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SCIENTIFIC ARTICLE

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Recent trends in agri-food trade and the future in a changing geopolitical environment

ABSTRACT

Global agri-food trade is undergoing profound structural change, driven by escalating geopolitical tensions, climate-related shocks, and evolving market dynamics. Agri-food trade has become central to food security, shaping access and availability across diverse regions. Recent trends indicate a modest resurgence in agricultural trade as a share of total global trade and a growing regionalisation of trade flows. While the European Union and Brazil have consolidated surplus positions through strategic policy alignment and export diversification, the United States faces declining competitiveness, trade stagnation, and a widening import gap. Simultaneously, China has emerged as the leading global importer, reshaping trade relationships and intensifying competition among suppliers. The volatility induced by trade wars, the COVID-19 pandemic, and the war in Ukraine has been compounded by the proliferation of trade restrictions, which pose acute risks for import-dependent countries. These developments underscore the fragility of global food systems and the strategic implications of trade balances. As trade agreements are reconfigured and economic nationalism rises, long-term sustainability will hinge on investments in domestic agricultural capacity, modern infrastructure, and multilateral cooperation. Future trajectories of agri-food trade will be shaped by structural shifts in global demand, persistent trade costs – including tariffs, transportation bottlenecks, and non-tariff measures – and the increasingly complex intersection of environmental regulation and market access. With agricultural production projected to increase by over 21% globally in the next decade, addressing the compound pressures of geopolitical fragmentation and climate change will be essential to maintaining stable, equitable, and sustainable food systems.

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Introduction

The landscape of agri-food trade has been shaped significantly by historical events and geopolitical dynamics that have influenced countries' comparative advantages and designed trade routes (Anderson, 2014). Colonial and neo-colonial legacies have left enduring patterns of dependency and inequality, particularly in the Global South where bulk, low-valued commodities are largely exported (Horner and Nadvi, 2018). These historical patterns have led to structural dependencies that continue to affect food security, rendering many nations vulnerable to external shocks and market manipulation (d'Amour and Anderson, 2020; Hellegers, 2022). The concept of food systems encompasses a complex network of activities necessary for feeding a population, including production, processing, distribution, and consumption (Pinstrup-Andersen, 2009; Santeramo, 2015; Clapp, 2022). These systems have historically been influenced by external agricultural policies, perpetuating cycles of dependency that affect contemporary food security challenges (Smith and Glauber, 2020). Moreover, the interaction between agricultural trade and global capital flows has further complicated the agri-food landscape. The geopolitical environment continues to evolve, with significant disruptions in trade patterns occurring due to trade wars, supply chain issues from the COVID-19 pandemic, and ongoing conflicts such as the Russia-Ukraine war, all of which have altered trading dynamics and introduced new challenges (Awokuse *et al.*, 2024; Kornher *et al.*, 2024). The significance of agri-food trade extends beyond mere economic transactions; it is pivotal for global food security, impacting billions of lives worldwide (Godfray *et al.,* 2010). As nations navigate a complex web of trade agreements and barriers, understanding these trends is essential to ensure stable food supplies and address vulnerabilities, particularly for nations in the Global South that remain heavily reliant on imports (Savary *et al.,* 2022). The past few years have seen a notable shift towards regionalisation in agri-food exchanges, and for agricultural trade, after years of decreasing as a proportion of total trade, the tendency is now steady with a slight increase observable over the last 15 years (Piñeiro and Piñeiro, 2024).

The United States is the world's second largest agricultural trader, behind the European Union (EU), with emerging pressure from increasing imports and competition of emerging markets like Brazil and Argentina[1]. Moreover, geopolitical events such as trade wars, the COVID-19 pandemic, and the ongoing conflict in Ukraine have profoundly disrupted established trade patterns[2], resulting in price volatility and complicating supply chains (Awokuse *et al.,* 2024; Kornher *et al.*, 2024), and trade has been further disrupted by trade restrictions[3]. Controversies surrounding trade restrictions have emerged (Larch *et al.,* 2024). These measures raise concerns about food accessibility and security, especially for vulnerable countries, endangering their food security (Afesorgbor *et al.,* 2024a). Furthermore, geopolitical tensions have catalysed a re-evaluation of trade agreements. The future of agri-food trade hinges on strategic collaboration, investments in local production, and enhanced infrastructure to foster resilience against external shocks (Awokuse *et al.,* 2024). As global agricultural production is projected to increase by over 21% in the next decade, addressing the interconnected challenges of geopolitical dynamics and climate change will be crucial for maintaining food security and stability in the agri-food sector.

Shifting Global Agri-Food Trade Balances

Global agri-food trade has experienced significant transformations over the past two decades, influenced by shifting geopolitical landscapes, evolving consumer preferences, climate variability, and changing production capacities. Central to this transition is the reconfiguration of trade balances among the world's major exporters and importers, signalling broader structural shifts in the global food system. Regions such as the European Union and Brazil have recorded notable increases in export volumes and surpluses, while the United States – traditionally a dominant agricultural power – has witnessed a relative stagnation in exports and a widening import gap. Simultaneously, China has emerged as a major structural driver of global import demand, further altering traditional trade flows and supplier dynamics (Table 1).

The EU has consolidated its status as one of the most competitive and diversified agri-food exporters globally[4]. In 2024, the EU27's exports to countries outside the Union reached €235.4 billion, an increase of 2.9% over the previous year, while imports rose by 7.8% to €171.9 billion. The resulting trade surplus of €63.5 billion underlines the region's robust external position in agri-food markets. This performance has been underpinned by successive reforms of the Common Agricultural Policy (CAP), which have enhanced productivity, market responsiveness, and sustainability. The EU's top export categories – cereal preparations and milling products (€24.8 billion), dairy products (€19.7 billion), and wine and wine-based products (€17.4 billion) – reflect not only high output levels but also a strategic focus on value-added goods. Premium exports such as chocolate and confectionery (€11.8 billion, +9.7%) and coffee, tea, cocoa, and spices (€10.7 billion, +32%) have also recorded significant growth, driven by global demand for specialty foods with traceable and certified origins.

Despite the rise in imports – especially of tropical and seasonal products – the EU has preserved a positive balance. The most imported agri-food products in 2024 were coffee, tea, cocoa, and spices (€30.3 billion, +47.5%), fruit and nuts (€24.9 billion, +11.6%), and oilseeds and protein crops (€20 billion, -5.2%). These figures highlight both the EU's global integration and its dependence on agricultural products not widely produced within its borders. Nonetheless, its strong export orientation, complemented by preferential trade agreements and efficient logistics, positions the EU as a resilient actor in the global agri-food system.

Brazil has similarly emerged as a formidable agri-food exporter, particularly in commodities such as soybeans, beef, poultry, and sugar. In 2024, Brazil's agri-food exports surpassed $100 billion, a dramatic rise from approximately $20 billion in 2010. This fivefold growth is a result of extensive agricultural land resources, cost-effective production systems, and increasing productivity. Brazil has strategically expanded its presence

Table 1: Key Global Agri-Food Trade Statistics in USD bn (2024).

Country	Exports	Imports	Key Export Categories
EU27	235	170	Cereals, dairy, wine, confectionery
Brazil	100	150	Soybeans, beef, poultry, sugar
United States	197	200	Grains, meat, soybeans, processed foods
China	103	200	Soybeans, dairy, fruit, meat
India	50	35	Rice, spices, tea, seafood
Argentina	60	10	Soy products, meat, maize

Source: Author's elaboration from data retrieved from WTO and COMEXT

[1] Data available form the Global Trade Alert database, available at: https://global-tradealert.org/

[2] Notably, during this tumultuous period, the grain and oilseed trade demonstrated remarkable resilience as importers sought alternative suppliers and adjusted inventory management practices in response to fluctuating supply conditions.

[3] Data recovered from the WTO World trade in agricultural products, available at: https://www.wto.org/english/tratop_e/agric_e/ag_imp_exp_charts_e.htm

[4] Data are retrieved from https://agriculture.ec.europa.eu/system/files/2023-05/agri-food-extra-eu27_en.pdf

in Asian markets – most notably China – which now absorbs a significant share of its soybean and meat exports. Geopolitical tensions, including trade disputes among other major players, have further enhanced Brazil's role as a reliable supplier in times of global disruption. With favourable climatic conditions and continued government investment in infrastructure, Brazil is likely to increase its market share in global exports over the next decade, especially in high-demand commodities.

Conversely, the United States has experienced a notable shift in its agri-food trade trajectory. While historically among the world's largest net agricultural exporters, the U.S. recorded a trade deficit of approximately $3 billion in 2022 – the first in decades – compared to a surplus of $40 billion in 2010. Imports have steadily climbed to around $200 billion, driven by rising consumer demand for fresh, organic, and specialty products not always produced domestically. Meanwhile, exports have plateaued around $197 billion, partly due to the strong U.S. dollar, which makes American goods more expensive on global markets.

This trend is compounded by stagnation in trade diplomacy. Unlike the EU and emerging exporters such as Brazil, the United States has not concluded significant new trade agreements in recent years, limiting its access to fast-growing markets. Trade tensions – particularly with China – have also disrupted longstanding export channels. For instance, retaliatory tariffs on soybeans and other agricultural goods during the 2018–2020 trade conflict led China to increase its reliance on Brazilian suppliers, reshaping long-term trade flows. Domestically, regulatory complexity, fragmented policy responses, and limited infrastructure investment have further inhibited the international competitiveness of the U.S. agri-food sector.

In parallel, China has emerged as the world's most significant agri-food importer. In 2024, its total imports exceeded $200 billion, reflecting structural challenges such as limited arable land, rapid urbanisation, and changing dietary patterns. China's key import categories include soybeans, dairy products, meat, and fruit. Its demand for these products has not only transformed global trade flows but also elevated the strategic importance of suppliers like Brazil, Argentina, and the EU. In response to previous supply shocks – most notably during the trade dispute with the United States – China has adopted a diversification strategy, establishing long-term import relationships to reduce overdependence on a single partner. As a result, China has become not only a major consumer but also a critical actor shaping the direction and distribution of global agri-food trade.

The agri-food trade balance, in this context, functions as a barometer of structural competitiveness, policy coordination, and market access. Countries maintaining positive trade balances typically exhibit several key characteristics: a diversified export portfolio that includes value-added goods; reliable and efficient logistics; access to multiple preferential markets; strong national branding; and alignment between agricultural, trade, and environmental policies. These elements are evident in the agri-food strategies of both the EU and Brazil.

In contrast, regions experiencing trade balance deterioration often face overreliance on a narrow range of exports, limited investment in food processing and infrastructure, and reduced adaptability to geopolitical shocks. The U.S., while still a leading exporter in absolute terms, exemplifies how strategic stagnation and reactive policy approaches can lead to an erosion in trade performance.

Looking ahead, the future of agri-food trade will depend on the capacity of nations to navigate intersecting global challenges – ranging from climate change and supply chain vulnerabilities to geopolitical instability and shifts in consumer behaviour. Maintaining a favourable trade balance is no longer a mere economic metric; it is an expression of resilience, adaptability, and strategic foresight. Countries must prioritise investment in sustainable production, value-chain integration, and multilateral trade engagement to remain competitive in a global food economy increasingly characterised by volatility and interdependence.

In sum, the rebalancing of global agri-food trade reflects not only competitive market dynamics but also broader questions of sovereignty, sustainability, and security. As food systems become more integrated and exposed to global shocks, the trade balance serves as a critical indicator of national preparedness to ensure food availability, affordability, and political influence in an interconnected world.

Food System Transformation in the Context of Global Food Security

Global agricultural production is projected to grow by 21.4% over the next decade, driven by increased investment and technological advancements (OECD–FAO, 2025). However, this expansion will not be evenly distributed across regions and is expected to interact with evolving trade patterns and structural shifts. The United States, for example, is anticipated to see a decline in its share of global agricultural exports – from 34% to 29.5% by 2030 – reflecting intensifying competition from emerging exporters such as Brazil and Argentina (USDA, 2025).

Simultaneously, global food demand is projected to rise by approximately one percentage point per year, primarily fuelled by population growth in low- and middle-income countries. In contrast, high-income countries are expected to see relatively stable levels of food consumption, owing to demographic stagnation and dietary saturation (Barrett *et al.,* 2022). These trends underscore ongoing structural transformations within the global food system – affecting labour allocation, trade flows, technological diffusion, and logistical infrastructure (Reardon *et al.,* 2021; Afesorgbor *et al.,* 2025).

According to the OECD–FAO (2025), per capita demand growth for most agricultural commodities will remain limited, with dairy products being a notable exception. Population growth in regions such as Sub-Saharan Africa, South Asia, and the Near East and North Africa will account for the bulk of overall demand increases. This demographic shift will place additional pressure on national food systems, especially in

Table 2: Number of Severely Food Insecure People (in millions) by region (2014–2023).

Region	2014	2023	Absolute Change	Relative Change (%)
Africa	191.2	315.5	+124.3	+65%
Asia	313.5	467.3	+153.8	+49%
Central America	10.8	13.8	+3.0	+28%
Europe	10.9	14.6	+3.7	+34%
Northern America	3.7	3.7	0.0	0%
Oceania	3.3	4.7	+1.4	+42%
South America	16.2	31.6	+15.4	+95%

Source: Author's elaboration from data retrieved from FAO

terms of logistics and international trade. Currently, approximately 80% of global food consumption is sourced domestically. This share is likely to increase further in developing countries, where local production will be critical for meeting food security needs. Nonetheless, international trade will continue to play a central role in stabilising markets, particularly in regions with structural food deficits (FAO, 2018).

The urgency of these dynamics is underscored by recent trends in food insecurity across regions. Between 2014 and 2023, the number of severely food insecure people rose sharply in every continent except North America, where levels remained constant. Africa and Asia accounted for the largest absolute increases, adding 124.3 and 153.8 million severely food insecure individuals, respectively, while South America recorded the most dramatic relative increase (+95%) (see Table 2). These figures highlight a troubling decoupling between aggregate food availability and individual food access. They reflect both structural vulnerabilities and the inadequacy of current systems to deliver food to all populations equitably. Even in regions with rising agricultural output, widespread insecurity persists, pointing to systemic failures in distribution, affordability, and resilience.

While global commodity prices have softened and markets remain largely stable, the World Bank's June 2025 data highlights a disconnect between international trends and local realities. High domestic food inflation persists across low- and middle-income countries, undermining household purchasing power despite falling global prices. In Africa, logistical inefficiencies exacerbate the challenge, with over one-third of perishable foods lost in transit due to inadequate infrastructure. This situation reinforces the importance of complementary investments in supply chain logistics, cold storage, and domestic market efficiency to realise the full benefits of international trade and rising global output. Additionally, the continued prevalence of acute food insecurity in several regions despite favourable global trends suggests that access – not just availability – remains a core issue in global food systems (World Bank, 2025).

A key feature of this transformation is the growing role of services and technological innovation across agri-food value chains. Service-oriented activities such as logistics, quality control, and input provision are increasingly central to competitiveness in global markets (Reardon, 2015; Swinnen and Kuijpers, 2019; Manghnani *et al.,* 2021). Meanwhile, the adoption of digital tools, precision farming technologies, and data-driven crop management systems is enhancing productivity and resilience across supply chains (Santeramo *et al.,* 2024). In this context, international trade is no longer solely about the movement of commodities; it also enables the diffusion of technology, standards, and knowledge, thereby contributing to the development of more nutrition-sensitive and environmentally resilient food systems (D'Odorico *et al.,* 2019).

Crucially, recent empirical work by Paul Jr. (2024) emphasises the growing significance of global agri-food value chains (GAVCs) in shaping food security and nutrition outcomes. Analysing trends between 1990 and 2020, Paul Jr. documents increased global participation in GAVCs, particularly in processed food products greater GAVC integration is positively associated with higher dietary energy consumption and reduced prevalence of undernourishment, especially in upper-middle-income countries.

In low-income countries, GAVC participation is most closely linked to reductions in child stunting, while the benefits in lower-middle-income countries are more mixed, including reductions in stunting alongside increases in both undernourishment and overweight prevalence. While integration into GAVCs can support improved food and nutrition security, its impacts are uneven and contingent on contextual factors such as income distribution, governance capacity, and local value chain competitiveness (Paul Jr., 2024).

Therefore, as global food systems evolve, enhancing participation in GAVCs must be accompanied by tailored policy measures. These include ensuring food safety standards, promoting technology transfer, and supporting the inclusion of smallholders and vulnerable populations in global value chains. Moreover, policy frameworks should be sensitive to the distributional consequences of trade integration – recognising that the benefits of globalisation have not accrued equally across or within countries.

Trade balances, costs and trade regimes

Global agri-food trade is undergoing a significant rebalancing. This shift is shaped by structural changes in market demand, geopolitical tensions, environmental pressures, and disruptions to supply chains. Trade balances among major

agri-food economies reveal pronounced divergences, with the EU and Brazil strengthening their surplus positions, while the United States faces growing deficits. At the same time, China has emerged as a dominant importer, reshaping trade flows globally. These transformations underscore the strategic importance of trade balances not only as economic indicators but also as reflections of deeper competitiveness, trade cost structures, and regulatory choices (Godfray *et al.,* 2010; Savary *et al.,* 2022).

In 2024, the EU27 recorded agri-food exports totalling €235.4 billion and imports at €171.9 billion, producing a robust trade surplus of €63.5 billion. This surplus reflects sustained competitiveness supported by CAP reforms, food quality certification schemes, and trade agreements that provide extensive market access. Key export categories such as cereal preparations (€24.8 billion), dairy products (€19.7 billion), and wine-based products (€17.4 billion) highlight the EU's comparative advantage in high-value-added agri-food goods. Imports remain concentrated in off-season and tropical products, including coffee, tea, cocoa and spices (€30.3 billion, +47.5%), and fruit and nuts (€24.9 billion, +11.6%).

Brazil has emerged as another major surplus holder, with agri-food exports exceeding $100 billion in 2024 – a fivefold increase since 2010. Its expansion is largely commodity-driven, with soybeans, beef, poultry, and sugar leading exports. Brazil's success has been bolstered by increasing Asian demand – particularly from China – and its ability to maintain consistent exports during global shocks such as the COVID-19 pandemic and the Ukraine conflict (Piñeiro & Piñeiro, 2024). Its competitive advantage is reinforced by large-scale, low-cost production systems, logistics investment, and trade alignment strategies.

In contrast, the United States has experienced a decline in its agri-food trade position, recording a $3 billion deficit in 2022, down from a $40 billion surplus in 2010. This reversal stems from a surge in imports (around $200 billion) alongside stagnant export growth (approximately $197 billion), compounded by an overvalued U.S. dollar and the erosion of market share in China due to prior trade disputes (Awokuse *et al.,* 2024). A lack of new trade agreements and inconsistent policy initiatives have weakened U.S. agricultural competitiveness, while rising consumer demand for fresh and specialty products has increased dependency on imports.

China's transformation into a global agri-food importer – with imports exceeding $200 billion in 2024 – has shifted the gravitational centre of global trade. Its import structure prioritises soybeans, dairy, meat, and fruit, and the country has aggressively diversified suppliers following trade tensions with the U.S., strengthening ties with Brazil, Argentina, and the EU (Afesorgbor *et al.,* 2024b). China's role as both a trade partner and strategic actor further complicates the agri-food landscape, as supplier competition intensifies.

These evolving trade balances must be interpreted through the lens of trade costs, which remain critical in shaping agri-food flows. As noted by Beghin and Schweizer (2021), transportation costs, border tariffs, and non-tariff measures (NTMs) continue to dominate the cost structure of agricultural trade. Agricultural products tend to be bulky, perishable, and of low value-to-weight ratio, making them particularly sensitive to such costs (Fiankor and Santeramo, 2023). Despite their importance, transportation costs are often poorly captured in empirical studies due to their heterogeneity across commodities, routes, and time. Beghin and Schweizer (2021) argue that improving data and methods to capture these dynamics – beyond simplistic distance proxies – could generate more accurate cost models and better policy insights. They emphasise that liberalising transportation services could significantly lower trade barriers and improve supply chain resilience.

Tariff levels, meanwhile, have declined dramatically over recent decades and are expected to remain low, apart from isolated protectionist episodes like the Trump administration's unilateral measures. However, NTMs have grown in prominence and complexity, representing the most difficult trade costs to quantify and regulate. According to Beghin and Schweizer (2021), NTMs – particularly standard-like measures such as Sanitary and Phytosanitary (SPS) regulations and Technical Barriers to Trade (TBTs) – pose challenges in terms of transparency, aggregation, and policy evaluation. The authors call for enhanced detection of protectionist motives and recommend policy frameworks that encourage transparency and risk-based regulation.

The empirical literature supports this view but also reveals a high degree of heterogeneity in the effects of NTMs. A meta-analysis by Santeramo and Lamonaca (2019) shows that NTMs can act either as barriers or catalysts, depending on the type of measure, the proxies used to quantify them, and the granularity of the data. Their study found that Maximum Residue Limits (MRLs) and ad valorem equivalents (AVEs) often facilitate trade, while other NTMs – such as some SPS and TBT regulations – can restrict it. Moreover, the level of disaggregation in studies, and the methodological choices made (such as controlling for multilateral resistance or zero trade flows), significantly influence the results.

Santeramo and Lamonaca (2019) conclude that no generalisable effect of NTMs can be asserted. Instead, outcomes vary by product, country, and institutional capacity. This aligns with the broader literature suggesting that NTMs reflect a complex balance between legitimate consumer protection and disguised protectionism (Larch *et al.,* 2024). Policymakers are therefore encouraged to focus on institutional capacity building and evidence-based regulatory design that minimises trade distortion while upholding safety and sustainability standards.

In summary, the rebalancing of global agri-food trade reflects not only shifts in demand and supply but also the evolving nature of trade costs and governance. The EU and Brazil have enhanced their trade positions through diversified, competitive, and policy-aligned export strategies. Conversely, the United States' declining trade surplus points to structural weaknesses in its trade policy and regulatory alignment. Trade costs – especially transportation and NTMs – remain central to explaining these trends. As Beghin and Schweizer (2021) and Santeramo and Lamonaca (2019) demonstrate, a nuanced understanding of these costs is essential for crafting effective agricultural trade policy in a highly interconnected and increasingly volatile global environment.

Geopolitical tensions

Rising geopolitical tensions and increasing economic fragmentation are exerting profound and multifaceted effects on global food security. As states respond to international competition and conflict by erecting trade barriers, imposing tariffs, and enacting economic sanctions, they disrupt established supply chains and fuel volatility in global agri-food markets. These disruptions are particularly acute in countries of the Global South, where heavy reliance on food imports, limited production capacities, and constrained fiscal space render populations highly vulnerable to price shocks and supply interruptions (Afesorgbor *et al.,* 2024b).

Among the most frequently deployed instruments in this evolving geopolitical landscape are trade restrictions – particularly export and import bans on critical agricultural commodities. These measures, intended to shield domestic markets or apply strategic pressure, have been observed in at least 72 documented instances in recent years. At the same time, economic sanctions have become widespread tools of political leverage, frequently resulting in significant reductions in bilateral trade volumes. In some cases, comprehensive sanctions have reduced agricultural trade flows by as much as 70%, with devastating implications for the availability and affordability of food in targeted regions (Bosone *et al.,* 2024).

Emerging empirical evidence underscores that the consequences of economic sanctions extend beyond trade disruption. Sanctions are strongly correlated with rising food prices, increased undernourishment, and worsening food insecurity in affected countries. These effects are particularly damaging in low-income and import-dependent economies, where even modest price increases can have disproportionate effects on household food access. As Afesorgbor *et al.* (2024b) observe, sanctions not only impede market functioning but also intensify humanitarian crises, raising ethical questions about their design and deployment in a world increasingly interlinked by agri-food trade.

At the institutional level, the entrenchment of food insecurity within trade policy frameworks has exposed the limits of existing multilateral mechanisms. As Margulis (2014) argues, the World Trade Organization (WTO) has become both a site of contestation and a geopolitical actor in its own right within the global agro-food system. The 2007–2008 Global Food Crisis, in particular, catalysed a re-legitimisation of the WTO as a relevant stakeholder in food security governance. Despite its institutional paralysis, the WTO became increasingly integrated into global policymaking networks such as the High-Level Task Force on Global Food Security and inter-agency coordination mechanisms.

However, this institutional prominence has done little to resolve growing tensions between established agro-powers and emerging ones. As Margulis (2014) notes, recent WTO negotiations around export restrictions, public stockholding, and the Special Safeguard Mechanism (SSM) have revealed deep fractures between Net Food Exporters (NFEs) and Net Food Importers (NFIs). The failure to secure exemptions for vulnerable food-importing countries in multilateral trade rules – particularly regarding food export restrictions – illustrates how power asymmetries in global trade are being reconfigured but not necessarily ameliorated. In fact, the transition towards a polycentric agro-food system may be reproducing conditions that are less favourable for the world's most food-insecure populations.

The case of trade restrictions during geopolitical crises reinforces this point. Measures justified as necessary for domestic stability often translate into external vulnerabilities, exacerbating scarcity and price volatility for low-income countries (Kornher *et al.*, 2024). Margulis (2014) emphasises that food export restrictions have become a focal point in WTO negotiations, as agro-powers seek to preserve policy space while simultaneously shaping global norms. This dynamic complicates traditional North–South framings, highlighting instead a spectrum of conflicts that includes intra-South disagreements and emerging alignments among new agro-powers. These shifts necessitate a more nuanced geopolitical lens that accounts for the evolving architecture of influence within global food systems.

Considering these transformations, there is an urgent need to explicitly embed food security considerations within the design of trade and foreign policy instruments. While trade restrictions and sanctions may be intended as political tools to exert pressure on states, they often produce unintended humanitarian consequences for civilian populations (Rodríguez, 2024). Incorporating food security safeguards – such as exemptions for basic staples, humanitarian carve-outs, and transparency requirements – can help mitigate the adverse effects of these instruments on vulnerable groups.

Furthermore, institutional reforms at the multilateral level, particularly within the WTO, must address the increasingly visible disconnect between trade governance and global food needs. As Margulis (2014) observes, geopolitical struggles over WTO rules have not diminished but intensified, particularly as NFEs and NFIs seek to reshape the rules governing agri-food markets. Recognising food security as a central dimension of trade policy is not merely a normative imperative but a strategic necessity in an era marked by supply chain fragility, climate risk, and intensifying geopolitical competition.

In sum, the intersection of trade policy and food security is no longer a marginal issue. As geopolitical tensions rise, the tools used to navigate global conflicts – sanctions, tariffs, and export bans – must be reassessed for their humanitarian implications. Trade governance institutions must adapt to the realities of a more polycentric and contested agro-food system, where the stakes of food security are higher than ever and the power to shape its future is more widely distributed but not evenly shared.

Environmental Rules and Agri-Food Trade

Integrating climate-resilient agricultural practices is essential for sustaining food production in the face of accelerating environmental pressures. Precision agriculture, artificial intelligence–driven crop management systems, and other

climate-smart farming approaches offer pathways to improve yields, increase water-use efficiency, and reduce input waste. These strategies not only enhance productivity but also support long-term food security and nutritional outcomes, especially under conditions of increasing climatic variability. A holistic approach to sustainability in agri-food trade must therefore bridge ecological resilience with socioeconomic equity – promoting biodiversity conservation, efficient resource management, and inclusive development.

However, the expanding use of technical regulations aimed at environmental protection introduces new complexities to the global agri-food trade landscape. Environmental technical measures (ETMs) – including regulations on emissions, input standards, and sustainable sourcing – are now more prevalent and less transparent than traditional tariffs (Santeramo *et al.,* 2025). Although these measures are designed to serve vital non-trade objectives, their indirect effects on trade flows are increasingly evident. Recent evidence suggests that such environmental policies can substantially reduce both trade volumes and values, particularly in developing countries, where compliance infrastructure is less robust. The risk is that these regulations, while well-intentioned, may inadvertently act as technical barriers to trade (TBTs), especially when implemented unilaterally or without adequate transparency.

Lamonaca and Santeramo (2025) further elaborate on this point, applying advanced gravity modelling techniques to national-level trade flow data. Their study confirms that ETMs often increase compliance costs and introduce uncertainty into trade relationships, ultimately discouraging market participation. This dynamic can disproportionately affect exporters in the Global South, reinforcing structural inequalities in agri-food markets. As the international community moves toward more ambitious environmental targets, it is crucial to balance these goals with mechanisms that ensure equitable access to global markets and reduce the unintended exclusion of environmentally vulnerable economies.

This concern is echoed in the broader literature on the environmental impacts of agri-food trade. A systematic review by Balogh and Jámbor (2020) finds that most empirical studies associate agricultural trade with increased environmental externalities – including deforestation, biodiversity loss, soil erosion, and greenhouse gas (GHG) emissions. Their analysis, covering over 65 peer-reviewed articles, shows that agricultural trade frequently accelerates resource-intensive production practices and relocates pollution from developed to developing countries. Notably, trade liberalisation has often contributed to land-use change in regions such as Brazil and Southeast Asia, driven by demand for export crops like soy, palm oil, and beef. Although some studies note positive effects – such as technology transfer and efficiency gains – the predominant finding is that agricultural trade tends to intensify environmental degradation unless strong regulatory frameworks are in place.

The environmental footprint of agri-food trade is further underscored in the comprehensive review by Baylis *et al.* (2021), who highlight the growing spatial reallocation of agricultural production in response to liberalied trade. According to their findings, global agricultural trade has expanded more rapidly than production itself since 2000, with Latin America and Eastern Europe increasing their export shares, while Asia and Africa have grown as net importers. This shift, while improving market access and food availability in many regions, has raised concerns about the sustainability of production at new frontiers. Agriculture already consumes 70% of global freshwater resources and occupies 40% of terrestrial land (OECD–FAO, 2025); trade-induced changes to production locations exacerbate pressures on these natural systems.

Baylis *et al.* (2021) also point to a critical theoretical insight: the environmental impact of trade depends not solely on trade flows, but on domestic environmental policy quality. In regions with weak property rights or ineffective enforcement, trade can exacerbate negative externalities. By contrast, if trade occurs alongside robust environmental governance, it may incentivise sustainable production and promote more efficient use of natural resources. The paper further emphasises the potential of private sustainability initiatives – such as eco-labelling and certified supply chains – to support environmental outcomes, although the empirical evidence for their effectiveness remains limited and highly context-specific. Importantly, both ecological and economic disciplines agree on the need for international coordination to address these challenges and align trade and environmental goals.

Given these dynamics, understanding the trade-offs and spillover effects of environmental regulations is vital to crafting coherent and equitable trade policy. While environmental technical measures are essential for achieving sustainability objectives, they must be designed to minimise distortive effects and ensure compatibility with multilateral trade norms. Mechanisms such as transparency obligations under the WTO, capacity-building for compliance in developing countries, and differentiated implementation timelines could help reconcile environmental ambitions with inclusive trade participation.

In this context, future research must address the dual challenge of environmental integrity and market efficiency. As highlighted by Santeramo *et al.* (2025) and Lamonaca and Santeramo (2025), methodological innovations in measuring the trade effects of ETMs will be key to improving policy diagnostics. Additionally, the work of Baylis *et al.* (2021) and Balogh and Jámbor (2020) underscores the importance of integrated, interdisciplinary analysis – bringing together environmental science, economics, and political ecology – to capture the full spectrum of environmental outcomes linked to agri-food trade.

In conclusion, promoting sustainability in global agri-food trade requires not only investments in climate-smart agriculture and resource efficiency but also institutional innovations that can manage the intersection between trade regulation and environmental protection. Without careful design, the tools intended to protect the planet may inadvertently constrain those most in need of access to global food markets. Achieving a balance between environmental goals and trade equity will demand more than technical fixes – it will require a shared global commitment to inclusive, transparent, and ecologically responsible trade governance.

Concluding remarks

The evolving landscape of agri-food trade is deeply shaped by historical legacies, geopolitical dynamics, and environmental challenges, all of which interact to influence global food security. While agricultural production is set to increase, the distribution of benefits will be uneven, with emerging markets gaining export share and intensifying competition. Rising geopolitical tensions have led to fragmented trade policies, including sanctions and trade barriers, which disrupt supply chains and disproportionately threaten food security in vulnerable, import-dependent countries. At the same time, the growing complexity of trade agreements reflects both economic and strategic considerations, where regulatory cooperation can facilitate trade but overlapping standards may increase compliance costs. Moreover, the increasing prevalence of environmental technical measures adds another layer of complexity, as efforts to promote sustainability risk imposing trade restrictions that could hinder market access and resilience. To navigate these intertwined challenges, coordinated investments in climate-smart agriculture, infrastructure, and strategic trade engagement are essential. Policymakers must balance environmental objectives with the need for efficient and inclusive trade systems to ensure stable and equitable food supplies worldwide. Ultimately, fostering a resilient, nutrition-sensitive, and sustainable global food system requires holistic approaches that integrate geopolitical realities, technological innovation, and environmental stewardship to meet the demands of a growing and changing global population.

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SCIENTIFIC ARTICLE

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Global challenges and the EU's shifting agri-trade goalposts

ABSTRACT

Over the past quarter of a century, the European Union has transformed itself from a defensive agricultural trade player into the world's largest agri-food exporter and importer, driven by successive Common Agricultural Policy (CAP) reforms and market-oriented adjustments. This paper traces the evolution of EU agri-trade, highlighting the role of decoupled payments, structural competitiveness, and diversification of trade flows. It assesses the EU's resilience to recent crises – from COVID-19 to energy shocks and the Ukraine war – while examining growing tensions between trade liberalisation, environmental standards, and geopolitical fragmentation. The analysis stresses the mounting challenges in reconciling climate goals with food security concerns and warns against regressive policy trends that ignore past reform achievements. Ultimately, the paper argues for maintaining evidence-based, market-oriented strategies to preserve the EU's global leadership in sustainable agri-trade amid rising demands for food sovereignty and strategic autonomy.

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Introduction

When the Seattle WTO Ministerial Conference ended up in disarray on December 3, 1999, the European Union (EU) and its agricultural policy were among the main (and for some the main) culprits of an anti-globalisation wave that dominated the public debate on the benefits and risks of trade liberalisation. The EU was not the only target of this wave, but when the often incoherent anti-trade sentiment focused on agriculture, the EU was the easy target for both those adamantly opposed to trade liberalisation as well as for those looking for ways to unravel farm policy bottlenecks that hampered the process.

To a certain extent, the basic arguments of the anti-globalisation sentiments have changed little since, although the focus now is spread among so many global tensions. Both pro- and anti-trade camps would associate EU agriculture and the policy underpinning it, the Common Agriculture Policy (CAP), as arch-enemies of their opposing views on what constitutes progress. Neither has the confusion around trade policy issues around trade has changed – if anything, it has become even more confused.

Yet what has changed since, and in a dramatic way, is the EU's position on agricultural trade issues, both in terms of policy stance as well as well as in terms of statistical facts. During a quarter of a century, to the surprise of many following agricultural trade issues and of many more that occasionally encounter the odd statistic on agricultural trade, the EU became the largest agricultural importer and exporter in the world. More, significantly, it reversed its agricultural net trade position, with the value of its agri-food trade surplus exhibiting a persistent upward trend despite several challenges that placed this trend at risk during this period. It was not expected to turn out like this, but it did, despite the fact that most analyses of expected impacts from the global agricultural trade liberalisation process had shown more problems than gains for EU agriculture.

This process has been anything but linear. It started with the Uruguay Round Agreement on Agriculture (1994) that gave an initial push for farm policy in the EU and the US, although subsequently only the EU continued its reform path towards more market orientation, with the US returning to a trade-distorting counter-cyclical form of price support. It continued (on paper at least) with the Doha Development Round (launched in 2001 and essentially today in a state of limbo, despite the major step of the abolition of export subsidies at the Nairobi Ministerial in 2015). Ultimately, it has reached its present state of reversal of a long-term arduous path of trade liberalisation with the Trump US administration undermining the very global foundations that previous US administrations advocated for.

In this gradual trade liberalisation process, the EU continues pushing for more global, multilateral and bilateral trade agreements as if little has changed in terms of its priorities and ambition despite this reversal in prospects. This push is evident by the long list of agreements the EU has signed or wants to sign, with more expected. This is despite significant internal disagreements, especially in relation to Mercosur. It is also in spite of a new dimension that has been added in these priorities, namely the aim of introducing "mirror clauses", provisions that claim to ensure imported products meet domestic production requirements (implicitly considering

that the Agreement on the Application of Sanitary and Phytosanitary Measures, SPS, is not enough).

In an interesting twist of events, the "reciprocity" that is referred to in the public debate has been considered to be the litmus test of these "mirror clauses" on issues linked these days to primarily environmental standards, and has been the battle cry of the new US administration on its new strategy on trade tariffs. Long gone seem the days when the virtues of comparative advantage informed the rationale of trade agreements… How this new, essentially demand-driven orientation, fits into the often conflicting and contradictory, supply-driven and more traditional orientation on agricultural trade will to a large extent determine the manner whereby what was observed in the first quarter of this century in EU's agricultural trade will continue, be strengthened or get reversed.

The aim of this paper is to assess these prospects by a) briefly examining the current state of EU agricultural trade in terms of its long-term drivers, b) identifying the risks stemming from current instabilities in global markets and the challenges of adapting to the impact of geostrategic tensions on trade policies and the global trade framework, and c) draw the broader implications from these factors for the EU's policy debate and priorities on sustainability, food security and climate change action.

The gradual but steady transformation of EU agri-trade

Facts and trends

The structure of EU agricultural trade and its more recent trends are well presented on the dedicated website of DG AGRI, which includes annual reports and monthly updates for a variety of product groups and details by export destination and import origin (EC, 2025). The same site includes several studies assigned by the Commission to analyse the potential impact of previous trade agreements of the European Union on the EU's agricultural sector.

Consequently, and to facilitate the points that will be raised in this paper, only a summary of facts and trends of EU agri-food trade developments is presented here. To incorporate the impact of successive enlargements of the EU and of Brexit, the most recent statistics incorporating EU-27 will be used, but the overall trend is the same, regardless of what EU configuration one uses for the period after the CAP reform process was initiated.

Three distinct features have so far characterised EU agricultural and agri-food trade developments this century. First, EU agri-food trade has grown simultaneously on both the export and the import side. Although the growth in agri-food trade has experienced fluctuations, it is interesting to observe the overall rather consistent pattern of development in both exports and imports. For the EU's agri-food chain, trade has genuinely been a two-way street, with exports almost tripling in size from 2002 until 2004, increasing by almost 220 percent. During the same period, imports increased a bit less, by 170 percent, with the combined effect resulting in a 430 percent increase of the EU's agri-trade surplus (Figure 1). This trade surplus has seen a steady long-term trend despite increased volatility observable in recent years, but still remains above 60 billion euros.

Second, the export side is characterised by a higher share of value-added products than commodities, while the import side is more balanced. This explains the growing surplus of EU agri-food trade. According to the WTO's classification, in 2003 63% of EU agri-food exports were processed and 19% semi-processed products, with 8% horticultural and just 10% bulk commodities. On the import side, the respective shares were 40%, 23%, 17% and 19%.

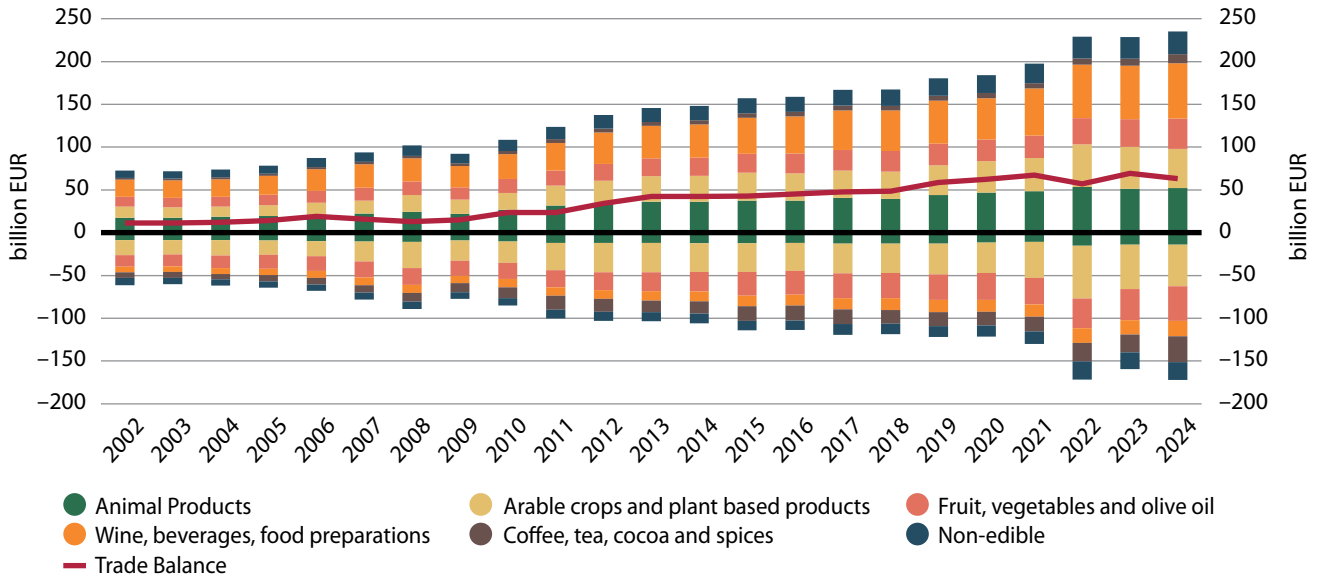

Figure 1: EU agri-food trade between 2002 and 2024, in billions of euros.
Source: Eurostat (2025)

When considering the classification DG AGRI uses in its grouping of agri-food products, the top three exports from the EU were cereal preparations and milling products, dairy products and wine, combining for more than a quarter of the value of EU exports. On the import side, the top three product groups by value are coffee, cocoa and tea, fruit and nuts, and oilseeds and protein crops, with their combined value representing just over 40% of all imports.

A closer look into the details of changes over this period indicate the impact of recent food price inflation on the value of EU's trade, both on the export as well as the import side. Since most of the growth in exports is driven by processed products, the cumulative impact of increases in costs explain to a large extent the jump in exports witnessed in 2022-24, while coffee, cocoa and tea led increases on the imports side (Figure 1). With both export and import values volatile, the constant upward path of the balance of agri-food trade has also exhibited signs of volatility recently.

Third, the EU mostly exports to developed high income economies (developed in real terms, though China is still classified as a developing country in WTO statistics), and mostly imports from developing countries, for a large number of whom it reserves preferential no-tariff treatment. Nevertheless, the EU is chiefly characterised by the very diverse nature of both the destinations and the origins of its trade.

As a result, the EU agri-food sector can better withstand the shocks of major trade disruptions by finding alternative markets, as was the case with Russia (which has dropped from representing a tenth of EU agri-food exports to just 3%), and in the opposite direction, with China (which jumped from 4% in 2012 to almost 10% in 2020, before dropping back to 8% by 2022). However, it is consistently the case that the UK represents more than fifth of EU agri-food exports and a tenth of imports, the US around 12% of exports and 7% of imports, while Brazil hovers around 10% of EU imports.

The causality of trends – policy design and reform

While the facts and the trends described above have been amply presented in the monthly Monitoring Agri-Food Trade publication of DG AGRI-European Commission, the reasons behind the trends have now faded in the weakening institutional memory of both European Commission and agricultural trade academics. Yet the transformation of the EU agri-food system into a net exporter did not happen overnight, neither did it occur in a policy vacuum. It happened as the result of a series of reforms which gradually, with inconsistencies and delays but nonetheless firmly in terms of policy orientation, focused on increased competitiveness and market orientation of EU agriculture.

Initially, this orientation came from US pressure to accommodate negotiations leading to the creation of the WTO, and it had as its main aim the reduction of EU support prices (their level was so much higher than world markets that they acted as an incentive for overproduction, public stock accumulation, and the eventual dumping of surpluses on world markets with the use of export subsidies). Figure 2 presents in a condensed and implicit manner the role successive CAP reforms played in terms of increasing the agri-food trade of what was a changing EU, whose composition has been transformed from initially 10 to today's current 27 Member States.

The reduction of support prices (most of which are now either abolished or irrelevant in the current context of world price levels) and the partial compensation of producers in the form of coupled payments ("blue box" payments in WTO terminology) reduced significantly the role and costs of public intervention ("amber box") and of export subsidies (considered "red" and eventually abolished by WTO in 2015). The MacSharry reform of 1992 was the main driver of these changes, whose initial main impact was domestic by

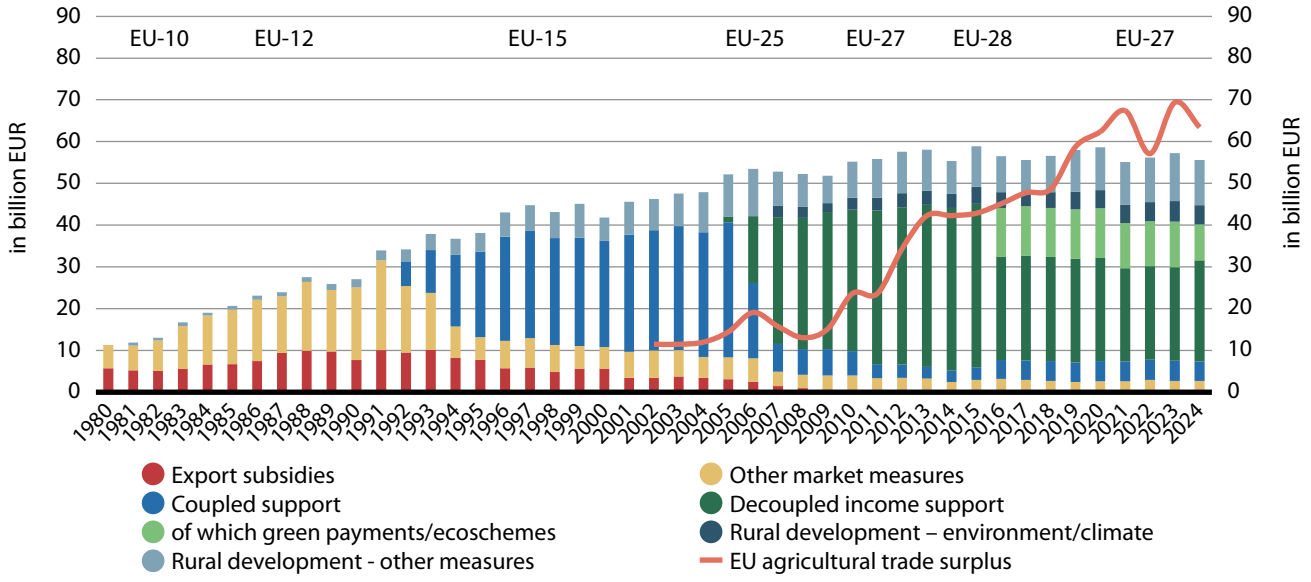

Figure 2: CAP reforms and trade.

Source: European Commission, DG Agri

significantly reducing the abuse of input use resulting from the incentives to overproduce inherent in the previous system.

However, the main unleashing of the EU's agri-food potential came with the Fischler reform of 2003 which, by decoupling direct payments from support specific to products and linking it to environmental cross-compliance, opened the farming sector to market developments. It is this change that allowed production to adjust and, combined with the subsequent decisions in 2008 to gradually abolish the quota systems for sugar and dairy, turned the EU agri-food sector into the major export and import player it is today.

The above developments might sound like history to some, but as recent history they have implications for the current policy debate on the future of the CAP, as a recent example demonstrates. In the May 2025 Conference of DG AGRI on the Future of EU agriculture, the Vice-Chair of the European Parliament's Committee for Agriculture characterised decoupled payments as "blind payments", expressing in this way indirectly his (and others) wish to resort to some form of undefined system of support that will focus on products and support prices. Lost in such wishes is the fact that the few sectors based on coupled support continue to struggle in terms of competitiveness in the EU. So is the reality that, far from blind, it is decoupled payments that have opened the eyes of EU producers to what markets require – with a safety-net layer of income support on top.

EU and others

The EU is clearly not the only agri-food player whose exports have increased since the turn of the century. Globally, agri-food trade exhibited impressive gains in the aftermath of the URAA and the creation of the WTO. Several trade frictions and disputes have made the headlines, although they constituted a minimal part of total agricultural trade. And, as in any compromise agreement, not all aspects of the WTO framework that have applied to agriculture have satisfied everyone, yet all parties have had to perform within an acknowledged, stable environment.

It is within this environment that agri-food of the big-five agri-food systems, Brazil (by all accounts the big winner of the URAA), US and EU saw their trade surpluses increase up until the middle of the last decade, and even India witnessed a small surplus increase. Only China exhibited a growing deficit, driven primarily by its demand for feed and animal products (Figure 3).

Since 2014, however, a major transformation has been taking place, with the US gradually reducing its traditional agri-food trade surplus, and turning into a net importer as the world has been exiting from the COVID pandemic. It is beyond the scope of this paper to analyse the reasons of this change, though it has its relevance when one looks at the impact that the domestic farm policy structure has on trade (the US still heavily depends on the export of a few bulk commodities whose support is counter-cyclical to market price developments).

What matters is, faced with a growing increase of imports from various origins and in various products, the US considers trade deficit development a reason for unilateral actions (from threats to temperamental and arbitrary adjustments to tariffs) which not only complicate its trade relations with the EU, but also put at risk the foundations of the post World-War II global rules-based system.

Global tensions and their potential impact on the EU

Lessons from three crises – COVID, energy, Ukraine

The optimism that some sort of linear upward movement of economic growth would spread throughout the world, the corollary of the "end of history" thesis, was severely tested with the financial crisis of 2006-08 and its aftermath, which impacted severely the political and economic cohesion of the EU (as well as the belief that markets self-regulate).

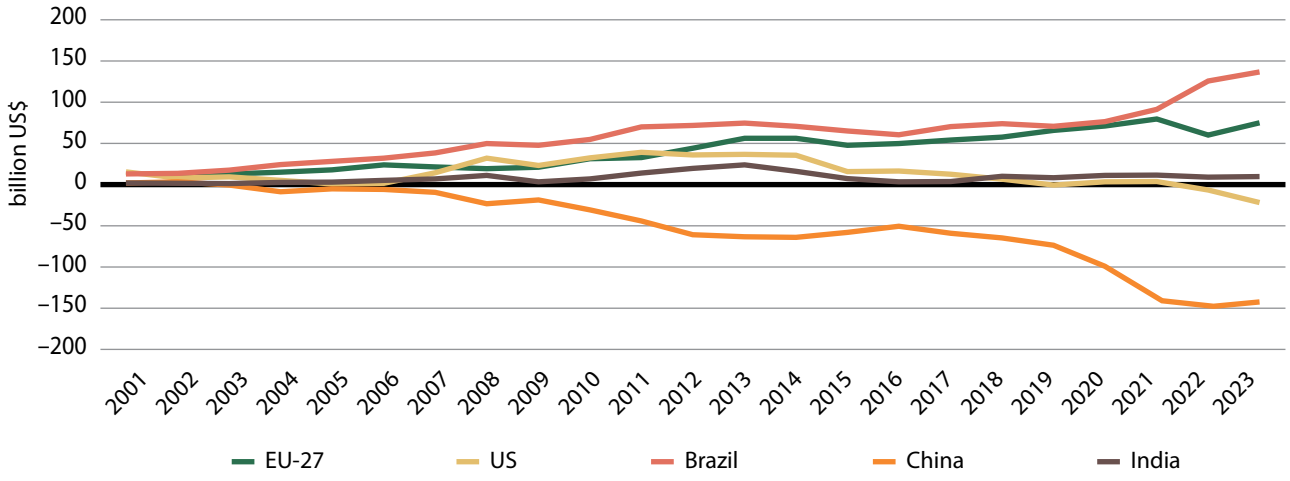

Figure 3: Agri-food trade and the big-5.
Source: Eurostat (2025).

Throughout the crisis, however, the EU agri-food system exhibited a remarkable resilience (as was the case globally), not by staying immune from the crisis but instead by avoiding the most severe consequences that other sectors faced.

However, this period demonstrated the first tensions within the EU's domestic food chain since the increase in energy and fertiliser costs, driven by a series of factors that pushed prices in the same upward direction, left primary agriculture with the short straw of food chain price developments. The imperfect price transmission from producer to consumer prices, especially when the former fall, led to legislation on "unfair trading practices" (with little effect as the more recent policy debate around this issue demonstrates).

This is also the period during when the EU also faced the first impact from geostrategic tensions with the sanctions imposed on trade with Russia after the latter's illegal 2014 annexation of Crimea. The EU lost overnight a market representing almost a tenth of its exports. Yet looking in retrospect in the evolution of EU exports, imports and trade balance in agri-food, one hardly notices any impact as the sector responded swiftly by either expanding more in traditional markets or finding new markets for EU food products.

Nevertheless, the challenges EU agriculture faced from the financial crisis of 2006-08 and its aftermath pale when compared to the successive impact from COVID, the energy tensions with Russian supply of natural gas and the subsequent Russian invasion of Ukraine. One after the other these crises put a significant upward pressure on all commodity prices, increased volatility and negatively impacted inflation, especially food inflation.

From a short-term perspective, the manner by which the EU food system responded to the above crises exhibited significant resilience. This resilience, coupled with a persistent decrease in its emissions – a feat achieved while all other major global food systems saw increases – provided support to those arguing for a more balanced assessment of its strengths and weaknesses, rather than the severest of its critics' catastrophic portrayal of it as "broken".

Nevertheless, it would be erroneous to consider that the positive trajectory of agri-food trade developments of the past couple of decades provides an indication of its automatic extrapolation into the future. The type of challenges the above three crises introduced were new in many respects, at least where the post-WTO policy global agricultural trade environment is concerned. When combined with the realities of the green transition and the sustainability prerequisites that this implies, a significant gap has begun to emerge between expectations and the potential for their realisation in a series of areas that directly or indirectly impact the supply of, demand for and trade in agri-food products. Among other manifestations, this gap is also evident in global price developments.

Global price trends and EU risks

If there is one element that above all clearly demonstrates how previous CAP reforms have benefitted the EU's trade position, it is the bridging of the gap between world and domestic prices for most agricultural commodities. Initially, this happened with the reduction in support prices as a result of CAP reforms and the parallel reduction of tariffs as a result of the WTO agreement. The gap was not fully bridged by this, but the action taken was enough to make EU agriculture more sensitive to developments on world markets, and more responsive to the supply adjustments required by price signals. This also occurred under the influence of broader commodity price developments, in energy, in metals and in minerals, which increased world prices and thus brought EU prices into alignment with world price levels for almost all major agricultural products.

While price signals from world markets are not purely reflections of competitive conditions – being instead prone to volatility caused often by broader commodity market developments – this does not alter the fact that EU agriculture has become more market-oriented. After all, a significant layer of decoupled income support was designed to serve this very purpose: to allow EU farmers to be partly cushioned against market volatility, a factor inherent to agricultural commodities, so that their market adjustments would be smoother, though certainly not painless.

Recent price developments have appeared, however, to introduce a completely novel element in terms of the manner whereby agricultural markets interact with the broader commodity environment. In the aftermath of the financial crisis of 2006-08, no matter what causality one would attribute to global market price volatility, expectations were that, in the long-run, agricultural prices would resume their long-term downward trend in real terms. Yet developments stemming from the combined effect of the three crises identified above seem to have to cast significant doubt upon this expectation.

It is true that the asymmetric exit from COVID and the numerous bottlenecks it created put an inevitable upward pressure on prices. It is also evident that tensions in the European energy market in the summer of 2021 added to this upward price trend, especially observable in Europe's natural gas, and by extension, fertiliser markets. Moreover, the Russian invasion of Ukraine added insult to injury, pushing prices even higher. All this took place at a time when the EU was debating and designing the policies for its green energy transition.

The impact of such developments was not localised in the EU, but felt globally. As a result, the downward path of real agricultural prices, which had seemed to slow during the first decade of this century, now appears to have reversed, placing global real agricultural prices on an upward trajectory. This shift is expected to persist for a longer period than any other past interruption of their assumed long-run downward trend.

Coupled with this, energy and fertiliser prices are increasing at a faster rate than primary production prices, worsening the profitability of the farming sector at the time of a slowdown in productivity of some staple food commodities. And while all this is happening at the supply side, demand of food has been affected by food inflation rates that exceed by far any impact on food prices seen by previous agricultural commodity price booms.

The extent to which the global food chain used the combined effect of a pandemic and geostrategic tensions to potentially inflate profit margins will remain an issue of debate and speculative arguments as long as data on price

transmission along the food chain lack even basic transparency. But the end result is clear, what for decades has been taken for granted, the significant decline in the share of food in household expenditure, seems to be at a halt even in very developed societies. Compounded by growing issues of uneven income distribution, this development puts at risk the gains that EU agri-food had achieved in the previous two decades both in terms of competitiveness and in terms of its public policy recognition and acceptance.

Real and perceived weaknesses and the "sovereignty" debate

If there is one omission that is striking in the European Commission's "Vision for Agriculture and Food" Communication, it is the absence of any reference to one of the most fundamental challenges that agriculture is facing globally, that of the need to focus on and enhance "sustainable productivity".

One could consider this omission accidental; after all the text is full of references to competitiveness, innovation and several other buzzwords that could be linked to productivity and the need for its sustainable growth. But this omission is actually reflective of a whole set of arguments that both within and outside the Commission have plagued and polarised the policy debate.

Central in this respect is the debate and the worries about the EU's dependence in the import of many raw materials, which has rendered it vulnerable to exogenous shocks. Both COVID and the war in Ukraine, for completely different reasons, fed this debate and led to the Draghi Report on the competitiveness (rather, the lack thereof) of the EU at large. Absent from this Report, however, was the EU food chain system, which in several areas exhibits a high degree of competitiveness, be it in food trade, machinery (the EU is a major supplier of agricultural machinery worldwide), innovation in food safety standards and some of the most advanced applications of earth observation in agriculture (an area where the EU was a world leader from early on).

Form the various facets of this debate, which are beyond the scope of this paper, one is characteristic of perceived versus real weaknesses of EU agriculture, that of the so-called "protein deficit" of the EU. What is meant by this is the trade deficit in one form of proteins, those going to animal feed especially through imported soyabeans, which are viewed in isolation from the surplus they feed in the form of exported EU animal protein. Yet more important is another, often ignored, aspect of the role of the surplus position of the EU when it comes to food protein from cereals, especially wheat. In fact, when one examines the big picture relating to trade in products linked to the provision of food proteins, two divergent developments are evident (Figure 4).

First, while the trend in the trade deficit of the EU in the arable crops, oilseeds and protein crops category is rather stable over time, with its occasional variability explained by essentially exogenous factors (climatic or input cost developments), the surplus in animal products kept a steady upward trend, indicative of efficiency gains and the increase in the value-added component of such exports (e.g. in dairy products).

Second, the EU cereal sector has a unique characteristic when compared with other exporters. While oilseed yields are quite similar around all major players (soyabean yields are roughly 3 tonnes per hectare, whether one looks into the US, Brazil, Argentina, Canada, China or the EU), wheat yields provide a completely different picture. Wheat yields in the traditional soyabean exporters are similar to soyabean yields (actually slightly lower), while in the EU wheat yields are almost double those of soyabeans (China also has higher wheat yields). Therefore, if the EU were to substitute

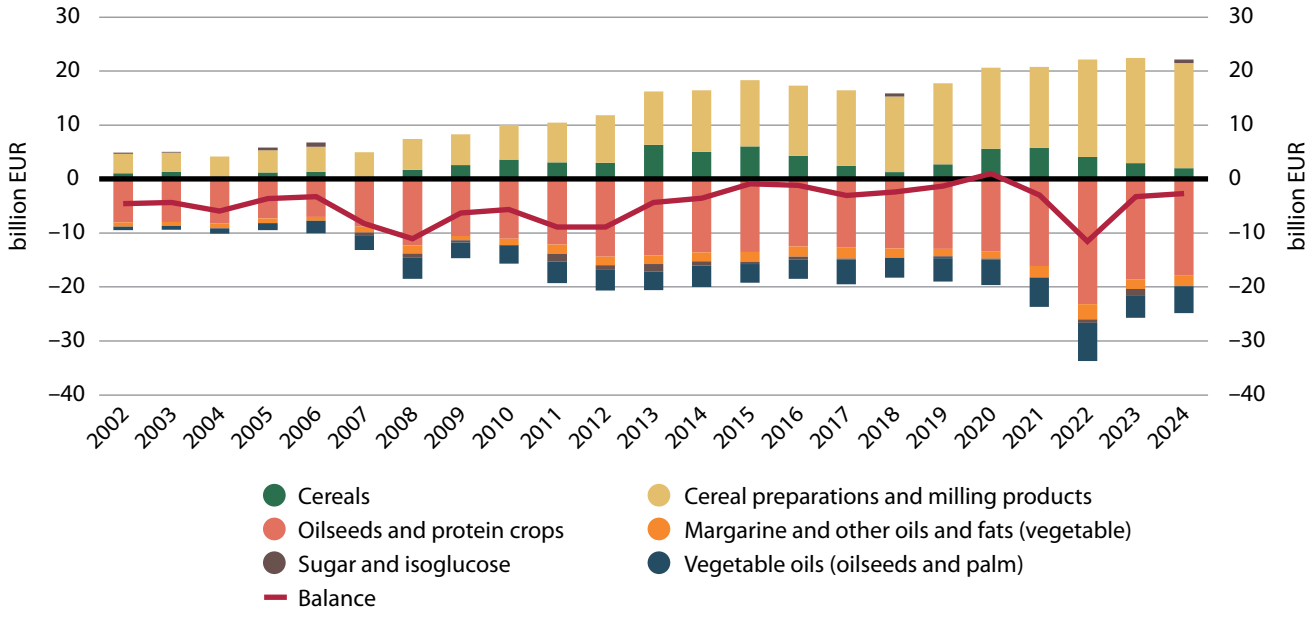

Figure 4: EU C.O.P. trade balance (2002-2024).

Source: Eurostat (2025).

imported soyabeans with domestically produced soya, given the lack of land availability it is the EU's wheat export surplus that would be drastically reduced, with the world facing an annual shortage of roughly 30 million tonnes of wheat compared to present levels.

In other words, instead of improving the EU's "food sovereignty", such a switch would be to the detriment of global food security. Moreover, although it is often argued that such a change should be accompanied by dietary shifts that reduce animal-based proteins, the characteristics of EU agriculture are such that both the availability of extensive grassland and crop yield realities explain why even in such a case things would not change much. It is not just from an economic, but also from an environmental point of view that efficiencies in EU land management, which have not been reflected in its agri-food trade developments, will also matter in terms of global crop and animal food supply efficiencies even if such shifts materialise.

What's next for EU agricultural trade policy?

Food security and climate action – substitutes or complements?

Ever since the 2015 Paris Agreement on Climate Change brought the need to address climate change with action addressing both mitigation and adaptation needs into the forefront of policy debate, the polarisation of opinions treating food security and climate action as either/or solutions has dominated the policy debate. Especially in the European Union, this polarisation is not new. "Even before climate change took centre stage in the EU public debate, it had become clear that, in all basic human needs – food, shelter, clothing, energy, transport – we are rapidly moving from a phase of solving economic and social problems at the expense of the environment towards a phase of potentially solving economic and environmental problems, yet with often increasing social tensions." (Haniotis, 2020).

Yet the COVID19 crisis triggered a resurgence of this polarisation in a debate around two global challenges that need to be solved in tandem – climate change and food security. In this polarisation, two diametrically opposed views whose origin is common, the genuine need to address these issues, put different weights on solutions (either climate change or food security first), often resulting in considering as trade-offs areas where there are potential synergies and imagining synergies where there are trade-offs. The pandemic crisis briefly helped as proof that, despite claims that "food systems are broken" and policies around food are a "catastrophe", the food system, despite its genuine shortcomings, which are part of a much broader, complex picture, exhibited a remarkable degree of resilience, reflective of adaptability and innovative sophistication, especially when compared with other parts of the economy.

But old habits die hard, and the recovery from the pandemic, asymmetric not only in terms of economic impacts but also in terms of policy responses, brought the polarisation around food security and climate action back into the core of the debate about the future of the EU food system. In the real world, food security and climate change are global problems that require global solutions – hence the great difficulty of coordinating actions for such solutions. But as global problems, they also require a global view of their various dimensions. The EU cannot be criticised for lacking a global view for such solutions (and this does not preclude doubts on the practicality of its proposals). Yet when it comes to food security, the global view on what the problem means in concrete practical policy terms disappears from the debate.

On the one hand, those prioritising climate action consider that the EU does not face any food security issues given its trade position. If anything, they consider that there is space for substitution of some of its imports and the need for a reduction in its livestock production. They thus treat food security as a regional issue, considering (without openly admitting it) the necessary increase in sustainable productivity as a threat to the achievement of climate targets (which are also viewed locally in practice). This stance seems to have learned little from the increasing gap between the excessive targets set and the declining prospects for their realisation, and thus the need to adapt strategy and tactics to achieve real progress.

On the other hand, those allergic to climate action (also up until recently not openly admitting it) find in food security the pretext to block any ambitious action to address climate change either because they consider that the cost of such action is prohibitive, at least in the short-term, and find the presence of an economic crisis (for which there is no shortage of late) as an excuse to procrastinate. Where both points of view seem to agree is on turning food security into an anti-globalisation platform. Solutions that, in the specific context of addressing domestic demands, are absolutely legitimate (strengthening the domestic production potential, encouraging innovative local networks), are presented as the magic wand that would solve real and perceived problems of globalisation by ignoring that food security is, after all and above all, a global challenge that "food-sovereign" solutions can only make worse.

Risks, tensions and potential synergies

Seen in their isolation, and especially in their regional dimension, arguments from both sides of this debate have their merit. With climate change exceeding even pessimistic scenarios in terms of its impact and Europe being the continent where warming is the fastest prioritising climate action regardless of what other parts of the world are doing makes sense. It is not by slowing down progress so that others catch up that progress has been achieved in as many areas of human activity. On the contrary, assuming leadership in climate action has its own merit, provided that successful results can act as models convincing others for action.

Food security concerns are also linked to the need for less import dependence when it comes to strategic sectors, and food is by its nature strategic as addressing the most essential human need. Rebalancing trade flows in a manner that helps the local food industry has multiplier effects throughout the

food chain as long as it is not based on trade distorting policies which risk retaliatory measures.

Yet putting together climate action and food security in the concrete case of the EU shows the complexity of the underlying causes for this polarisation. All major agricultural countries and regions faced constrains in meeting the growing demand needs from an increasing world population. Yet their emissions footprint has been very different during the past 30 years. The starting point obviously makes a difference, and the EU was coming from a very intensive use of inputs, but its agriculture has shown steady progress in reducing its fertiliser use or its cattle herd, unlike what happened in other major global players such as China, India and Brazil (the US has increased emissions form agriculture only slightly).

This reality brings tensions in a series of areas. First of all, between the developing world and the EU with the former arguing in favour of food security as a primary concern advocating slower progress in climate action. Second, within the EU, between those arguing for faster climate action, and thus inevitably considering insufficient any progress made within the EU. Third, between the EU and other developed countries because of the reluctance of the EU to apply technologies that could accelerate productivity growth in a more sustainable way than today.

The above tensions are characteristic of a persistent set of negative attitudes in the EU that act as communicating vessels feeding each other covering trade, science and productivity. Food needs to flow where needed. Trade, far from perfect in terms of the spread of its benefits, is a mechanism that mitigates the negative impacts from food deficits. Science is the mechanism that covers gaps in knowledge and innovation in addressing climate change with new more sustainable practices. And productivity is the means to cover globally the additional food production needs.

The facts clearly point out to an uncomfortable reality – globally, we need to produce more with less; therefore, both economic and environmental efficiency matter. Maybe not all current production needs to be consumed everywhere, but as long as we agree that choices cannot be imposed, but should instead be guided, then what will be produced better be produced with the lowest joint environmental and economic cost. The EU as a supplier of food provides plenty of examples that this is not something that is only potentially possible in the future, but is instead something happening already. Yet the EU, as a consumer of food, provides evidence that the gap between facts and perceptions can have a significant impact on the manner by which trade, as the meeting point of supply and demand, can be affected by such tensions.

It will not be that easy for the future CAP

This paper described a period when the EU exploited the benefits of its reform process in its agri-food trade performance in a manner that, normally speaking, should deserve recognition. In fact, if one were to remove the CAP reform from the OECD's Producer Support Estimate (PSE), global agriculture would have very little to show for itself in terms of moving to less trade distorting policies.

Yet the world of today is not one whose priorities are those that led to the previous CAP reform paths that had market orientation at their core. The world today, at least the EU part of the world, is one where EU citizens select their food from the widest and safest set of food choices possible, and yet this unprecedentedly *abundant and secure food supply* is criticised for its impact on health.

It is a world where the vast territory of EU landmass contributes more to the production of its food and feed, and less to its fuel and fibre, in a complex symbiosis between agriculture and the environment that is hotly debated in terms of the balance between its negative and positive externalities on air, water, soil and biodiversity.

It is a world where the small and constantly shrinking EU primary sector, supplied upstream by inputs and supplying downstream its output, is more integrated as part of a global food chain system and bio-economy, with its growing sophistication globally recognised, placing it in many areas at the technological frontier of food trade or environmentally savvy precision farming. Yet, while the benefits are both widespread and measurable in terms of growth and jobs in the overall economy and in trade, so is criticism about the perceived and real bottlenecks in the food system and the uneven distribution of its benefits.

It is in this complex context that the future of the EU agri-trade will be shaped. How exactly will become clear soon. The move away from supporting products into supporting producers led to an undisputed economic outcome – a significant improvement in the competitiveness of the EU's agri-food sector. This came about not by accident, but as the result of policy design based on analytical evidence. Despite signs to the contrary, one can only hope that the debate that will shape the future CAP will not overlook this crucial lesson.

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SCIENTIFIC ARTICLE

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China's Agri-Food Trade in a Shifting Global Landscape: Policies, Lessons, and Challenges

ABSTRACT

This paper examines the evolution of China's agri-food trade over the past two decades amid increasing global uncertainty. Using a combination of quantitative trade data and qualitative policy analysis from 2000 to 2023, it explores how China has navigated crises such as the global financial crisis, the COVID-19 pandemic, and geopolitical tensions. The findings highlight that China's agri-food trade growth has been driven by trade liberalisation, domestic support policies, and a strategic focus on diversification and food security. However, challenges remain, including heavy import dependence, rising production costs, and environmental pressures. The study concludes that strengthening domestic capacity, investing in green innovation, and expanding trade partnerships are critical for long-term food system stability. These insights offer valuable lessons for other agricultural economies striving for greater resilience in a volatile global environment.

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Introduction

Global trade has played a vital role in ensuring food security, driven largely by sustained trade expansion. The share of agricultural products in global trade has steadily increased over the past two decades, rising from an average of 15% in 2000 to 23% in 2023, indicating that trade has grown faster than agricultural production (OECD/FAO, 2024). However, recent years have seen the emergence of significant challenges, including rising anti-globalisation sentiment, the COVID-19 pandemic, and escalating geopolitical tensions that have profoundly impacted food trade. For instance, the United States imposed additional tariffs on imports from multiple countries to protect domestic industries, triggering widespread trade frictions. Geopolitical conflicts, such as instability in the Middle East and the Russia–Ukraine war, have further disrupted food production and trade. These shocks have led to heightened price volatility in global food markets, the proliferation of trade barriers, and widespread supply chain disruptions, posing serious risks to food security and social stability worldwide.

As a major actor in the global agri-food system, China has played a pivotal role in this evolving landscape. Over the past decade, China has accounted for 28% of the global growth in food and agricultural consumption (OECD/FAO, 2024). During this period, the country transitioned from a net exporter to the world's largest agricultural importer, reflecting both surging domestic demand and a broader commitment to trade liberalisation. Amid the shifting dynamics of global trade, China's agri-food sector now faces a complex set of new challenges.

Since China's accession to the World Trade Organization (WTO), a large body of research has examined the evolution of its agricultural trade, including structural trends, the effects of external shocks, and the role of trade and domestic policy measures. Notably, scholars have analysed post-WTO reforms such as significant tariff reductions, the removal of non-tariff barriers (Ni *et al.,* 2016), and a strategic reorientation toward market-based resource allocation (Martin, 2001). These reforms aligned China's policies with global trade norms and aimed to mitigate emerging challenges.

Trade liberalisation has produced mixed outcomes. On the one hand, the surge in agri-food imports has reduced self-sufficiency for certain commodities and exerted competitive pressure on domestic farmers, especially due to price differences with low-cost foreign products. On the other hand, imports have allowed China to capitalise on comparative advantages, easing domestic resource and environmental constraints. For example, agricultural trade has enabled the importation of "virtual" land and water, saving an estimated 3.27 million hectares of global cropland annually from 1986 to 2009 (Qiang *et al.,* 2013). Moreover, trade-driven export growth and rising non-farm incomes have contributed significantly to rural poverty reduction (Huang *et al.,* 2007).

Nonetheless, the global agri-food trade environment has become increasingly volatile in recent years. The 2018 U.S.–China trade war disrupted agricultural sectors in both

countries, reshaped trade flows, and increased carbon emissions due to rerouted supply chains (Elobeid *et al.,* 2021). The COVID-19 pandemic further strained global agri-food logistics and disrupted the livelihoods of nearly 70% of China's migrant workforce (Cao *et al.,* 2020; Zhang *et al.,* 2021). While markets have shown adaptive capacity in the face of climate change, the complexity of overlapping risks continues to grow (Xie *et al.,* 2020). These shocks have prompted global reassessments of trade interdependence and food security strategies.

In response, scholars have increasingly analysed the evolution of China's agri-food trade policies, assessing their effects on trade patterns, domestic production, and food security (Gale, 2013; Huang *et al.,* 2010, 2017; Li *et al.,* 2016; Yu *et al.,* 2010; Zhu *et al.,* 2018). This body of literature underscores the multifaceted implications of China's agricultural trade for both domestic socio-economic systems and global food networks. It also highlights the importance of policy instruments in navigating the tension between competitiveness, sustainability, and food security amid growing uncertainty.

Against this backdrop of intensifying geopolitical tensions and climate-related risks, a systematic and forward-looking review of China's agri-food trade policies is urgently needed. This paper provides a comprehensive analysis of China's agri-food trade policy development since WTO accession, synthesising key experiences and lessons to inform future policy responses in China and other countries confronting similar uncertainties.

Methodology

This study employs both quantitative and qualitative methods to analyse China's agri-food trade patterns and the evolution of related policies from 2000 to 2023. Trade data were sourced from UNCTADstat and FAOSTAT, with a focus on primary agricultural commodities and processed food products. The quantitative component assesses trends in trade volumes, self-sufficiency ratios, and the diversification of trade partners. The qualitative analysis draws on policy documents, academic literature, and government reports to examine the rationale behind China's trade-related measures and their policy impacts. In addition, the study includes case analyses of key policy transitions, such as WTO accession, the implementation of domestic support measures, and recent diversification strategies, to illustrate the changing policy landscape.

To assess the international competitiveness of China's agri-food products, the study utilises the Revealed Comparative Advantage (RCA) index for major agricultural goods from 2000 to 2023, based on data from UNCTADstat. The RCA index is a widely used indicator that measures the degree of export specialisation and comparative advantage of a particular product in international trade. It is calculated by comparing the share of a product in a country's total exports with its share in global exports, thus reflecting the relative competitiveness of that product in the international market. The RCA formula is expressed as:

$$RCA_{ij} = \frac{X_{ij}/X_{tj}}{X_{iw}/X_{tw}} \quad (1)$$

where:
X_{ij} = Export value of product i from country j
X_{tj} = Total export value of country j
X_{iw} = Global export value of product i
X_{tw} = Total global export value

The numerator represents the share of the product in the country's total exports, indicating its relative domestic export emphasis, while the denominator represents the product's share in total global exports, serving as a global benchmark. An RCA value greater than 1 indicates that the country has a comparative advantage in that product and is competitively positioned as an exporter. The higher the RCA index, the stronger the country's export advantage in that specific product.

Agri-Food Trade Situation in China

This paper compiles data on China's agricultural and food trade from 2000 to 2023, sourced from UNCTADstat, encompassing both primary agricultural commodities and processed food products. The dataset is used to examine the structural characteristics and long-term trends in China's agri-food trade since its accession to the WTO.

Over the past two decades, China's agricultural imports have grown rapidly, positioning the country as the world's largest importer of agricultural products, while export growth has remained comparatively modest (Figure 1). Between 2000 and 2023, agricultural imports rose sharply from USD 8.07 billion to USD 209.82 billion, whereas exports increased from USD 13.37 billion to USD 78.56 billion. This shift reflects China's transformation from a net agricultural exporter to a nation with a persistent and widening trade deficit in agri-food products, which reached USD 131.26 billion in 2023. The surge in imports following WTO accession, combined with relatively slow export growth, resulted in the transition from a trade surplus to a sustained deficit beginning in 2008.

China's share in global agricultural trade has also expanded significantly. Its share of global agricultural imports rose from approximately 2% in 2000 to 11.9% in 2023, firmly establishing China as the world's leading importer. In contrast, its share of global agricultural exports increased only modestly, from 3.5% to 4.5% over the same period—underscoring the growing imbalance between import and export dynamics.

The composition of China's agri-food trade reveals a persistent structural imbalance (Figure 2). This pattern highlights China's continued reliance on imports of land- and capital-intensive commodities such as soybeans, meat, cereals. Meanwhile, China's primary agricultural exports remain largely labour-intensive, including vegetables, edible preparations, fish, and shellfish. These trends point to underlying structural weaknesses in China's agri-food trade system, particularly its heavy dependence on imported

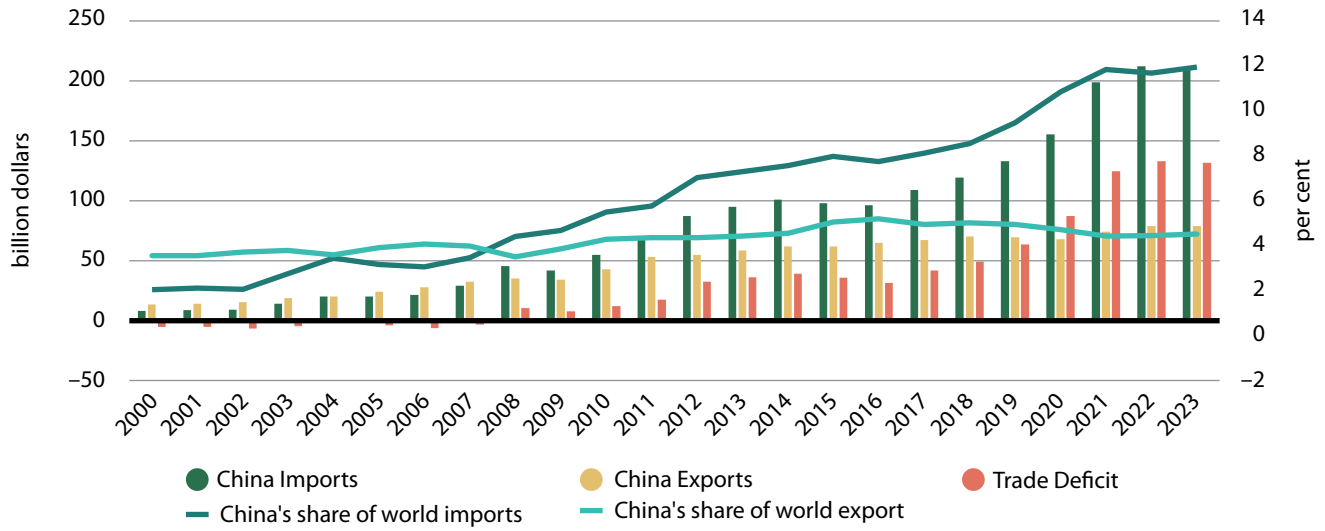

Figure 1: China's agri-food trade volume and its global share.

Source: Own composition based on UNCTADstat (2025)

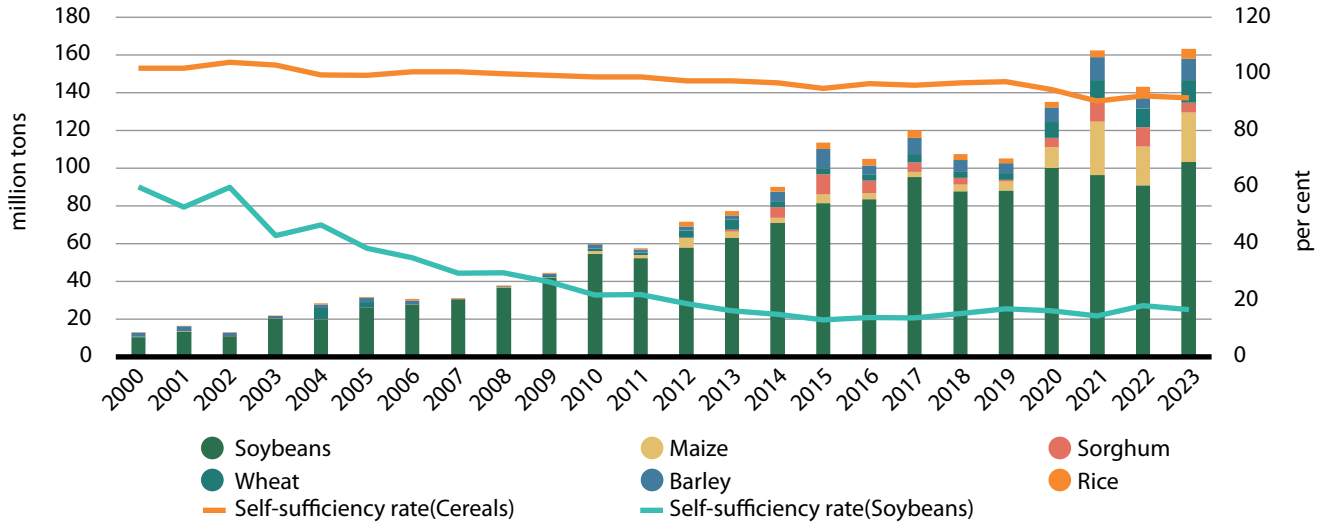

Figure 2: China's Imports and Self-sufficiency in Cereals and Soybeans.

Source: Own composition based on UNCTADstat (2025)

essential commodities and its limited advancement in exporting higher value-added agricultural goods. While both imports and exports of agricultural products have increased significantly over the past two decades, raw products dominate imports, whereas processed foods account for a larger share of exports. Raw products made up more than 60% of total imports and remained relatively stable, while their share of exports declined below 40% and reached 28.9% by 2023. This reflects the imbalanced nature of China's agricultural sector, which remains heavily reliant on labour-intensive production while depending on foreign markets to meet demand for land- and capital-intensive goods.

Since 2000, soybeans have consistently been China's most critical imported agricultural commodity, representing nearly one-quarter of total agri-food imports each year and accounting for approximately 50% around 2008. In 2000, China imported 10.42 million tons of soybeans worth USD 2.27 billion; by 2023, imports had surged to 103 million tons valued at USD 59.44 billion. Other major imports in 2023 included fruits (USD 16.7 billion), beef (USD 14.43 billion), vegetable oils (USD 12.72 billion), and corn (USD 9.03 billion). On the export side, vegetables, fruits, poultry, rice, and nuts were the top contributors, with export values in 2023 reaching USD 12.24 billion, USD 6.6 billion, USD 2.17 billion, USD 1.97 billion, and USD 1.42 billion, respectively.

While China's cereal imports have increased in recent years, the self-sufficiency rate has remained relatively stable. Imports rose from 3 million tons in 2000 to 52.2 million tons in 2022, while the self-sufficiency rate declined only modestly, from over 100% in 2000 to approximately 91.7% in 2023. This stability can be attributed to continued growth in domestic cereal production, which rose from 401 million tons in 2000 to 641 million tons in 2023. In stark contrast, soybean imports have increased dramatically, accompanied by a sharp drop in self-sufficiency. In 2000, China produced 15.41 million tons of soybeans and imported 10.21 million tons. By 2023, domestic production had risen modestly to 20.84 million tons, while imports surged to

103.38 million tons, resulting in a self-sufficiency rate of just 16.8% in 2023, down from approximately 60% in 2000. This trend underscores China's growing dependence on global markets for soybeans, with domestic production now contributing only a small fraction of national demand (Figure 2).

China's meat imports began to increase rapidly around 2011, accompanied by a noticeable decline in self-sufficiency (Figure 3). In 2010, domestic meat production reached 73.92 million tons, while imports stood at just 403,000 tons, resulting in a self-sufficiency rate of 99.45%. By 2023, although production had risen to 97.48 million tons, imports had surged to 7.16 million tons, reducing the self-sufficiency rate to 93.1%. China's meat imports are concentrated primarily in beef and pork, with significantly lower demand for chicken and goat meat from international markets.

Finally, we estimated the self-sufficiency rates of macronutrients by combining trade volumes, production data, and food composition tables. The results are shown in Figure 4. Over the past two decades, nutritional self-sufficiency has declined noticeably: energy fell from 99.3% in 2000 to 84.8% in 2022; protein from 95.3% to 73.8%; and fat from 95.9% to 80.0%. These trends reflect both a growing reliance on international markets and shifting dietary preferences among Chinese consumers.

China's sources of agri-food imports have exhibited a notable trend toward diversification, characterised by a discernible decline in dependence on the United States and a substantial increase in imports from Brazil (Figure 5). Prior to 2012, the proportion of agri-food imports sourced from the United States remained at approximately one-quarter, positioning it as the primary origin of China's agri-food imports. After this period, there was a gradual reduction in imports from the United States, with a shift toward other countries and regions. Notably, until the 2018 U.S.-China trade war, approximately 20% of China's agri-food imports still originated from the United States; this trade conflict served as a catalyst prompting a significant reduction in imports from the United States. In contrast, China's imports from Brazil have witnessed a dramatic increase, rising from $503 million in 2000 to $56.75 billion in 2023. This growth has elevated Brazil's share of China's agri-food imports from 6.2% to 27%, establishing it as the largest source of China's agri-food imports. Additionally, other Asian

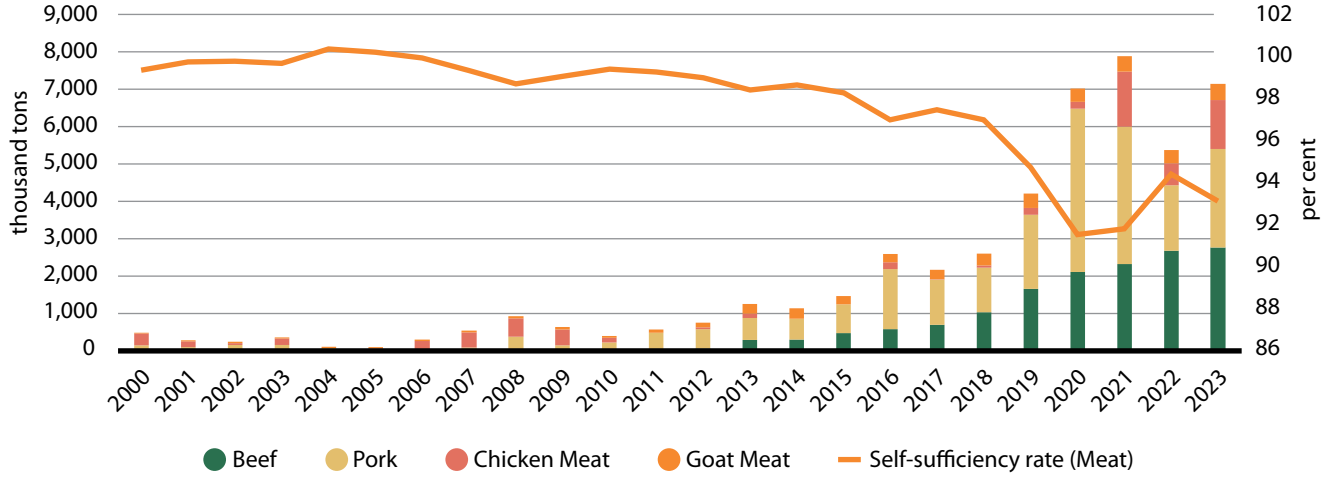

Figure 3: China's Imports and Self-sufficiency in Meat.

Source: Own composition based on UNCTADstat (2025)

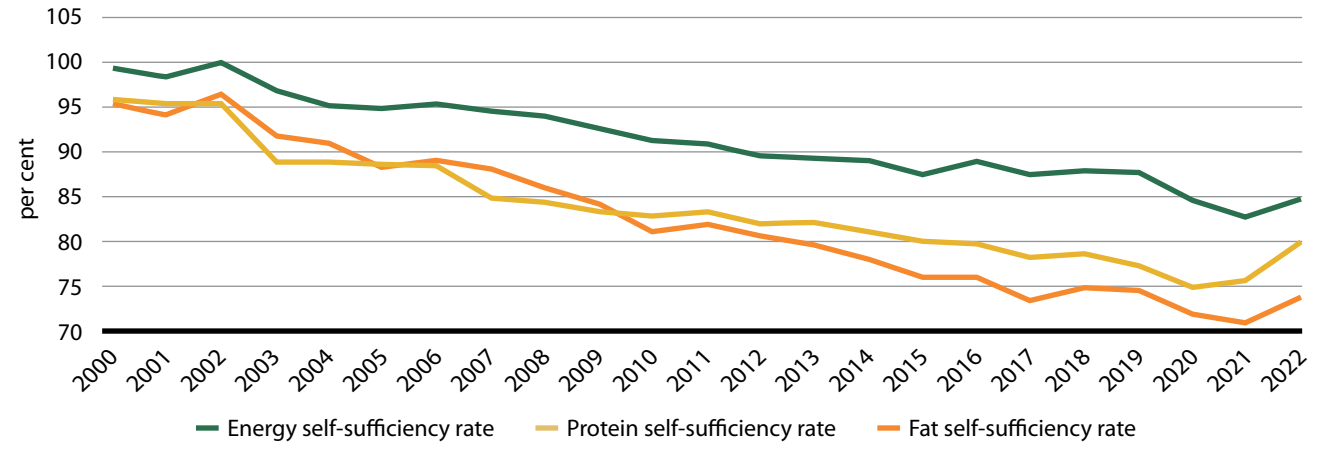

Figure 4: China's self-sufficiency rate of nutrient composition.

Source: Own composition based on UNCTADstat (2025)

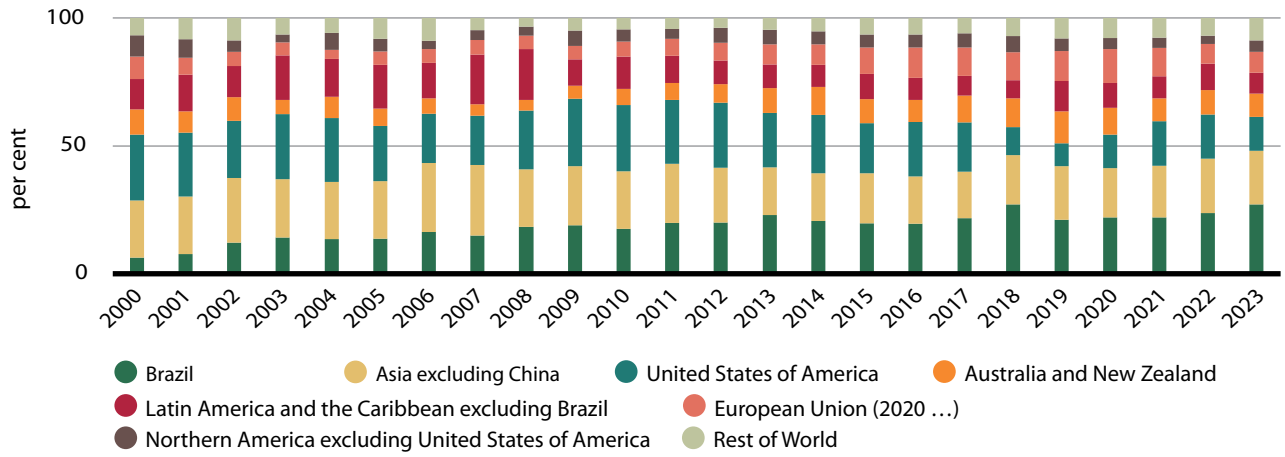

Figure 5: China's Agri-food Imports Sources.
Source: Own composition based on UNCTADstat (2025)

countries have emerged as important contributors to China's agri-food import portfolio. Collectively, these developments underscore the increasing diversification of China's agri-food import sources, with the shares of major origins evolving toward a more balanced distribution.

Together, these findings highlight three key patterns: (1) the rapid expansion and structural transformation of China's agri-food trade; (2) a growing concentration of imports in a few key commodities, particularly soybeans; and (3) increasing diversification of trade partners to mitigate geopolitical risks. These trends reflect the complex trade-offs China must navigate between safeguarding food security, supporting domestic production, and deepening integration into global markets.

Evolution of China's agri-food (and trade) policies

The evolution of China's agri-food trade has closely mirrored shifts in its trade policy, which has undergone several major transformations since the early 2000s. China's accession to the WTO in 2001 marked a pivotal moment, ushering in a period of rapid growth in agri-food trade. In the years following WTO entry, China introduced domestic support policies in 2004 aimed at protecting and strengthening its agricultural sector, which temporarily slowed import growth. Around 2010, in response to rising production, stockpiles, and imports, the country began implementing market-oriented reforms. These reforms, which gained momentum around 2012, allowed market forces to play a greater role and helped moderate import growth. Since 2015, China has actively pursued a trade diversification strategy that has expanded overall trade volumes while reducing dependence on a limited set of trading partners.

Figure 6 illustrates the evolution of China's agri-food trade policies since its accession to the WTO. This chapter offers a detailed analysis of each policy and the context in which it was implemented. These policy shifts were not merely reactive but part of a strategic response to domestic modernisation goals and global economic changes. They reflect an evolving approach aimed at balancing national development priorities with deeper integration into the global economy. The following subsections examine the major phases and instruments of China's agri-food trade policy since WTO accession, highlighting their motivations, mechanisms, and impacts.

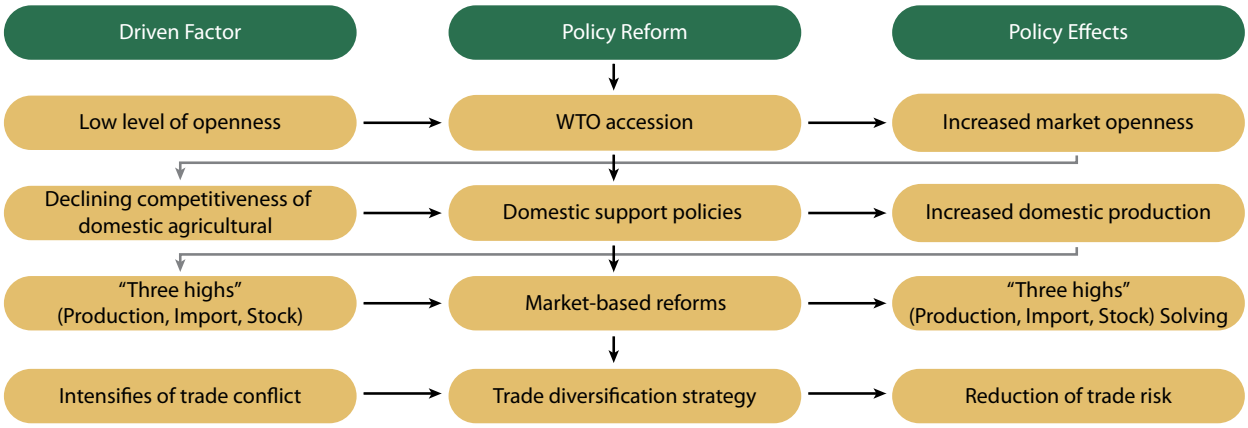

Figure 6: Evolution of China's agri-food trade policy.
Source: Own composition

WTO Accession: A Major Turnaround in Agri-food Trade Policy

China's formal accession to the WTO in 2001 marked a new era in its agri-food trade policy. One of the most significant changes was a sharp reduction in import tariffs, which fell from an average of around 40% in the 1990s to approximately 15% after accession. For example, soybean tariffs were cut to just 3%, in effect fully liberalising that market. China's agricultural subsidy policies became subject to WTO disciplines, allowing the implementation of constrained "Yellow Box" policies, unconstrained "Green Box" policies, and "Blue Box" policies. Among these, the "Yellow Box" policies are subject to the Aggregate Measure of Support (AMS), which cannot exceed 8.5% of output value (WTO,2001).

These reforms expanded market access, boosted imports, and established China as a major player in global agri-food trade. WTO membership also opened export opportunities for labour-intensive products, such as vegetables and fruits, where China holds comparative advantages. However, it also exposed domestic producers to intensified competition from lower-cost imports, particularly from developed economies like the United States and the European Union. To manage the risks associated with liberalisation, China introduced tariff-rate quotas (TRQs) on sensitive products, such as rice, wheat and maize, helping to stabilise domestic supply and prices while facilitating integration into global markets.

Domestic Support Policies: Enhancing Agricultural Competitiveness

China implemented a series of domestic support measures to offset rising production costs and protect farmer incomes since 2004. These measures included direct subsidies for grain farmers, input subsidies for seeds, fertilisers, and machinery, as well as substantial investments in rural infrastructure such as irrigation and transportation.

A key component of this support system was the Minimum Purchase Price (MPP) programme for staple grains like wheat and rice. Under this mechanism, government entities, primarily the China National Grain Reserve Corporation, purchased grain when market prices fell below a set threshold, helping to stabilise farmer incomes and maintain production during periods of price volatility.

From 2007 onward, temporary storage programmes for commodities such as corn, soybeans, and cotton were introduced to manage surpluses, prevent price collapses, and stabilise markets. These efforts, together with infrastructure improvements, enhanced agricultural productivity and resilience, while supporting more efficient trade and distribution.

Collectively, these domestic policies strengthened the competitiveness of China's agricultural sector by improving production efficiency and quality. They boosted China's export capacity and reduced dependence on imports, thereby reinforcing the country's bargaining power in international trade.

Market-Oriented Reforms: Pursuing Efficiency and Sustainability

With the development of China's economy, farmers have migrated to urban areas for employment, leading to rising agricultural labour costs. Coupled with increased agricultural subsidies, domestic agricultural production costs have risen, driving up prices. However, this has also resulted in an expansion of price differences between domestic and international markets. Market prices for most Chinese agricultural products tend to be higher than international prices, necessitating substantial imports to meet domestic demand. Figures 7 and 8 compare domestic and international prices for several crops and livestock products, respectively. Together, they reveal that prices for Chinese agricultural products began rising sharply around 2010. During this period, domestic agriculture faced the so-called "three highs" phenomenon: high import, high production, and high stock (Zhu *et al.,* 2021).

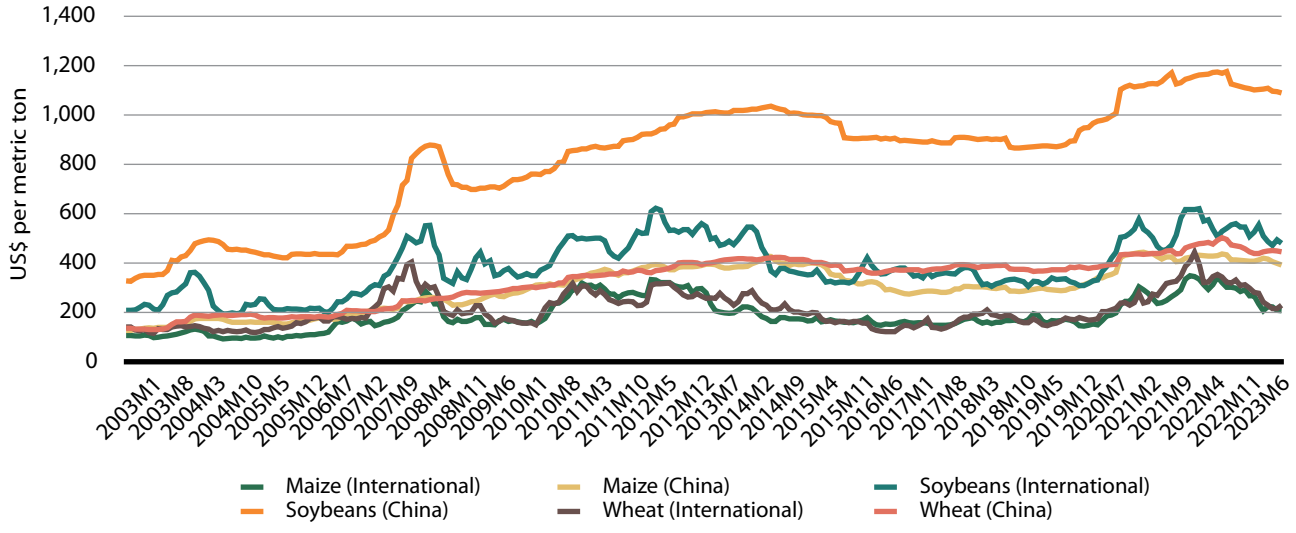

Figure 7: Price comparison of selected grains and soybeans.

Source: China National Bureau of Statistics (CNBS) and IMF (2025) data

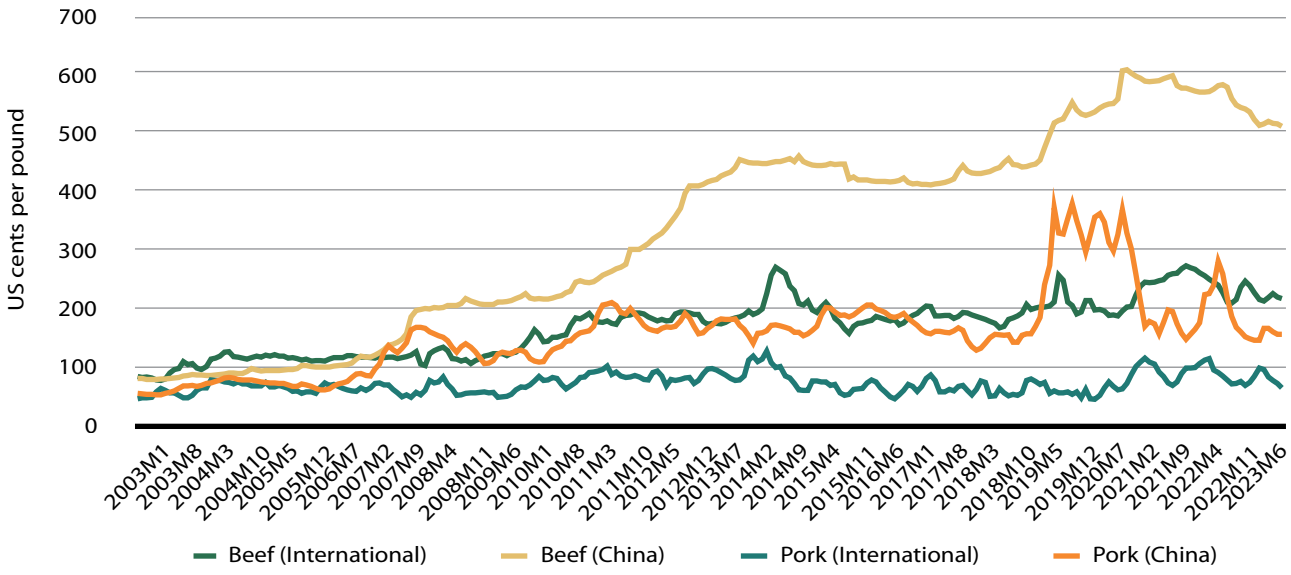

Figure 8: Comparison of prices of selected livestock products.
Source: China National Bureau of Statistics (CNBS) and IMF (2025) data.

In response, starting around 2010, China launched market-oriented reforms to address inefficiencies and ease the fiscal burden of extensive state intervention. This involved phasing out temporary storage policies and adjusting minimum purchase prices, allowing market forces to play a greater role in price determination. For example, floor prices for wheat and corn were gradually lowered to introduce more pricing flexibility. As shown in the figures, prices started to stabilise around 2014, signalling the initial effectiveness of these reforms. Notably, the international and domestic prices of corn and wheat closely mirror each other, with nearly identical trends, reflecting strong substitutability between these two staple grains. In contrast, soybean prices are considerably higher than those of corn and wheat, although their overall price trends show similar patterns.

At the same time, China significantly increased investment in agricultural innovation. Advances in precision farming, seed development, and post-harvest technologies enhanced productivity while minimising environmental impact. These reforms marked a strategic shift from quantity-driven to quality-oriented trade.

Sustainability also became a key focus. Programmes promoting soil testing, formula fertilisation, organic alternatives, and manure recycling were implemented to reduce agricultural pollution and improve environmental outcomes. These initiatives helped align trade expansion with ecological objectives.

Trade Diversification: Expanding International Market Reach

In response to rising protectionism and global geopolitical uncertainties, China has intensified efforts to diversify its agri-food trade. The Belt and Road Initiative (BRI), launched in 2013, has become a key platform for building trade partnerships. Through bilateral agreements, demonstration zones, and agricultural technology exchanges, China has strengthened ties with Southeast Asia, Central Asia, and Africa.

Regional agreements have further supported diversification. The Regional Comprehensive Economic Partnership (RCEP), signed in 2020, established a vast free trade zone across the Asia-Pacific. Earlier, the China-ASEAN Free Trade Area, completed in 2010, deepened trade within the region. Additionally, bilateral free trade agreements (FTAs) with countries such as Chile, Pakistan, and Australia have opened new markets for agri-food products (Ministry of Commerce of China, 2025).

Complementing these agreements, China has hosted major trade expositions, including the China International Import Expo and the Agricultural Products Trade Fair, to attract global suppliers and promote export opportunities for domestic producers.

Together, these initiatives have reshaped China's agri-food trade by broadening sourcing options, reducing overreliance on specific markets, and embedding the country more deeply into global value chains.

On the whole, China's agri-food trade experience over the past two decades presents a compelling mix of strategic achievements and important lessons. This section synthesises the key insights relevant to national policy development as well as broader international efforts to enhance food security and trade resilience.

Strategic Achievements

Trade Enhances Nutrition and Alleviates Environmental Pressure

China's deeper integration into global agri-food trade has markedly enhanced dietary diversity and nutri-

tional outcomes. Since joining the WTO, the country has increased imports of premium, nutrient-rich foods-such as tropical fruits, dairy products, and high-quality meats, to meet growing demand for healthier diets. Trade liberalisation has helped lower food prices and expand access to nutritious products, thereby supporting improved public health.

Simultaneously, trade has eased pressure on domestic natural resources. The large-scale importation of land- and water-intensive commodities like soybeans has effectively outsourced some of the environmental costs of production. These imports represent "virtual" savings in arable land and water use (Ali *et al.,* 2017), helping China curb overuse of fertilisers, irrigation, and farmland, particularly in ecologically sensitive areas.

Trade Policy Drives Agricultural Modernisation

Strategic openness to trade has been a key driver in modernising China's agricultural sector. Access to international markets has incentivised the adoption of advanced technologies, including precision agriculture, improved seed varieties, and modern supply chain logistics. These advancements have significantly boosted productivity and raised rural incomes.

Complementing trade openness, domestic policy tools such as subsidies, minimum price mechanisms, and infrastructure investments have strengthened the competitiveness of China's agricultural products. China's strong focus on staple grain self-sufficiency, supported by measures like tariff-rate quotas and the "Storing Grain in Land and Technology" strategy, has helped maintain resilience in the face of global shocks, including the 2008 financial crisis.

Diversification and Reserves Strengthen Resilience

China's trade diversification strategy has broadened sourcing options and reduced dependence on a limited number of trade partners. By enhancing ties with countries along the Belt and Road Initiative and deepening regional cooperation through agreements such as the RCEP, China has secured alternative supply routes for critical commodities.

These efforts are supported by a robust grain reserve system, which employs advanced storage technologies and multi-tiered stockpiling. This system helps buffer against price volatility and supply disruptions. For example, during the COVID-19 pandemic and the global fertiliser shortage in 2022, China's reserves played a vital role in stabilising domestic food availability and prices. Together, diversified imports and reliable reserves have reinforced China's position as a stabilising force in global agri-food markets.

Persistent Challenges and Lessons Learned

Despite these accomplishments, China's agri-food trade strategy has encountered several challenges.

Slow Structural Adjustment

Despite rapid trade expansion, China's agricultural export structure remains concentrated in low-value, labour-intensive goods. Meanwhile, high-value imports such as dairy and oilseeds dominate the import mix. This imbalance, compounded by rising labour and input costs, continues to erode the competitiveness of China's agricultural exports (Ni *et al.,* 2018).

Domestic Market Vulnerability

Trade liberalisation has increased China's exposure to external shocks and market volatility. Events like the 2008 financial crisis and the 2018 Sino-U.S. trade tensions have disrupted domestic markets, reducing farmer incomes and amplifying risks in key sectors. This underscores the challenge of balancing consumer benefits from cheaper imports with the need to protect domestic producers.

Environmental Impacts of Intensification

China's trade-linked agricultural intensification has led to significant environmental costs. Rising feed demand, particularly for livestock, has overwhelmed manure management infrastructure, leading to pollution. Monoculture practices driven by import demands have degraded soil health and reduced biodiversity. These outcomes threaten the long-term sustainability of China's agri-food system.

Future challenges

Despite impressive achievements in expanding trade volumes, optimising import structures, and strengthening global influence, China's agri-food trade now faces a new era of heightened uncertainty. Political tensions, shifting supply-demand dynamics, domestic policy limitations, and accelerating climate change are creating complex, interrelated challenges at both national and international levels.

Geopolitical Tensions and Trade Disruptions

The global political landscape has become increasingly volatile, with rising geopolitical conflicts disrupting established trade flows. The Russia-Ukraine war, for example, has significantly altered global food supply chains, as both nations are major exporters of wheat and corn. Blockages in Black Sea ports have led to global price spikes and heightened food insecurity (Zhu *et al.,* 2023). At the same time, prolonged U.S.-China trade frictions have introduced

volatility and uncertainty into bilateral agri-food trade, raising transaction costs and undermining predictability. These developments underscore the need for more adaptive and diversified trade strategies to buffer against geopolitical risks.

Competitiveness Gaps and Constrained Support

China lacks a comparative advantage in the production of most agri-food products, only a small subset of products demonstrates strong international competitiveness, while the competitive position of certain Chinese agri-food goods exhibits notable temporal characteristics. To assess the international competitiveness of China's agricultural products, this paper utilises the Revealed Comparative Advantage (RCA) index based on data from UNCTADstat covering the period from 2000 to 2023.

The competitiveness of different categories of agricultural products varies significantly. Most Chinese agri-food products exhibit an RCA index below 1, indicating a lack of comparative advantage. Figure 9 presents selected representative products. Among them, shellfish, vegetables, and fish show relatively strong international competitiveness, with RCA indices displaying a generally upward trend. Conversely, while some Chinese agricultural products had a comparative advantage around the year 2000, this edge has diminished over time due to rising land and labour costs. Notably, the RCA indices for cereals, nuts, and poultry declined significantly before 2008, with cereals ultimately losing their comparative advantage. Other products, such as dairy, animal fats, vegetable oils, alcoholic beverages, and cocoa, have consistently recorded low RCA values, reflecting China's persistent weakness in producing these goods.

Overall, the international competitiveness of China's agricultural products experienced moderate improvements around 2008 and again around 2013, periods that correspond to the global financial crisis and China's push for market-oriented agricultural reforms.

China's comparative advantage in agricultural production varies significantly across different levels of processing. Among processed categories, "Processing: Salt, Sugar, and Ingredients" exhibits relatively strong competitiveness, with the ingredients subcategory showing a particularly notable rise in its RCA index, from below 1 in 2000 to over 1.5 by 2023. In contrast, "Processing: Fermentation and Smoking" remains less competitive in the international market (Figure 10).

Notably, the international competitiveness of unprocessed primary agricultural products from China has been on a consistent decline. While these products held an RCA index above 1 prior to 2003, indicating a comparative advantage, that figure had fallen to 0.79 by 2023, suggesting a loss of competitiveness in global markets.

At the same time, China faces structural constraints in enhancing agricultural support. Rising input costs, especially for land, labour, and energy, are squeezing farm profits. Fiscal space for subsidies is limited, making it harder to sustain policy support at scale. Meanwhile, China's agricultural exports remain dominated by low-value, minimally processed goods, with limited progress in branding, quality certification, and value addition. Innovation and sustainable practices also lag behind global benchmarks, limiting China's ability to compete in premium markets or respond to rising consumer expectations for safe and eco-friendly products.

Under World Trade Organization (WTO) rules, the compliance of China's agricultural subsidy policies has garnered significant international attention. In recent years, the

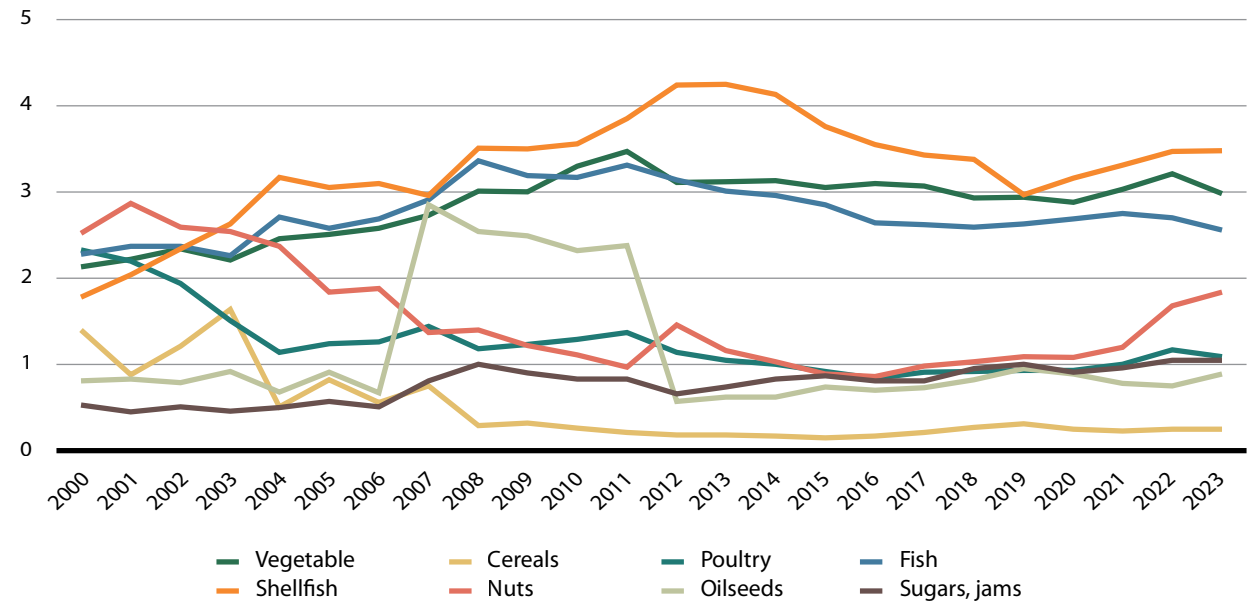

Figure 9: RCA index for different agri-food products.

Source: own composition based on UNCTADstat (2025) data

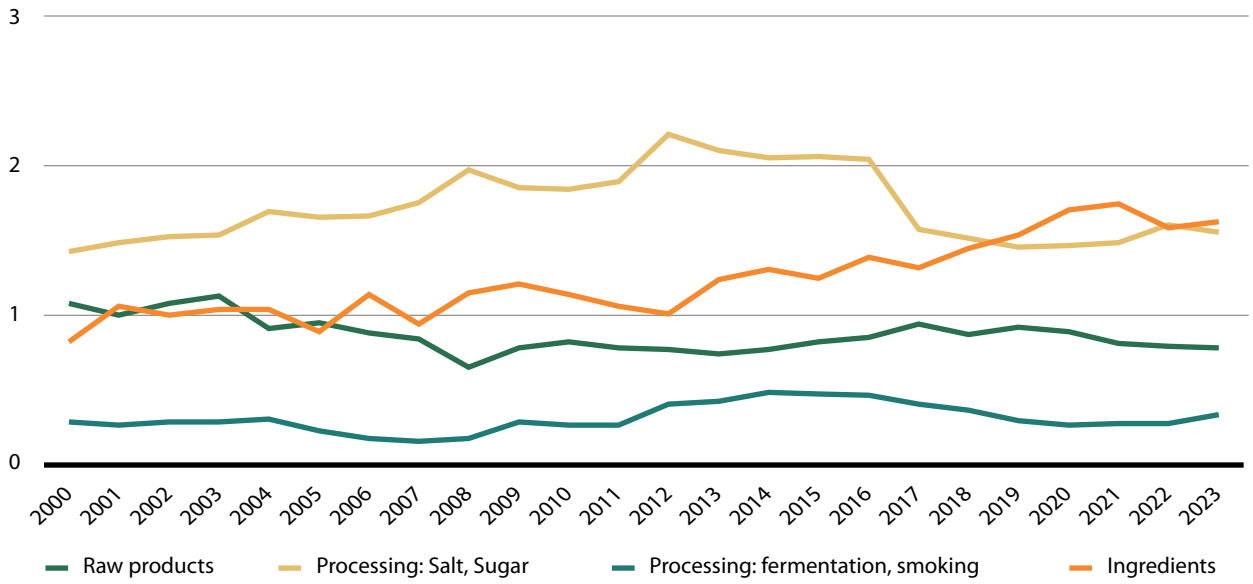

Figure 10: RCA index for agri-food products with different levels of processing.
Source: own composition based on UNCTADstat (2025) data

efficacy of China's agricultural subsidy framework has shown signs of diminishment, with certain policies demonstrating a notable divergence between their actual impacts and intended objectives. This misalignment has created a dual challenge: not only have these policies failed to achieve their designed outcomes, but they have also raised concerns regarding WTO consistency, risking a suboptimal equilibrium where policy goals and international regulatory requirements remain unmet (Xu *et al.,* 2020).

To address this, China must undertake strategic reforms to its agricultural subsidy regime, focusing on facilitating policy transformation and enhancing implementation efficiency. Such reforms should aim to align subsidies more precisely with the genuine needs of agricultural production while ensuring strict adherence to WTO obligations. By bridging the gap between policy design and operational effectiveness, China can strengthen the sustainability of its agricultural support systems while upholding its commitments within the global trading system.

Growing Import Dependence and External Vulnerability

Rapid economic growth and shifting consumer preferences have driven a surge in China's agricultural imports. While this has enhanced food availability and quality, it has also increased the country's reliance on international markets. Such dependence exposes China to various external risks, including export restrictions, climate shocks in supplier countries, and disruptions in global logistics. These vulnerabilities threaten domestic price stability and overall food security, underscoring the importance of reducing strategic exposure through greater self-sufficiency and diversification. This trend highlights the ongoing need for policy innovation to improve agricultural production methods and technologies and to enhance both the quantity and quality of domestic agricultural output.

Climate change poses a mounting threat to agricultural production and trade. Extreme weather events, such as floods, droughts, and heatwaves, are already disrupting crop cycles, reducing yields, and damaging infrastructure across China. Climate volatility also distorts trade patterns by limiting export availability in key producer countries and raising price volatility worldwide. China's own exports, particularly perishables like fruits and vegetables, face increased logistical challenges and spoilage risks. To address these risks, China must invest in climate-resilient agriculture, modernise cold-chain logistics, and implement adaptive policymaking for systemic resilience.

Policy Implications for China and Beyond

Over the past two decades, China has made remarkable strides in agri-food trade, increasing trade volumes, diversifying import sources, and expanding its influence in global markets. However, in an era marked by intensified globalisation and geopolitical uncertainty, China must navigate an increasingly complex landscape of risks and opportunities. To remain resilient and competitive, the following strategic priorities should be emphasised.

Strengthen Domestic Production and Agricultural Modernisation

Enhancing domestic production capacity is essential for bolstering food security and reducing vulnerability to external shocks. This requires sustained investment in high-value,

high-yield agricultural products, modernisation of supply chains, and upgrades to rural infrastructure. Technological innovation, particularly in precision agriculture, sustainable inputs, and cold-chain logistics, should serve as the foundation of modernisation efforts.

Promote Trade Diversification and Strategic Partnerships

Diversifying trade relationships is critical to mitigating geopolitical and supply chain risks. China should continue to deepen engagement with Belt and Road Initiative (BRI) partner countries, fully leverage regional frameworks such as the Regional Comprehensive Economic Partnership (RCEP) and pursue new bilateral free trade agreements. Strengthening South–South cooperation and expanding trade with emerging markets will be key to enhancing flexibility in sourcing and market access.

Balance Openness with Strategic Safeguards

While maintaining openness to trade remains crucial, it must be complemented by robust strategic safeguards. These include well-managed food reserves, targeted import controls for critical commodities, and comprehensive risk management frameworks. Such measures will help insulate domestic markets from external disruptions and enhance stability during periods of global volatility.

Invest in Sustainable and Climate-Resilient Agriculture

Sustainability should be at the core of China's future agricultural and trade strategies. Investments in climate-resilient farming practices, environmental stewardship, and circular economy models are essential. Policy measures that promote ecological agriculture, efficient water use, and low-carbon production systems will help align agri-food trade with long-term environmental objectives.

Strengthen Global Food Governance and Knowledge Sharing

China's evolving role in global agri-food markets offers valuable insights for enhancing international food governance. As a major agricultural importer, China should take a more active role in multilateral forums, support global efforts to stabilise agri-food markets, and share best practices with other developing nations. Promoting international cooperation on trade facilitation, food security, and climate adaptation will contribute to building a more inclusive and resilient global food system.

On the whole, this study presents robust evidence and actionable policy recommendations to support the continued evolution of China's agri-food trade strategy. Its insights also hold broader relevance for countries facing similar structural, environmental, and geopolitical challenges. Ultimately, China's ability to balance openness with resilience, foster innovation and sustainability, and lead in transforming the global food system will be pivotal in shaping a more secure and sustainable future for international agriculture.

Acknowledgements

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SCIENTIFIC ARTICLE

Robert L. THOMPSON[A]

Navigating Uncertainty: Trump and the Changing U.S. Policy for Agri-Food Trade

ABSTRACT

This paper draws implications of Trump's re-election for the U.S. agri-food sector and in turn international agri-food trade. It begins with a historical perspective on U.S. agri-food trade and its role in world markets. It then turns to a review of Trump policies during his first term as President, 2017-21, and the significant market losses American farmers suffered during his first term. Despite these losses, farmers were an important constituency in re-electing Donald Trump President in 2024. The next section discusses American farmer attitudes and the sources of their continuing support for Trump in the 2024 election. This is followed by a critical review of what Donald Trump fails to recognise (or chooses to ignore) about international economics and the agri-food sector. The paper then reviews Trump's policy announcements in the first four months back in office and draws inferences for American agriculture and the global agri-food sector in an environment that might best be described as navigating uncertainty.

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Keywords:
Trump, agri-food trade, agricultural policy, WTO, tariff.

JEL classifications:
Q17, Q18

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Introduction

"To the Great Farmers of the United States: Get ready to start making a lot of agricultural products to be sold INSIDE of the United States. Tariffs will go on external product on April 2nd. Have fun!" Donald J. Trump @realDonaldTrump (Truth Social), 3 March 2025.

"Tariffs are about making America rich again and making America great again, and it's happening, and it will happen rather quickly……There will be a little disturbance. But we're OK with that. It won't be much." Donald J. Trump to Joint Session of Congress, 4 March 2025.

Donald J. Trump's perception of the global economy and the role of the United States in it is significantly different from that of the mainstream economics profession. He has a nostalgic view of the late 19th and early 20th century American economy, a period of prosperity based on high employment of labour in goods manufacturing protected by high import tariffs. He sees the post-World War II era of globalisation driven by tariff reduction and a rules-based trading system as a period that opened the United States to exploitation by the rest of the world (Rehman, 2024). In his view, the United States provided – at great cost to its taxpayers – defence security to much of the world, but what it got in return was loss of jobs, a decline in manufacturing, and a negative balance of trade (Swanson, 2025). As early as 1987, he paid for full-page advertisements in major U.S. newspapers espousing this view.

Trump sees the hollowed-out old steel and auto manufacturing heartland in the Upper Midwest, often referred to as the "Rust Belt," as evidence of this exploitation. He sees the entrance of China into the WTO in 2001 as a watershed moment which accelerated the loss of manufacturing jobs in the United States and growth in the U.S. trade deficit. In effect, Trump sees international trade as a zero-sum game in which one country can gain only if another loses (Swanson, 2025).

Furthermore, Trump sees the key currency role of the U.S. dollar and the openness of U.S. capital markets as causing the dollar to be overvalued, thereby lowering the cost of imports to American consumers and raising the cost of U.S. exports to foreign buyers. In his view, it is unfair for U.S. exports to be subjected to value-added taxes when imported by other countries when those products have already been subjected to U.S. corporate income taxation. Similarly, he sees the rebate of value-added taxes on other countries' exports as an unfair trade practice, subsidisation of their exports (Lighthizer, 2023).

With this background and philosophy, when Trump became President of the United States in 2017 and again in 2025, his anti-globalisation approach to international economic policy can be described as aggressive nationalist, unilateral, and transactional: "America First." His stated policy priorities are to bring manufacturing jobs back to the United States and to eliminate the balance of trade deficit; import tariffs are his chosen policy instrument. He even refers to himself as "Tariff Man." (Swanson, 2025).

This paper draws implications of Trump's re-election for the U.S. agri-food sector and in turn international agri-food trade. It begins with a historical perspective on U.S. agri-food trade and its role in world markets. It then turns to a review of Trump policies during his first term as President, 2017-21, and the significant market losses American farmers suffered during his first term. Despite these losses, farmers were an important constituency in re-electing Donald Trump President in 2024. The next section discusses American farmer attitudes and the sources of their continuing support for Trump in the 2024 election. This is followed by a critical review of what Donald Trump fails to recognise (or chooses to ignore) about international economics and the agri-food sector. The paper then reviews Trump's policy announcements in the first five months back in office and draws inferences for American agriculture and the global agri-food sector in an environment that might best be described as navigating uncertainty.

Historical Perspective on U.S. Agri-food Trade

Exports have played an important role in American agriculture since its colonial times. In 2024, the United States exported $170.5 billion worth of agricultural products, which generated over 20 percent of U.S. farm sales revenue and represented about 13 percent of world agricultural exports. In 2024, the United States imported about $204 billion of agricultural products (ERS, 2025).

The United States is endowed with a significant comparative advantage in temperate zone agricultural production with large expanses of deep black fertile soil, abundant rainfall and a large fluvial system that provides low-cost river transport to the coast. The Mediterranean climate on the West Coast is also a uniquely productive agricultural resource. Large, sustained public and private investments in agricultural research have provided rapid growth in total factor productivity for over a century, making American agriculture some of the most productive in the world (Ball *et al.*, 2016).

U.S. agriculture thrived during World War I with large exports to feed Europe, and the period, 1910-14, became known as the "Golden Age" of American agriculture. However, with the recovery of European agriculture after the war, farm product exports collapsed. American agriculture went into depression in 1921, while the rest of the economy boomed for another eight years before entering the Great Depression.

With President Franklin D. Roosevelt's Depression era social welfare policies ("the New Deal"), the Federal Government came to farmers' aid with the Agricultural Adjustment Act of 1933 which guaranteed them a minimum price for their commodities. Under this new authorisation, the U.S. Department of Agriculture (USDA), through its Commodity Credit Corporation (CCC), was authorised by Congress to purchase and store any quantity offered of the supported commodities at guaranteed prices. The purchased commodities were to be held off the market until such time as the market price rose above the support level. Section 22 of the Act authorised restrictions on imports of the supported commodities since the support prices exceeded world market prices (Bowers *et al.*, 1984).

Thus began an era when American agriculture was generally absent from world agricultural trade. Stocks accumulated by the USDA CCC through its price support purchases became burdensome as market prices rarely rose to the politically determined support prices. Over time various devices were implemented to limit farmers' production of the supported commodities through quotas or payments to idle farmland. In 1954, the "Food for Peace" programme was developed nominally to provide food aid to starving people around the world, but in reality, its purpose was inventory disposal.

American farmers became comfortable with their government support payments operating behind protectionist import barriers. In 1944, when the Bretton Woods Conference proposed the creation of an International Trade Organization (ITO) at the same time as the World Bank and the International Monetary Fund, aggressive opposition from American farm organisations was a major influence on the U.S. Congress' refusal to ratify the ITO. So strong was farmers' opposition that President Harry Truman declined to submit the General Agreement on Tariffs and Trade (GATT) to the Congress for ratification, but instead, signed it on his own executive authority (Irwin, 2017).

Commercial exports of U.S. agricultural products resumed only after two U.S. dollar devaluations in the early 1970s and a policy change in the Soviet Union reopened its agricultural imports. U.S. agricultural exports boomed through the 1970s, but collapsed after 1981, when the U.S. dollar surged in value. The minimum support prices that Congress had legislated in nominal dollars in 1981, when converted to foreign currencies, exceeded the 1982 world market prices. Government-owned inventories of grain acquired through price support operations exploded as U.S. farmers delivered their grain to the CCC instead of the export market. This experience made it obvious that a country could not be both a large exporting country and have full freedom of action in its domestic policy formulation (Thompson, 2005). This realisation led the United States both to move its domestic farm policy in a more market-oriented direction and to take leadership in the Uruguay Round of GATT negotiations to bring all countries' trade-distorting agricultural supports under some discipline.

In the mid-1980s the U.S. and the EU, both burdened with inventories of agricultural commodities accumulated as a result of their respective price support operations, engaged in competitive export subsidisation to get rid of those stocks. Both eventually concluded there had to be a better way. The Uruguay Round Agreement on Agriculture capped each member country's trade distorting agricultural support, banned agricultural export subsidies, and encouraged countries to replace non-tariff barriers to agricultural imports with tariffs. Countries also agreed to reduce their agricultural supports and import protection over time and to resume negotiations within five years to reduce them further. The

Uruguay Round Agreement, which also created the World Trade Organization (WTO), came into force on 1 January 1995. With the resulting liberalisation, global agricultural trade expanded rapidly. The U.S. soybean, maize, wheat and meat sectors all benefited from the larger exports that resulted (Thompson, 1987; Fuglie *et al.*, 2024).

In 1987, the first U.S.-Canada Free Trade Agreement was negotiated, and in 1994 the North American Free Trade Agreement (NAFTA) which added Mexico came into effect. These agreements enabled significant integration of the U.S., Canadian and Mexican agri-food markets and supply chains. U.S. agricultural exports to Canada and Mexico grew five-fold by 2020, and Canada and Mexico became the second and third largest markets for U.S. agriculture (after Japan) (Zahniser, 2015).

During this period U.S. agricultural policy underwent significant reform consistent with the Uruguay Round Agreement, culminating in the Federal Agricultural Improvement and Reform Act of 1996 (the so-called "Freedom to Farm" Act) which terminated U.S. agricultural supports linked to the volume and/or market price of the supported commodities. In their place, it provided annually decreasing "transition payments" to move American farmers from government supports to a free market. U.S. agri-food exports at this time were about $20 billion per year of bulk commodities, mostly grains, oilseeds and cotton, and $40 billion per year of higher value products like dairy, meats, fruits and vegetables (Glauber and Smith, 2021; OECD,2024).

During this period of rapid globalisation, the character of U.S. agri-food exports changed, and global agri-food value chains became increasingly integrated. The share of high value products, including processed products, grew rapidly relative to bulk commodities, which had historically dominated U.S. agri-food exports (ERS, 2025). In 2014 the U.S. exported $103 billion of high value agri-food products and $52 billion of bulk agricultural commodities. The agri-food sectors of Mexico and Canada, the United States' second and third largest agri-food export markets, became tightly integrated with the U.S. markets with back-and-forth movements of commodities like beef in their production cycles. After it joined WTO in 2001, China became an important and rapidly growing market for American agricultural exports, predominantly bulk commodities, led by soybeans. By 2012 China was the largest export market for U.S. farmers, reaching almost $30 billion per year (Hansen *et al*, 2017; Beckman *et al*, 2017).

The Doha Round of international trade negotiations was launched in November 2001; however, enthusiasm for further multilateral liberalisation had waned. Between 2001 and 2012, the United States negotiated 11 bilateral trade agreements, but mostly with small countries. There was widespread public perception that manufacturing jobs were being lost to China, Mexico and other low wage countries. The United States had a Trade Adjustment Assistance (TAA) Program to help transition workers and communities hurt by job losses; however, it was never adequately funded or seriously implemented. There was much less acknowledgement that jobs were being created in the industries enjoying greater export success (Thompson, 2005).

Anti-globalisation movements became more active after the 2008-09 global financial crisis. Populist rhetoric in several countries, including the United States, began to question immigration, globalism, and multilateralism. U.S. agricultural policy after 2002 shifted from decoupled (non-trade distorting) income supports to price- and revenue-based countercyclical subsidies, heavily subsidised agricultural insurance, and conservation programmes (Glauber *et al.*, 2021).

With little progress occurring in the Doha Round of multilateral trade negotiations, New Zealand, Chile, Singapore and Brunei formed a free trade group in 2005. Eight more countries, the U.S., Canada, Mexico, Australia, Japan, Peru, Malaysia and Vietnam, negotiated to join the group in what was to be called the Trans-Pacific Partnership (TPP). In the agri-food space the parties agreed to reduce agricultural tariffs, adjust tariff rate quotas and reduce non-tariff barriers to agricultural imports. The U.S. beef, pork, fruit and vegetable sectors were particularly enthusiastic about the increased export prospects that they saw the TPP opening up in the Pacific Rim, particularly in rapidly growing developing countries. The United States Government also saw the TPP as a means of competing with China's growing geopolitical influence in Pacific Rim countries (Schott, 2018).

The final TPP agreement was reached in October 2015, and other countries began ratifying it. Whatever enthusiasm there was for the TPP in the United States waned after the Presidential election campaign of 2016 got underway. The United States Congress had not yet ratified the TPP Agreement when Donald Trump was elected President of the United States in November 2016.

Trump's First Term as President (2017-2021)

Donald Trump came into office in January 2017 with an "America First" agenda, committed to bringing manufacturing jobs back to the U.S., to ending what he perceived as unfair trade practices against the U.S., and to reducing the U.S. trade deficit. In 2016, the United States' balance of trade deficit was $502 billion, of which $347 billion was on bilateral trade with China (BEA, 2025). Trump viewed bilateral trade deficits as *prima facie* evidence of unfair treatment of the United States in the world trading system. He argued that multilateral trade agreements unfairly constrained the United States' commercial freedom (Lighthizer, 2023). His distaste for multilateralism was further reflected in his withdrawing the United States from the Paris Climate Agreement as one of his first acts in office.

Soon after his inauguration Trump withdrew the United States from the Trans-Pacific Partnership and demanded renegotiation of the North American Free Trade Agreement. He argued that NAFTA and other trade agreements had cost the U.S. jobs and contributed to growing trade deficits. Mexico and Canada, under threats from Trump to raise tariffs on automobile imports, acquiesced in Trump's demand to renegotiate NAFTA, and, in 2018, a new United States-Mexico-Canada

Agreement (USMCA) was signed. It went into force in mid-2020. The new agreement resembled the NAFTA agreement closely, but with greater protection to the U.S. automobile industry and somewhat stricter labour standards and dispute settlement mechanisms. With respect to the agri-food sector the USMCA modestly increased U.S. dairy access to Canada and addressed several U.S. concerns about biotechnology and sanitary and phytosanitary standards (Schott, 2018).

In December 2018 the other 11 countries which had been party to the TPP negotiations proceeded to implement the agreement without the United States. It was renamed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). Left outside, American exporters had less favourable access to those markets than exporters in the 11 member countries now enjoyed. The fact that China accounted for 69 percent of the United States' 2016 trade deficit attracted Trump's intense scrutiny. Accusing China of unfair trade practices, intellectual property theft and forced technology transfers, Trump unilaterally imposed tariffs on over $250 billion worth of Chinese goods, including consumer electronics, furniture, clothing, machinery and some agri-food items in 2018. He claimed legal authority for these tariffs under Section 301 of the Trade Act of 1974 which allows the U.S. unilaterally to impose trade sanctions if another country violates trade agreements or engages in discriminatory practices (Brown and Kolb, 2018).

China responded with retaliatory tariffs of 25-70 percent on about $110 billion of U.S. exports of predominantly agri-food products, including soybeans, pork, maize, wheat, dairy, almonds, apples, wine and whiskey, as well as automobiles and machinery. China was strategic in retaliating against products produced primarily in states which had strongly supported Trump in the 2016 election. In 2017 China bought $24 billion worth of U.S. agricultural exports; this dropped to $9 billion in 2018. China, which had bought 60 percent of U.S. soybean exports in 2016, bought 75 percent less in the following year and turned to Brazil to supply most of the rest of its soybean imports (Brown and Kolb, 2018). A tit-for-tat trade war between the U.S. and China ensued with retaliation and counterretaliation. U.S. tariffs eventually covered over $360 billion of imports from China. Losing their largest customer, American farmers suffered severe financial losses from the resulting depressed markets for their products (CRS, 2025).

Drawing upon the discretionary authority granted to the Secretary of Agriculture in the Commodity Credit Corporation Charter Act of 1948 "to stabilize, support and protect farm income and prices," the USDA provided $28 billion of compensation to farmers in 2018 and 2019 (the "Market Facilitation Program") to offset their losses. The trade war ultimately ended with negotiation of the "Phase One Agreement," signed in January 2020. China agreed to buy $40 billion of U.S. agricultural products in each of the next two years. In this agreement, some tariffs were reduced, but many were left in place. While China's purchases of U.S. agri-foods recovered somewhat, with the onset of the COVID pandemic, the agreed upon volume of purchases was not fulfilled, global supply chains were restructured, and diversion of trade away from the United States continued.

Trump unilaterally imposed tariffs across many sectors of the American economy, some of which had indirect impacts on the agri-food sector. Section 232 of the Trade Expansion Act of 1962 grants the President authority to impose tariffs to protect industries "essential to national security." Using this authority in March 2018 he unilaterally imposed tariffs of 25 and 10 percent on imports of steel and aluminium, respectively. He threatened to use it also to levy tariffs on imports of automobiles and uranium. The U.S. prices of steel and aluminium rose, raising the cost of production of all machinery and equipment containing these metals, including farm machinery and transport equipment.

Exports from the U.S. agri-food sector suffered from other countries' retaliation to the steel and aluminium tariffs. The EU retaliated by raising tariffs on Bourbon whiskey, peanut butter, cranberries, and orange juice; Canada, against ketchup, yogurt, orange juice and maple syrup; and Mexico, against cheese, pork, apples, whiskey and various food manufacturers. Trump also used the threat of unilaterally imposing tariffs as a bargaining chip to gain greater import access into several countries, including dairy into Canada, rice into Japan, beef into Brazil, and poultry into China. His tariffs threats did not succeed in gaining greater access to the European Union market for U.S. agri-food products.

Trump's willingness to ignore U.S. obligations under the GATT and NAFTA trade agreements undermined trust in the United States. As a member of the WTO, the United States was obliged to honour the bindings on each tariff line agreed to in the last round of GATT negotiations, to extend Most Favoured Nation treatment to all other members, and to pay compensation for unilaterally changing the bound tariff rates. The U.S. had been a primary author of both the General Agreement on Tariffs and Trade and the Uruguay Round Agreement, and these had facilitated expansion of global agri-food trade and supply chains from which American agriculture had benefitted greatly.

An important product of the Uruguay Round was creation of an iron-clad WTO dispute settlement capacity, implemented through its Appellate Body, which had the power to levy damage assessments on members found to have violated the rules of trade. Despite the fact that the United States had won more cases than it had lost in the Appellate Body, in 2021 Trump refused to confirm new judges to replace those whose terms were expiring. Without enough judges, the Appellate Body ceased to function in December 2021. This situation continues today (Irwin, 2017).

During the Trump Administration farmers benefitted from reductions in personal and corporate income tax rates in the 2017 Tax Cuts and Jobs Act. Many farmers appreciated his executive orders that weakened environmental regulations, particularly those relating to protection of wetlands and endangered species. By the end of Trump's term in office the U.S. trade deficit with China had declined, but the deficit in the overall U.S. balance of goods trade had grown by 21 percent to $916 billion relative to the year before he became President. It is impossible to delineate the economic effects of Trump's tariff policy and whether they contributed much to increasing U.S. manufacturing production and jobs during his four years in office, as they

are confounded with the effects of the COVID pandemic which shut down the economy in March 2020.

While the Trump tariffs were a significant shock to the rules-based international trading system and to global agri-food supply chains and to U.S. market share, American farmers' incomes were substantially protected by $28 billion from the Market Facilitation Program and another $14 billion from COVID recovery assistance grants. By 2020 over 40 percent of U.S. net farm income came from government payments (Glauber, 2025a; CRS, 2025).

U.S. agricultural exports resumed their growth during the Biden Administration (2021-25), reaching their all-time record in 2022. During this period the fraction of high-value products grew further relative to traditional bulk commodities, and U.S. agri-food exports penetrated a more diverse array of country markets. The market share destined for China failed to recover as China diversified its countries of origin, particularly to Brazil and Argentina. Brazil supplanted the United States as the world's largest soybean exporter and also became an important supplier of maize to the world market. Biden kept most of the Trump tariffs in effect through his presidency and generally reinstated the environmental regulations which Trump had weakened.

Farmer Attitudes towards Trump

Despite the uncertainty and loss of credibility as reliable export suppliers during the Trump Administration, American farmers turned out in large numbers to vote to re-elect Donald Trump in November 2024. They had been compensated well for their financial losses during the trade wars of 2017-20 and generally opposed many of the Democratic Party's initiatives during the Biden years. The Biden Administration had rejoined the Global Climate Agreement and was pushing for zero-net emissions from agriculture.

Using what many farmers perceived as flawed scientific arguments, the Biden Administration tightened restrictions on pesticide and fertiliser application, wetlands use, and large-scale livestock and poultry production. Modern American agriculture sees itself as having the highest productivity, most efficient food and fibre production system in the world, and many farmers perceived the Administration as favouring a return smaller-scale, less efficient, production of food and fibre. Many livestock producers objected to what they saw as Federal encouragement to reduce meat consumption and replace it with plant-based sources of protein. The Democratic Party was seen as advocating stricter gun control, which many farmers oppose. Many farmers became culturally alienated as they saw "woke" cultural themes like gender identity and pronoun use as inconsistent with their traditional rural values. During the 2024 Presidential election campaign Trump successfully portrayed Democrats as hostile to rural values and modern farming practices, and farmers overwhelmingly voted for him (Iowa State University, 2019).

In the U.S. federal fiscal year that ended 30 September 2024, the Federal Government budget deficit was $1.83 trillion. The deficit in the balance of trade in goods totalled $1.2 trillion, with trade with China and Mexico accounting for about half of the total deficit (BEA, 2025). During his election campaign Trump ran on a populist agenda of creating jobs for Americans by deporting undocumented workers and bringing manufacturing jobs back by increasing tariffs on imported goods. He argued that the tariffs would generate so much revenue that the Federal budget deficit and income taxes could both be reduced. Furthermore, he argued that the burden of paying the tariffs would fall on the foreign suppliers of the imports.

The Second Trump Administration (2025-29)

When Trump took office as President of the United States in 2017, he was inexperienced in politics, coming from a background as a New York City real estate developer and reality television personality. When he returned to office on 20 January 2025, he had a better understanding of how the Federal Government works, and he immediately started implementing his populist agenda through Executive Orders. Consistent with the opposition to multilateralism that he exhibited through his first term, Trump promptly withdrew the United States from the Paris Climate Agreement, the World Health Organization, and the United Nations Human Rights Council. Trump has even threatened to withdraw the United States from the WTO.

At the same time, he empowered a new "Department of Government Efficiency" ("DOGE") with the announced objective of reducing the Federal budget deficit by slashing Federal Government expenditures and downsizing the U.S. Government bureaucracy. Many Federal employees accepted early retirement buyout offers, and thousands more were summarily terminated, including many career professionals engaged in functions like food safety inspection, administration of agricultural support programmes, and even tax collecting. Several Federal agencies were completely extinguished, including the U.S. Agency for International Development (USAID), the principal implementing agency for U.S. foreign aid, among whose responsibilities was providing food aid to poor people in low-income countries. Many Federal grants to support research at universities and other institutions, including agricultural research, were terminated.

In his first days back in office Trump also launched an aggressive effort to round up and deport as many undocumented workers from the United States as could be found. This is creating a large potential problem for American farmers, as an estimated 42-50 percent of the U.S. farm labour force is undocumented. Farmers and the meat sector may be challenged to sustain their volume of production in labour intensive sectors like dairy, fruit, and vegetable production and livestock and poultry slaughtering, unless they can further mechanise and automate their operations.

A second objective announced during Trump's first week back in office was to close down the flow of undocumented immigrants and of illicit drugs, particularly fentanyl, into the United States. China is a primary source of fentanyl and the

raw materials from which to make it, and Mexico has been a primary conduit into the U.S. Some also cross into the U.S. from Canada.

On 1 February 2025, Trump invoked the authority granted to the President in the International Emergency Economic Powers Act of 1977 (IEEPA) "to regulate international commerce after declaring a national emergency in response to any unusual and extraordinary threat to the United States which has its source in whole or substantial part outside the United States." Using this never-before-used authority, Trump declared that the flows of fentanyl and undocumented immigrants into the United States were a national emergency. He announced 25 percent tariffs on all imports from Mexico and Canada and a 10 percentage point increase in tariffs on Chinese goods and said these tariffs would remain in force until the flow of fentanyl and illegal immigrants into the United States stopped.

Canada immediately announced it would retaliate by imposing 25 percent tariffs on its imports of American-made goods. Mexico announced it was considering retaliation. Two days later, after receiving commitments of best efforts from both Mexico and Canada to stop the flows of drugs and undocumented immigrants, Trump delayed implementation of the tariffs on those countries until March. The tariffs went into effect on Chinese goods, and China retaliated with 10-15 percent tariffs on American farm machinery and natural gas and suspended the import licenses of three firms that import soybeans from the U.S. Trump added another 10 percent to the U.S. tariffs on imports from China, in response to which China placed 10-15 percent import tariffs on chicken, cotton, wheat, maize, soybeans and pork from the U.S. (Brown, 2025).

On 4 March Trump ended the 30-day pause on Canada and Mexico and announced a 10 percent increase in tariffs on Canadian oil and energy products, a 25 percent tariff on the rest of imports from Canada and on all imports from Mexico, and a 10 percent additional tariff on Chinese goods. Canada announced it would reciprocate with 25 percent tariffs on U.S. goods. Trump then backed off, announcing that the 25 percent tariffs would apply only to USMCA non-compliant goods, and the rest of USMCA trade would be free of tariffs. Canada agreed to the same conditions. Out of deference to American farmers, Trump reduced the tariff on USMCA non-compliant potash fertiliser from Canada to 10 percent.

On 12 March 2025, Trump imposed 25 percent tariffs on steel, aluminium and derivative products from all origins citing Section 232 authority. He added automobiles to the list on 26 March. Commission President von der Leyen announced that the E.U. would retaliate against $28 billion worth of imports from the U.S., the same value as the EU's sales of steel and aluminium to the U.S., with agri-food goods expected to bear the brunt. Trump never followed through on his threat. The EU's retaliation list included, e.g. fruits, vegetables, meat, alcoholic beverages, and Harley Davidson motorcycles.

When Trump returned to the Presidency, the overall U.S. goods trade deficit was even larger than when he took office eight years previously. On 2 April, dubbed "Liberation Day" by President Trump, he declared the United States international goods trade deficit to be a national emergency and under authority granted to the President by the IEEPA announced a blanket tariff of 10 percent to be levied of all goods entering the U.S. from most countries starting 5 April. (White House, 2025). To this, he added for 180 individual countries and territories what he called "reciprocal" tariffs "to correct for currency manipulation and trade barriers," to be implemented on 9 April. (The only countries excluded from the "reciprocal tariff" list were Canada and Mexico, which had already been addressed, and Russia, North Korea, Belarus, and Cuba) (Glauber, 2025b, Glauber et al, 2025).

Trump asserted that the existence of an imbalance in bilateral goods trade was *prima facie* evidence of unfair trade practices. In calling the measures "reciprocal," Trump said without citing evidence that they were intended to mirror and offset the trade barriers that each country must be using to cause the bilateral trade deficit.

Each country's "reciprocal tariff" rate was calculated as one-half of the balance of goods trade with that country divided by the value of U.S. goods imports from that country. This resulted in many very high "reciprocal tariff" rates. To illustrate, the announced rates for Vietnam, China, India and the EU were respectively 46, 34, 26 and 20 percent. The higher the bilateral trade deficit with a country, the higher its "reciprocal tariff" rate was set.

The media characterised these tariffs as the most protectionist trade action by the United States since the infamous Smoot-Hawley Tariff Act of 1930. In response to Trump's "Liberation Day" announcement global stock markets crashed, and enough foreign holdings of U.S. Government debt were dumped on the U.S. bond market to drive down bond prices and raise interest rates. Trump retreated within a few days and announced that, except for China, the "reciprocal tariffs" would be "paused" for 90 days during which the affected countries could bring bilateral proposals for how they would increase access to their markets for U.S. goods. The 10 percent across the board tariffs would stay in effect.

On 4 April, China announced a retaliatory tariff of 34 percent on imports of all U.S. products, matching Trump's "reciprocal" tariff on Chinese goods. China banned the export to the U.S. of rare earth minerals. After a series of tit-for-tat retaliations and counterretaliations, on 6 May, the U.S. tariff on Chinese goods had reached 145 percent, and the Chinese tariff on American goods, 125 percent – clearly prohibitive levels. On 12 May, China and the U.S. agreed to roll back most of the tariffs to 10 and 30 percent, respectively, and declared a 90-day ceasefire in their tariff war.

The EU published a list of imports from the U.S. on which it would levy retaliatory tariffs, but paused implementation for 90 days pending negotiations with the U.S., and the U.S. and UK announced a framework arrangement for a trade deal. In mid-April Trump imposed port fees on foreign flag vessels carrying imports to the U.S.

Numerous court cases were filed challenging the Trump tariffs, and numerous industries lobbied for exemptions from the tariffs. In mid-April the U.S. automobile industry, which is very tightly integrated with factories in Canada and Mexico, was granted tariff reductions on autos and auto parts.

On 28 May, the United States Court of International Trade found the tariffs Trump imposed under the IEEPA on

imports from Canada, Mexico and China to address fentanyl and border security and from the world to address goods trade deficits went beyond the authority granted by the IEEPA and ordered their removal. The Trump Administration immediately appealed this ruling, and the court allowed the tariffs to stay in force while the appeal is being considered. This ruling has no effect on the tariffs Trump imposed under authority of Sections 232 and 301, only those under IEEPA. In mid-April the Trump Administration announced it would withdraw from a 2019 agreement that suspended an antidumping investigation into fresh tomato imports from Mexico. As a result, most tomato imports from Mexico will now be subject to a tariff of almost 17 percent.

On 4 June, Trump raised the tariff on imports of steel and aluminium and derivative products containing them to 50 percent (exempting the U.K. from the increase due to the framework agreement). On 3 July the Congress passed authorising legislation for Trump's entire policy agenda in one "One Big Beautiful Bill" Act. In it the Congress extend the personal income tax cuts made during his previous Administration which would otherwise have snapped back at the end of 2025 to their higher former rates. This legislation also includes subsidies to physical investment in factories and equipment by allowing investors to "write off" an entire capital investment against their income tax obligations in the year the investment is made rather than having to wait and claim only the annual depreciation spread against business income earned over the life of the asset. This provision also applies to farmers.

The authorising legislation for current agricultural support programmes, the Agricultural Improvement Act of 2018, expired on 30 September 2023, and since then it has been extended only one year at a time. The "One Big Beautiful Bill" Act extends the authorisation for farm support programmes (but not everything in the 2018 Act) five more years and adds an additional budget authorisation of $65.6 billion over the next 10 years for agricultural commodity support programmes. It raises the reference prices for supported commodities 11-20 percent, increases subsidies to crop insurance, and allows farmers to add up to 11.8 million more hectares to the area of crop land on which they can receive agricultural subsidies. The legislation also reduces food assistance to low-income Americans. The Congressional Budget Office has estimated that this overall package of tax reductions and spending increases will increase the annual Federal budget deficit, cumulatively adding $3.4 trillion to the Federal Government debt plus interest over the next decade.

Several Things that Trump Appears Not to Understand (or Chooses to Ignore)

Donald Trump is not consistent in his reasons for imposing higher tariffs. He frequently asserts that tariffs will bring in a big increase in tax revenue which would allow reduction in personal income taxes. On the other hand, when he announced the "reciprocal tariffs," he invited all countries to come and negotiate reductions in exchange for greater market access for American goods to their markets. These are mutually exclusive objectives. Perhaps his tariff announcements are merely negotiating ploys.

Trump's approach to economic policy flies in the face of more than a century of developments in international economics. Bilateral balance of goods trade is a meaningless concept. It makes no more sense for every pair of countries to have balanced goods trade between themselves than it does for a household to have balanced trade with its grocer, its barber, its automobile mechanic, and every other firm with which it does business. What matters is whether the household is living within its means, and, if it is borrowing to consume more than it is earning, that it will have the capacity to repay the cumulated debt in the future. Trump's fixation on eliminating every bilateral trade deficit is neither sensible nor achievable.

Trump's fixation with the balance of trade in goods ignores the reality that the United States runs a balance of trade surplus in services. In 2024, the U.S. deficit in goods trade was $1.2 trillion, one quarter of which was offset by a $0.3 trillion surplus on trade in services, leaving a net deficit on trade in goods and services of $0.92 trillion (BEA, 2025).

Donald Trump often claims that it is the foreign exporters who will pay the tariffs he levies on imports into the United States. This is a standard incidence of a tax question. The incidence of a tax is borne by buyers and sellers in inverse proportion to their relative elasticities of supply and demand. The proportion of an import tariff borne by American buyers is the ratio of the elasticity of their excess demand relative to the elasticity of excess supply of the rest of the world. Only in the small country case (price taker) in which U.S. buyers would confront an infinitely elastic excess supply would 100 percent of the tax be paid by the U.S. buyers. On the other hand, for Trump to assert that 100 percent of the tariffs would be paid by foreign sellers would require zero elasticity of import demand by Americans, an equally improbable case.

The preponderance of estimates of the elasticity of supply from the rest of the world to the U.S. are highly elastic relative to the U.S. demand elasticity for those imports. This means that most of the incidence of the tariffs resides on U.S. buyers. How much of that tax is then passed through from the importing firm to the final consumer or absorbed in lower profits will reflect competitive conditions in the retail sector. In general, we can expect a higher cost of living in the United States to result when the higher import tariffs are levied (Olarreaga and Santander, 2025).

Donald Trump's infatuation with bringing back manufacturing jobs, particularly to the old northern industrial heartland, flies in the face of the structural transformation that an economy normally undergoes in the course of its economic development. Starting with the bulk of the labour force employed in agriculture, economies go through an evolution as higher productivity in agriculture allows the higher wages in manufacturing to pull unskilled labour out of agriculture. As labour productivity and wages rise in manufacturing, low skilled jobs tend to move offshore to lower wage countries and workers move into service sector jobs. Those remaining in high-wage manufacturing must have high levels of technical expertise.

Today in the United States only 1.5 percent of the workforce is employed on farms, and only 8.4 percent in manufacturing. Over 90 percent of the workforce is employed in services (for reference, non-farm agri-food employment – in both food manufacturing and food service jobs – is about 10.4 percent of the workforce) (USDA ERS, 2024; BLS, 2024).

If Trump raises prices of manufactured goods in the United States by providing tariff protection against imports, some growth in manufacturing output may occur, but little growth in manufacturing jobs can be expected. With the increased automation and use of robots in modern manufacturing, any return of manufacturing will be highly mechanised with any growth in employment requiring workers with high technical skills (Baldwin, 2025).

Trump also exaggerates the loss of manufacturing jobs to China and Mexico from the hollowing out of the old northern manufacturing belt. In 1970 that region had nearly half of all manufacturing employment in the United States, and Southern states had less than one-quarter. Today the proportions are flipped. The South has more than half of U.S. manufacturing jobs, including many in automobile manufacturing. A significant number of the "lost jobs" did not move offshore; they moved south within the United States (Ohanian, 2014).

When he announced his across-the-board import tariffs, Trump's call for American farmers "to get ready to start making a lot of agricultural products to be sold INSIDE of the United States" (his emphasis) demonstrated a lack of understanding of the U.S. agri-food sector and of the gains from trade. Perhaps reflecting his experience as a New York City real estate magnate, Donald Trump seems to view every transaction as a zero-sum game in which, if one party to a transaction gains, the other must lose.

Trump demonstrates no comprehension of the potential for gains from trade among countries with different factor endowments or stages of economic development. For example, he ignores that fact that the U.S. can gain by taking advantage of the fact that its Midwest is endowed with well-watered fertile soils capable of producing vastly larger quantities of temperate zone crops than American consumers want to buy. The country gains when the excess is sold abroad in exchange for goods in which other countries have a comparative advantage and lower relative production cost such as tropical fruits and beverage crops that U.S. does not have climatic conditions to grow or out-of-season fruits and vegetables (Thompson, 2007).

United States Agri-food Trade Before Trump's 2025 Tariffs1

In 2024 the United States imported $204 billion worth of agri-food products, representing about 15 percent of all food consumed in the United States. The largest food import category in 2024 was seafood ($21.5 billion), which accounted for 80 percent of U.S. seafood consumption. The second largest category of U.S. food imports was baked goods, pasta and cereals ($14.9 billion). The U.S. imported $13.4 billion each of fresh fruits and fresh vegetables and another $13.4 billion worth of processed fruits and vegetables. This represented 20-30 percent of consumption of each category. Wine, beer and spirits imports totalled $12 billion (35 percent of U.S. consumption).

The U.S. imported $12.6 billion of vegetable oils (20-25 percent of consumption) and $11.7 billion worth of beef and beef products (10-15 percent of consumption). The largest U.S. agri-food imports as a percent of consumption (98 percent) were coffee ($6.6 billion) and chocolate and cocoa products ($4.8 billion). Sugar and sweetener imports, which totalled $5.4 billion, represented 15-20 percent of U.S. consumption. The U.S. also imported $5.4 billion of dairy products and $1.7 billion of pork and pork products (Glauber *et al*, 2025).

In terms of world market shares imported by the U.S., seafood, at 15 percent, is the only category that exceeds 10 percent. The U.S. imports about 10 percent of world exports of coffee, sugars and sweeteners, and vegetable oils, and 7-9 percent of the beef and beef products traded. All other categories are in the four to six percent range. The price depressing impact of U.S. import tariffs can be expected to be proportionately higher, the larger the U.S. share in world trade in any given product.

Recognising the political influence of farm organisations in Republican majority states and the role farmers' votes played in re-electing Donald Trump, countries frequently choose for retaliation agri-food products that they buy from the United States. In 2024 the United States exported $170.5 billion worth of agri-food products. More than 20 percent of farm sales revenue is generated by export sales.

The largest U.S. agricultural export is soybeans ($24.6 billion in 2024). This represented 52 percent of U.S. production and made up one-third of the soybeans that moved in world trade. Adding to this $6.4 billion of soybean meal exports (27 percent of production and 16 percent of world exports) illustrates the huge economic importance of soybeans in the U.S. agricultural economy. The second largest agri-food export was maize at $13.9 billion, about 55 percent of production and 40 percent of world exports. The U.S. exported 10-15 percent of its production of fruits and vegetables ($13.5 billion). Beef and beef product exports of $10.5 billion represented 10-15 percent of U.S. production; this made up about 22 percent of world exports of beef and beef products.

The largest U.S. agri-food product export category in terms of fraction of production exported is tree nuts (the largest being almonds, followed by walnuts and pistachios). The $9.8 billion of their exports represented 60 percent of the value of U.S. tree nut production. The U.S. exported $8.6 billion worth of pork and pork products, 20-25 percent of production. U.S. dairy product exports totalled $8.2 billion (5-10 percent of production). Wheat exports of $5.8 billion took 45-50 percent of U.S. production, and poultry meat and product exports of $5.5 billion represented 15-20 percent of production. The

[1] Data cited in this section are drawn from USDA ERS (2025a and 2025b), Plume (2025), Braun (2025), Barron's (2025), FAO (2025), Glauber (2025a) and various industry sources.

world market shares of these other categories were in the three to five percent range. Finally, the diverse categories of food preparations and wine, beer and spirits generated $6.3 billion and $4.1 billion, respectively, of overall agri-food export revenue in 2024.

The significant fractions of U.S. production of tree nuts, soybeans, maize, wheat, pork, poultry and beef illustrate why these commodities are often victims of retaliation against U.S. protectionist measures. They suffered an estimated $24 billion in losses as a result of the tariff war Trump started in his first presidency.

The greatest impacts of the Trump tariffs will be on Mexico and Canada whose agri-food sectors have become tightly integrated with the U.S. agri-food sector since implementation of the NAFTA and USMCA free trade agreements. Mexico supplied 22.2 percent ($47.2 billion) of U.S. agri-food imports and bought 17.2 percent ($30.3 billion) of U.S. agri-foods exports in 2024. Canada supplied 16.4 percent ($35.0 billion) of U.S. agri-food imports and bought 16.1 percent ($28.4 billion) of U.S. agri-foods exports in that year.

China was the third largest U.S. agri-food export destination in 2024, taking 14.0 percent ($24.7 billion) in 2024, followed by the European Union at 7.3 percent ($12.8 billion). Japan and South Korea were the fifth and sixth largest markets ($12.0 billion and $8.5 billion, and 6.8 and 4.8 percent shares, respectively). The remainder of the top 10 U.S. agri-food export markets were medium- to high-income developing countries, Colombia, Taiwan, Philippines and Vietnam, each with $3-5 billion of agri-food imports from the U.S. (each with about a two percent share of U.S. agri-food exports).

The third largest supplier of U.S. agri-food imports was the European Union, with 15.4 percent share ($32.9 billion), followed at a distance by Brazil at 3.1 percent ($6.5 billion). China was the fifth largest agri-food supplier to the U.S. at 2.5 percent ($5.3 billion). The other large agri-food exporters to the U.S. are concentrated in Latin America and the Caribbean, with Chile, the largest, at $4.5 billion, followed by Peru with $3.9 billion. While these exporters' market shares in the U.S. market are small, the volumes often represent very significant shares of those countries' agri-food export sales. Imposition of import tariffs by the U.S. on their export products can be very damaging to both their agri-food sectors and their economies in general. It is the countries whose agri-food sectors are most open (in percent terms) to the world market that can anticipate the most significant shocks from Trump's tariffs.

If, in the final structure of U.S. agri-food tariffs, there is significant difference in the tariff rates applied to a same good coming from different countries (in violation of the Most Favoured Nation principle), as Trump proposed on 2 April, this could significantly alter global agri-food supply chains. Retaliation against U.S. agri-food exports could create greater agri-food export opportunities for other nations, as occurred when Brazil, and to a lesser extent, Argentina, supplanted the United States as the largest supplier of soybeans to China.

The Uncertain Future

The only thing one can say with certainty concerning the global agri-food sector at the time of this writing (early July 2025) is that we will be navigating during the four years of the Trump Administration in a sea of great uncertainty. No one knows at this point what the final tariff rates will be on individual products and countries. The announced tariff rates have changed from day to day and week to week. Negotiations are underway with most trading partners; however, Trump seems committed to the 10 percent across the board tariff that he announced on 2 April being the minimum. For reference, the United States' average import tariff at the beginning of 2025 was 2.4 percent; in early July 2025, the average U.S. import tariff was 17 percent.

Broad framework agreements have been announced with only two countries at the time of this writing.The U.S.-U.K. framework agreement announced on 8 May 2025 sets the U.S. import tariff on nearly all goods imported from the U.K. at 10 percent, and the U.K. will reduce its average tariff on imports of U.S. goods to 1.8 percent. Many details remain to be negotiated. On 2 July 2025, the U.S. and Vietnam announced they had reached a framework agreement. The tariff rate charged on all U.S. imports of all goods produced in Vietnam will be 20 percent, and all U.S. goods will enter Vietnam duty free. The rate will be 40 percent on all goods made in other countries which are trans-shipped through Vietnam. This provision is clearly designed with China in mind.

Trump wants to stimulate investments in manufacturing capacity that will bring production of imported goods back to the United States. However, with the lack of clarity and frequent changes in the announced tariff rates, no investors are going to commit millions or billions of dollars to new investments until they perceive that the announced rates will remain in place unchanged for at least several years to come (Posen, 2025).

The one thing that is certain is that when tariffs are imposed, they will put a wedge between domestic prices and prices received by exporters, raising domestic prices and lowering the prices received by exporters. Less certain is whether and how much the impacted exporting countries choose to retaliate against U.S. agricultural exports.

Even if we knew the final, hopefully stable, structure of Trump tariffs, there are many offsetting and reinforcing general equilibrium forces that will determine the net effects. Perhaps none has greater potential impact than the strength of the U.S. dollar. Will the dollar strengthen or weaken as a result of Trump's tariff action? Conventional analysis generally says that if new tariffs reduce a balance of trade deficit, the country's currency is likely to strengthen. However, there are a number of forces putting downward pressure on the U.S. dollar relative to other currencies, most prominently, the projected addition of $3.4 trillion to the U.S. Federal debt in the next 10 years by Trump's One Big Beautiful Bill Act, a significant share of which will need to be sold to foreign investors.

Americans have traditionally had a low savings rate compared to many countries, only 2 to 4 percent of GDP (Obstfeld, 2025). If this savings behaviour continues, U.S. Federal Government borrowing from abroad must increase. To the extent that investment in manufacturing does increase as Trump wishes, there will have to be even larger borrowing from abroad. The market clearing condition in the foreign exchange market requires that there be a net capital inflow to pay for the sum of a government budget deficit and any shortfall in domestic savings relative to investment expenditures. To generate a net capital inflow there must be a deficit in the balance of trade in goods and services as long as the U.S. dollar is allowed to continue floating. Other things being equal, an increase in the U.S. Government's federal budget deficit requires an increase in the deficit on trade in goods and services. To achieve this, the U.S. dollar must strengthen to reduce the price of imports to U.S. consumers and increase the cost of U.S. goods to foreign buyers.

Trump has threatened several times to replace the Chairman of the Board of Governors of the Federal Reserve Bank with a political appointee. Foreign holders of U.S. government debt, if they begin to doubt the U.S. commitment to macroeconomic stability, may reduce their holdings of that debt, putting downward pressure on the dollar. This will be accentuated if they perceive growing risk that the U.S. central bank, the Federal Reserve, is allowing the inflation rate to increase. To fight inflation, the Fed would need to raise interest rates.

Foreign holders of U.S. Government debt may also demand a higher risk premium to continue to hold U.S. dollar-denominated debt, putting further upward pressure on interest rates. To some extent, this appears to have happened already. The U.S. dollar has dropped over 10 percent since the beginning of 2025. Foreign bond holders clearly demonstrated their concern on 2 April in response to Trump's "reciprocal tariff" announcement. To the extent that the dollar weakens, this will offset part of the protection tariffs were put in place to provide.

A June 2025 Peterson Institute for International Economics working paper by McKibben *et al.* (2025) analysed the likely global economic effects of the announced tariffs as of 10 May 2025 using the G-Cubed computable general equilibrium model. The authors found that "the tariffs significantly reduce US and global economic growth and increase inflation in many countries" and "retaliation by other countries worsens the economic losses and inflation increases." "The tariffs disproportionately hurt the US agriculture and durable goods manufacturing sectors by reducing output and employment and increasing prices." They also simulated a loss in confidence in US macroeconomic management. In that simulation the US dollar weakened further, and longer-term interest rates rose.

There is a very real possibility that the U.S. Federal Reserve will be put in the difficult position of having to deal with increasing inflation simultaneous with a decline in GDP (recession), "stagflation," a situation it has not had to deal with since the 1970s. Some of the announced tariff rates have changed already since the McKibben *et al.* (2025) study was initiated, and Trump has said that the bilateral negotiations underway with many countries could result in lower "reciprocal tariff" rates than those he announced on 2 April. In any case, one should anticipate average U.S. import tariffs to be higher in the future than in recent decades.

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SCIENTIFIC ARTICLE

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Brazilian Agri-Food Trade Amid Geopolitical Turbulence: New Perspectives on Old Challenges

ABSTRACT

This article analyses the evolving role of Brazil in the global agri-food system within the context of rising geopolitical and geoeconomic instability. It explores how Brazil, a leading food producer and exporter, navigates the mounting challenges posed by climate change, shifting trade alliances, protectionist policies, and new sustainability standards, particularly those imposed by key partners. Drawing on statistical data, policy analysis, and a comprehensive literature review, the study develops a critical and exploratory framework to understand the implications of these dynamics for Brazil's agri-industrial sector. The paper traces Brazil's agricultural transformation since the 1970s, driven by technology adoption, productivity gains, and export orientation. Brazil has achieved global competitiveness in agricultural products; however, its trade revenues are still highly concentrated on a restricted set of agricultural products and largely dependent on a few large importing countries, especially China. This dependency raises vulnerability amid global trade tensions and demand shifts. Simultaneously, emerging environmental regulations like the EU's Deforestation Regulation introduce new compliance pressures, prompting the development of compliance and certification mechanisms. Although short-term gains have stemmed from geopolitical shifts such as the US–China trade war, long-term sustainability and market access hinge on Brazil's ability to meet evolving environmental and governance expectations. This paper also highlights Brazil's unique positioning as a "mid-level power" capable of leveraging its resource wealth, agri-food expertise, and diplomatic neutrality to play a pivotal role in a multipolar world. The paper concludes that Brazil's path forward must balance competitiveness with sustainability, deepen public-private institutional collaboration, and strategically diversify trade relations. Robust governance is essential to safeguard Brazil´s agri-food leadership amid intensifying global uncertainty.

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Introduction

Throughout the centuries, the world has experienced cycles of protectionism and trade liberalisation, in which the rise and decline of economies and changes in political landscapes across different countries and regions have continuously reshaped the balance of power and the logic of international markets. With the emergence of a broad global financial market, new and significant variables have entered the economic and political reasoning that underpin trade, foreign investment, and international diplomacy.

Agri-food trade has consistently played a dual role throughout these phases and cycles, both shaping and being shaped by geopolitics. Territory, natural resources, political and military power, international relations, and cultural and ideological factors are foundational elements that, at various times and with differing degrees of relevance, have influenced the patterns of global trade. Cohen (2014) emphasises that ideological, economic, and territorial reconfigurations produce substantial adjustments in trade routes, partners, and networks.

More recently, the intensification of global social and environmental challenges – such as increasing migratory flows from impoverished or conflict-affected regions, as well as heightened concern over the impacts of climate change – has gained significance in the understanding of international relations, configuring a new global geopolitical landscape.

The interdependence among countries – whether in the supply or demand for strategic inputs such as energy, fertilisers, or food – and the diversification of these interdependencies have further contributed to the complexity of external relations and their influence on domestic socioeconomic policies. The deepening of the conflict between Russia and Ukraine, along with growing instability in the Middle East, adds to the mounting effects of climate change, increasing

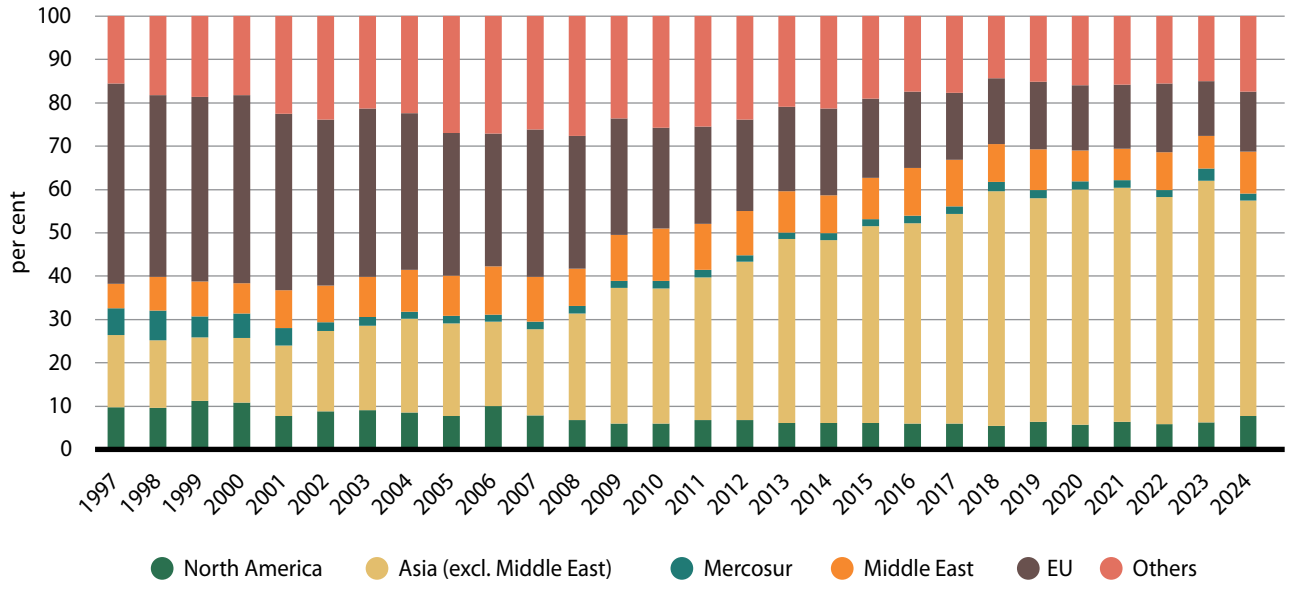

Figure 1: Agri-industrial Brazilian export share in major regions or economic blocs (percentage of total exports in US$ FOB), 1997–2024.

Note: Covers HS codes 01 to 24, including Chapter 03.
Source: Own composition based on ComextStat (2025) data

uncertainty and volatility in global markets, including that of agri-food trade.

In the case of Brazil, due to its historical trajectory as a former European colony, one can assert that until the late 1990s, its political and economic relations were primarily oriented toward Western countries – Europe and North America. However, in recent decades, a new economic and political axis has emerged in Asia, offsetting Western influence and posing new challenges for Brazilian economic diplomacy and foreign policy. The shift in Brazil's primary trade axis from Europe toward Asia is illustrated in Figure 1, which displays the export share of Brazil's agri-industrial products across major economic blocs and destination regions from 1997 to 2024.

Despite trading with a large number of countries, Brazil's export profile remains highly concentrated in a few commercial partners, and in the agricultural sector; this concentration is also evident in a limited number of production chains. Figure 1 underlines that, over time, the European Union (EU) has diminished in relative importance as an importer of Brazilian agri-industrial products, declining from 46.2% in 1997 to 13.8% in 2024. In contrast, during the same period, Asia – mainly China – increased its Brazilian agri-industrial import-share from 16.7% to 49.6%.

This evolution also reflects changes in Brazil's foreign policy, which has gone through various phases, some characterised by closer alignment with the United States, while others, such as during the period of the Independent Foreign Policy (Política Externa Independente, PEI) in the early 1960s, characterised by the pursuit of autonomy from both the United States and the Soviet Union, have promoted exports to all countries, including communist states (Cervo and Bueno, 2008; Vizentini, 2003). Even under the military governments beginning in 1964, the autonomy of the Itamaraty (Brazilian Ministry of Foreign Affairs – MRE) was respected, allowing Brazil to pursue an open foreign policy. This approach, throughout the 1970s and 1980s, became known as the Policy of Responsible and Ecumenic Pragmatism (Pragmatismo Responsável e Ecumênico) and led to strengthened diplomatic and trade relations with Arab and African countries. Notably, in 1974, Brazil also established diplomatic and trade relations with communist China, clearly demonstrating the success of its independent foreign policy and pragmatic diplomacy, known as Universalist diplomacy (Cervo and Bueno, 2008; Vizentini, 2003).

According to Vizentini (2003), the administration of President Fernando Henrique Cardoso (1995–2002) "emptied" the Itamaraty as the main center for foreign policy formulation, transferring economic responsibilities from the MRE to the Ministry of Economy, while its political dimension came to be led by "presidential diplomacy". Actually, since early 1990s, the foreign policy also focused on strengthening integration among South American countries, culminating in the creation of the Southern Common Market (Mercosur). Beyond regional integration, starting with the Itamar Franco government (1992–1994) and extending through to the Dilma Rousseff administration (2011–2016), Brazil adopted external commitments in defense of democracy, social justice, human rights, individual liberties, and development.

In 2001, Goldman Sachs economist Jim O'Neill coined the acronym BRIC in the report Building Better Global Economic BRICs, referring to a group of countries – initially Brazil, Russia, India, and China – which held their first formal meeting in 2006. Today, these four countries play a prominent role in global economic discussions and the group was enlarged, firstly to include South Africa (2010) and, in 2023, with the invitation of other additional six countries. It is also noteworthy that BRICS created, in 2014, the New

Development Bank (NDB) in order to finance infrastructure and sustainable development projects in member states and other emerging economies. The NDB was presented as an alternative to the World Bank and the International Monetary Fund (IMF), two institutions predominantly led by the United States of America (USA) and the European Union.

This growing political and economic alignment among Brazil, India, Russia, and China raises opportunities, but also diplomatic challenges for Brazil's current government: how to maintain a strategy of "good neighbour" diplomacy with all partners amid escalating conflicts that pit traditional Western allies – the United States and the European Union – against new strategic partners – Russia and China. When focusing on the supply of food, technological products, and strategic inputs such as energy, countries from the Southern Cone of South America, India, and Russia also emerge as significant geoeconomic actors. At the same time, a substantial portion of the global population remains marginalised in terms of access to these critical resources.

As one of the world's leading food suppliers, and home to some of the largest reserves of tropical forests and freshwater, Brazil can no longer rely solely on its use of technology and competitive pricing to promote its role in global food markets. In the current context – marked by the urgency of climate change mitigation, the widespread availability of communication technologies that bring consumers closer to the origin of their food, the growing importance of agroecological transitions, and increased consumer awareness of corporate social and environmental responsibility – new demands are being placed on agri-food systems.

Simultaneously, with supply chains increasingly integrated globally and greater attention given to value chains in the food system, Brazilian agribusiness sector and food producers must develop differentiated strategies. While maintaining productivity and competitiveness, Brazil must demonstrate to both domestic and international consumers that it is aligned with the emerging principles of the new food system and actively seeking solutions to the adjustments it requires.

This article, therefore, aims to offer a broad perspective on the challenges that global geopolitical instability in its various dimensions poses for international agri-industrial trade, with a particular focus on Brazil. To that end, it develops an exploratory and critical discussion based on statistical data analysis and a literature review, placing emphasis on developments over the past three decades, future perspectives and potential scenarios.

Brazil's role in the international market and recent movements in domestic policy and external demands

Brazil ranks among the world's top ten exporters of agricultural and food products, according to World Trade Statistics, accounting for 7% of the global flow in 2023. Collectively, the top ten exporters represented 71.3% of total exports in this category (WTO, 2025), as shown in Figure 2. Although some trade analysts criticise Brazil's export profile for relying heavily on primary agricultural commodities, rather than products with higher value added, this performance stems largely from the country's competitive advantage in the production of grains, cereals, and meats. This advantage, in turn, is partially a result of cumulative productivity gains in agriculture sector since the 1970s.

Average agricultural productivity in Brazil has shown a consistent upward trend, despite the wide variation across regions. These gains are driven by the incorporation of new

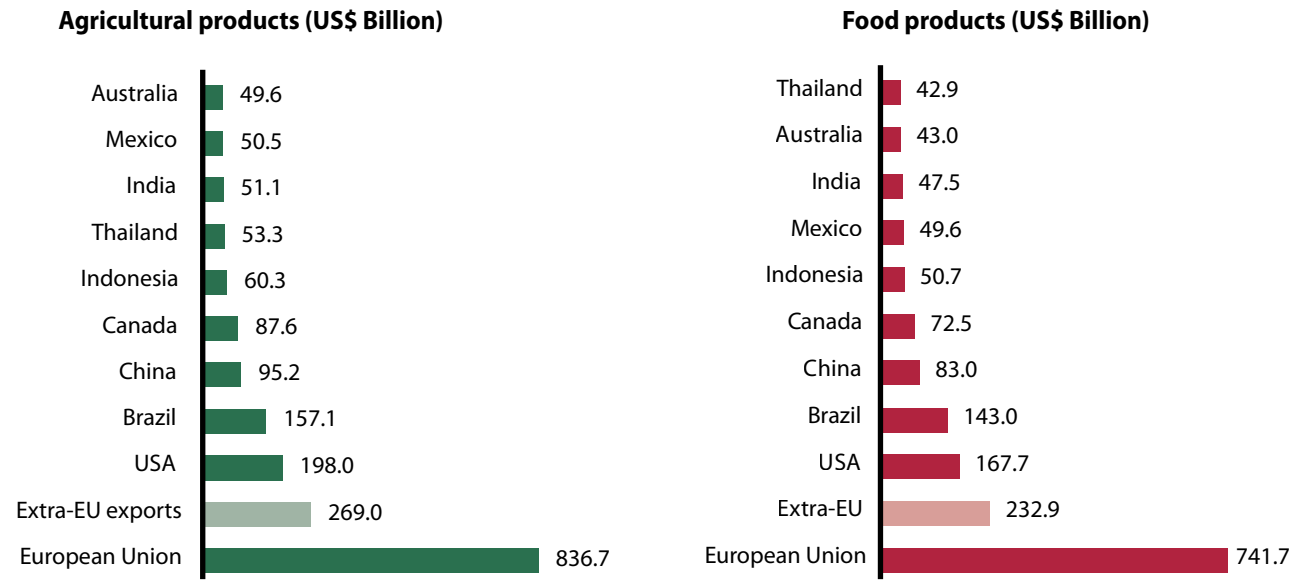

Figure 2: Top 10 exporters of agricultural products and food, 2023 (in US$ billion).
Source: own composition based on WTO (2025) data

technologies, which have enabled more efficient use of economies of scale and contributed to significant reductions in production costs. However, the country's strong agricultural performance has not been solely attributable to increased productivity levels. A substantial share of output growth has also come from the expansion of cultivated land and livestock activities, mainly in the Cerrado region.

Brazilian agribusiness, though considering not only the agriculture commodities and animals, but their products, are widely recognised for their international competitiveness, and underlined by the indices presented in Figure 3. Notably, even amid the appreciation of the Brazilian Real during a long period since 2005 (ICR), the export volumes of agribusiness products have continued on a consistent upward trajectory (IVE-Agro) over since 2000. Figure 3 displays four trade indices calculated by Cepea/USP, which has defined a basket of the major exported agri-industrial products to monitor the volume exported, the exporting price in US$, and the effective real exchange rate for that basket, taking into account the main importers and the exporting price converted to Reais, i.e., the price received by Brazilian exporters in Reais (IPER-Agro).

Over the past 25 years, various State policies – often involving multiple federal agencies and ministries – have aimed to diversify exports, support family farming and small-scale agriculture, and integrate these actors into export chains, including traditional communities. The National School Feeding Program (PNAE) exemplifies this effort by enabling direct sales to municipal and state-run school programmes, offering a short supply chain alternative. Another example is the recent inclusion of certain sociobiodiversity products in the price monitoring list of CONAB, the public agency currently overseen by the Ministry of Agrarian Development.

Successive Brazilian governments have promoted GHG mitigation and adaptation through the Low-Carbon Agriculture Program (Programa ABC) (Gianetti and Ferreira Filho, 2021) support for scientific research, and dissemination of environmentally friendly technologies like biological control. Tools such as biodiversity protection, bans on illegal burning and deforestation, mandatory Rural Environmental Registration (CAR), and enforcement of the Forest Code (Law No. 4,771/1965) – which requires preserving native vegetation on rural properties – have long contributed to more sustainable production systems, despite ongoing enforcement challenges.

Environmental certification initiatives, led by the private sector – including companies, NGOs, and professional associations – have also emerged as some of the most significant instruments in driving this transformation. Recent examples include the certification of soybean and corn producers by the Round Table on Responsible Soy (RTRS). This certification is expected to accelerate the adjustment of productive systems or, alternatively, attest to practices already in place, with the aim of complying with the requirements established by the European Union Deforestation Regulation (EUDR). Another notable example is RenovaBio, established under the National Biofuels Policy (Federal Law No. 13,546/2017), which seeks to promote the expansion of biofuels within Brazil's energy matrix and support the transition to a low-carbon economy, based on the principles outlined in the Paris Agreement (MME, 2023). Under RenovaBio, production processes are certified according to the technological pathways adopted – such as first-generation ethanol, biomethane etc, as described by Pinto and Lima (2023).

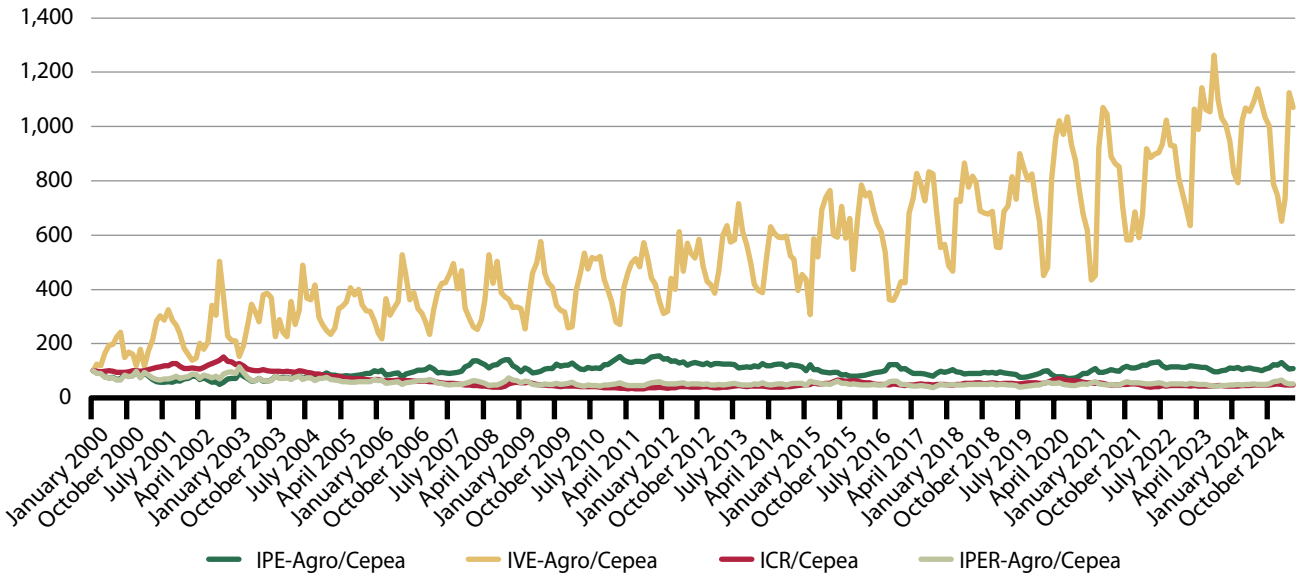

Figure 3: Brazilian Agribusiness Export Indices, Cepea/Esalq-USP. January 2000 to April 2025.

Note: Considers 16 product categories classified as agribusiness items, according to the specific methodology available at: https://www.cepea.org.br/br/metodologia/metodologia-1.aspx.
IPE – Brazilian Agribusiness Export Price Index (prices in US$ FOB);
IVE – Export Quantum Index for Brazilian Agribusiness;
ICR – Real Exchange Rate Index for Brazilian Agribusiness;
IPER – Brazilian Agribusiness Export Price Index in Local Currency (BRL).
Source: own composition based on CEPEA (2025) data

Among the current challenges facing Brazil's food production sector, one of the most pressing is the effective communication of product-related information, compliance with applicable standards and regulations, traceability data, and other elements increasingly demanded by global markets.

To assess the impact of Brazil's environmental image on agri-industrial trade with the EU, Silva (2021) created an explanatory variable using text mining and content analysis of New York Times articles. Incorporated into a gravity model, this variable showed a significant negative effect on trade flows. Similarly, Oliveira (2024) used a gravity model to examine how Brazil's environmental reputation affects its main agri-industrial importers. She developed a reputation index based on text mining and content analysis of tweets from a selection of national and international authorities engaged in sustainability and/or in trade. Although her results were not statistically significant, they also indicated a negative relationship between environmental reputation and Brazil's agri-industrial exports from 2013 to 2022.

The two aforementioned studies reinforce the need for both the public and private sectors in Brazil to invest in transparency tools that ensure information on product quality, sanitary and phytosanitary attributes, origin, traceability, and environmental and social compliance of food production systems, and that make this information readily accessible to importers and end consumers.

Multipolarisation, Geoeconomics, and Environmental Geopolitics: A Challenging Context

According to Imessaoudene (2022), the end of the Cold War in the 1990s marked a shift in which geopolitics – traditionally the main driver of foreign policy and strategy – was replaced by geoeconomics, whereby states utilise economic and policy instruments such as investment rules, commodity restrictions, and financial sanctions to achieve geopolitical objectives and advance national interests.

Brazil has recently experienced a case that clearly falls within this framework. Disagreements over the Brazilian federal government's discourse and policies on environmental issues and deforestation led to the suspension of the Amazon Fund in August 2019. Dialogue on the fund was only resumed following the election of President Lula in November 2022. This context of economic interdependence has enabled major trade partners to adopt so-called "carrot and stick" strategies – that is, the use of both incentives and sanctions – as a means of influencing other countries to align with the priorities of dominant economic powers. Another strategy in international relations – also common in the realms of trade and socio-environmental governance – is the so-called naming and shaming, which aims to publicly expose and embarrass target countries in ways that damage their reputations. A key reference on this topic is the work of Tingley and Tomz (2022).

An illustrative case of this dynamic for Brazil is the set of environmental conditionalities imposed by the European Commission on Mercosur countries as prerequisites for ratifying the free trade agreement between the two regions. Dupre and Kpenou (2024) note that these requirements arose from concerns that Mercosur countries might not adhere to the sustainability principles promoted by the European Commission. Accordingly, the Commission explicitly incorporated two additional elements beyond what is typically included in its preferential agreements: (i) a reference to compliance with the Paris Agreement (Article 6), which addresses trade and environmental concerns; and (ii) a clause on trade and sustainable forest management (Article 8), encouraging trade in sustainably harvested timber and the inclusion of local and Indigenous communities in related supply chains.

Indeed, the international policy agenda of the world's leading trade and investment powers – particularly those in the Western bloc – has been dominated by concerns over which foods should be produced, where, and how, and more recently, the carbon footprint associated with these products. In response, Western economic powers have imposed standards on other countries that often do not align with their national priorities, production models, social infrastructure, political goals, or technological capabilities. Gomes (2025) expresses concern that the EU Deforestation Regulation (EUDR) will disproportionately impact small and medium-sized producers in exporting countries, who generally have less access to financial and informational resources necessary to meet the new requirements.

Whereas environmental geopolitical issues have been at the forefront of Brazil's relations with the EU and the United States of America (USA), tariff and non-tariff trade policy has been especially strategic in Brazil's relations with both, USA and China. In 2017, the commercial dispute – or trade war – between China and the USA had widespread effects on global agricultural markets. Miranda *et al.* (2020) observe that Brazil's agri-food exports benefited from this trade war, as Chinese demand for Brazilian products rose significantly between 2016 and 2018, just as US exports to China declined – particularly in the cases of soybeans, poultry, and cotton, with nearly proportional shifts in trade flows.

Other geopolitical events, while not directly involving Brazil, have also had significant economic impacts on the country. The war between Ukraine and Russia, for example, led to energy price shocks, especially in Europe, which were aggravated by Russian sanctions in response to NATO countries' political and financial support for Ukraine. Russia limited its gas exports to Europe, triggering a surge in energy prices. Given Russia's importance as a global supplier of both agricultural commodities and energy, the conflict has indirect political and economic repercussions for Brazil. As previously mentioned, Brazil's longstanding commitment to Universal diplomacy, coupled with its growing alignment with Russia through the BRICS coalition, has led to ambiguity in its diplomatic stance on the war. This lack of a clear position has generated criticism among Western nations and may, in the future, result in retaliation or other adverse outcomes, again reflecting the dynamics of a "stick" policy.

More than simply noting the potential for conflict arising from competing global priorities, current developments offer clear evidence of both increasing tensions and new

opportunities for collaboration. Confronting climate change and implementing mitigation and adaptation strategies, while also ensuring food security – not only in developed countries, but especially in developing and least-developed nations – are crucial for reducing poverty and hunger, and, ultimately, preventing the collapse of modern society and the global economic system.

From a political standpoint, Brazil's historical foreign policy strategy of maintaining diplomatic relations with countries across all ideological and economic spectrums, once considered an asset due to its independence from Western hegemonic interests, has now become a diplomatic dilemma in today's volatile global environment. This ambiguity carries geoeconomic implications within the context described by Imessaoudene (2022). Furthermore, there remains the risk of escalating military conflicts involving other nations, which could exacerbate global instability.

As Imessaoudene (2022) argues, singular global events such as the Covid-19 pandemic or the war in Ukraine can produce cascading political and economic effects worldwide. Decades of technological advancement in communication and information systems, combined with deepening globalisation, have increased the interdependence among nations.

The transformation of the geopolitical landscape – both in its structural dimensions and in response to recent shocks – presents formidable challenges for governments and populations across all regions. At the same time, it also creates new opportunities. These changes affect not only the traditionally dominant economic and political powers – such as the USA, the EU, and Russia – but also so-called "peripheral" countries such as China, India, and Brazil. In recent years, these shifts have become so pronounced that, while politically the world may still resemble a bipolar order, in environmental, social, and economic terms, one can increasingly discern a multipolar environment in which regional and middle powers, once labeled as peripheral, are assuming a central role in shaping geopolitical and geoeconomic dynamics.

The Role of Brazil in the Global Agri-Food System

Since the 1970s, with the establishment of Embrapa (the Brazilian Agricultural Research Corporation) and the implementation of a series of instruments and policies aimed at promoting technological development and adoption in the agricultural sector, Brazil has experienced a notably positive response in terms of productivity gains for its main grains and cereals. Despite persistent structural challenges – such as land concentration, limited access to technical assistance, the still underutilized cooperative model, and, most importantly, the heterogeneity of farming and livestock systems – there has been significant technological advancement. These developments have resulted not only in increased production levels, but also in additional positive outcomes.

Among these are Brazil's scientific advances in pasture-land restoration, biological pest control, no-tillage farming, and crop-livestock-forest integration systems. Progress in quality control, traceability, and sanitary and phytosanitary legislation has also enabled the country to obtain certifications that opened access to previously restricted international markets.

As shown in Figure 4, which presents the evolution of average yield for Brazil's main grains and cereals, the observed productivity gains were not limited to export-oriented crops such as soybeans and cotton. Commodities such as rice, beans, and corn – the latter having only recently transitioned from an imported to an exported commodity – have also shown significant and sustained yield increases throughout the analysed period.

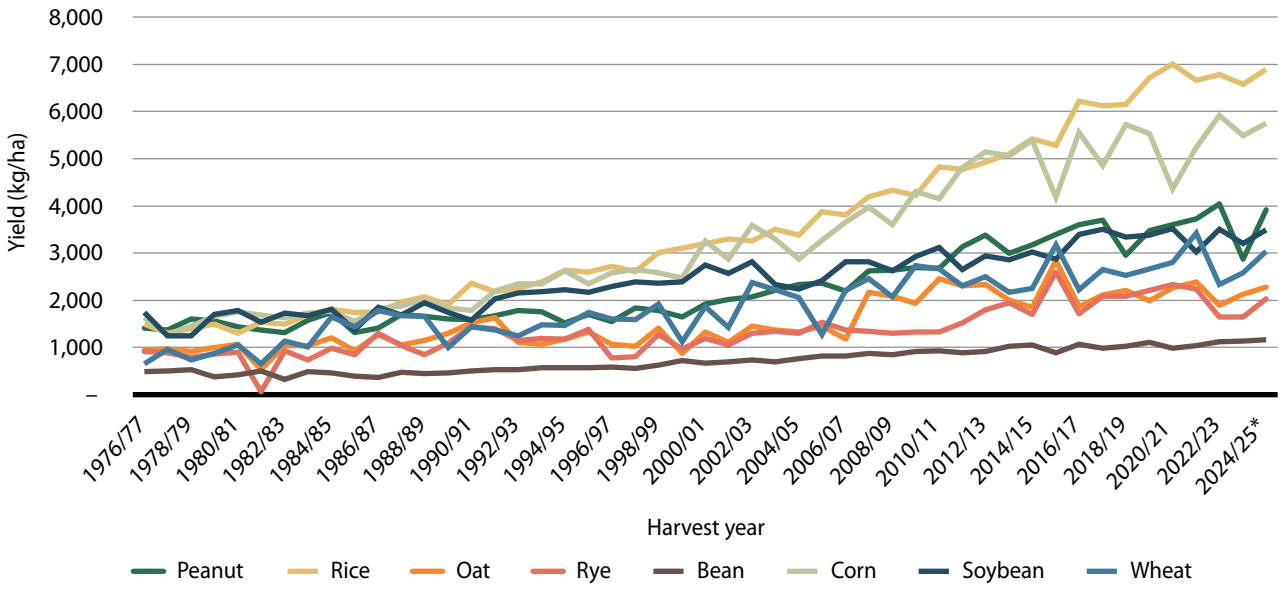

Figure 4: Yields for main crops (grains, cereals, and oilseeds) in kg/ha from 1976/77 to 2024/2025 in Brazil.
Source: own composition based on CONAB (2025) data

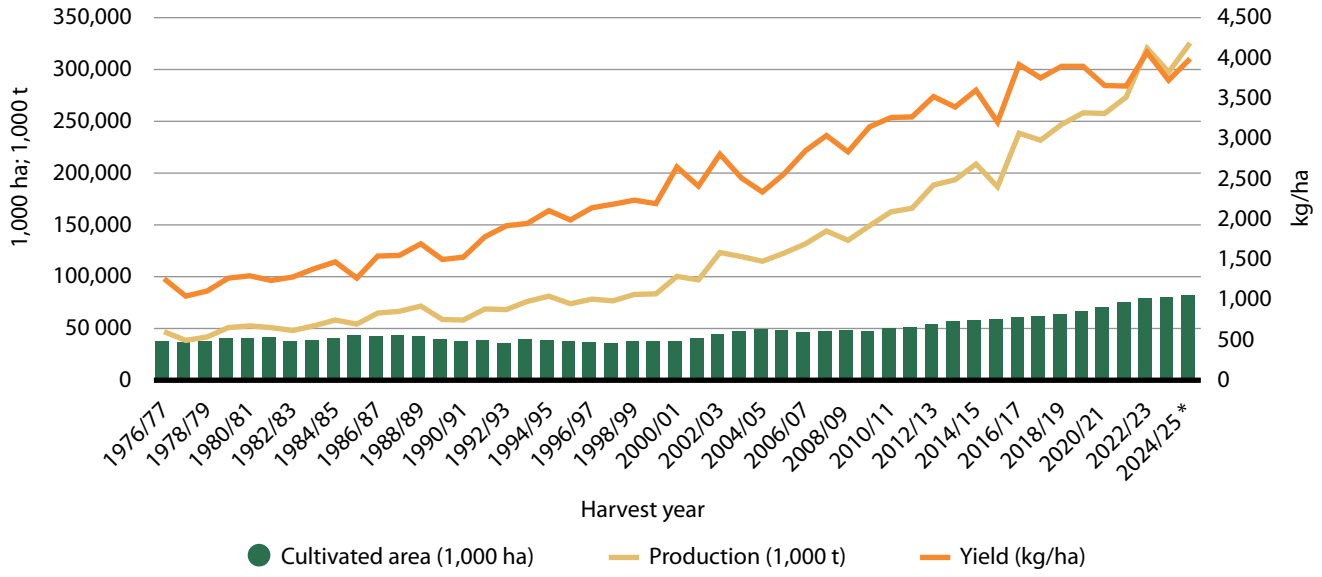

Figure 5: Evolution of total cultivated area, yield, and production of major cereals and grains in Brazil from 1976/77 to 2024/25.
Source: own composition based on CONAB (2025) data

Over recent decades, Brazil has laid the foundations for a competitive agri-industrial sector, with certain segments becoming integrated into the international market through participation in global supply chains. This is particularly evident in the animal protein sector – beef, pork, and poultry. Achieving high average productivity is a critical step toward ensuring food security; however, providing an abundant supply of high-quality staple foods at accessible prices is not, by itself, sufficient. In emerging and less developed countries, the demand side must also be addressed, particularly the economic conditions affecting access for socially vulnerable groups.

In addition to its involvement in global supply chains, Brazil also holds considerable potential to promote value chains based on sociobiodiversity products. Beyond contributing to the valorisation of these products and to food sovereignty, strengthening sociobiodiversity product chains, can also foster more sustainable income generation alternatives for smallholders and traditional communities.

In addition to technologies from Embrapa and other institutions – which supported frontier expansion into the Cerrado and leveraged Brazil's land-based comparative advantage – agricultural growth has also relied on expanding cultivated land. Figure 5 shows that while productivity gains were the main driver behind Brazil's rise as a major grain and oilseed producer, land expansion also played a role.

From the 1976/77 crop year to 2023/24, Brazil's production of grains, cereals, and oilseeds increased by approximately 576.3%, while cultivated area expanded by 111.1%. Over the entire period, yields increased by 363% for rice, 126% for beans, 245% for corn, 361% for wheat, and 105% for soybeans. It is important to note that these statistics reflect national averages, and significant variation exists across different states and regions. Technological adoption has not occurred uniformly throughout the national territory, nor has it extended evenly across all crops.

In this context, a growing pressure point for both domestic food security policy and international relations concerns the fact that traditional crops, regionally adapted species, and foods consumed in their natural form – such as fruits, vegetables, and greens – have not experienced the same productivity gains as grains and oilseeds.

Ferreira Filho *et al.* (2015) noted that Brazil's rise as a major food supplier was driven by farmland expansion at the expense of forests. They questioned whether the country could meet rising global food demand while preserving its forests. Using a dynamic, multiregional CGE model with a land-use change module based on satellite data, they analysed deforestation scenarios linked to public policies. The study found that food production could grow without expanding farmland, notably by converting low-productivity pasture into cropland. Moreover, according to their results, deforestation control led to only minor reductions in output, offset by modest productivity gains.

Another critical aspect to discuss when characterising Brazil's role as an agricultural producer and exporter is the food prices issue. Considering the country's high level of social inequality and the large portion of the population affected by food insecurity, it is important to underscore that the production expansion over nearly five decades has been accompanied by a long-term downward trend in the relative prices of food in the domestic market – an established pattern identified decades ago.

Figure 6, taken from Barros (2023), shows the evolution of an index for the agricultural prices in Brazil between 1950 and 2018, as well as for industrial products, and allows noticing that the ratio between the two indeces allows verifying the long-term decrease of agricultural prices. In the same picture, Barros shows that, if we also consider 1950 to be the base year, after a period of increasing consumer prices in Brazil until beginning of 1970s, the IPC for the São Paulo metropolitan area indicates a continuous decrease.

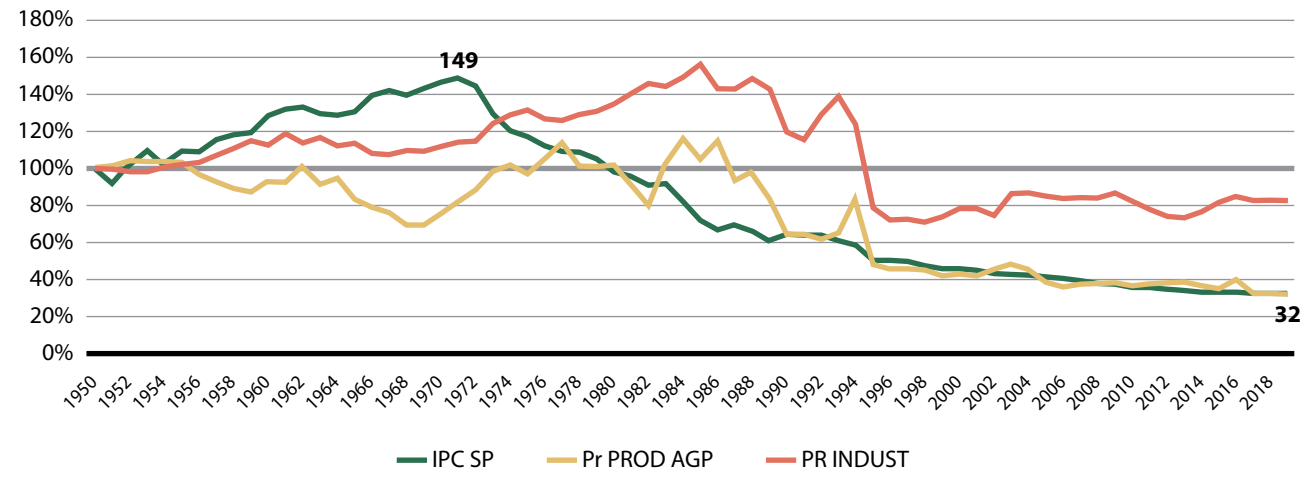

Figure 6: Prices index in Brazil: Consumer prices (IPC SP), agricultural products prices (PR PROD AGP) and industrial products prices (PR INDUST), 1950 to 2018.

Note: IPC SP – Consumer prices index – São Paulo; PR PROD AGP – Index of Agricultural products prices; PR INDUST – Index of industrial products prices.
Source: Extracted from Barros (2023), calculated by the author based on FIPE and IBGE

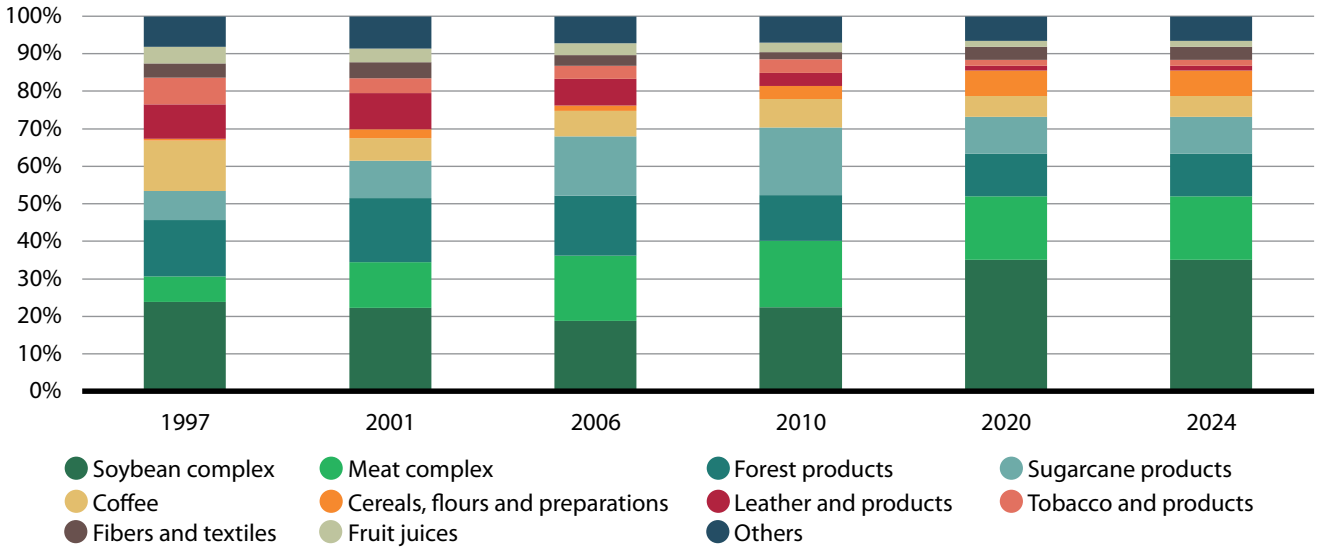

Figure 7: Composition of Brazilian agribusiness exports by product groups for selected years (share of total export revenue, %).

Source: own composition based on Agrostat (2025) data

According to Silva (2021), between 1995 and 2008, "agribusiness transferred R$641 billion to other economic sectors in the country, a result of the sector's loss of potential income due to increased production coupled with falling prices – a development beneficial to Brazilian society, particularly for lower-income segments". The sector expanded its output while maintaining stable or decreasing prices, ensuring the domestic supply of food at relatively lower prices in the medium and long term, alongside a steady growth in exports. Barros *et al.* (2019) highlight several contributing factors to this outcome, including productivity gains, support from public policies (agricultural policy, notably through credit instruments), and an expanding global market.

As a result of this productive competitiveness, and following Brazil's economic stabilisation in July 1994, its agribusiness exports recorded significant growth. In 2001, this trend was further accelerated by China's market opening, which led the country to become the largest importer of Brazilian agricultural products.

Despite these relatively recent developments, long-standing patterns in Brazil's international trade still persist. The structure of Brazil's agribusiness exports continues to reflect historical features: since the colonisation period, Brazil's trade balance has been characterised by the export of agricultural commodities – initially hardwoods, such as pau-brasil to Europe, followed by sugar and coffee, the latter two dominating exports throughout the 19th and 20th centuries.

Today, in the 21st century, Brazil's export portfolio remains highly concentrated in a relatively small number of agricultural product categories. In 2024, 10 product groups accounted for more than 92% of total agribusiness exports (Figure 7).

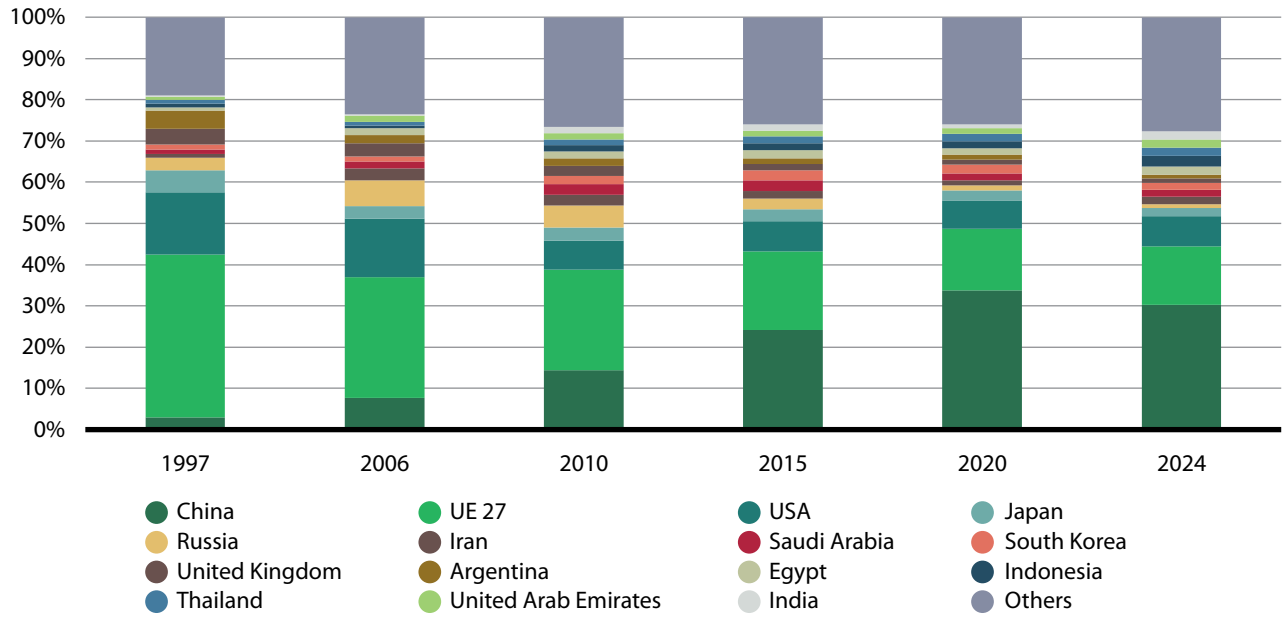

Figure 8: Importers market-share in the total Brazilian agribusiness exports measured in US$ FOB (%), for selected years.
Source: own composition based on Agrostat (2025) data

Another enduring characteristic is the concentration of export destinations: although Brazil maintains trade relations with a large number of countries, three of them – China, EU and USA – imported roughly 51% of the total Brazilian agribusiness exports, according to estimates from Agrostat (Figure 8).

Navigating Geopolitical Tensions in Agri-Food Trade

Geopolitical and geoeconomic factors are increasingly relevant when considering Brazil's role in the global landscape, particularly its comparative advantages in agriculture and food production, as well as the expansion of farming and livestock activities in the frontier regions of the Cerrado and the Amazon. Greater international concerns over the impact of agricultural expansion on forest conservation have raised over the past two decades and have intensified further with the emergence of climate change as a global priority, prompting urgent actions for adaptation and mitigation.

For Brazil, these concerns have arisen in parallel with the consolidation of an international trade pattern centered on mineral and agricultural commodities, largely driven by surging Chinese demand. Agricultural and environmental issues are thus deeply interconnected and they have become strategic for maintaining the country's trade competitiveness and continuing to attract foreign investments.

At the same time, large-scale global events have shaped this context, presenting multifaceted challenges for Brazil. These include the rising costs of inputs and energy due to armed conflicts in the Middle East and Ukraine; shifts in the US trade policy; political divergence and economic instability in South America; and a perceived return to a bipolar world order inferred from current alliances and hostilities, which confronts the traditional Brazilian Universalist foreign policy and diplomacy. As military conflicts force countries to take sides, the geopolitical environment – previously evolving toward multipolarity – now appears to be reconfiguring along bipolar lines. A form of bipolarity distinct from that observed during the Cold War, given that other strong and middle-income economies – some of which are key powers in specific arenas (like food security, energy, and climate issues) now face greater constraints in offering unconditional support to either pole. These constraints stem, among other factors, from domestic pressures within those nations, which today are more visible and influential than during the bipolar world from the 1950s to the late 1980s.

Some reflections absent from earlier sections are essential to completing the picture of current geopolitical and geoeconomic instability. First, major food-importing countries are increasingly adopting protectionist policies. Second, China's economic slowdown is weakening import demand, raising concerns for exporters like Brazil. Third, political transitions in several EU countries have empowered parties focused on jobs, local production, and tighter immigration – raising the risk of protectionist trade measures and reduced support for new liberalisation agreements. Lastly, US trade policy has shifted again, with new tariffs announced in early 2025 and an expanded trade war with China, now encompassing broader disputes between the two powers.

Various factors identified in the economic literature, besides those already mentioned here, are heightening uncertainty in global trade policy. One key indicator already reflecting this is international food prices. While similar trends affect minerals, energy, and manufactured goods, this paper focuses on food prices, given Brazil's prominent role as a major global supplier.

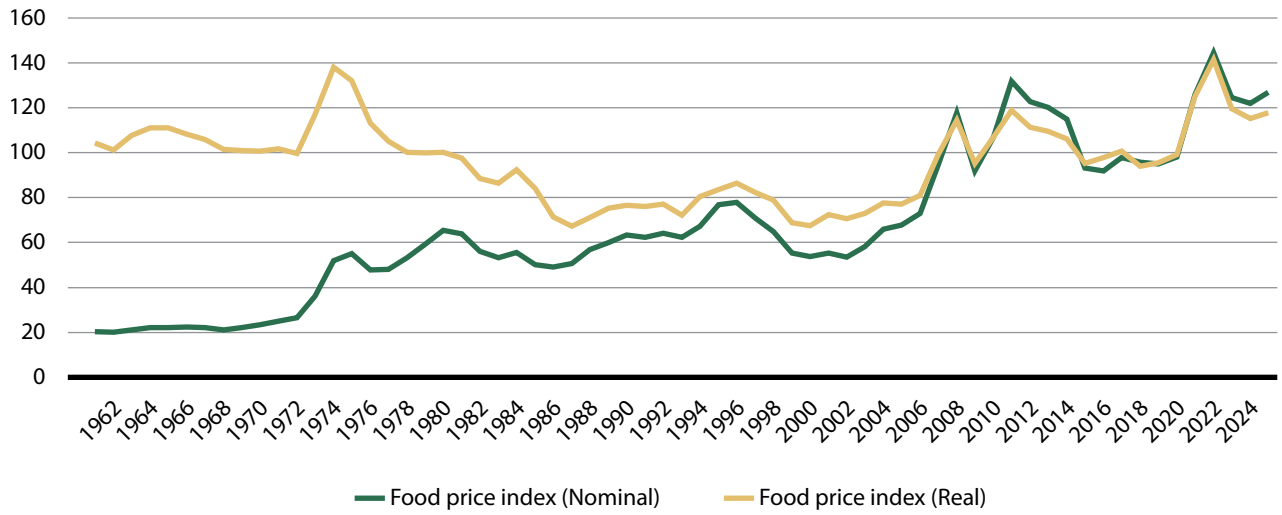

Figure 9: FAO Food Price Index. 1963–2024.
Source: own composition based on FAO (2025) data

Rising food prices worsen social vulnerability and food insecurity, especially in low-income countries, heightening the risk of unrest and migration. Figure 9 shows the FAO Food Price Index, supporting Headey and Ruel's (2023) view that the long decline in global cereal prices reversed in the 2000s, with sharp increases after the 2007–2008 crisis and another spike during the Covid-19 pandemic. Russia's invasion of Ukraine in February 2022 further disrupted energy, input, and food markets, pushing the Index to a record high in March 2022, matching the real price peak of 1974.

In Brazil, despite a broad domestic food supply, international price pressures are transmitted to the domestic market, affecting both exported and imported products. Adami (2024), based on the International Price Parity analysis, explain that agricultural prices in Brazil are significantly influenced by international price fluctuations and the exchange rate, considering this concept applies to open and competitive markets. When exports become more attractive due to favorable international prices, domestic supply tends to decrease, exerting upward pressure on local prices until they converge with parity levels (Adami, 2024). In fact, the evolution of the IPER-Agro index shown in Figure 3 illustrates this situation.

In recent decades, Brazil has not only consolidated its position as a major global food producer but has also established strong connections with other key international players, largely due to the integration of global value chains. The integration of global value chains promotes cooperation while simultaneously increasing vulnerabilty to financial and political crises, which can result in disruptions or reorientations of global trade.

As previously discussed, environmental issues are among the most critical factors for Brazil when analysing the current geopolitical and geoeconomic context, given the growing pressures exerted through trade restrictions, international financing conditions, and the negotiation of international agreements. In this context, the EU emerges as a strategic partner due to its ambitious environmental policies and goals, and as highlighted by Thorstensen and Prado (2025), its leadership in global climate change policy.

The Farm to Fork Strategy for 2030 (European Commission, 2020), part of the European Green Deal launched in December 2019, seeks to transition the EU food system to a sustainable model. Complementing this, Regulation (EU) 2023/1115 – the EU Deforestation Regulation (EUDR), enacted in May 2023 – bans agricultural imports linked to deforestation or forest degradation. Aimed at reducing the EU's environmental footprint, the regulation impacts trade in soy, rubber, beef, palm oil, timber, cocoa, coffee, and related products such as leather, charcoal, chocolate, and paper (European Commission, 2024).

Although most of Brazil's soy and meat exports currently go to China, both public and private sectors are working to build the infrastructure needed to meet EUDR requirements. While simplified procedures apply to low-risk countries or pre-assessed products, full compliance is still required. In high-risk cases, authorities can immediately block imports or exports. To meet EUDR requirements, companies must collect extensive data on their products, including geolocation of production sites and supplier information, ensuring complete product traceability. They must assess the deforestation risk associated with their products, guided by the EU's risk classification. Gomes (2025) notes that the regulations provide some flexibility, particularly for small and micro-enterprises.

Gomes (2025) highlights tensions between sustainability policies and the economic realities of producing countries, warning that environmental burdens could shift to regions with weaker regulations. As such, the EUDR may significantly impact global trade and may not fully align with multilateral rules. Prazeres (2024) adds that it could act as a trade barrier, potentially triggering tensions between the EU and exporters – making continued dialogue essential to avoid punitive unilateral measures that threaten trade agreements.

If Brazil is classified as a high-risk country, the impacts could be significant. As reported by Gomes (2025), the commodities regulated by the EUDR accounted for 29% of Brazil's total exports and 36% of its exports to the EU in 2020. Hence, beyond the direct economic risks, there is a potential reputational impact, which may affect Brazil's trade performance.

Sá and Jank (2022) identify potential impacts in the Matopiba region, Brazil's agricultural frontier that remains vulnerable to legal deforestation. They warn that although Europe has reduced its share in Brazilian soy imports, it continues to influence market standards. Another issue raised is Brazil's objection to the classification criteria for deforestation risk, which the government considers arbitrary. This classification could lead to retaliatory measures and additional costs for exporters, directly affecting the Mercosur-EU trade negotiations.

In response to environmental demands on soy and meat exports, Brazil's agricultural sector has long invested in certification processes. Voluntary certifications ensure product quality, safety, and sustainability, meeting consumer expectations and promoting innovation. By adopting certified standards, agribusiness gains economic advantages while advancing sustainable and efficient production.

The Soy Moratorium, launched in 2006 and extended indefinitely in 2016 (Soares, 2016), halted soy expansion in the Amazon. Silva Junior and Lima (2018) found that while 65% of soy farms in Amazonian Mato Grosso violated the Forest Code, they complied with the Moratorium, which helped establish the Round Table on Responsible Soy (RTRS), setting socio-environmental standards across the soy value chain.

Although environmental requirements from importers aren't strictly trade barriers, they are often shaped by developed countries, whose dominant role in setting standards has drawn criticism for overlooking the realities of developing nations.

In February 2025, the European Commission released Vision for Agriculture and Food, a guidance document aimed at enhancing the long-term competitiveness of the agri-food sector. Based on Eurobarometer data showing public support for food security, the roadmap emphasises stable supply, access to healthy food, fair remuneration, combating unfair practices, youth engagement, and innovation. Whether the implementation of the policies outlined in the Vision for Agriculture and Food will have positive or negative consequences for the EU's environmental agenda – and, in turn, for food exports from Brazil and other supplying countries – remains to be fully analysed.

Nonetheless, this document appears to reinforce a narrative that has emerged in the EU over recent years, in favor of prioritising local production over imported goods. For example, it questions the rationale of using soybean meal for animal feed when EU member states could produce their own animal feed, thereby reducing dependence on foreign imports and lowering the carbon footprint associated with transportation.

Another factor driving instability in international markets is the new North-American trade policy. Although initially focused on China, it has evolved into a broader strategy of increasing tariffs on several other trading partners. This shift represents a breach of longstanding tariff commitments established under GATT and the WTO, raising concerns about additional measures, including non-tariff barriers of sanitary, technical, anti-dumping, and even environmental nature. One might consider noting that this instability is further exacerbated by the stagnation of the WTO and the paralysis of its Dispute Settlement Body as an effective forum for resolving trade disputes.

Further uncertainty arises from President Trump's policy of involvement in the armed conflict between Israel and Iran. An escalation of tensions in the Middle East, potentially extending to Iran's allies, could trigger further instability in oil and derivative markets and cause new price shocks, with inflationary pressures reverberating globally. For Brazil specifically, a widespread conflict in the region could jeopardise agri-industrial exports to the Middle East, which accounted for approximately 9.7% of the country's exports in 2024, according to ComexStat data (Agrostat, 2025).

Brazil's agri-food exports saw significant gains during the US–China trade war, as Chinese demand for Brazilian soybeans, poultry, and cotton rose sharply between 2016 and 2018, while USA exports declined (Miranda *et al.,* 2020). By 2025, the expected gains for the US competitors remain uncertain, as tariff hikes extended beyond China. While short-term effects may seem positive, medium- and long-term impacts are unpredictable, especially given the likelihood of further trade actions under President Trump. This North-american strategy violates multilateral rules, threatening the WTO's integrity. Thorstensen and Prado (2025) argue that the US tariff policy represents a rupture that undermines the multilateral trade system. These authors suggest that the United States retrenchment projects a scenario of multipolarity, potentially increasing the geopolitical influence of China and other medium powers, thereby intensifying global competition for hegemony. Thorstensen and Prado (2025) note that such a scenario could lead to new regional dynamics and a possible reconfiguration of international trade rules.

According to Mair (2025), although the liberal world order and globalisation have been in crisis for about two decades, Trump's disruptive approach to international trade, his preference for bilateral agreements, and his disregard for common values contribute to the potential fragmentation of the global system into rival blocs or competing spheres of influence.

From Brazil's perspective, environmental geopolitics – especially with the EU – have increased pressure on agri-food trade, foreign investment, and environmental funds like the Amazon Fund. The US policy disruptions, along with scenarios presented by Mair (2025) and Thorstensen and Prado (2025), may alter how Brazil is approached in trade and environmental negotiations, potentially raising external expectations and pressures.

On the other hand, the declared intention of the current North-American administration to withdraw from the Paris Agreement may facilitate closer political and economic ties between the EU and medium powers, including Brazil. This

could serve as an incentive to accelerate the ratification and implementation of the EU-Mercosur Agreement.

Amid rising US–China rivalry – both parties being major Brazilian trade partners – Kallout and Guimarães (2022) suggest Brazil should adopt a "hedging" strategy, blending bandwagoning and balancing tactics. They argue Brazil should strengthen formal and informal agreements to mitigate risks and seize opportunities, noting its potential role in this bipolar context as both a BRICS founding member and OECD candidate.

While recent wars, new North-american trade policies, and associated reactions are reshaping trade flows, it is essential to recognise that the current global context, though increasingly polarised, features a more diversified distribution of economic and trade powers compared to the Cold War era.

According to Miranda *et al.* (2020), both China and Brazil have assumed roles as global players in the agri-food sector in recent decades. China has actively proposed various forms of trade and partnership agreements, such as the Belt and Road Initiative (BRI) and the Economic and Trade Agreement between the United States and China (Phase One), signed on January 15, 2020. The authors suggest that this latter agreement could significantly influence Brazil's agri-food exports to China. Food security and trade policies are major priorities for both countries, though Brazil has not been as proactive as China in negotiating bilateral and regional agreements.

Indeed, Thorstensen and Ferraz (2014) emphasise Brazil's isolation in the preferential trade agreement landscape and the resulting loss of market access. This difficulty in securing regional and bilateral agreements appears to be a broader Latin American trend. For example, according to Moreira *et al.* (2016), as of October 2015, China had signed 13 free trade agreements, only three of which were with Western Hemisphere countries: Chile (2005), Peru (2009), and Costa Rica (2011).

As countries grow more reliant on a few trade partners for key imports or exports – especially in agriculture and energy – these ties become tools of influence and geopolitical repositioning, as seen in Brazil–China and US–China trade dynamics. Miranda *et al.* (2020) link Brazil's early 21st-century export boom to rising Chinese demand. Cepea data show that, despite the 2008 crisis and a strong real currency, Brazil's agricultural exports remained competitive, unlike its struggling manufacturing sector – largely due to Chinese demand.

However, Brazil's current dependence on China, concentrated in a few commodities (soybeans, meat, timber, pulp), is a concern. Shifts in global trade could have major impacts. Although Chinese investment in Brazil has grown, the agricultural sector has not been a primary focus over the past decade, yet remains relevant in geoeconomic analysis.

According to Cariello (2021), between 2007 and 2020, Chinese companies executed 176 projects in Brazil, totaling USD 66.1 billion – 47% of total Chinese investment in South America. Nearly half (48%) of this investment went to the electricity sector, followed by oil and gas extraction (28%), metal mining (7%), manufacturing (6%), infrastructure (5%), and just 3% to agriculture, livestock, and related services.

Brazil's Center-West region attracted 4.6% of Chinese investment projects, including significant resources in agriculture and related services. Notably, COFCO – a Chinese state-owned enterprise – acquired global trading companies Nidera and Noble, both of which operated in Mato Grosso (Cariello, 2021). Additional port, transportation, and logistics projects could attract more investment, given Brazil's ongoing infrastructure needs and the strong capacity of Chinese firms in this domain.

Final comments

This decade began with the Covid-19 crisis and a wave of political and economic instability across multiple countries which encompassed migration flows, food insecurity, extreme weather events, political shifts in several Western nations, rapid technological disruption, and the rise of mid-level global powers like India. Together, these factors are driving ongoing geopolitical and geoeconomic multipolarisation.

These dynamics also present new challenges for agri-industrial and food production systems. There is an urgent need to develop and adopt technologies that are less environmentally harmful and more resource-efficient, supporting the transition to sustainable production and consumption. Simultaneously, 21st-century food systems are being reshaped by rapid technological advances and disruptive innovations impacting the entire supply chain, affecting both emerging consumer groups and segments of producers.

The rapid and often overwhelming flow of information – some of it inaccurate or manipulated – demands careful attention from both governments and food-producing companies, which must manage their communication strategies and public image. Despite potential shocks from geopolitical turbulence, a large share of global food trade remains concentrated in the hands of transnational corporations operating across nearly all countries.

Despite ongoing armed conflicts, rising protectionism, and signs of de-globalisation, nations – especially major powers – cannot overlook the risks of climate change. In this context, food production and distribution remain critical. Securing affordable food or providing income support for vulnerable groups is as strategic as ensuring energy supply. According to the FAO, agricultural output must rise by 60% to feed the global population by 2050.

Brazil has made significant contributions and holds valuable experience in these areas. Despite ongoing socioeconomic and environmental challenges, its role as a food and energy supplier, advances in agricultural technology, rich natural resources, large yet underutilised consumer market, and universalist diplomacy position the country for leadership in food security and environmental conservation – reinforcing its status as a mid-level power in an increasingly multipolar world.

Brazil's greatest challenge, in light of geopolitical turbulence, the need to remain a global food supplier, and, above all, the imperative of securing a sustainable development process, lies in adopting appropriate governance models that promote stronger public-private interaction and the consolidation and strengthening of institutions.

Despite commercial gains, Chinese investment in Brazil, and seemingly beneficial cooperation, several geopolitical factors could disrupt current strategies and spark debate over future trends. Recent developments – such as the Russia–Ukraine war, Middle East conflicts, US–China tensions, and international pressure on Brazil's environmental policies – further complicate the geopolitical landscape. Although multipolar in nature, some of these developments suggest that the world may once again be shifting toward a new form of bipolarity. In Brazil's case – a country with significant economic ties to the United States, China, Russia and the EU – this scenario presents major challenges.

All these factors may have far-reaching impacts not only on the economic outcomes of agricultural production and trade but also on food security, climate change mitigation efforts, and, specifically for Brazil, on the delay in resuming a sustainable development trajectory.

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SCIENTIFIC ARTICLE

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The Challenges to agri-food trade in Southern Africa

ABSTRACT

Deepening and expanding agricultural trade patterns require institutional and infrastructural investments that have to compete with other country and regional priorities such as expenditure on poverty alleviation and adaptation to, and mitigation of, the effects of climate change. As a result, arguments for expenditure on trade facilitation and on trade infrastructure need to be evidence-based. In this article we provide an overview of the wide range of challenges facing the Southern African region, then present two case studies that illustrate the benefits of investment in trade infrastructure. A reduction of 25% in the cost of regional trade in maize benefits producers and consumers, while reducing the cost of exporting citrus from South Africa leads to a 4.1% annual gain in revenue to producers.

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Introduction

The purpose of this article is to identify the main challenges confronting agricultural trade in Southern Africa. We take the African Union's definition of Southern Africa as point of departure, namely Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe, noting South Africa's dominance of agricultural trade among these countries.

In the first section, we identify the main characteristics of trade flows in the region. This is followed by the identification of a series of challenges to the management of these trade patterns, with the emphasis on infrastructural deficiencies. The impact of inadequate infrastructure on regional trade is illustrated with two case studies in section 4. Section 5 concludes.

Agri-food trade flows in Southern Africa

Figure 1 shows exports and imports of agricultural products[1] expressed as a share of total sector output from 1990 to 2019. What is immediately evident is that while exports continued to grow after the formation of the World Trade Organisation (WTO) in 1995, the trend in trade growth continued beyond the global financial crisis (around 2008 and 2009), before imports started a long-term trend of relative decline around 2010. The export decline followed later, and a few years before the worst drought that affected the region in over a century.

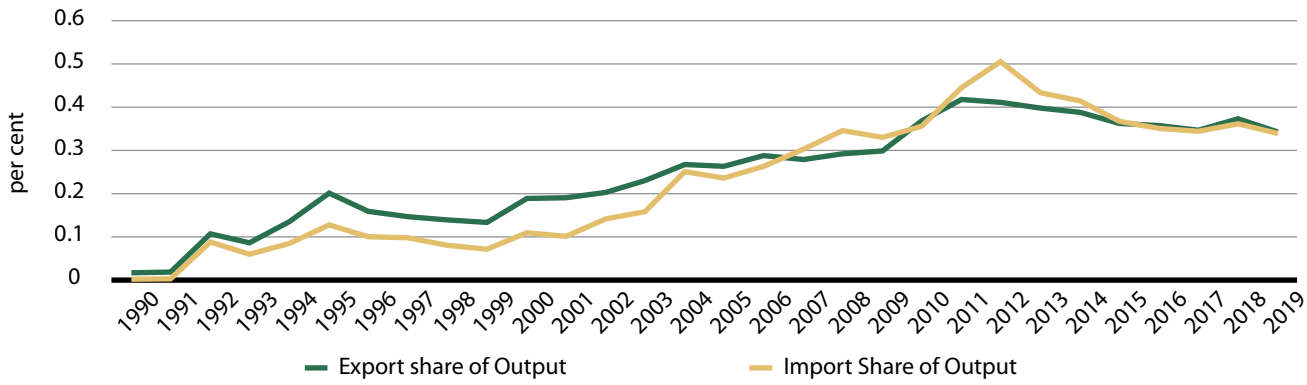

Figure 1: Southern African agricultural trade as % of output, 1990-2019.

Source: own composition based on WITS (2025) and ITC (2025) data.

[1] Defined as those in the Harmonised System (HS) Chapters, 01,02,04-24, 41-43 and 51-52.

Table 1: Average Southern African exports (1990-2023), nominal $m.

Products	Exports to RoA	Imports from RoA	Net exports to RoA	Exports to RoW	Imports from RoW	Net exports to RoW
Other processed	1,565.86	1,374.87	190.99	9,139.71	8,957.77	181.94
Animal products	422.23	337.99	84.24	2,935.99	4,439.42	–1,503.43
Field crops	1,063.02	676.82	386.20	827.95	1,305.81	–477.86
Horticulture	363.29	305.98	57.31	2,167.45	2,179.14	–11.69
Total	3,414.40	2,695.66	718.75	15,071.10	16,882.15	–811.04

Notes: ROA = Rest of Africa; ROW = Rest of the World.
Source: own calculations based on WITS (2025) data

Table 2: Regional and continental exports (in 1000 USD) and export shares (average 1990-2023).

	Exports to RoA	Exports to southern Africa	All exports	Export share to RoA	Export share to Southern Africa
Angola	28,389.39	1,273.00	37,011.67	77%	3%
Botswana	115,826.95	113,660.75	183,163.47	63%	62%
Eswatini	292,984.89	265,059.87	416,985.66	70%	64%
Lesotho	141,542.14	138,698.00	151,894.75	93%	91%
Malawi	309,836.40	172,417.34	1,173,608.92	26%	15%
Mozambique	181,309.80	166,013.29	698,807.18	26%	24%
Namibia	503,794.51	497,036.49	626,672.47	80%	79%
South Africa	4,183,375.00	3,346,016.06	11,901,283.62	35%	28%
Zambia	608,534.33	351,814.12	793,381.14	77%	44%
Zimbabwe	945,950.14	919,711.48	1,486,294.62	64%	62%

Source: own calculations based on WITS (2025) data

The Southern African region is a net exporter of farm products to the African continent, with "Other processed products"[2] the largest at an average of about $1.6bn per year between 1990 and 2023. Table 1 shows that the region is a net importer from the world. The largest imported product category is animal products[3].

Africa and the Southern African region are important destinations for agricultural exports. The region's dependence on South African exports is mirrored. Table 2 illustrates that all countries, except Angola, depend on the area as a market. Regional trade as a share of output has stagnated in the past decade. This is attributed to political instability and natural and geopolitical shocks in addition to macroeconomic challenges (e.g. Zimbabwe) and political decisions (e.g. Angola's concentration on the oil industry).

Challenges to agricultural trade in southern Africa

There are many opportunities and threats to agricultural trade in the Southern African region, but the purpose here is to identify those that are expected to have the greatest impact on agricultural trade in the region. In order to identify these, we start with a conventional environmental scan. The specific key challenges that we identify are discussed in terms of their potential impact on the region, rather than merely as components of the environment.

Political stability in the region

Table 3 is derived from the Worldwide Governance Indicators project of the World Bank (2024). This project assesses opinions about six elements of governance from a wide range of sources. Importantly, the elements are forward-looking to anticipated changes. Each element consists of a wide range of indicators, and a country's score is represented as units of a standard normal distribution, ranging from about -2.5 to +2.5, with the lower bound representing the weakest performance. According to these data, the region displays weak governance and political instability. Botswana scores highest in most of the elements, followed by Namibia. Zimbabwe scores lowest in four of the six elements, while South Africa has negative scores for three of the six. This latter observation is important, because the bilateral trade between South Africa and Zimbabwe was for a long time the largest flow of intra-Africa trade.

For southern Africa, only 16 of the 60 scores for the ten countries are positive. Botswana has been able to maintain its expected political stability since 2002, and has improved control of corruption since 2020 after a decline that had lasted for a decade (2010-2020), but it has lost ground in the other four elements. Namibia has seen an improvement in the maintenance of the rule of law (from 2017) and in voice and accountability (from 2008), but a weakening in the other elements from around 2008. At the other extreme, Zimbabwe, with its low scores, has seen an improvement in

[2] Other processed products include Harmonised System (HS) Chapters, HS11, 13-16; 18- 23, 41-43 & 50.
[3] Animal products are included in HS 01, 02, 04, 05 and 51.

Table 3: Political stability and governance in Southern Africa, 2014-2023.

Element	Angola	Botswana	Eswatini	Lesotho	Malawi	Mozambique	Namibia	South Africa	Zambia	Zimbabwe
Political Stability	–0.45	1.03	–0.34	–0.28	–0.16	–0.95	0.60	–0.37	0.08	–0.82
Government Effectiveness	–1.05	0.36	–0.66	–0.87	–0.78	–0.84	0.13	0.03	–0.70	–1.27
Regulatory Quality	–0.83	0.60	–0.46	–0.55	–0.79	–0.71	–0.01	0.02	–0.55	–1.54
Rule of Law	–1.02	0.43	–0.44	–0.36	–0.31	–1.01	0.34	–0.04	–0.43	–1.33
Voice and Accountability	–0.95	0.46	–1.33	0.03	–0.01	–0.48	0.55	0.68	–0.24	–1.16
Control of Corruption	–1.09	0.72	–0.38	–0.15	–0.65	–0.82	0.25	–0.12	–0.55	–1.30

Notes: The country's score is given in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. Green denotes the country with the highest score (i.e. the best performer for that element), orange the second highest, and red the lowest.
Source: own composition based on World Bank (2025) data

all six elements from around 2007-2009, but sentiments still remain in negative territory despite almost two decades of improvement.

The general trend across the countries is one of negative expectations. Seven of the countries have lost ground in terms of government effectiveness and regulatory quality, and five each in terms of political stability and violence, and the rule of law. These are all elements that are vital to smooth and growing trade between the countries of the region, hence the outlook is not positive, and is only somewhat mitigated by the fact that six of the countries are better off now in terms of the voice and accountability element.

People and the social environment

The social environment includes issues that affect the well-being of the people of the region, and conventionally this includes their levels of education, health status, access to services, mobility, and their material wealth. The World Development Indicators of the World Bank provides a comprehensive list of indicators along these dimensions. The challenges facing the region are reflected in some of these, shown in Table 4. The following implications are pertinent:

- South Africans have the best access to services, scoring highest in three of the four indicators. However, the country does less well on indicators of education and health. Botswana's population has relatively good access to basic services, scoring highest in access to basic drinking water, second highest in access to basic sanitation, having the best primary school pupil/teacher ratio and the highest life expectancy.
- The Gini Index shows that South Africa is one of the most unequal societies in the world with little improvement over the past 30 years. The other countries also don't fare well, with only Lesotho and Malawi scoring lower than 0.5. Where South Africa scores highest is in the proportion of women in parliament.
- Some 200 million people live in Southern Africa, up from 100 million in 1993. This increment is, however, less than the increase in sub-Saharan Africa (SSA) as a whole, as the region now makes up 15.9% of the SSA population, compared to 18.7% in 1993.
- The region's population is on the move, both internally and across international borders. Half of the countries have urban population growth rates in excess of 4% per year, while only South Africa and Namibia have a net positive rate of in-migration. Migration is partly demand-led, but also the result of political instability. The UN High Commission for Refugees (UNHCR), for example, highlights the crises in northern Mozambique as well as

Table 4: Selected indicators of social well-being in Southern Africa, 2014-2023

	Angola	Botswana	Eswatini	Lesotho	Malawi	Mozambique	Namibia	South Africa	Zambia	Zimbabwe
Access to electricity (% of population)	48.50	75.90	82.30	50.00	14.00	33.20	56.20	86.50	47.80	50.10
% of poorest 40% with a bank account	..	47.59	61.21	58.64	33.09	34.48	56.38	77.82	32.91	46.92
% using at least basic drinking water	57.72	92.57	73.47	73.97	71.87	63.20	85.91	94.49	68.25	62.29
% using at least basic sanitation	52.18	80.55	64.42	50.28	49.24	37.38	35.84	77.63	36.30	34.62
Literacy rate (% ages 15 and above)	72.40	86.82	90.75	82.01	68.08	61.00	88.00	95.00	87.50	89.85
Pupil-teacher ratio, primary	50.03	23.71	26.60	32.95	58.68	55.27	25.09	30.33	42.06	..
Life expectancy at birth (years)	62	66	56	53	63	60	58	61	62	59
Proportion of women in parliament (%)	33.64	11.11	13.51	26.45	22.92	42.40	44.23	46.50	15.06	30.57
Gini index	51.2	53.30	54.60	44.90	38.50	50.30	59.10	63.00	51.50	50.30
Net migration	–995	–7,306	–8,549	–6,023	–5,231	–34,936	22,212	233,284	–8,566	–102,828
Urban population growth (% p.a.)	4.06	2.51	1.86	2.64	4.17	4.42	4.55	2.13	4.01	1.99
Per capita GDP as % of World GDP, 2023	0.18	0.59	0.27	0.07	0.05	0.05	0.32	0.46	0.10	0.16

Green denotes the country with the highest score (i.e. the 'best' performer for that indicator), orange the second highest, and red the worst performer.
Source: own composition based on World Bank (2025) data

the protracted refugee situations in Botswana, Malawi, Namibia, Zambia and Zimbabwe (UNHCR, 2025), while Human Rights Watch (2024) discusses the impact of political instability as the source of the refugee problems of the region. These migration patterns result in a strain on urban infrastructure and hence on social service delivery throughout the region, resulting in excessive informal economic activity, which adds layers of direct and indirect costs (in the form of waste, for example of food, energy and water).

The general poverty in the region creates a need to spend on social infrastructure, but this diverts money away from necessary spending on the physical and institutional infrastructure required for trade.

Limited structural transformation

Part of the reason for mobility in the region's population rests in the search for economic opportunities. Table 5 presents unemployment rates, which remain in double digit territory for most of the countries and have only improved in 3 countries over the past decade. Real GDP per capita in constant purchasing power parity (PPP) terms reflects limited purchasing power in the region, a critical constraint to increased intra-regional trade. Concerningly, it also illustrates that improvements in spending power have been slow at best, with negative growth in more than half the countries of the region.

Economies remain largely resource-based, relying heavily on agriculture, mining and energy, with slow development of industrial manufacturing. Figure 2 presents the share of agriculture in total GDP on average over the past three years, along with the average annual change over the past 30 years.

Agriculture's dominance stretches beyond just output, with half of the countries relying on primary agricultural commodities for foreign exchange. Furthermore, agriculture remains the dominant source of employment in the sector, accounting for anything from 13.8% of total employment in Eswatini to as much as 69% in Mozambique. Conversely, industry accounts for only 14.8% of total employment on average (World Bank, 2025).

The persistence of agriculture's strong contribution reflects the slow process of structural transformation in the region. Rodrik (2018) noted that many African economies

Table 5: Income and unemployment in southern Africa.

	Unemployment 2024	Unemployment 2015	Real GDP per capita (PPP) average 2022/24	Growth in GDP per capita 2015/24
	%			
Angola	14.5	16.5	8,870	–3.0
Botswana	23.1	18.9	17,200	1.0
Eswatini	34.4	23.3	10,989	1.9
Lesotho	16.1	16.3	2,858	–1.7
Malawi	5.0	5.0	1,530	0.2
Mozambique	3.5	3.4	1,483	–0.2
Namibia	19.1	20.8	10,255	–2.3
South Africa	33.2	25.1	13,892	–0.9
Zambia	6.0	5.9	3,686	0.2
Zimbabwe	8.6	5.4	4,430	–0.6

Source: own composition based on World Bank (2025) data.

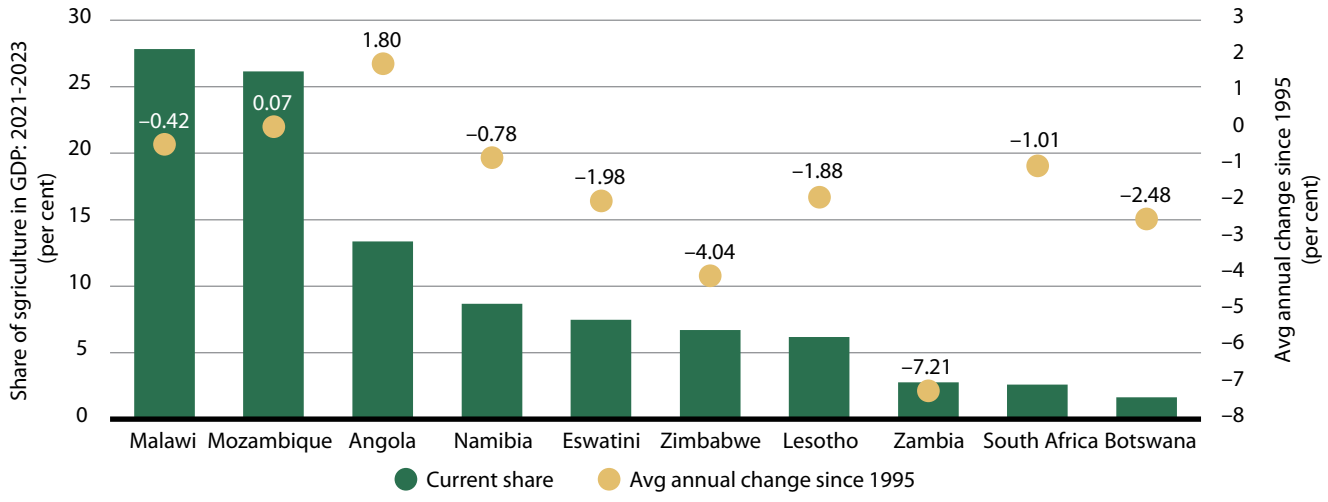

Figure 2: Share of agriculture in total GDP.

Source: own composition based on World Bank (2025) data

have de-industrialised, with labour shifting into informal, low productivity services, thus limiting potential growth in manufacturing. Structural transition to higher value adding sectors is critical to increasing overall income and purchasing power (McMillan *et al.,* 2014), thus structural change in Africa is critical to both improved spending power and advancing international trade.

Despite the slow overall pace of transformation and regression in some countries due to policy uncertainty, such as Zimbabwe's land reform programme and premature deindustrialisation in South Africa (Andrioni and Tregenna, 2021), there are also success stories, particularly in food manufacture. Reardon *et al*. (2021) note the emergence of several, often unaccounted for SMME processors in food value chains, which could contribute more meaningfully in an enabling environment that facilitates growth.

The technological environment

While the reach and speed of mobile and internet connectivity has improved globally and has led to some efficiencies in agricultural trade, not all sub-sectors and service providers have benefited from this access equally. Rural areas still suffer from poor connectivity, hindering their communication efficiency as well as access to digital marketplaces and real-time data (TechAfrica News, 2024). Border authorities in Southern Africa still largely rely on non-digitised systems and widespread inefficiency causes delays for perishable agricultural produce.

This lack of digital infrastructure has also reduced the attainable gains in cost reduction and efficiency enhancement, e.g. smart livestock monitoring, automation and precision irrigation in horticulture, and active participation in digital markets. Sustained but incomplete efforts to harmonise seed policy in the region, for example, have limited region-wide adoption of the latest seed technologies (Kassie *et al.,* 2013), which could potentially reduce the time lag between release of a variety and its access by farmers (Langyintuo *et al.,* 2010), while non-adoption of modern banana handling systems has resulted in high post-harvest losses in Zimbabwe (Mvumi *et al.*, 2016).

Without the latest technologies, tracking livestock origins and health history across borders becomes nearly impossible, an important factor given the Foot and Mouth Disease status of some regions in southern Africa. Countries that have been able to achieve this, such as Namibia and Botswana, have successfully exported premium products to Europe. Moreover, an adequate cold chain is vital for meat and fresh produce trade, and IoT-enabled technologies offer opportunities to improve such a chain's integrity, but high road transport and logistics costs have inhibited the degree of value chain integration within the region (Gregory and Bumb, 2006).

Furthermore, digital certification platforms for horticultural exports (e.g. GlobalG.A.P.) have encouraged transparency of product standards between producers and retailers (Tennent and Lockie, 2012) and enabled South Africa's participation in the global market. Surplus production in turn ensures local (and regional) affordability of products. The certification of herbicide and pesticide technologies that will enable weed, insect, etc. control without damaging the environment or jeopardising human health is as important. Examples from Mexico (Alcantara-de la Cruz, 2021) and France (Jacquet *et al.,* 2021) emphasise the potential dangers of neglecting this aspect.

In summary, while technological advancements offer transformative potential for agricultural trade, their uneven adoption and infrastructural limitations continue to constrain the sector's competitiveness in the region. Bridging the digital divide, harmonising regulatory frameworks, and investing in scalable, climate-smart innovations are therefore critical to unlocking the full benefits of technology.

Trade institutions

Five of the regional countries belong to the Southern African Customs Union (SACU), while all 10 are members of the Southern African Development Community (SADC), which has six other members from beyond the region. Four (Eswatini, Malawi, Zambia and Zimbabwe) are members of the Common Market for Eastern and Southern Africa (COMESA), which has another 15 members, while all are members of the African Continental Free Trade Area (AfCFTA) along with all other African countries. Even in SACU, where there are not supposed to be any hindrances to trade, there have been incidents of practices that are inconsistent with the agreements, when, for example, countries don't seek to resolve the matter before executing what are deemed retaliatory measures. This is usually attributed to a lack of protection from tariffs during adverse situations, such as supporting local producers to sustain competition from regional exporters.

Import tariffs in the region are generally low, often leaving local producers vulnerable to imported products. More importantly, South Africa's dominance in agricultural trade can be very disruptive. While more than half (53.8%) of the total tariff lines for SACU's common external tariff are duty-free, some products have tariffs higher than 50%, mostly at South Africa's insistence, e.g. some poultry meat and cheeses, pineapples, and worn clothing. The highest *ad valorem* rate (95%) applies to some dairy products, and the highest *ad valorem* equivalent (532.3%) applies to some worn textile articles. While these high tariffs are exceptions, they are also seen by competitors as a means of protectionism against the spirit of international trade.

Another practice by South Africa and its SACU members that has caused tensions is the use of contingency trade remedies, including anti-dumping duties, countervailing measures and safeguard measures. Between 2014 and 2022, South Africa initiated 25 anti-dumping investigations, while it already had 40 in force on 19 categories of products (WTO, 2025). Several safeguard investigations were initiated, provisional and final measures were adopted or extended, and investigations were terminated during this review period. A bilateral safeguard measure on frozen chicken cuts from the EU expired in 2022. While fewer than 5% of these initiatives involved the agricultural sector, these were in sensitive industries such as poultry, potatoes and milling products.

Environment and climate change

Southern Africa has experienced intensifying environmental challenges, primarily driven by climate change, which affects food systems in several ways ranging from direct effects on crop production to changes in markets, food prices, and supply chain infrastructure (Gregory *et al.*, 2005). The region has witnessed a marked increase in average temperatures, more frequent and severe droughts, erratic rainfall patterns, and extreme weather events (Sabola, 2024). These shifts have had differentiated impacts across agricultural subsectors:

- *Livestock:* The prevalence of extensive, pasture-based systems suggests that the livestock sector is particularly vulnerable to heat stress, water scarcity, and pasture degradation, leading to increased mortality, reduced fertility, and lower milk and meat yields. Additionally, the spread of vector-borne diseases such as Rift Valley fever and tick-borne illnesses has intensified under warmer conditions (Nhemachena *et al.,* 2020).
- *Field Crops:* Staple crops such as maize and sorghum have often experienced declining yields due to shortened growing seasons, increased evapotranspiration, and soil degradation. Rain-fed agriculture, which dominates the region, is especially susceptible to rainfall variability. Crop failures linked to droughts have become more frequent, undermining both food security and export potential (Sabola, 2024). For instance, in 2024 drought resulted in a year on year decline in maize production of 50% in Zambia, 70% in Zimbabwe and 20% in South Africa.
- *Horticulture:* While horticultural crops offer high-value trade opportunities, they are sensitive to temperature extremes and water availability. Climate-induced disruptions in flowering and fruiting cycles, coupled with increased pest and disease pressures, have constrained productivity and quality standards required for export markets (Nhemachena *et al.,* 2020).

From a trade perspective, these environmental challenges can lead to declining and/or more volatile yields and quality inconsistencies, which reduce competitiveness in global markets. Adaptation measures such as climate-resilient seeds, irrigation, shade netting, and pest control, etc. raise production costs while supply shocks exacerbate price volatility, complicating trade planning and contract fulfilment.

On the other hand, environmental challenges also create opportunities resulting from enhanced resilience through the adoption of climate-smart agricultural practices such as conservation agriculture, integrated pest management and drought tolerant crop varieties (Sabola, 2024). Growing global demand for sustainable and traceable agricultural products has also attracted investment in green technologies and climate-resilient infrastructure, offering new pathways for trade diversification.

These environmental challenges are reshaping the trade landscape, not just through adaptation measures but also through mitigation strategies and policies among some trade partners. While the threats to productivity and trade competitiveness are significant, they are not insurmountable. Strategic investments in climate adaptation, regional cooperation, and sustainable agricultural practices can turn them into catalysts for innovation and inclusive trade growth.

Infrastructure

Agri-food trade in Southern Africa is significantly constrained by infrastructure-related challenges. Awuah (2024), for example, reports that logistics inefficiencies can elevate food prices by up to 75%, and the African Union's emphasis on improving transport and trade infrastructure underscores that inadequate roads, unreliable fuel supply, and poor logistics are major impediments to intra-African agri-food trade (African Union, 2025).

Ports serve as critical nodes in the agri-food supply chain. However, most ports in southern Africa are plagued by congestion, outdated infrastructure, and inefficient customs procedures. These result in significant delays and elevated logistics costs (e.g. Munuhwa and Hove-Sibanda, 2024; Randrianandrasana *et al.*, 2024). Border posts are another critical component of the trade infrastructure. Inefficiencies create bottlenecks that, along with poor roads, the lack of return loads[4], and limited competition among transporters, result in higher transport costs (Arndt and Roberts, 2018).

A related problem is the availability of fuel, especially in landlocked countries (e.g. WFP, 2023). The Rockefeller Foundation (2022) highlights that broken distribution channels and logistical inefficiencies – including those caused by fuel shortages – are major contributors to post-harvest losses, which reduce income for smallholder farmers and disrupt market access. The World Bank (2021) also emphasises that while agriculture is central to poverty reduction, logistical constraints remain key barriers.

Rail transport presents a cost-effective alternative to road, but the rail infrastructure is outdated and poorly maintained. Luke and Walters (2023) recommend targeted investments and regulatory reforms to revitalise the rail sector. Similarly, reliable electricity supply, vital for processing, storage, and transportation within the agri-food supply chain, is bedevilled by limited rural electrification and frequent power outages. Of course, perishable agricultural products depend heavily on energy sources for a functioning cold chain. Awuah (2024) notes that the highest levels of fresh food losses occur in the early stages of the supply chain due to poor logistics and absent cold chain facilities. Finally, trade facilities such as warehouses, distribution centres, logistics hubs and storage facilities are also integral to the agri-food supply chain.

The negative impact of these deficiencies poses significant challenges to agri-food trade in southern Africa. Addressing them requires coordinated investments and policy reforms, and an accurate understanding of the impact that they have on intra-regional trade

[4] Note that almost 80% of South Africa's agricultural exports into the rest of Africa are transported by road. Because imports into South Africa are only a third of this, two thirds of returning trucks are empty.

The impact of infrastructure limitations

Dewberry (2020) demonstrated that improved logistics performance can significantly enhance intra-African agricultural trade. In this section we present two further case studies to quantify this impact, using partial equilibrium models. The first is focussed on maize trade across five Southern African countries and the second on citrus in South Africa. Both models are dynamic and recursive in nature, based on balance sheet principles and specified in line with partial equilibrium modelling principles. The primary difference is the method of closure, designed in each instance to provide the best possible replication of market structure and price formation principles. The use of a simulation model enables *ex ante* analysis, while the choice of model structure represents a trade-off between broad sector coverage and the level of detail required to replicate the unique price formation mechanisms for the commodity in question.

The modelling analysis was conducted in two phases, starting with the simulation of a forward-looking baseline, based on macro-economic assumptions contained in the International Monetary Fund's World Economic Outlook and a set of other assumptions related to technological advancement over time and stable weather conditions. The baseline presents a benchmark against which the alternative scenarios can be measured.

High trade costs affect affordability of core food staples

Maize is the core food staple commodity in southern Africa. The analysis was prepared using the multi-market model first specified in Davids *et al.* (2018). The model covers 13 countries across Southern, East and West Africa, with differences in commodity coverage across the countries. Maize is included in all countries.

Model specification is based on a combination of econometric assessment, economic theory and specialist input, in line with supply and demand responses. Its novelty rests in the trade specification and market closure, which enables multiple simultaneous market interactions across various trade regimes (Davids *et al.*, 2018). Prices represent an equilibrium where total supply in each country is equal to total demand, with trade providing dynamic influence between markets based on arbitrage opportunities in a spatial equilibrium specification, but with finite elasticities. Trade is influenced not only by relative prices, but also trade related costs, including tariffs and transport rates. When arbitrage opportunities initiate trade, associated market interactions occur. This representation was developed to capture multiple dynamic price relationships between maize markets. Apart from South Africa, which has a well-developed yellow maize sector, these markets bear limited influence from global dynamics, given the predominance of non-GM white maize. While no single county is large enough to move global markets, there is significant influence between markets within the region, particularly when trade occurs (Davids *et al.* 2017).

In evaluating the impact of transport connectivity on food security in Africa, Kunaka *et al.* (2025) suggest that long supply chains and inefficient distribution systems increase regional trade costs by up to 25%. Transport expenses can account for up to 45% of the cost of lower value commodities, while the cost of trade is 20% higher between African countries than between them and external trade partners. This perpetuates food insecurity, raising the cost of food in net importing countries and limiting potential revenues in net exporting countries.

To illustrate the impact of high transport costs on maize markets in Southern Africa, a 25% reduction in freight rates is modelled. Figure 3 presents a summary of the key results, measured as the average difference between the "business as usual" and the reduced cost scenario between 2026 and 2030.

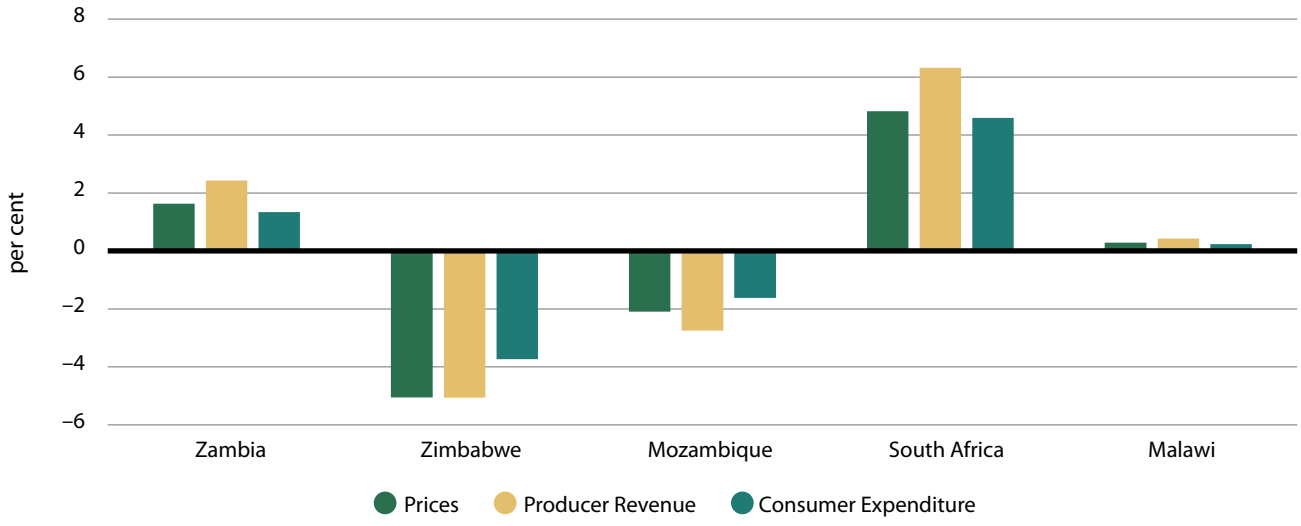

Figure 3: The impact of reduced transport costs.
Source: own composition

There are two key points worth noting:

- In surplus producing South Africa and Zambia, the reduction results in higher prices on average, as prices do not have to fall as far for arbitrage opportunities to initiate trade. This suggests that more products can be exported, but at a higher average price. The price increase ranged from 0.3% to 4.8%. Producer revenue in these countries also increased, from the higher price as well as higher production volumes as producers respond to improved prices.
- In deficit countries that typically import maize to supplement domestically produced volumes (such as Zimbabwe and Mozambique), prices declined, as imports became more affordable due to reduced trade costs. The decline ranged from 2.1% to 5.1%. Despite higher volumes consumed, consumer expenditure on maize in deficit countries declined due to improvements in affordability, bolstering food security.

While the impacts may seem small, a 25% reduction is conservative, given the high share of trade costs in total revenue. Further, while the simulation model quantifies impact just on the maize sector, all of agriculture will benefit from reduced trade costs, hence total impact will be substantially higher.

Cost of port delays affects profitability in South Africa

To illustrate the impact of high trade costs oriented to exports, the second case study considers South Africa's citrus industry (BFAP, 2025). Citrus is the biggest contributor to agricultural exports in South Africa, with most production shipped through Durban, whose port has experienced severe congestion challenges in recent years.

Given South Africa's position as the largest exporter of citrus from the Southern hemisphere, logistical delays evidently result in price impacts in destination markets. In this case study, the cost of inefficiencies was represented in direct costs, indirect costs and waste, where indirect costs refer to market impacts and lower prices resulting from volume fluctuations and the need to redirect products to alternative markets as a result of delays and subsequent quality impacts. Waste refers to products not harvested, not packed or not shipped due to quality implications.

Direct costs (including additional costs on farm, in the packhouse, cold storage facilities, transportation, stacking in port and additional handling, and re-packing costs at destination on affected cartons) are estimated at R1.56 billion in 2024, amounting to R654 per tonne exported, or 8.8% of the export price. Indirect costs are tougher to quantify, thus this scenario focusses on direct costs, making it conservative, but still illustrating the potential producer response to improved returns on exports as a result of improved logistical efficiency.

The model disaggregates oranges, soft citrus, lemons and grapefruit. Supply responds to changes in export revenue, domestic fresh sales and fruit sent for processing, whereas demand, both domestically and in key export markets, is driven by changes in consumer income, price and population dynamics. Producers supply into any one of the three market segments, responding to relative price changes – hence if export prices increase relative to alternative market segments, additional produce will be exported, considering that quality differentials mean that a share of produce will always be destined for domestic fresh and processing sales. The simulation accounts for reduced revenue in other market segments should more produce be shifted into exports. It also considers the impact that additional volumes from South Africa would have on prices, which will offset some of the benefit of the revenue gains from cost savings.

After simulating the baseline, an alternative scenario is presented, where returns from exports are increased by 8.8% in the event that inefficiencies from port congestion can be overcome. While substantial investment in capacity will be required, along with operational improvements, it remains a conservative estimate given that indirect impacts are not considered. The adjustment is phased in over a three-year period starting in 2026. Results are presented as an impact relative to the baseline by 2034, as the long-term nature of the industry, where trees take time to establish and reach full production, requires time for the production response.

Figure 4 presents the results. The greatest benefit is attained in oranges and lemons, both of which currently comprise a substantial share of fruit produced for processing

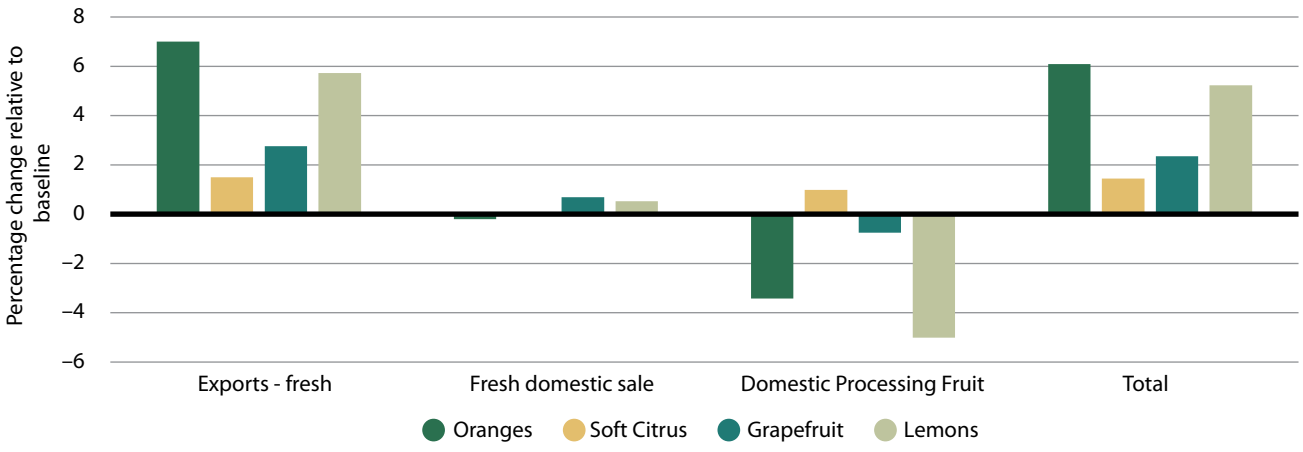

Figure 4: Percentage change in revenue in 2034.

Source: own composition

that could be diverted to exports. This is also reflected in the reduction in revenue from processed fruit. In the case of grapefruit, the potential benefit is smaller. For both grapefruit and lemons, revenues from domestic fresh sales also increase marginally.

The additional revenue attained from soft citrus is the smallest amongst the different products. In this case the expectation of significant additional volumes from already established orchards brings prices under pressure, limiting further expansion. The expected additional volumes raise additional revenue in both the export and processing markets, with limited impact on fresh market revenues, as volume and price movements are largely offsetting.

In total, across all 4 products, in all 3 market segments, the additional revenue generated amounts to R2.3 billion per year by 2034, equal to a 4.1% gain in producer revenues, from a reduction of 8.8% in total logistical costs. The fact that the full benefit of 8.8% does not accrue to producers reflects the impact that additional export volumes from South Africa has on prices, as South Africa is the biggest exporter of fresh citrus during the Southern Hemisphere season.

Conclusions

Agricultural trade in the southern African region is dominated by South African exports into and imports from the region. Deepening, expanding and balancing these trade patterns requires institutional and infrastructural investments that have to compete with other country and regional priorities such as expenditure on poverty alleviation and adaptation to and mitigation of the effects of climate change. Trade challenges revolve largely around the institutional and physical infrastructure required to facilitate trade, including regional integration mechanisms, closer cooperation in problem solving, and roads, ports, railways, and energy supply for cold chain logistics. Social aspects encompass political stability, policy certainty and poverty alleviation, while adaptation and mitigation require attention to almost all aspects of agricultural production, distribution and processing at all levels of the supply chain.

Our purpose was to identify these challenges and to emphasise the constraints to government action. As a result, we argue that arguments for expenditure on trade facilitation and on trade infrastructure need to be evidence-based. In this article we have provided an overview of the wide range of challenges facing the region, then presented two case studies that illustrate the benefits of such investment. These represent important arguments in favour of investments needed to support regional trade in agricultural products.

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