
Dairy Trade and Non-Tariff Measures: Cross-Country Analyses

Beliyou Haile and Tancredi Musco*

Abstract

This study investigates non-tariff measures (NTMs) on dairy imports, recognizing the nutritional and economic significance of dairy and its suboptimal consumption in developing countries. Dairy demand is projected to grow faster than domestic production in many developing countries, creating opportunities to grow the domestic sector and international trade. At the same time, the dairy sector has one of the most complex food value chains, involving multiple exchanges of highly perishable products. It faces safety, quality, traceability, and sustainability concerns, and is among the most regulated sectors. Although most of the global dairy trade occurs among developed countries with more uniform NTM environments, dairy imports by developing countries are growing faster, with dairy trade among developing countries experiencing the fastest growth. The average number of NTMs applied to dairy products imported by developing countries, captured by an NTM prevalence score, is 11 (versus 14 by developed countries), but regulatory heterogeneity is markedly greater among developing countries than across developed ones, underscoring the need for harmonization to further promote trade. The study discusses innovations that can strengthen the dairy sector and improve dairy standards in developing countries, especially in systems where compliance cost can be high due to the dominance of numerous and scattered small-scale milk producers.

Keywords: Dairy, nutrition, trade, non-tariff measures, regulatory heterogeneity, developing countries

* Beliyu Haile is a Senior Economist at the Economics and Market Research (CER) Department at the IFC, email: bhaile@ifc.org. Tancredi Musco was a Consultant in CER, email tancredi.musco@gmail.com. This paper serves as a background paper to the *World Development Report 2025: Standards for Development*. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and International Finance Corporations (IFC) and their affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.

Introduction

The poor quality of diets is a major risk factor for undernutrition and micronutrient deficiencies in developing countries. Consumption of nutritious foods, including animal-sourced foods (ASFs), is suboptimal. Animal-sourced foods contain a higher concentration of bioavailable nutrients that are either scarce or have limited bioavailability in plant-sourced foods (Beal et al. 2023; Chan et al. 2019; Leroy et al. 2022). Higher consumption of animal-sourced foods is shown to enhance nutrition in settings where diets are dominated by cereals and starchy roots (Haile and Headey 2023). Dairy products specifically contain numerous high-quality nutrients essential for normal growth and development,¹ especially for children, such as calcium, magnesium, selenium, riboflavin, and vitamin B12. The dairy sector is also a crucial source of jobs and livelihoods for millions of dairy sector operators in developing economies (Herrero et al. 2013).

The demand for dairy products and other animal-sourced foods is projected to grow significantly in developing countries due to rising incomes, population growth, urbanization, and shifting consumer preferences toward convenient and nutritious foods. Although markets for plant-based substitutes for milk and other animal-sourced foods are also expected to grow, constraints related to consumer awareness and acceptance, affordability, and regulatory standards can limit the growth of this emerging sector at least in the short to medium term (Malila et al. 2024; Talwar et al. 2024). The projected growth in demand for dairy products is faster than growth in domestic production in many countries in Africa, Southeast Asia, and the Middle East and North Africa (OECD and FAO 2024). Data from the Food and Agriculture Organization (FAO) show that more than 90 percent of the world's milk-producing herd in 2023 was in developing countries. This creates opportunities to sustainably enhance the productivity and efficiency of the domestic dairy sector, when economically feasible, and to expand dairy trade.

The value chain for the dairy sector is among the most complex, involving multiple exchanges of highly perishable products. Food safety, quality, traceability, and environmental sustainability are among the concerns facing the sector (Headey et al. 2024). The dairy sector is also among the most regulated sectors, through both tariffs and non-tariff measures (NTMs) (Arita, Beckman, and Mitchell 2017; Li and Beghin 2012; Sanjuán et al. 2023; UNCTAD and World Bank 2018). For dairy operators in developing countries, integration into regional and global dairy markets necessitates full compliance with an increasingly complex web of safety, quality, and environmental standards demanded by regulators and consumers alike (Rahmat, Chew, and Hamid 2016). Common NTMs that apply to dairy trade include maximum residue limits for veterinary medicines, standards for hygiene, and packaging and labeling requirements.

This study examines NTMs imposed on dairy imports, considering the nutritional and economic contributions of dairy products and the dairy sector in developing countries, the relatively high levels of protection the sector faces, and the significant regional variation in trends in dairy production and international trade. Analysis of the NTM regulatory environment at the commodity-specific level is necessary (beyond the distinction between agriculture versus non-agriculture products), given cross-sectoral differences in NTM coverage and variations in trade patterns across space (UNCTAD 2025). This study examines NTMs on dairy imports in the context of global dairy production and trade trends and highlights selected strategies to develop the dairy sector and enhance the capacity of dairy processors in developing countries to comply with complex NTM requirements.

Data

Data on mandatory NTMs enacted by laws or regulations come from UNCTAD TRAINS, a global database compiled by the UN Trade and Development (UNCTAD) that provides information on regulations and trade control measures affecting international trade (UNCTAD 2018, 2019, 2025). NTM data are reported at the importer, exporter, and 6-digits Harmonized System (HS) level, which this study uses to identify dairy products.² TRAINS data cover 114 countries, as well as the European Union (EU), which is reported as a single entity. More than 60 percent of the NTM data comes from developed countries (refer to the appendix for data details).

This study focuses on NTMs that are strictly and fully applied on dairy imports and measures the intensity of dairy NTMs using a prevalence score (PS). The prevalence score is defined as the ratio between the total number of combinations of NTMs and dairy products and the total number of dairy products. The indicator is a trade-free measure that is not prone to downward bias that may arise if NTMs prevent dairy trade altogether. A higher prevalence score may reflect a stricter NTM regulatory framework but should not be interpreted as an indicator of stringency (Disdier and Fugazza 2019). Considering the cross-country variation in coverage of NTM data over time, the study focuses on the period 2015–22 to capture the state of NTMs in more recent years and averages the prevalence score over this period for countries with multiple data points.

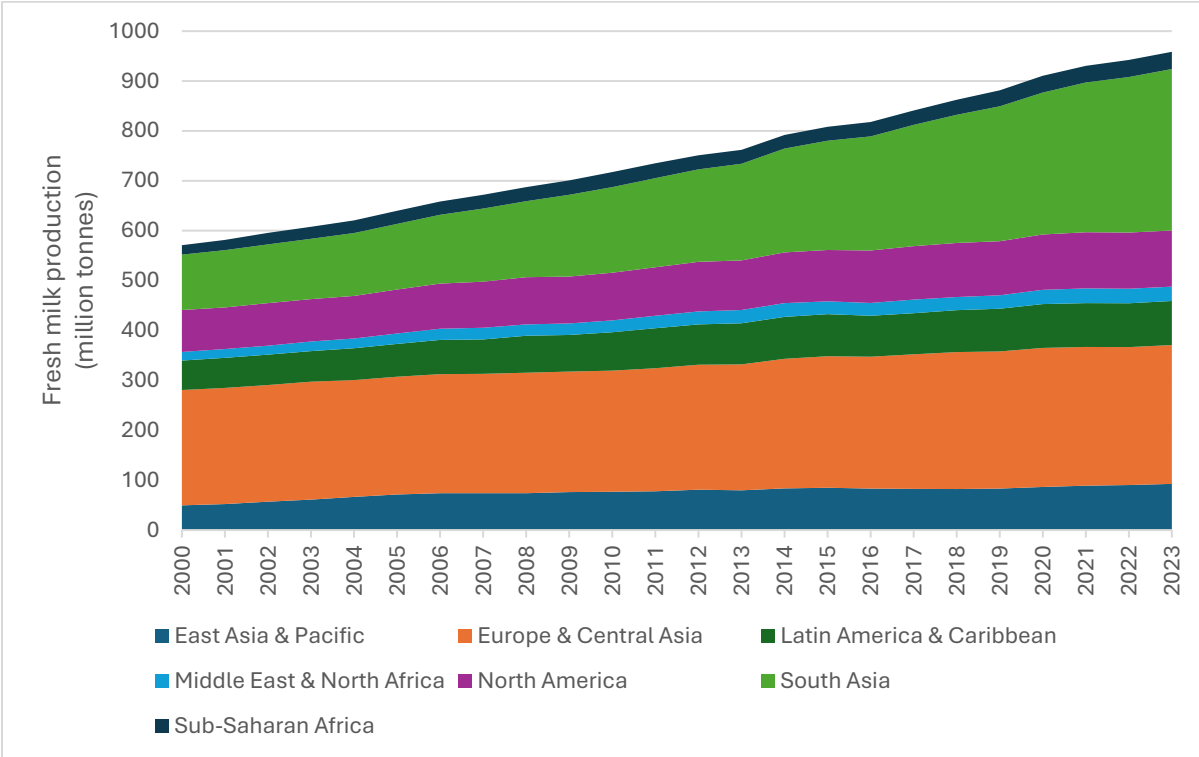
Bilateral dairy trade data for 2010–23 come from the BACI database of CEPII, a French research institute specializing in international economics that studies global and European economic issues (Gaulier and Zignago 2010).³ These data are at the level of importer, exporter, year, and HS6 code, with the HS6 classification used in this study to identify dairy products. Data on domestic milk production come from the Food and Agriculture Organization of the United Nations (FAO) for the period 2000–23. Population data used to compute per capita domestic milk production are sourced from the United Nations, while the World Bank's World Development Indicators (WDI) are used for classifications of countries by region and income level.

Results—Stylized facts

Trends in milk production

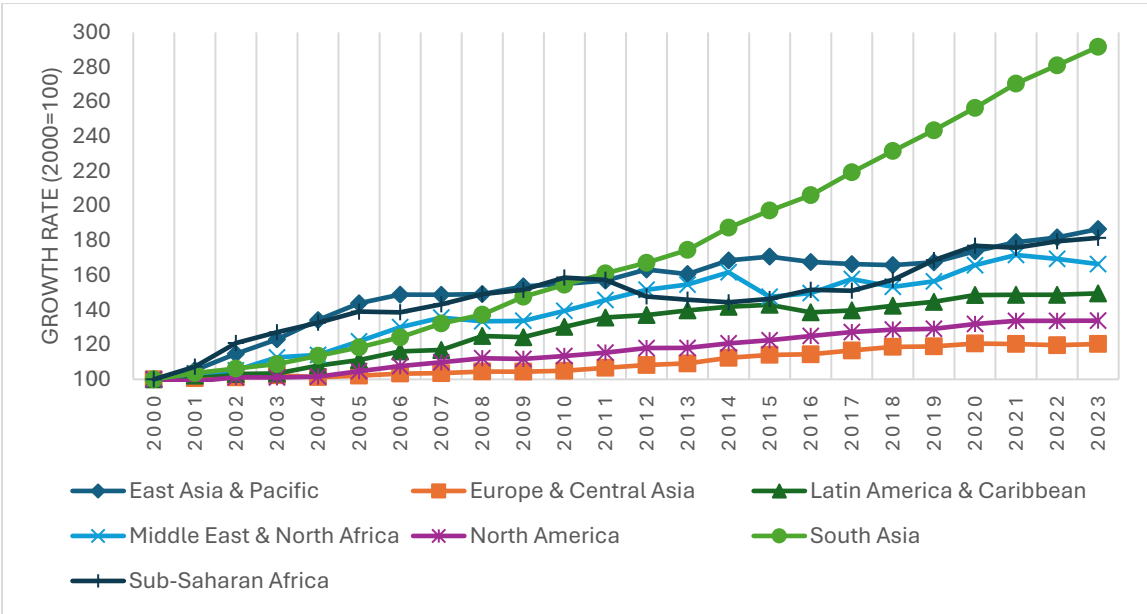
Europe and Central Asia, South Asia, and North America produce most of the world's fresh milk. These three regions accounted for about 75 percent of the total production in 2023. On the other hand, the Middle East and North Africa and Sub-Saharan Africa account for less than 4 percent of the total production each (refer to figure 1). Europe and Central Asia and North America also top the list in terms of per capita fresh milk supply, producing, respectively, 361 kilograms per capita per year (k/capita/y) and 276 k/c/y in 2023. Sub-Saharan Africa—which has the highest burden of undernutrition, with child stunting prevalence of 32 percent and 60 million stunted children—produced just 27 k/c/y in 2023, on average. Milk production has grown faster in developing countries than in high-income countries, with South Asia and East Asia and the Pacific experiencing the fastest growth (refer to figure 2). Per capita milk production is not only the lowest in Sub-Saharan Africa but has decreased in the last two decades due to low milk productivity and rising population (refer to appendix figure A4). Average annual total milk production over the last five years has been the highest in India, the United States, Pakistan, China, and Brazil, in that order.

Figure 1. Total volume of fresh milk produced by region



Sources: Original calculations based on data from the Food and Agriculture Organization of the United Nations (FAO).

Figure 2. Growth rate of fresh milk produced by region



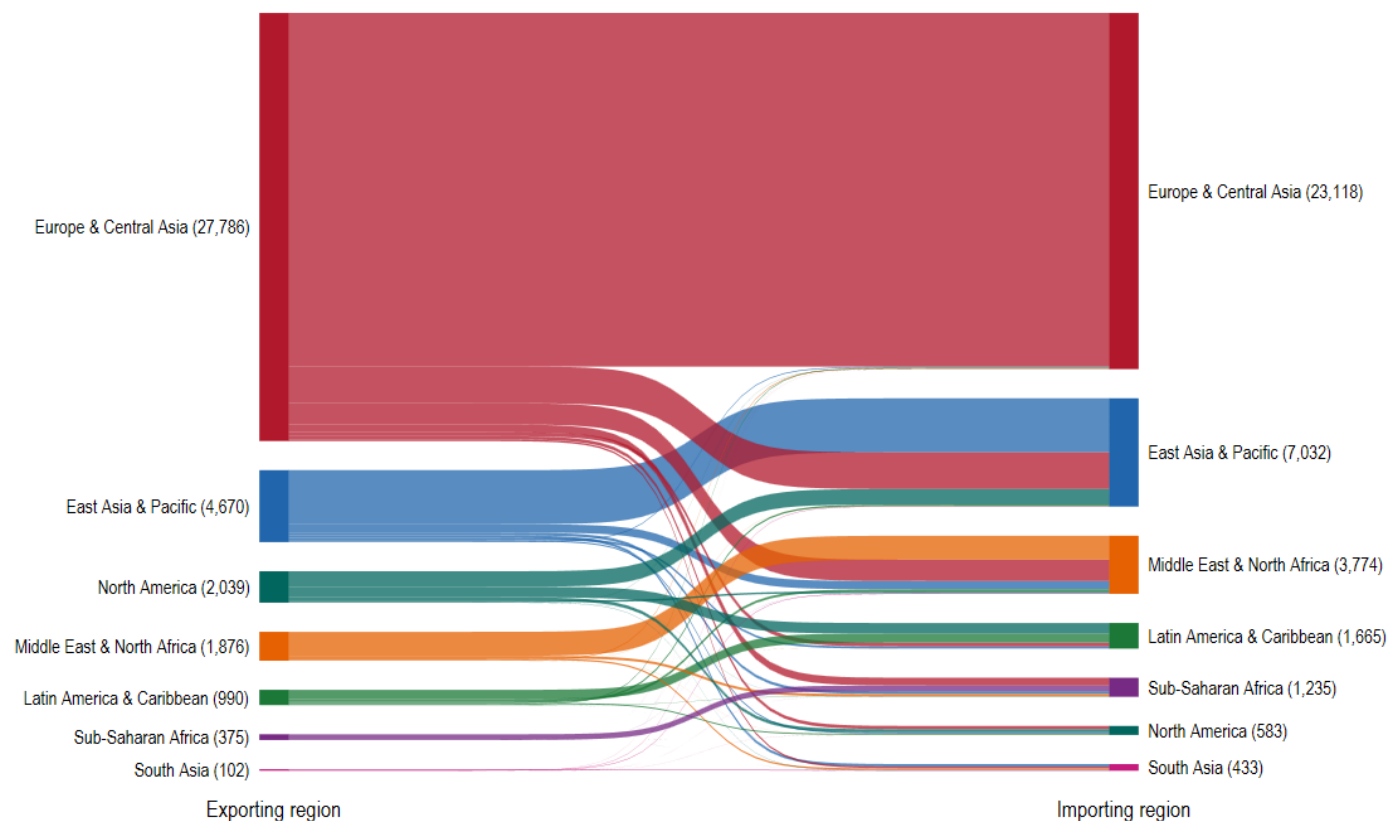
Sources: Original calculations based on data from the Food and Agriculture Organization of the United Nations (FAO).

Trends in dairy trade

Only about 7 percent of global fresh milk production is traded internationally, owing to its perishability and high water content. However, processed dairy products are the second most traded animal-sourced foods after meat (Chatellier 2021; OECD and FAO 2024; Sanjuán et al. 2023). Global dairy trade is strongly concentrated by region. Most of the dairy trade occurs within Europe and Central Asia and East Asia and the Pacific (refer to figure 3). About 70 percent of the global dairy trade occurs among high-income countries with well-developed and well-regulated dairy sectors (refer to figure 4). Although India is the world's largest producer of fresh milk, its share of global dairy trade remains small due to several factors, including strong domestic demand, a relatively limited export-oriented dairy processing sector, and trade policies. Albeit from a lower base, India's dairy imports to developing regions have grown faster than imports to high-income countries. Growth in international dairy trade has been fastest among developing countries (refer to figure 5).

Figure 3. Volume of international dairy trade by source and destination region

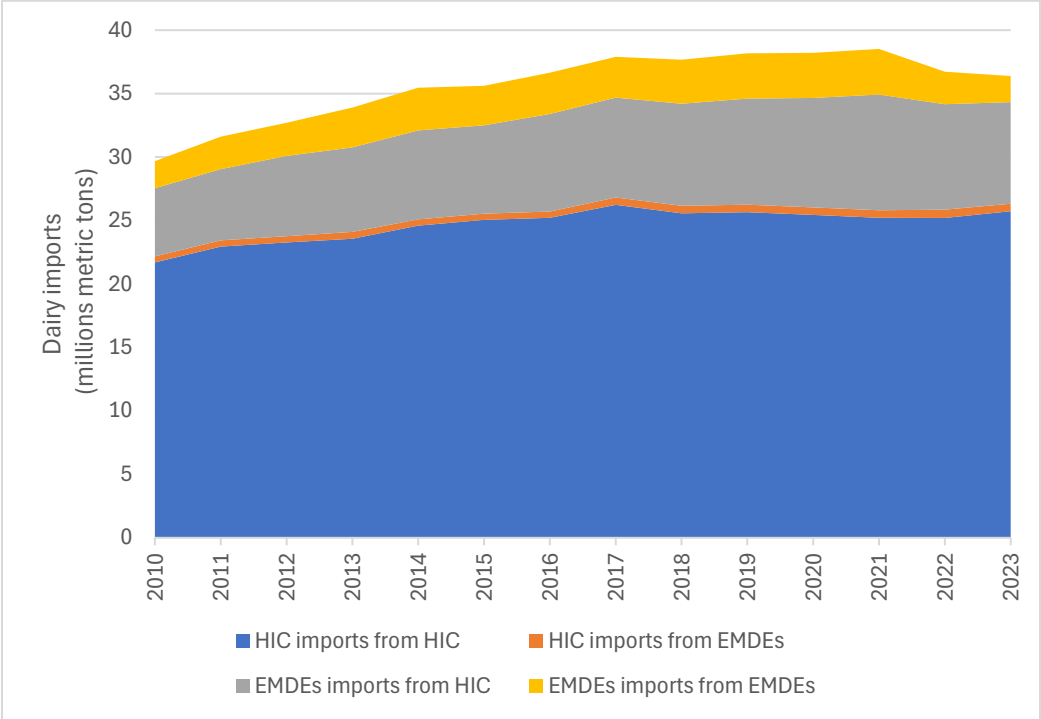
Thousands of metric tons



Sources: Original calculations based on dairy trade data from CEPII-BACI.

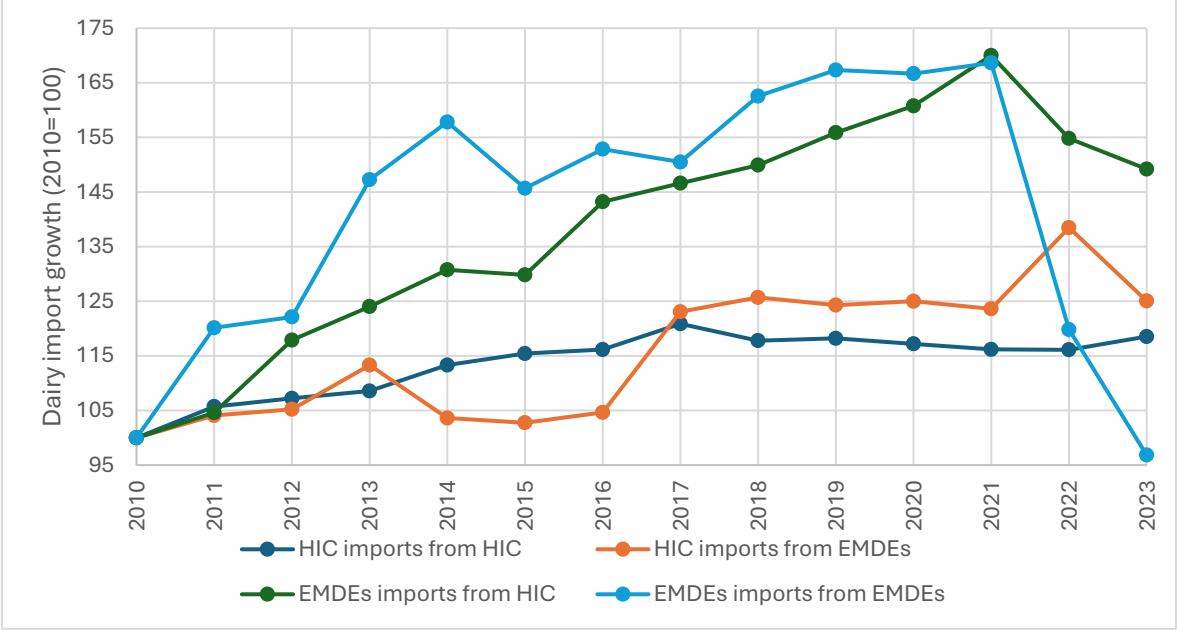
Note: Volumes in parentheses show average annual dairy trade for 2019–23. Averages are reported, given the high variation from year to year. CEPII-BACI is the BACI database of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Figure 4. Total international dairy trade volume by income level of source and destination countries



Sources: Original calculations based on dairy trade data from CEPII-BACI.
Note: CEPII-BACI is the BACI database of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). EMDEs = emerging markets and developing economies; HIC = high-income country.

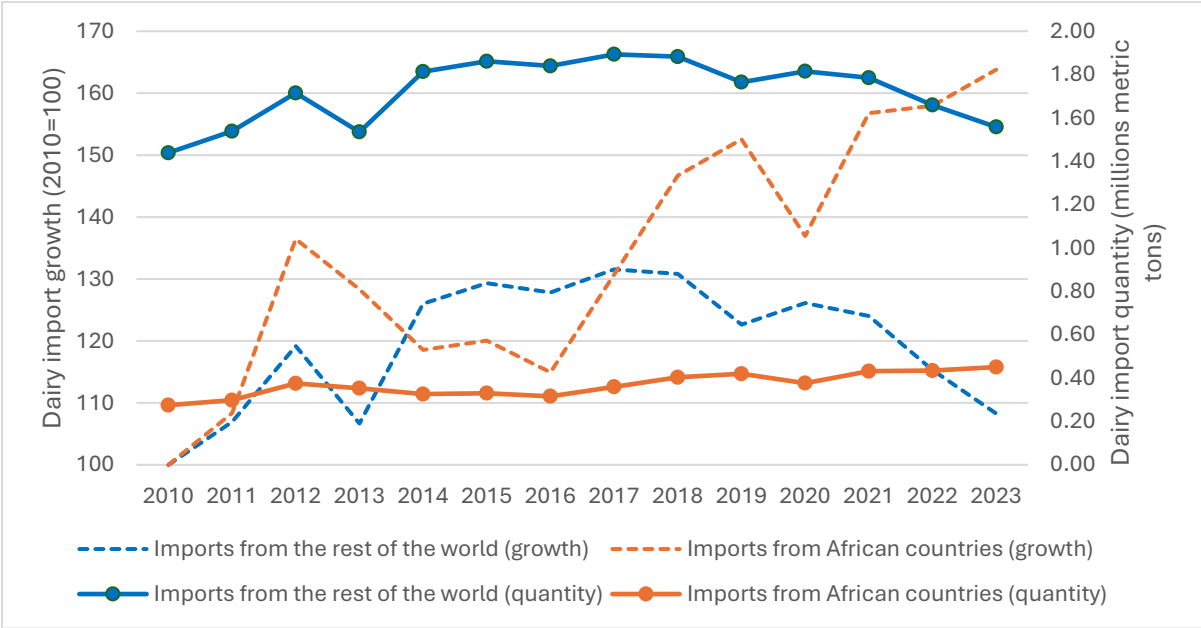
Figure 5. Growth rate of dairy imports by income level of source and destination countries



Sources: Original calculations based on dairy trade data from CEPII-BACI.
Note: CEPII-BACI is the BACI database of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). EMDEs = emerging markets and developing economies; HIC = high-income country.

The inability of the domestic dairy sectors in many developing countries to keep pace with growing demand has led to significant growth in dairy imports, especially in upper-middle-income countries. Even in countries with relatively large domestic dairy sectors, dairy imports play a critical role because of unstable supply and the limited integration of small-scale milk producers into formal markets (NMPFUS Dairy Export Council 2021). Dairy imports declined after the COVID-19 outbreak, especially in developing countries, where per capita milk consumption is far lower than recommendations for a healthy diet (Willett et al. 2019). Dairy imports within Africa have grown faster than imports from the rest of the world (60 percent versus 20 percent since 2010) (refer to figure 6), a trend that will likely continue given the ambitious goal of tripling intra-African food trade under the African Continental Free Trade Agreement (AfCFTA).

Figure 6. Dairy imports by African countries: quantities and growth, by source



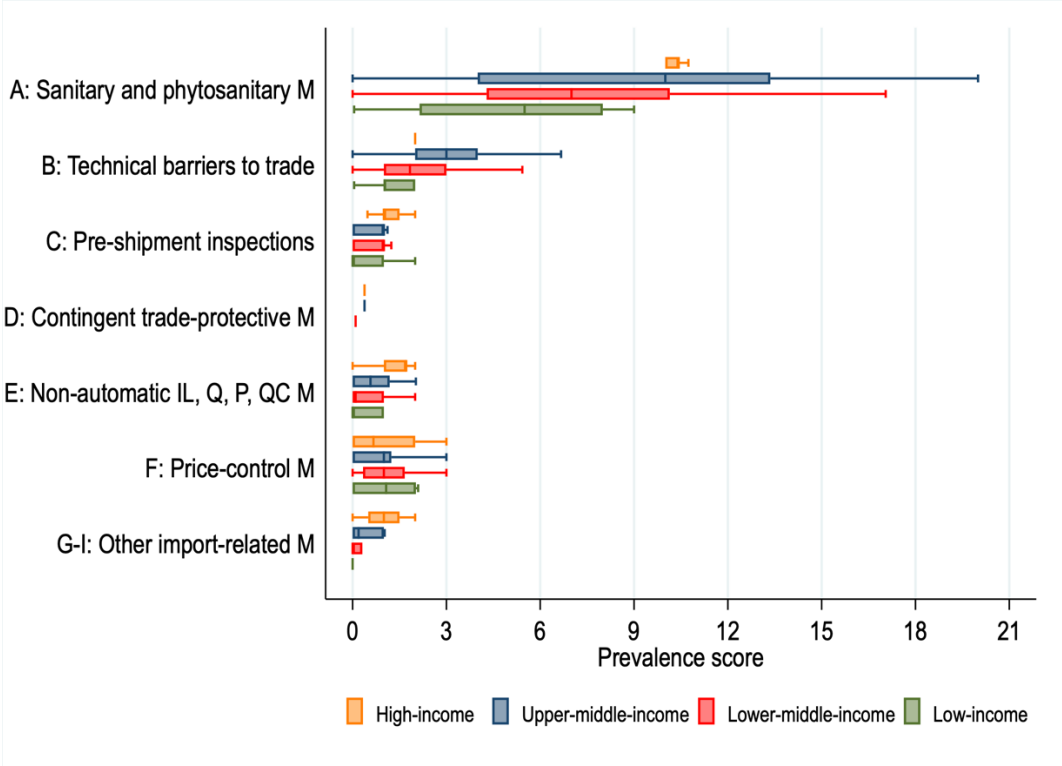
Sources: Original calculations based on dairy trade data from CEPII-BACI.
 Note: CEPII-BACI is the BACI database of the Centre d’Etudes Prospectives et d’Informations Internationales (CEPII).

NTMs on dairy imports

The average NTM prevalence score on dairy imports in this study’s sample is 13, meaning that each dairy product is, on average, subject to 13 NTMs. The average prevalence score is 11 for developing countries and 14 for developed countries. Sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBT) account for the bulk of these NTMs, with dairy products in developing countries subject to about 10 SPS and TBT measures on average, compared with about 12 in developed countries.

The variability in SPS/TBT measures is notably higher among developing countries. By contrast, developed countries impose higher but more uniform SPS measures, mirroring their stronger role in global dairy trade (refer to figure 7).⁴ Price control measures that protect the domestic dairy sector are the most common non-technical NTMs on dairy imports.

Figure 7. NTM prevalence scores on dairy imports by NTM chapter and income group

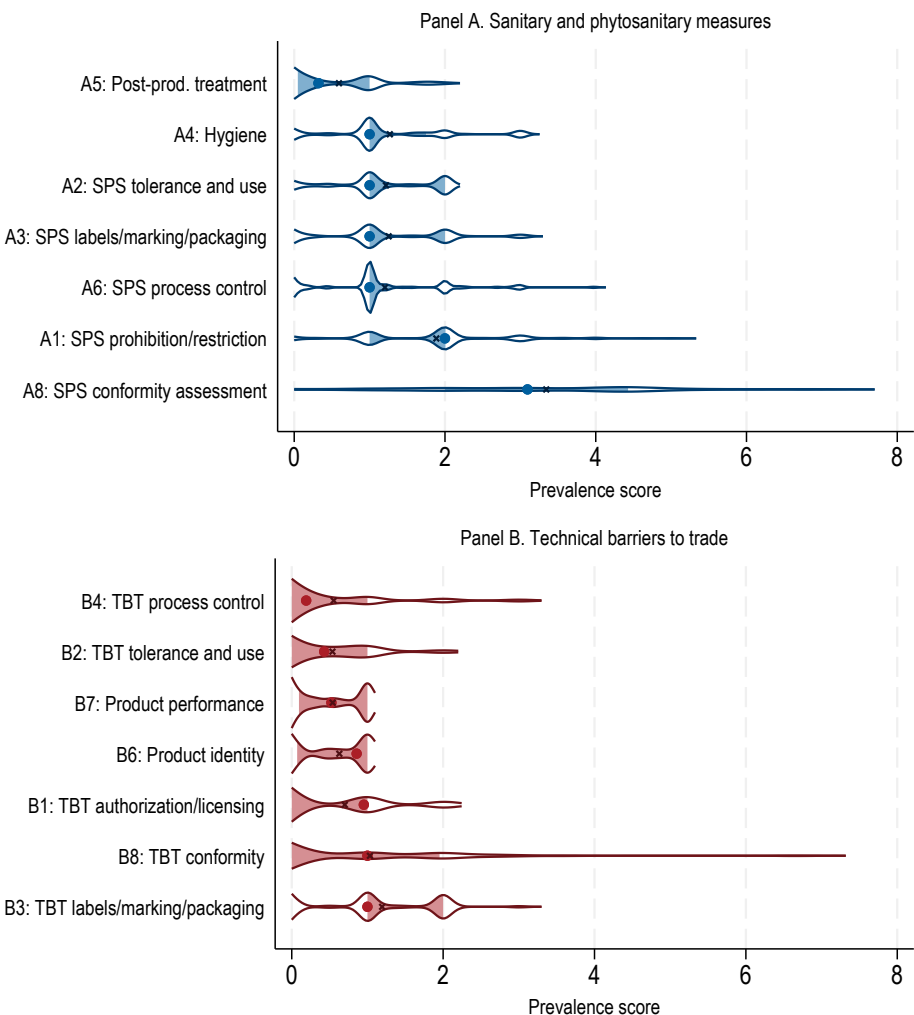


Source: Original calculations based on non-tariff measures data from UNCTAD.

Note: Letters A through I refer to the chapters in the International Classification of non-tariff Measures. M = measures; IL = import licensing; Q = quotas; P = prohibitions; QC = quality control. The bottom and top edges of each box show the 25th percentile and 75th percentile, respectively, with vertical lines inside each box showing the median. Whiskers below the boxes correspond to the 25th percentile minus 1.5 times the interquartile range (IQR), defined as the difference between the 75th and 25th percentiles. Whiskers above the boxes show 75th percentile plus 1.5 times the IQR. NTMs = non-tariff measures.

When looking at SPS requirements in particular, conformity assessments are by far the most common for dairy imports (refer to figure 8, panel a). Conformity assessments include testing and inspections for dairy contaminants, pathogens, and residues of veterinary drugs; certifications and approvals that dairy importers must secure from exporter's country; various quarantine requirements; health risk assessments; and labeling and packaging requirements (for example, about ingredients, nutritional content, and expiration dates). Within the TBT chapter, traceability requirements (such as labeling, marking, packaging) for managing risks in connection with food safety, labor standards, and the environment are the most prevalent (refer to figure 8, panel b).

Figure 8. Prevalence scores for sanitary and phytosanitary measures and technical barriers to trade for dairy imports



Source: Original calculations based on non-tariff measures data from UNCTAD.
Note: Letters “A” and “B” refer to chapters A and B, respectively, in the International Classification of Non-tariff Measures. Classifications are at the 2-digit NTM level. The figure shows the distribution of non-tariff measure (NTM) prevalence scores, with shaded area, x, and colored dot representing the inter-quantile range, mean, and median, respectively. SPS = sanitary and phytosanitary; TBT = technical barriers to trade.

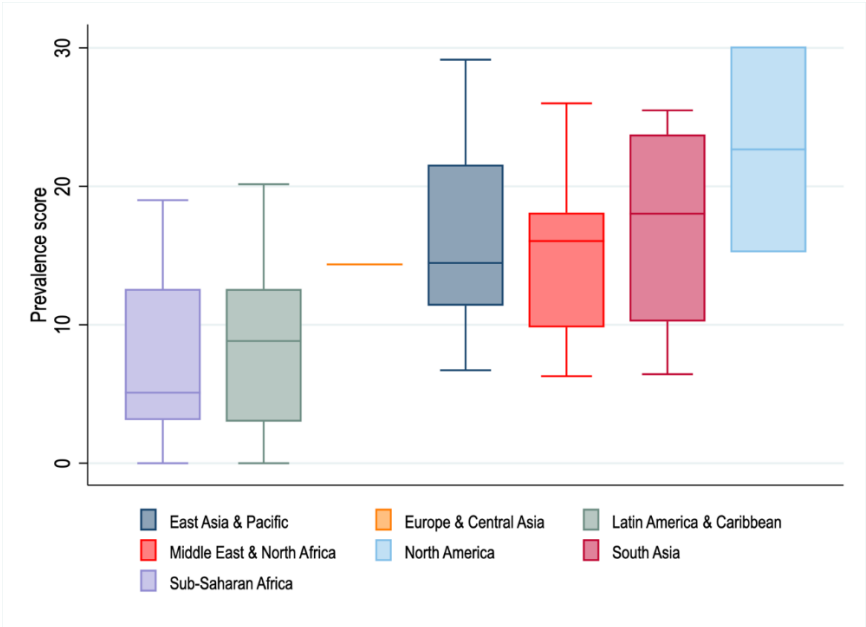
Full compliance with these SPS/TBT requirements by dairy exporters can be challenging and costly in developing countries, where dairy processing depends on fresh milk collected from numerous and fragmented small-scale milk producers (Fontagné et al. 2015). Compliance with increasingly complex quality, safety, and environmental standards will require innovations across the dairy value chain to address constraints to improve access to quality feed and veterinary services, dairy herd husbandry and milking practices, and cold chain infrastructures (De Vries, Kaylegian, and Dahl 2020).

Regional variations in NTMs on dairy imports

The NTM prevalence score for dairy imports is relatively lower in Sub-Saharan Africa and Latin America and the Caribbean (LAC) and the highest in North America, on average (refer to figure 9). Previous evidence suggests that while Africa faces the highest ad valorem equivalent (AVE) of NTMs on all goods, the AVE for agricultural goods is

the lowest relative to other regions (Johnson et al. 2022). Still, gains from reduced NTMs in Africa can be much higher than the gains from lower tariffs (Jensen and Sandrey 2015). As highlighted in the African Union Food Safety Strategy for Africa (2022–2036), food safety challenges and failures to meet SPS requirements can undermine the continent’s goal to boost agricultural and food trade within Africa (African Union 2021). Heterogeneity in NTM regulations, including those affecting dairy, poses a challenge for promoting dairy trade among developing countries and regions more broadly. At the same time, and specific to dairy imports in Africa, some have raised concerns about importation of vegetable fat-filled skimmed milk powder that do not meet health and environmental standards and Codex labelling requirements (Duteurtre, Christian, and Aurelie 2021).⁵

Figure 9. NTM prevalence for dairy imports by region



Source: Original calculations based on non-tariff measures data from UNCTAD.

Note: The bottom and top edges of each box show the 25th percentile (p) and 75th p, respectively, with vertical lines inside each box showing the median. Whiskers below the boxes correspond to the 25th p minus 1.5 times the interquartile range (IQR), defined as the difference between the 75th and 25th p. Whiskers above the boxes show 75th p plus 1.5 times the IQR. NTM = non-tariff measure.

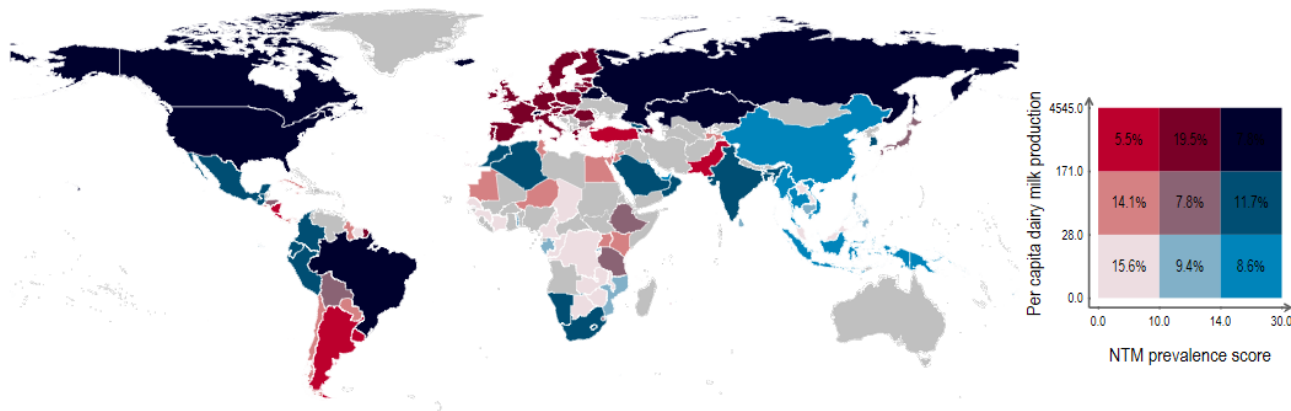
NTMs on dairy import by size of domestic dairy sector

NTMs can be imposed on dairy imports for a variety of reasons, including public safety. Their prevalence and intensity can depend on the level of development of the domestic dairy sector (Knips 2005, 2026). The bivariate map in figure 10 shows the association between the NTM prevalence score for dairy imports and a country’s per capita domestic milk production. The United States, Canada, Brazil, Iceland, New Zealand, and Russian Federation are among the countries falling in the top tercile of per capita milk production and dairy import NTM prevalence score. China, Indonesia, United Arab Emirates, Thailand, and Viet Nam also fall in the top tercile of NTM prevalence score on dairy imports, although their per capita milk production is in the lowest tercile.

Even though tariffs on food trade within Africa have been declining with the expansion of subregional free trade agreements, NTMs have increased (Beckman, Johnson, and Ivanic 2024). Algeria, Morocco, South Africa, and Namibia fall in the top tercile of NTM prevalence for dairy imports among countries with moderate per capita milk production, whereas NTM prevalence is lower for most other African countries for which NTM data are available. NTM regulatory differences within Africa and away from international standards will create asymmetric differences in compliance costs, impeding the facilitation of intra-African trade under the AfCFTA (African Union 2021; UNCTAD

2024). Indeed, one of the operational instruments of AfCFTA is the development of a Continental Online Tool to monitor and guide NTM incidences and policies.

Figure 10. Dairy import NTM prevalence score by country and by per capita fresh milk production



Source: Original calculations based on non-tariff measures data from UNCTAD and milk production data from FAO.
Note: Legend box shows non-tariff measure (NTM) prevalence scores (horizontal axis) and per capita dairy milk production (vertical axis). For each indicator, countries are divided into terciles resulting in a total of nine categories shown in the legend. Numbers inside each cell in the legend show the share of countries in the cell. No NTM data for countries in grey.

Innovations to strengthen the domestic dairy sector and promote trade in developing countries

For dairy operators in developing countries, integration into regional and global dairy markets necessitates full compliance with an increasingly complex web of safety, quality, and environmental standards demanded by regulators and consumers alike (Rahmat, Chew, and Hamid 2016). Several strategic policy reforms and investments examined in the discussion that follows can strengthen the domestic dairy value chain and trade in these markets. Given the limited tradability of fresh milk, infrastructure for safe and timely milk collection and dairy processing is critical to enable the transformation of raw milk into higher-value, longer shelf-lives, and easily transportable products such as cheese, yogurt, or milk powder. In turn, this will promote local job creation and improve dairy trade and nutrition security in developing countries. Efforts to simplify and harmonize NTMs among developing countries will be crucial to promote dairy trade given the heterogeneity especially in SPS and TBT measures. For example, in East Africa—which produces more than two-thirds of the continent’s fresh milk—dairy has been identified as one of the priority sectors for alignment of standards.

Public-private partnerships, equity injections, fiscal incentives, and trade agreements are enabling developing countries to decarbonize the sector, enhance milk productivity and dairy processing capacity, and participate in dairy trade. Some of the strategies being pursued include dairy cooperatives and milk collection centers (MCCs), quality-based milk payment systems (QBMPs), models that integrate small-scale milk producers into modern dairy processing chains, digital technologies to monitor value chain activities, and climate-smart dairy technologies.

When the dairy sector is dominated by small-scale milk producers, as is the case in many developing countries, market-oriented dairy cooperatives can enhance producers’ access to improved technologies, their linkages with domestic and international markets, and their bargaining power. In the world’s largest milk producer—India—

cooperatives account for more than half of the fluid milk produced (Koyi 2020; Landes et al. 2017). At the same time, the structure and conduct of dairy cooperatives influence both their own performance and that of their members, highlighting the need to identify entry points to strengthen dairy cooperatives and enhance benefits to small-scale milk producers (Matangaidze et al. 2025). Lessons from high-income countries show that market-oriented cooperatives are behind the modernization of key value chains, including dairy in the United States and the Netherlands, wine in Italy, grains in Canada, and fruits and vegetables in Spain.

Relatedly, milk collection centers that are well networked and well equipped (for example, that have testing infrastructure) play a critical role for timely collection of fresh milk from small-scale producers, thereby enhancing consistency in quantity, quality, and timing desired by dairy processors (Ndambi, Dido, and Gülzari 2020). Unlike industrial dairy systems common in high-income countries, an onsite cooling tank will not be financially feasible in small-scale milk production systems, making milk collection centers an ideal model to minimize milk spoilage. Dairy development models that integrate small-scale milk producers into export-oriented dairy processing value chains and large urban markets—as is done in Uganda, for example—have allowed milk producers to benefit from technical and financial assistance as well as marketing opportunities (Bachev and Manolov 2007; Bernard, Le Gal, and Triomphe 2011; Van Campenhout, Minten, and Swinnen 2021).

Small-scale milk suppliers have historically been rewarded based on the volume of milk supplied. In contrast, QBMPS incentivize not only volume but also quality, basing payments on parameters such as physical, chemical, and microbial characteristics; absence of antibiotic residues, adulterants, and toxic substances; and timely delivery. QBMPS are now widely used in leading milk-producing countries such as India and Brazil (Botaro, Gameiro, and Santos 2013) and have been piloted recently in Sub-Saharan Africa (Shinning Global Institute 2020). For example, QBMPS pilots in Kenya have demonstrated that the quality of milk can be improved by incentivizing producers to adopt better dairy herd husbandry practices (Ndambi, Dido, and Gülzari 2020).

With the expansion of digital infrastructure in developing countries, digital technologies are playing a role in enhancing the safety, quality and traceability of dairy products (Daum et al. 2022; Shinning Global Institute 2020). Some of these technologies include mobile applications to track milk collection, record milk quality tests, and manage payments; blockchain technologies to track activities at different nodes of the dairy value chain; Internet of Things (IoT) sensors to monitor the environment during milk production and handling (such as temperature and humidity); and artificial intelligence (AI) and machine learning technologies to support dairy data analytics.

Private sustainability certifications and buyer-led schemes have become more common in the dairy sector. For example, one study documents 19 farm-level dairy sustainability standards, revealing considerable variation in scope (McGarr-O'Brien et al. 2023). These standards tend to emphasize environmental dimensions (such as reduction of greenhouse gases, manure and water management, biodiversity preservation, and animal welfare) much more consistently than social or economic aspects and typically rely on audits for compliance (McGarr-O'Brien et al. 2023). Developing countries are adopting innovations to decarbonize the dairy sector, thereby aligning production with sustainability standards. For example, Ethiopia is piloting climate-smart “dairy hubs” to connect farmers to cooling and processing facilities to reduce methane emissions and enhance yields (Hughes 2023). Kenya is investing in climate-resilient infrastructure (such as Nakuru’s solar milk cooler program) to minimize milk wastage and enhance sales (Dairy Business Middle East & Africa 2025). In Viet Nam, the dairy giant Vinamilk launched a green farm product line utilizing carbon-neutral farming methods and advanced double vacuum technology, receiving the first carbon-neutral certification in the country (Vu Phong Energy Group 2025).

Trade agreements and market-access protocols are also expanding market opportunities for dairy operators in developing countries. For example, a 2024 dairy trade agreement between South Africa and China is expected to significantly boost South Africa’s dairy exports to China (Dairy Business Middle East & Africa 2024).⁶ Uganda is

gearing up to export powdered milk to Algeria, with three of its major dairy processors set to supply a shipment of 120,000 tones as part of a broader US\$500 million deal. In Latin America, a trade agreement between the European Union and Mercosur nations (Argentina, Bolivia, Brazil, Paraguay, and Uruguay) is expected to boost trade, including in dairy, by progressively lowering tariffs and NTMs and promoting cooperation on trade facilitating initiatives (EDA 2025).

Beyond strategies aimed specifically at enhancing dairy standards in developing countries, efforts to sustainably increase milk yields will help mitigate emissions. Despite the decline in dairy sector emissions intensity globally—thanks to improved management practices and productivity gains—total dairy emissions have risen due to faster growth in dairy production in the face of growing demand. The intensity of emissions from the dairy sector is higher in low-yield developing countries than in high-yield high-income countries, FAO estimates show. For example, between 2019 and 2023, average milk yields in North America and in Europe and Central Asia were about 19 and 7 times higher, respectively, than in Sub-Saharan Africa, where milk yields are not only the lowest but have also grown the least, contributing to the relatively limited reduction in dairy sector emissions intensity in the region (FAO and Global Dairy Platform 2018). In contrast, South Asia—which has experienced the fastest growth in milk yield—witnessed one of the fastest reductions in dairy sector emissions intensity (FAO and Global Dairy Platform 2018). Efforts to improve the genetic makeup of dairy herds, expand access to quality feed and veterinary services, and adopt better husbandry practices will be crucial to enhance yields and reduce emissions intensity.

Conclusion

Dairy consumption improves nutritional outcomes, especially among children in developing countries where intake is far below recommended levels for good health. Dairy demand is projected to expand rapidly in many of these countries, yet domestic production has not kept pace, underscoring the critical role of dairy trade in bridging the gaps. NTMs, particularly SPS and TBT measures, remain a defining feature of dairy imports. High-income countries—which account for the largest share of global dairy trade—impose an average of 14 NTMs on imported dairy products, but these markets benefit from a more uniform regulatory environment. Developing countries likewise impose high levels of NTMs, averaging about 11 on dairy imports, but face greater diversity in NTM regulations, which raises compliance costs and uncertainty, especially for smaller dairy operators. The burden of fragmented NTM frameworks can be especially severe in developing countries, where most of the fresh milk is supplied by numerous small-scale milk producers. Complexities in NTM regulations and their enforcement will restrict opportunities for dairy trade among developing countries and regions, at a time when such trade is increasingly vital to meet rising demand.

Beyond efforts to harmonize dairy NTM regulations, strategic policy innovations and investments discussed in this study can strengthen the domestic dairy sector in developing countries and enhance the sector's capacity to comply with dairy standards. Market-oriented cooperative models and milk collection centers can facilitate the integration of small-scale milk producers into formal dairy processing value chains, while quality-based payment systems can incentivize compliance with dairy standards. Digital technologies and climate-smart dairy practices further offer opportunities to improve traceability, promote sustainability, increase milk productivity, and reduce milk spoilage. Taken together, these strategies highlight the dual imperative of enhancing dairy supply in developing countries by promoting sustainable growth of the domestic sector and dairy trade as appropriate.

Notes

¹ This study uses the term “dairy products” to refer to fresh milk and processed products such as skim/whole milk powders, condensed/evaporated milk whey, cheese, long life creams, butter, and enriched milk powders.

² Dairy products cover all items with HS6 codes starting with 0401, 0402, 0403, 0404, 0405, or 0406.

³ For more information about CEPII, the Centre d’Etudes Prospectives et d’Informations Internationales, and the BACI database, which covers bilateral flows for more than 500 products and 200 countries, refer to https://cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp.

⁴ The detailed classification of NTMs by UNCTAD, the International Classification of Non-tariff Measures, encompasses 16 chapters (A to P) (for more information, refer to <https://www.tradebarrierswa.org/measures>). SPS measures are covered in chapter A. TBTs are covered in chapter B.

⁵ Codex refers to the Codex Alimentarius, a set of international food standards, guidelines and codes of practice established by FAO and WHO to promote the safety, quality and fairness of international food trade. For more information, refer to <https://www.fao.org/fao-who-codexalimentarius/about-codex/pt/>.

⁶ China has recently suspended dairy imports from South Africa following a flare-up of foot-and-mouth disease in certain provinces.

References

- African Union. 2021. *Food Safety Strategy for Africa 2022–2036*. African Union.
- Arita, Shawn, Jayson Beckman, and Lorraine Mitchell. 2017. "Reducing Transatlantic Barriers on U.S.-EU Agri-food Trade: What Are the Possible Gains?" *Food Policy* 68 (April): 233–47.
- Bachev, Hrabrin, and I. Manolov. 2007. "Inclusion of Small-Scale Dairy Farms in Supply Chain in Bulgaria (A Case from Plovdiv Region)." SSRN Electronic Journal, doi:[10.2139/ssrn.989805](https://doi.org/10.2139/ssrn.989805).
- Beal, Ty, Christopher D. Gardner, Mario Herrero, and Lora Ianotti. 2023. "Friend or Foe? The Role of Animal-Source Foods in Healthy and Environmentally Sustainable Diets." *Journal of Nutrition* 153 (2): 409–25.
- Beckman, Jayson, Michael E. Johnson, and Maros Ivanic. 2024. "Agriculture and AfCFTA: NTM Reductions Increase Intra-Africa Trade." *Agricultural Economics* 55 (2): 200–22.
- Bernard, Jennifer, Pierre Yves Le Gal, and Bernard Triomphe. 2011. "Involvement of Small-scale Dairy Farms in an Industrial Supply Chain: When Production Standards Meet Farm Diversity." *Animal* 5 (6): 961–71.
- Botaro, Bruno, Augusto Hauber Gameiro, and Marcos Veiga dos Santos. 2013. "Quality Based Payment Program and Milk Quality." *Scientia Agricola* 70 (1): 21–26.
- Chan, Chin Yee, Nhung Tran, Shanali Pethiyagoda, Charlet C. Crissman, Timothy B. Sulser, and Michael J. Philips. 2019. "Prospects and Challenges of Fish for Food Security in Africa." *Global Food Security* 20 (March): 17–25.
- Chatellier, Vincent. 2021. "Review: International Trade in Animal Products and the Place of the European Union: Main Trends over the Last 20 Years." *Animal* 15 (Suppl 1): 100289.
- Dairy Business Middle East & Africa. 2024. "South Africa, China Sign Dairy Trade Agreement to Enhance Export Opportunities." <https://dairybusinessmea.com/2024/09/10/south-africa-china-sign-dairy-trade-agreement-to-enhance-export-opportunities/>
- Dairy Business Middle East & Africa. 2025. "Digital Tools Transform Dairy Farming in Kenya." <https://dairybusinessmea.com/2025/02/27/digital-tools-transform-dairy-farming-in-kenya/>
- Daum, Thomas, Thanamalar Ravichandran, Juliet Kariuki, Mizeck Chagunda, and Regina Birner. 2022. "Connected Cows and Cyber Chickens? Stocktaking and Case Studies of Digital Livestock Tools in Kenya and India." *Agricultural Systems* 196 (February): 103353.
- De Vries, Albert, K. E. Kaylegian, and Geoffrey E. Dahl. 2020. "MILK Symposium Review: Improving the Productivity, Quality, and Safety of Milk in Rwanda and Nepal." *Journal of Dairy Science* 103 (11): 9758–73.
- Disdier, Anne-Celia, and Marco Fugazza. 2019. *A Practical Guide to the Economic Analysis of Non-Tariff Measures*. United Nations (UN Trade and Development) and World Trade Organization.
- Duteurtre, Guillaume, Corniaux Christian, and Aurelie De Palmas. 2021. "Milk, Trade and Development in the Sahel Socioeconomic and Environmental Impacts of European Vegetable Fat Dairy Blend Imports in West Africa." Report for the "Greens" and "S&D" Groups of the European Parliament. CIRAD Final Report, May 2021. Montpellier, France: CIRAD.
- EDA (European Dairy Association). 2025. "Dairy Trade and Mercosur." EDA.
- FAO (Food and Agriculture Organization of the United Nations) and Global Dairy Platform. 2018. *Climate Change and the Global Dairy Cattle Sector—The Role of the Dairy Sector in a Low-Carbon Future*. Rome: FAO and Global Dairy Platform Inc.
- Fontagné, Lionel, Gianluca Orefice, Roberta Piermartini, and Nadia Rocha. 2015. "Product Standards and Margins of Trade: Firm-level Evidence." *Journal of International Economics* 97 (1): 29–44.
- Gaulier, Guillaume, and Soledad Zignago. 2010. "BACI: International Trade Database at the Product Level: The 1994–2007 Version," Document de Travail No. 2010-23, CEPII (Centre d'Etudes Prospectives et d'Informations Internationales).
- Haile, Beliyu, and Derek Headey. 2023. "Growth in Milk Consumption and Reductions in Child Stunting: Historical Evidence from Cross-country Panel Data." *Food Policy* 118 (July): 102485.

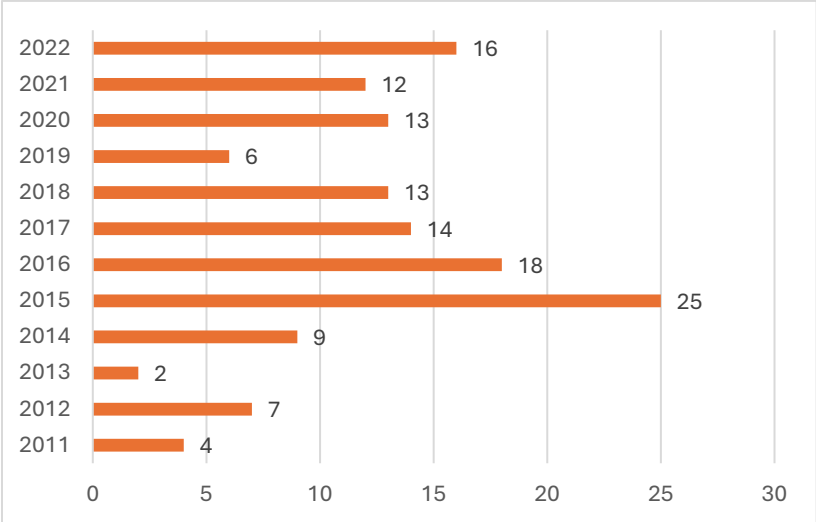
- Headey, Derek D., Harold Alderman, John Hoddinott, and Sudja Narayanan. 2024. "The Glass of Milk Half-Empty? Dairy Development and Nutrition in Low and Middle Income Countries." *Food Policy* 122 (January): 102585.
- Herrero, Mario, Delia Grace, Jemimah Njuki, and Nancy Johnson. 2013. "The Roles of Livestock in Developing Countries." *Animal* 7 (Suppl 1): 3–18.
- Hughes, Nigel Ross. 2023. "Green Milk? Sounds Good for Ethiopia's Dairy Industry." Africa Can End Poverty (blog), July 31, 2023. World Bank, Washington, DC.
- Jensen, Hans Grinstead, and Ron Sandrey. 2015. "African Agricultural Trade: Recent and the Future." *African Journal of Agricultural and Resource Economics* 10 (2): 12.
- Johnson, Michael E., Jarrad Farris, Stephen Morgan, Jeffrey R. Bloem, Kayode Ajewole, and Jayson Beckman. 2022. "Africa's Agricultural Trade: Recent Trends Leading up to the African Continental Free Trade Area." Economic Information Bulletin 244, United States Department of Agriculture (USDA) Economic Research Service (ERS).
- Knips, Vivien. 2005. "Developing Countries and the Global Dairy Sector Part I: Global Overview." PPLPI Working Paper 30, Pro-Poor Livestock Policy Initiative.
- Knips, Vivien. 2006. "Developing Countries and the Global Dairy Sector Part II: Country Case Studies." PPLPI Working Paper 31, Pro-Poor Livestock Policy Initiative.
- Koyi, Nabiswa P. 2020. "The Role of Dairy Cooperative Societies in Sustainable Dairy Development in Kenya." *International Journal of Community and Cooperative Studies* 8 (2): 1–24.
- Landes, Maurice, Jerry Cessna, Lindsay Kuberka, and Keithly Jones. 2017. "India's Dairy Sector: Structure, Performance, and Prospects" LDPM-272-01. 2017, United States Department of Agriculture (USDA), Washington, DC.
- Leroy, Frederic, Fabien Abraini, Ty Beal, Paula Dominguez-Salas, Pablo Gregorini, Pablo Manzano, Jason Rowntree, and Stephan van Vliet. 2022. "Animal Board Invited Review: Animal Source Foods in Healthy, Sustainable, and Ethical Diets— An Argument against Drastic Limitation of Livestock in the Food System." *Animal* 16 (3): 100457.
- Li, Yuan, and John C. Beghin. 2012. "A Meta-analysis of Estimates of the Impact of Technical Barriers to Trade." *Journal of Policy Modeling* 34 (3): 497–511.
- Malila, Yuwares, Iyiola O. Owolabi, Tanai Chotanaphuti, Napat Sakdibhornssup, Christopher T. Elliott, Wonnop Visessanguan, Nitsara Karoonuthaisiri, and Awanwee Petchkongkawe. 2024. "Current Challenges of Alternative Proteins as Future Foods." *npj Science of Food* 8, Article 53 (2024).
- Matangaidze, Rebecca, Aspinas Chapwanya, Mounir Adnane, Mandivamba Rukuni, and Godfrey Bernard Nyamushamba. 2025. "Assessing the Structure, Conduct, and Performance of Dairy Cooperatives: Insights into Smallholder Market Participation and Productivity in Emerging Dairy Systems." *Tropical Animal Health and Production* 57, Article 332 (2025).
- McGarr-O'Brien, K., Jonathan Herron, Laurence Shalloo, Imke J. M. de Boer, and Evelien M. De Olde. 2023. "Characterising Sustainability Certification Standards in Dairy Production." *Animal* 17 (7): 100863.
- Ndambi, Asaah, Sabdiya Dido, and Şeyda Ozkan Gülzari. 2020. "Milk Quality Assurance in Smallholder-dominated Dairy Chains: Lessons from Uganda and Kenya." Wageningen University & Research, Report number 31, doi:[10.13140/RG.2.2.10606.15683](https://doi.org/10.13140/RG.2.2.10606.15683)
- NMPFUS Dairy Export Council. 2021. *Dairy Market Opportunities in Sub-Saharan Africa*. NMPFUS Dairy Export Council.
- OECD (Organisation for Economic Co-operation and Development) and FAO (Food and Agriculture Organization of the United Nations). 2024. *OECD-FAO Agricultural Outlook 2024–2033*. Paris and Rome: OECD and FAO.
- Rahmat, Suharni, Boon Cheong Chew, and Mohd Syaiful Rizal Bin Abd Hamid. 2016. "Challenges of Developing Countries in Complying Quality and Enhancing Standards in Food Industries." *Procedia–Social and Behavioral Sciences* 224 (15 June 2016): 445–51.

- Sanjuán, Ana I., George Philippidis, Hugo Ferrer Perez, and Pilar Gracia de Renteria. 2023. "Empirical Insights on the Dynamics of SPS Trade Costs: The Role of Regulatory Convergence and Experience in EU Dairy Trade." *Food Policy* 119 (August): 102524.
- Shinning Global Institute. 2020. "Dairy Value Chain: What Model of Milk Collection Centers Is Efficient?" Shinning Global Institute, July 31, 2020.
- Talwar, Resham, Mathilda Freymond, Kalpana Beesabathuni, and Srujith Lingala. 2024. "Current and Future Market Opportunities for Alternative Proteins in Low- and Middle-Income Countries." *Current Development in Nutrition* 8 (Suppl 1): 102035.
- UNCTAD (UN Trade and Development). 2018. *UNCTAD TRAINS: The Global Database on Non-Tariff Measures User Guide* (2017, Version 2). UNCTAD.
- UNCTAD (UN Trade and Development). 2019. *International Classification of Non-Tariff Measures. Version 2019*. UNCTAD.
- UNCTAD (UN Trade and Development). 2024. *Non-tariff Measures and Deep Regulatory Integration in the African Continental Free Trade Area*. UNCTAD.
- UNCTAD (UN Trade and Development). 2025. *Making Sense of Non-Tariff Measures: A User's Guide to Accessing and Analysing the Data*. Geneva: UNCTAD.
- UNCTAD (UN Trade and Development) and World Bank. 2018. *The Unseen Impact of Non-Tariff Measures: Insights from a New Database*. UNCTAD and World Bank.
- Van Campenhout, Bjorn, Bart Minten, and Johan F. M. Swinnen. 2021. "Leading the Way—Foreign Direct Investment and Dairy Value Chain Upgrading in Uganda." *Agricultural Economics* 52 (4): 607–31.
- Vu Phong Energy Group. 2025. "The First Farm and Dairy Factory in Vietnam Certified Carbon-Neutral." Vu Phong Energy Group, June 1, 2023.
- Willett, Walter, Johan Rockström, Brent Loken, Marco Springmann, Tim Lang, Sonja Vermeulen, Tara Garnett, David Tilman, Fabrice DeClerck, Amanda Wood, Malin Jonell, Michael Clark, Line J. Gordon, Jessica Fanzo, Corinna Hawkes, Rami Zurayk, Juan A. Rivera, Wim De Vries, Lindiwe Majele Sibanda, Ashkan Afshin, Abhishek Chaudhary, Mario Herrero, Rina Agustina, Francesco Branca, Anna Lartey, Shenggen Fan, Beatrice Crona, Elizabeth Fox, Victoria Bignet, Max Troell, Therese Lindahl, Sudhvir Singh, Sarah E. Cornell, K. Srinath Reddy, Sunita Narain, Sania Nishtar, and Christopher J. L. Murray. 2019. "Food in the Anthropocene: The EAT-Lancet Commission on Healthy Diets from Sustainable Food Systems." *Lancet* 393 (10170): 447–92.

Appendix

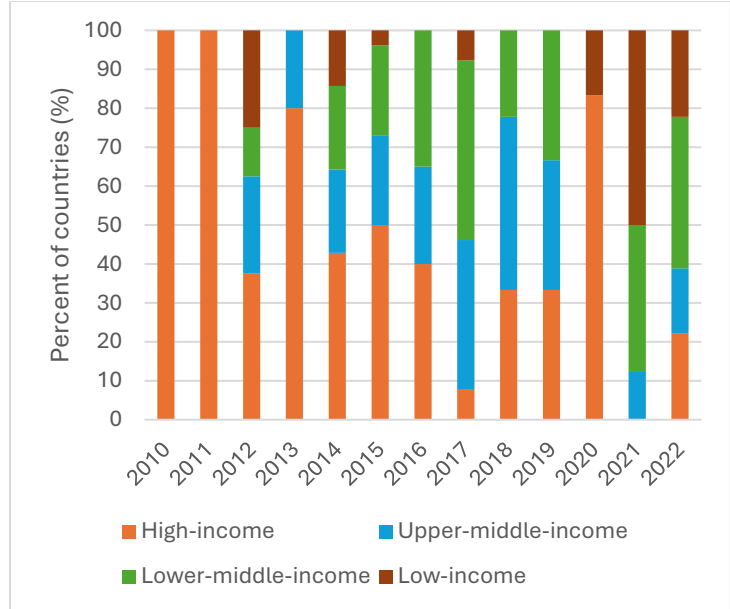
TRAINS NTM data for this study come from TRAINS NTM (*NTMs_hs6_2010_2022_H4v12.dta*), accessible here (<https://trainsonline.unctad.org/bulkDataDownload>). The data include non-tariff measures (NTMs) imposed by countries regardless of the circumstances (whether as part of a trade agreement or unilaterally) and follow the Multi-Agency Support Team (MAST) classification, but do not cover MAST NTM chapters J through O. This study analyzes NTMs that were strictly and fully applied on dairy imports (variable *ntm_FullCov_nonH*). It expands NTMs data for the European Union (EU) (listed as a single entity both as a reporter and partner) as well as the world (where the EU is listed as partner). Figures A1 to A3 summarize the temporal and spatial coverage of NTM data. Figure A4 presents data on per capita fresh milk production growth by region.

Figure A1. Number of countries in the TRAINS non-tariff measure database, by year



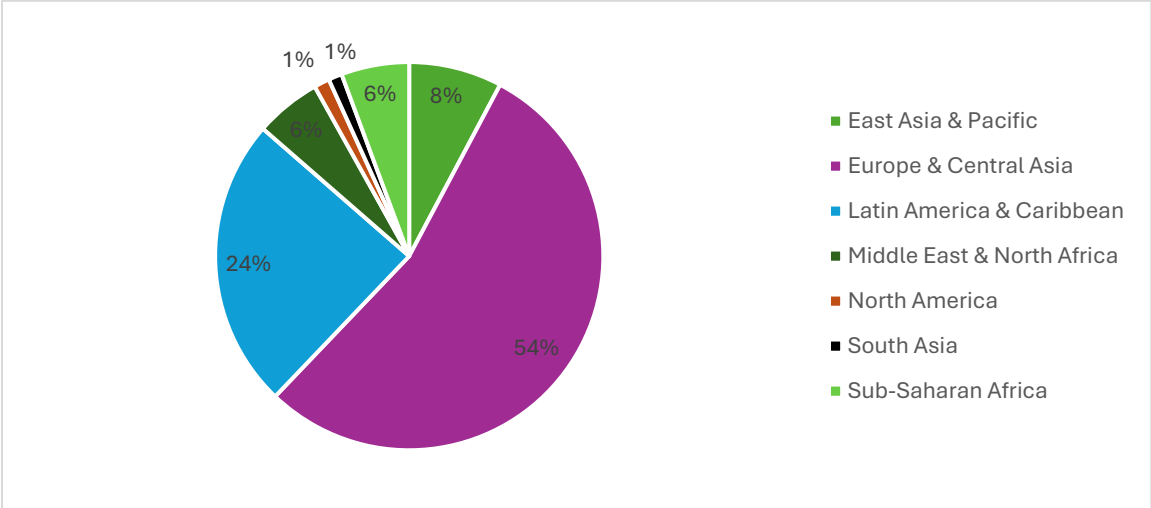
Source: Original calculations based on non-tariff measures data from UNCTAD.

Figure A2. Share of countries in the TRAINS non-tariff measure database, by year and income group



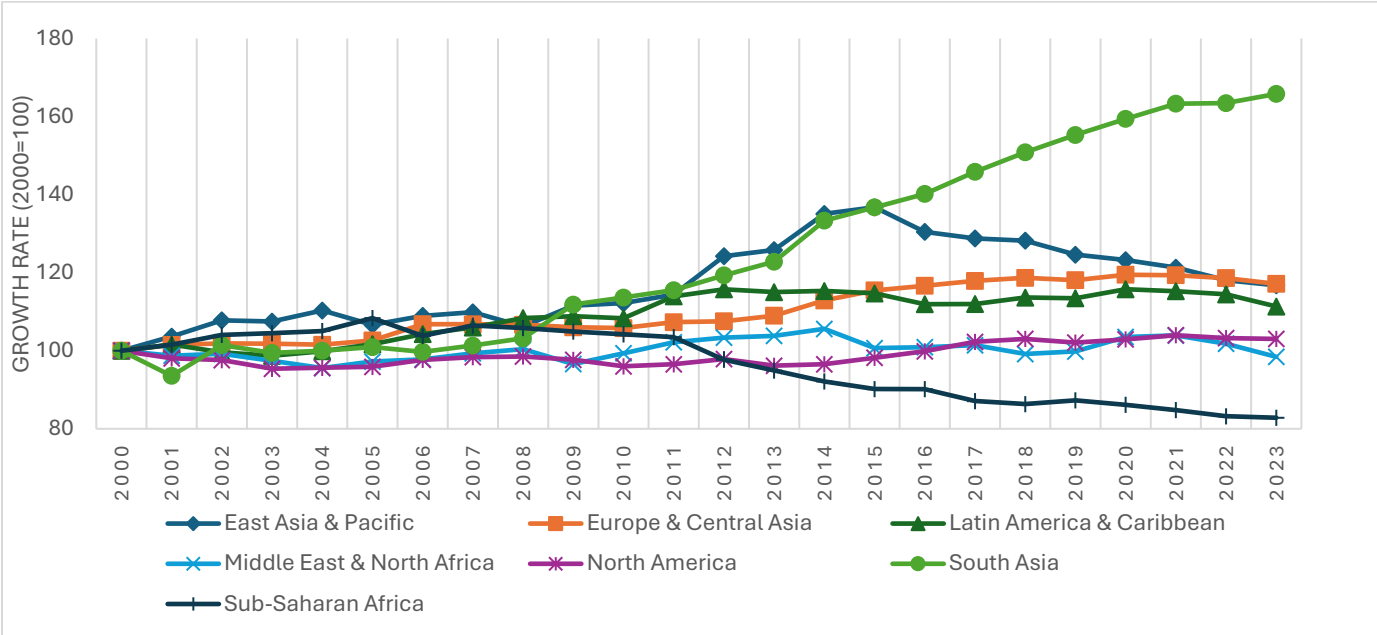
Source: Original calculations based on non-tariff measures data from UNCTAD.

Figure A3. Non-tariff measure coverage in the TRAINS database by region



Source: Original calculations based on non-tariff measures data from UNCTAD.

Figure A4. Per capita fresh milk production growth by region, 2000–23



Source: Original calculations based on data from the Food and Agriculture Organization of the United Nations (FAO).