 10% of the total meat production is processed in abattoirs that fully comply with standard requirements, while approximately 90% is processed using traditional methods, with significant volumes handled by small community-level slaughterhouses. Similarly, the processing of sheep and goat skins, wool, and hair is limited. However, advancements have been made in processing cashmere, yak

wool, and hides (Tserensonom, 2017; Gonchigsumlaa *et al.*, 2018; JICA, 2024; Morton *et al.*, 2024).

While a comprehensive analysis of the value chain mapping constitutes a distinct research endeavour; this study focuses on identifying the challenges encountered within the value chain and exploring strategies for economic diversification.

Challenges Facing the Production of Livestock-derived Products

Challenges encountered at various stages of the livestock value chain significantly impact the processing and sale of export products. Figure 6 illustrates the constraints faced at each stage of the chain. Numerous negative factors affect the production, processing, logistics, trade, and export of livestock-derived products, with several key challenges identified below:

- **Non-compliance with standards:** The most significant challenge is the non-compliance with good practices and standards at every stage of production, storage, transportation, and processing (MULS, 2018; Enkhmaa, 2020; Agipar *et al.*, 2023; JICA, 2024).
- **Underdeveloped infrastructure:** Limited infrastructure poses risks to competitiveness in international

Input supply	Inbound logistics: transportation, storage	Processing	Outbound logistics: transportation, storage	Sales
• The low yield and productivity of pastoral animal products are significant concerns. • The sector's complete dependence on nature and climate makes it vulnerable to various risks. • Many animal products are priced very low, with some being nearly worthless due to a lack of buyers. • A high prevalence of highly infectious livestock diseases, particularly those that result in export bans, compounded by inadequate veterinary services. • Poor adherence to good animal husbandry and hygiene practices, as well as substandard animal husbandry protocols, negatively impacts the quality of both raw materials and final products.	• The costs of collecting, storing, and transporting raw materials are high because processing plants are concentrated in a central region. • Infrastructure is underdeveloped, with the domestic railway network primarily connecting China and Russia only through Ulaanbaatar, increasing road transportation costs. • A shortage of collection centres and warehouses for primary processing and proper storage of raw materials. • Adherence to good practices and standards for the storage and transportation of animal products is inadequate.	• The current practices do not adhere to good manufacturing and hygiene standards, nor do they meet food safety requirements and the regulations of importing countries. • Production technology and equipment are outdated, coupled with limited investment capacity among manufacturers. • The shift of employees to the higher-paying mining sector negatively affects the skilled labor pool available for light and food industries. • Significant waste is generated due to non-compliance with standards during both the production and transportation phases.	• There is a shortage of storage centres and warehouses specifically designed for the proper storage of semi-finished and finished, particularly food products in accordance with established standards and technology. • Compliance with good practices and standards for the storage and transportation of these products is insufficient. • Weak infrastructural development results in a heavy reliance on road transportation for finished products, which in turn increases costs.	• Numerous tariff and non-tariff restrictions and barriers imposed by importing countries pose significant challenges. • Being landlocked and situated between two large nations, China and Russia, Mongolia's exports to other countries heavily depend on these neighbours. • The high costs associated with export transportation, particularly for air-freighted goods, further inflate prices, reducing the competitiveness of these products. • Inadequate infrastructure development negatively impacts export capabilities.

Figure 6: Value chain mapping of livestock products of Mongolia.

Source: Authors' composition based on data from various sources, as indicated in the text

markets. For instance, road development is inadequate, and transportation primarily relies on vehicles (Helbe *et al.*, 2020; JICA, 2024; Morton *et al.*, 2024), leading to inefficiencies throughout the value chain from production to marketing. Additionally, there is a shortage of warehouses that meet standards and technical requirements for local storage of livestock products (Tserensonom, 2017; Gonchigsumlaa *et al.*, 2018; Agipar *et al.*, 2023; Ringler *et al.*, 2023; JICA, 2024). According to the Asian Development Bank (2018), logistics costs account for 30% of production expenses.

- **Waste management:** A major issue in production, logistics, and processing is the significant amount of waste generated (Tserensonom, 2017; Agipar *et al.*, 2023). Middlemen, who play a crucial role in the value chain (Tsenguunjav and Munkhzul, 2015; Erdenechuluun *et al.*, 2017; FAO, 2023), often exacerbate this issue by contributing to the underutilization of resources (MULS, 2018). For example, sheep wool and skins are sold at extremely low prices, approximately MNT 1,000 per kilogram (about USD 0.3). Due to the limited number of processing plants, these products are often discarded. Although the government introduced a subsidy of MNT 1,000 per kilogram of wool supplied to domestic factories, which helps reduce wool waste, sheep skins remain undervalued at MNT 500-1,000 (about USD 0.1-0.3),

discouraging their sale. Middlemen often neglect these low-value raw materials, resulting in substantial waste. Meanwhile camel, horse, and cow hides are in relatively higher demand; however, poor adherence to slaughter standards leads to damage, creating additional waste at the processing stage (Tsenguunjav and Munkhzul, 2015; JICA, 2024).

- **Low productivity of pastoral livestock:** Whilst pastoral livestock farming is cost-effective, it suffers from low productivity and yields. Herders often prioritise increasing livestock numbers to boost income rather than improving livestock quality. This practice leads to negative consequences such as reduced productivity, lower yields, poor-quality raw materials, and significant waste during production and processing. (Agipar *et al.*, 2019; Agipar *et al.*, 2023; Dagys *et al.*, 2024)
- **Outdated technology:** Many processing plants operate with outdated equipment and inadequate technology, posing significant barriers to the export of non-mining products (Tsenguunjav and Munkhzul, 2015; Gonchigsumlaa *et al.*, 2018; MULS, 2018; Helbe *et al.*, 2020; Dagys *et al.*, 2023; JICA, 2024; Morton *et al.*, 2024).
- **Lack of skilled labour:** The manufacturing industry faces a shortage of skilled workers, undermining industrial competitiveness (Helbe *et al.*, 2020). This

issue is further exacerbated by the rapid growth of the mining sector and associated wage disparities, which lead to a shift of skilled labour from other sectors towards the mining sector (Gonchigsumlaa *et al.*, 2018; MULS, 2018; Dagys *et al.*, 2020; JICA, 2024).

- **Livestock diseases and trade bans:** The high prevalence of infectious livestock diseases, such as foot-and-mouth disease (FMD) and *peste des petits ruminants* (PPR), poses significant challenges. These diseases, coupled with international trade bans, restrict the export of livestock-derived products (Dagys *et al.*, 2017; Tserensonom, 2017; MULS, 2018; Agipar *et al.*, 2023; FAO, 2023).
- **Trade barriers:** Tariff and non-tariff barriers imposed by importing countries create significant obstacles to exports (Gonchigsumlaa *et al.*, 2018; Tsetsegmaa, 2020). While Mongolia has made strides in establishing trade facilitation agreements with partner countries, further efforts are required for continued progress (Dagys *et al.*, 2017; Tsetsegmaa, 2020, 2022; JICA, 2024).
- **Policy and investment gaps:** The lack of a robust legal framework, inconsistent government policies, and insufficient financial investment further hinder the manufacturing sector's development (EDP, 2020).
- **Climate change:** The reliance on nomadic livestock, which is entirely dependent on environmental and climatic conditions, renders the sector highly susceptible to the risks posed by climate change, contributing to livestock losses due to dzuds and droughts, pasture degradation, and water shortages (Oniki and Dagys, 2017; Agipar *et al.*, 2019; Gros *et al.*, 2022; Dagys *et al.*, 2023). These risks affect production resources, as well as the quantity, yield, and quality of livestock-derived products, ultimately affecting the sale and export of these goods (MULS, 2018; Agipar *et al.*, 2023; Ringler *et al.*, 2023; Agipar *et al.*, 2024; JICA, 2024; Morton *et al.*, 2024).

Policy recommendations

Based on the findings from the value chain mapping of livestock-derived products, the following policy recommendations at each stage of the value chain are proposed:

At the production stage

- Improve animal health status through public-private partnerships:
 - To export livestock-derived products and penetrate high-end global markets, improving animal health and securing verification of disease-free status are essential. Establishing disease-free zones or compartments with traceability systems, where feasible, is a critical step toward achieving this objective.
 - For effective implementation of these strategic objectives, the veterinary system, including both public services and private veterinary units,

must be sufficiently robust to control infectious diseases that lead to trade bans. Therefore, government investment and support are imperative to strengthen capacity-building programmes, enhance the competitiveness of veterinary units, and improve their overall capacity.

- Shifting herders' attitudes towards prioritising livestock health is also crucial. Emphasising the importance of fostering collaboration through public-private partnerships, including herders, private veterinary units, and public authorities, will support these efforts.
- *Improve the quality of animal breeds by changing herders' attitudes:* To improve productivity and yield, herders' attitudes should be changed through specific policies and awareness campaigns. Economic incentives, such as tax benefits, soft loans, and government support for herders and herder cooperatives, can encourage the adoption and compliance of production-level standards and good practices.

At the logistics stage

- *Enhance community-level raw material collection and supply chain systems:* Developing a robust raw material collection and supply chain system is crucial, with particular emphasis on addressing issues related to raw material preparation, storage, and transportation. At present, informal middlemen predominantly dominate the raw material preparation system, whilst inadequate infrastructure exacerbates these challenges. Establishing a unified raw material supply system at the community level for producers or herders is essential for implementing standards and practices, as well as ensuring proper primary processing, storage, and transportation.

At the processing stage

- *Enhance the competitiveness of processing plants through targeted financial and investment support:* Given the weak financial capacity of processing plants and their outdated technology and equipment, it is crucial to provide financial and investment support to these facilities. Upgrading technology and equipment is vital to enhancing their competitiveness. Investment can be attracted through public-private partnerships, redirecting a portion of mining revenue into this sector, offering soft loans, subsidies, and long-term concessions, and fostering collaborations with key importing partner countries.
- *Enhance the processing level of raw materials through public-private partnerships:* Enhancing the processing level of raw materials and products derived from traditional livestock in Mongolia is crucial for reducing the country's economic dependence on a single sector and promoting diversification. To achieve this strategy, public, private, and foreign direct investments can be mobilised to develop advanced technologies and techniques for processing plants.

At the export and sales stage

- *Establish a one-stop service supporting trade, export, marketing, traceability and blockchain technologies:* The establishment of a one-stop service for trade, export, and marketing support for manufacturers of export-oriented products should align with the digital transition and advancements in information technology, including blockchain technology for traceability of livestock-derived products.
- *Ease export barriers through trade facilitation agreements and free trade zones:* Efforts should focus on reducing tariff and non-tariff barriers imposed by trade partners. This can be achieved through trade facilitation agreements, the establishment of joint free trade zones between countries, or the creation of joint-processing enterprises with key trading partners and importing countries.
- *Facilitate the diversification of export markets by conducting comprehensive studies on markets and non-tariff barriers, and propose potential solutions:* At present, Mongolia's livestock-derived export products are limited to a few markets, such as sheep meat exported to the Middle East (e.g., Iran and Iraq), and horse meat, unprocessed, and primary-processed hides, skins, wool, and hair exported to China. To diversify and expand market opportunities, it is essential to explore potential new markets, including major countries like the United States and economic blocs such as the European Union (EU), the Association of Southeast Asian Nations (ASEAN), and the Eurasian Economic Union (EAEU). For each semi-processed and processed livestock-derived product, a detailed study should examine non-tariff barriers and import requirements. Based on these findings, strategies must be developed to overcome barriers and ensure compliance with market-specific requirements.

At the policy coordination and implementation stage

- *Develop and implement a holistic and comprehensive livestock sector policy and strategy:* This will enable the unified implementation and adequate coordination of policies related to pasture protection, animal breeding, veterinary services, animal husbandry risks, herders' livelihoods, and the collection, storage, and trade of raw materials.
- *Develop a comprehensive long-term strategic plan for the advancement of Mongolia's livestock-derived product processing industry:* This approach facilitates inter-sectoral coordination, addresses value chain challenges at multiple levels, and optimises the value addition process, thereby strengthening the capacity to compete in the global market with high-quality, competitively priced non-mining products.
- *Develop and implement an export development strategic plan:* Currently, Mongolia lacks a comprehensive export development strategic plan. This plan should incorporate potential processing and export-oriented

products identified through RCA analysis, detailed value chain assessments, export market destinations, import requirements, and trade barriers of key trading partners. Additionally, it should address potential gaps and provide corresponding solutions, including an outline of necessary policy measures and supporting documents, financial and investment proposals, and other actionable steps to facilitate export growth.

At all stages of the value chain

- *Ensure compliance with good practices and standards across the value chain:* Introducing, implementing, and adopting relevant standards and good practices across all stages of the value chain is essential. This includes Good Animal Husbandry Practices (GAHP) at the production level; Good Distribution Practices (GDP) during collection, transportation, and storage; and Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP), ISO 9001:2015 Quality Management Systems (QMSs), and ISO 22000:2018 Food Safety Management Systems (FSMSs) at the processing level. Furthermore, ensuring compliance with the import requirements of trade partners, such as Halal certification throughout all stages of the meat value chain, is critical for exporting meat products to Middle Eastern and Central Asian countries. Non-compliance with these standards, practices, rules, and instructions can lead to numerous negative consequences, including significant waste generation, compromised quality of final products, increased costs, diminished competitiveness, failure to meet the requirements of importing partners, and exposure to non-tariff restrictions.

Conclusions

The research aimed to identify strategies for diversifying Mongolia's economy by analysing the RCA index methodology and mapping the value chain for livestock-derived products. The RCA index analysis identified globally competitive products among Mongolia's exports. These products were categorized into sectors and value chains, with an emphasis on determining which value chains are crucial for diversifying the economy and advancing the industrial sector. The RCA analysis revealed 42 export-competitive products within the HS4 category, encompassing mining raw materials, livestock raw materials, and processed products that can hold their ground in the global market. These products are categorised into 19 distinct value chains: 12 linked to mining, three to livestock, and four to agricultural production sources. Notably, 15 out of 42 products depend on mining resources, while 24 are based on animal husbandry raw materials, highlighting the significance of livestock-derived raw materials and value-added products in Mongolia's economic diversification. In particular, the identification of 11 products within the meat value chain that exhibit a comparative export advantage underscores the necessity for targeted strategies and investments to bolster this value chain.

Given the competitiveness of livestock-derived products and their potential role in economic diversification, a detailed mapping of the value chain for livestock-derived products was created. This mapping integrated challenges encountered at each stage of the value chain, as identified through existing literature. Key challenges include a lack of adherence to good practices and standards throughout the value-addition process, leading to significant raw material and product waste. In primary production, issues such as animal health, low productivity, and vulnerability to natural and climatic risks threaten production stability. Weak infrastructure further exacerbates inefficiencies in the collection, storage, and transportation of raw materials during the logistics stage. At the processing stage, outdated technologies and techniques increase operational costs and reduce competitiveness, compounded by a shortage of skilled labour. Finally, as a landlocked nation situated between two large countries, Mongolia faces logistical challenges at the export stage, including tariff and non-tariff barriers imposed by importing countries that significantly impede trade.

This study focuses on identifying opportunities for economic diversification based on the current state of production and exports. It does not assess the economic impact of diversification, the development of the manufacturing sector, or the effectiveness of government policies in promoting diversification. Importantly, it is necessary to acknowledge the limitations of the RCA methodology, particularly within Mongolia's price-sensitive and export-dependent economy. The RCA index, whilst useful for identifying comparative advantages, does not account for factors such as market volatility, demand fluctuations, or the sustainability of resource use. Furthermore, the value chain mapping, relying on existing literature, provides an overview rather than a detailed analysis, and may not fully capture the dynamic and evolving nature of the sector. Future research should explore these limitations by incorporating quantitative data on price elasticity, market demand, and environmental impact.

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Appendix

Appendix 1: RCA index for competitive products exported by Mongolia, on average of 2019-2023 (HS4 digits).

HS code	Group	Product label	Value chain	RCI
'0104	Animal & Animal Products	Live sheep and goats	Live animal	3
'0106		Live animals (excl. horses, bovine animals, swine, sheep, goats, poultry)	Live animal	3
'0204		Meat of sheep or goats, fresh, chilled or frozen	Meat	4
'0205		Meat of horses, asses, mules or hinnies, fresh, chilled or frozen	Meat	272
'0504		Guts, bladders and stomachs of animals (other than fish)	Meat	5
'0507		Ivory, tortoiseshell, whalebone and whalebone hair, horns, antlers, hooves, nails, claws	Meat	17
'0510		Ambergris, castoreum, civet and musk; cantharides; bile	Meat	1
'0511		Animal products, unfit for human consumption	Meat	1
'0802	Vegetable Products	Other nuts, fresh or dried	Nuts	6
'1205		Rape or colza seeds, whether or not broken	Crop	3
'1506		Other animal fats and oils and their fractions	Vegetable/Meat	2
'1602	Foodstuffs	Prepared or preserved meat, meat offal, blood or insects	Meat	7
'2302		Bran, sharps and other residues	Feed	2
'2529	Mineral Products	Feldspar; leucite, nepheline and nepheline syenite; fluorspar	Fluorspar	258
'2601		Iron ores and concentrates, incl. roasted iron pyrites	Iron	8
'2603		Copper ores and concentrates	Copper	61
'2607		Lead ores and concentrates	Lead	21
'2608		Zinc ores and concentrates	Zinc	37
'2609		Tin ores and concentrates	Tin	3
'2611		Tungsten ores and concentrates	Tungsten	56
'2613		Molybdenum ores and concentrates	Molybdenum	29
'2616		Precious-metal ores and concentrates	Precious metals	21
'2701		Coal; briquettes, ovoids and similar solid fuels manufactured from coal	Coal	63
'2702		Lignite, whether or not agglomerated	Coal	11
'2704		Coke and semi-coke of coal, of lignite or of peat	Coal	2
'4104	Raw Hides, Skins, Leather, & Furs	Tanned or crust hides and skins of bovine, horse	Meat	2
'4105		Tanned or crust skins of sheep or lambs	Meat	9
'4106		Tanned or crust hides and skins of goats	Meat	22
'5101	Textiles	Wool, neither carded nor combed	Fibre/Textile	8
'5102		Fine or coarse animal hair, neither carded nor combed	Fibre/Textile	1 570
'5103		Waste of wool or of fine or coarse animal hair, incl. yarn waste	Fibre/Textile	4
'5105		Wool and fine or coarse animal hair, carded or combed	Fibre/Textile	67
'5108		Carded or combed yarn of fine animal hair	Fibre/Textile	2
'5109		Yarn of wool or fine animal hair, put up for retail sale	Fibre/Textile	2
'5111		Woven fabrics of carded wool or of carded fine animal hair	Fibre/Textile	2
'5507		Artificial staple fibres, carded, combed or otherwise processed for spinning	Fibre/Textile	2
'6102		Women's or girls' overcoats, car coats, capes, cloaks, anoraks	Fibre/Textile	1
'6106		Women's or girls' blouses, shirts and shirt-blouses, knitted or crocheted	Fibre/Textile	4
'6117		Made-up clothing accessories, knitted or crocheted	Fibre/Textile	3
'7108	Stone / Glass	Gold, incl. gold plated with platinum	Gold	5
'7111		Base metals, silver or gold, clad with platinum	Gold / Silver	3
'7403	Metals	Copper, refined, and copper alloys	Copper	2

Source: Authors' calculations based on ITC Trade Map (2024).

Appendix 2: Sensitivity analysis of RCA index, on average of 2019-2023 (HS4 digits).

HS code	Base RCA	RCA estimated based on the changes in export value of selected products									
		Coal		‘0510		‘0511		‘6102			
		10% increase	10% decrease	20% increase	20% decrease	10% decrease	20% decrease	10% decrease	20% decrease	10% decrease	20% decrease
‘0104	3.4	3	4	3	4	3	3	3	3	3	3
‘0106	3.4	3	4	3	4	3	3	3	3	3	3
‘0204	4.3	4	5	4	5	4	4	4	4	4	4
‘0205	272.4	261	288	261	288	275	275	272	275	275	275
‘0504	5.1	5	5	5	5	5	5	5	5	5	5
‘0507	17.3	17	18	17	18	17	17	17	17	17	17
‘0510	1.35	1	1	1	1	1.23	1.09	1	1	1	1
‘0511	1.02	1	1	0.98	1	1	1	0.92	0.82	1	1
‘0802	6.0	6	6	6	6	6	6	6	6	6	6
‘1205	2.5	2	3	2	3	3	3	3	3	3	3
‘1506	2.1	2	2	2	2	2	2	2	2	2	2
‘1602	6.8	7	7	7	7	7	7	7	7	7	7
‘2302	2.0	2	2	2	2	2	2	2	2	2	2
‘2529	258.0	247	273	247	273	260	260	258	260	260	260
‘2601	7.6	7	8	7	8	8	8	8	8	8	8
‘2603	61.3	59	65	59	65	62	62	61	62	62	62
‘2607	21.3	20	23	20	23	22	22	21	22	22	22
‘2608	36.7	35	39	35	39	37	37	37	37	37	37
‘2609	2.9	3	3	3	3	3	3	3	3	3	3
‘2611	56.3	54	60	54	60	57	57	56	57	57	57
‘2613	28.6	27	30	27	30	29	29	29	29	29	29
‘2616	20.7	20	22	20	22	21	21	21	21	21	21
‘2701	62.8	66	60	66	60	63	63	63	63	63	63
‘2702	11.1	11	12	11	12	11	11	11	11	11	11
‘2704	2.0	2	2	2	2	2	2	2	2	2	2
‘4104	1.5	1	2	1	2	2	2	2	2	2	2
‘4105	9.4	9	10	9	10	9	9	9	9	9	9
‘4106	21.7	21	23	21	23	22	22	22	22	22	22
‘5101	8.4	8	9	8	9	8	8	8	8	8	8
‘5102	1570.1	1,503	1,659	1,503	1,659	1,585	1,585	1,570	1,585	1,585	1,585
‘5103	3.5	3	4	3	4	4	4	4	4	4	4
‘5105	67.3	64	71	64	71	68	68	67	68	68	68
‘5108	2.4	2	3	2	3	2	2	2	2	2	2
‘5109	1.6	2	2	2	2	2	2	2	2	2	2
‘5111	1.6	2	2	2	2	2	2	2	2	2	2
‘5507	1.5	1	2	1	2	2	2	2	2	2	2
‘6102	1.36	1	1	1	1	1	1	1	1	1.24	1.10
‘6106	3.9	4	4	4	4	4	4	4	4	4	4
‘6117	2.6	2	3	2	3	3	3	3	3	3	3
‘7108	5.0	5	5	5	5	5	5	5	5	5	5
‘7111	2.6	2	3	2	3	3	3	3	3	3	3
‘7403	2.1	2	2	2	2	2	2	2	2	2	2

Note: light grey highlights with bold text indicate cases where the RCA index falls below 1 due to changes in export value. Dark grey highlights with bold text indicate the RCA values that remain robust despite changes in their respective export value.

0510: Ambergris, castoreum, civet and musk; cantharides; bile; 0511: Animal products, unfit for human consumption; 6102: Women's or girls' overcoats, car coats, capes, cloaks, anoraks.

Source: Authors' calculations based on ITC Trade Map (2024).